ATOLL RESEARCH BULLETIN
No. 267

AVIFAUNA OF THE SOUTHWEST ISLANDS OF PALAU

BY

JOHN ENGBRING

ISSUED BY

THE SMITHSONIAN INSTITUTION
WASHINGTON, D. C., U.S.A.

SEPTEMBER 1983

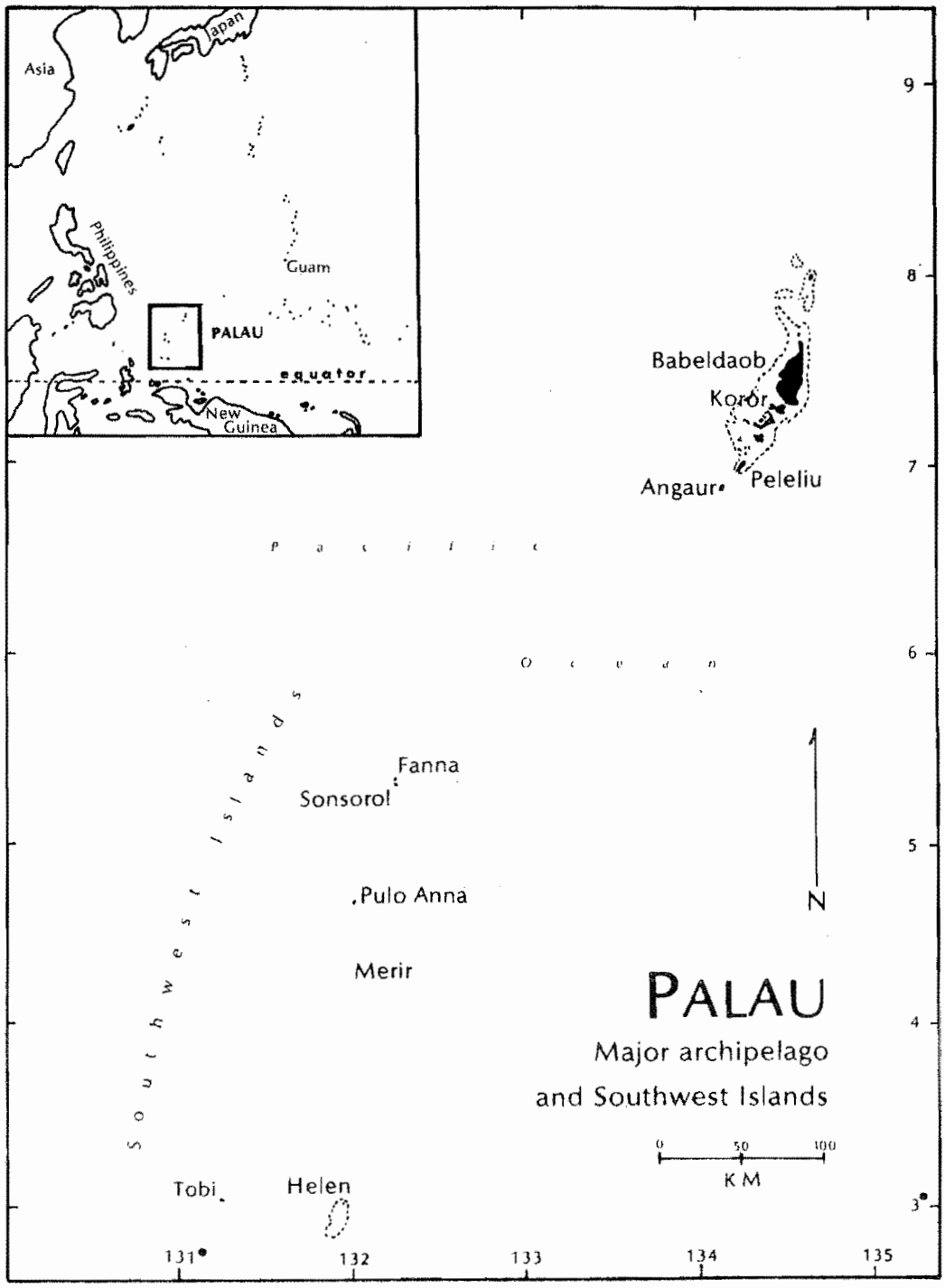

Figure 1. Major islands of Palau, including the six Southwest Islands.

AVIFAUNA OF THE SOUTHWEST ISLANDS OF PALAU

by John Engbring[1]

INTRODUCTION

The Palau Archipelago (7° 20' N, 134° 30' E) lies at the westernmost edge of the Pacific, just north of the equator and nearly equidistant from New Guinea to the south, the Philippines to the west, and Guam to the northeast (Figure 1). As a part of Micronesia, Palau became a United States Trust Territory following World War II. The government is now in a transitional state, and is shifting from a trust to independent status.

The Southwest Islands of Palau are composed of six tiny islands, each less than 2 km^2, extending 600 km southwest of the capital, Koror. The islands are Sonsorol and Fanna (the Sonsorol Islands), Pulo Anna, Merir, Tobi, and Helen. Other place names for the islands, and areas, are listed in Bryan (1971). Tobi and Helen, the southernmost of the group, lie only 400 km north of western New Guinea. All of the islands are of low elevation, with a substrate of coralline rubble interspersed with sandy areas. Most of the islands harbor minor deposits of phosphate, much of which was removed before World War II during the Japanese administration (Hutchinson 1950). The islands support relatively verdant forests, with coconut (*Cocos nucifera*) being the dominant species on most. Other trees include *Artocarpus* spp., *Ficus* spp., *Calophyllum inophyllum*, *Barringtonia asiatica*, *Pandanus* sp., *Tournefortia argentea*, *Scaevola taccada*, *Neisosperma oppositifolia*, and *Eugenia javanica*. Other than Helen, which has a large encircling outer reef and an inner lagoon, the islands are surrounded by fringing reefs that generally extend 200-600 m from land before dropping off steeply into ocean depths. These fringing reefs form rocky flats that are exposed at low tides.

Politically, the islands are part of Palau, but the residents are culturally distinct and speak a separate language. Historically, all the islands except Helen have been inhabited by Micronesians related to those of other outer islands in the Western Carolines (Eilers 1935, 1936). Though densely populated at one time, only a few families reside

---

[1] U.S. Fish and Wildlife Service, Honolulu, Hawaii

Manuscript received July 1981 -- Eds.

there today. The economy remains at a subsistence level, with copra the nearly sole source of income; other minor trade items include coconut syrup, shells, and handicrafts. On Helen, sea cucumbers are also collected, dried, and exported for consumption in the Orient. Contact with the outside world is made every 3-4 months by ship from Koror. This "field trip ship" stops for 1-2 days at each island, purchases copra, delivers staples, and fulfills other needs of the residents.

The avifauna of the Southwest Islands is undescribed, although large seabird colonies are present on Fanna and Helen. From Helen, Owen (1977a) recorded the Great Frigatebird (Fregata minor) and Lesser Frigatebird (Fregata ariel) and Yamashina (1940) recorded the Sooty Tern (Sterna Fuscata) and Crested Tern (Thalasseus bergii). Two unpublished reports, a checklist (Owen 1977b) and a field guide (Engbring 1981), give distribution and relative abundance of Southwest Island seabirds. Outside of these references little else is available on the birds of the region.

METHODS

The following report is based on two trips I made to the islands while working in Palau as a Smithsonian-Peace Corps Volunteer. One trip was in the fall from 9-20 November 1977, and one was in the spring from 18-26 May 1979 ("spring" and "fall" in this report refer to seasons of the Northern Hemisphere). During each of these trips the ship generally spent 1-2 days at each island, and I spent several hours per day on shore making general observations. Seabirds were also frequently recorded from the ship as it waited a few hundred meters from the outer edge of the reef. I spent a total of 6 daylight hours on Fanna, 14 on Sonsorol, 15 on Pulo Anna, 8 on Merir, 26 on Tobi, and 19 on Helen. Offshore (within sight of land) I spent 6 daylight hours at Fanna, 22 at Sonsorol, 8 at Pulo Anna, 6 at Merir, 16 at Tobi, and 10 at Helen. At Helen I stayed one night on shore, when I was able to observe the large number of birds returning to roost at dusk. Whenever possible, I questioned the local residents regarding avifauna.

Additional information was contributed by Warren King, Dennis Puleston, and Thomas Ritchie, who spent 18 and 19 October 1979 on Helen and Merir while traveling on the M.S. Lindblad Explorer; by Greg Bright, who visited the region from 24 November to 2 December 1978; and by Robert Owen, who spent 30 years in Palau and visited the Southwest Islands on several occasions.

THE ISLANDS

Sonsorol Islands; 5° 20' N, 132° 13' E

Because of their proximity, two islands are included in this group, Sonsorol (136 ha), which has about 25 residents, and Fanna (54

ha), an uninhabited island located 2 km north of Sonsorol. Residents of Sonsorol regard Fanna as a reserve, but make occasional foraging expeditions by dugout canoe to Fanna for fish, coconut crabs, and birds. Both islands are covered by a forest of tall trees with a relatively well-formed canopy and a moderately dense understory. Several huge, stately *Ficus* and *Artocarpus* grow on Fanna.

Fanna harbors spectacular seabird colonies. The Black Noddy (*Anous minutus*) and Red-footed Booby (*Sula sula*) nest in immense numbers. Although less plentiful, White Terns (*Gygis alba*) are also abundant. In Palau, Fanna is the only known nesting site for Great Frigatebirds, and possibly Lesser Frigatebirds as well. Also resident are the Brown Noddy (*Anous stolidus*), and a few Brown Boobies (*Sula leucogaster*). Only four seabirds are known to reside on Sonsorol, none in profuse numbers. In order of abundance these are the Brown Noddy, the White Tern, the Black Noddy, and the White-tailed Tropicbird (*Phaethon lepturus*). Fruit bats (*Pteropus sp.*) are conspicuous arboreal denizens on both Sonsorol and Fanna, but are not seen on the other Southwest Islands.

Pulo Anna; 4° 40' N, 131° 58' E

Pulo Anna (50 ha) is covered by large trees, with a relatively open understory. A shallow, open, brackish swamp, approximately 200 by 200 m, is located in the center of the island. The swamp is littered with decaying logs, remnants of mangrove trees that were cleared by U.S. military forces after World War II during a mosquito control program. Water level fluctuates with the tides, though there is no above-ground connection with the ocean. Approximately 20 or fewer people live on the island.

Resident seabirds include an abundance of Brown Noddies and White Terns, and lesser numbers of White-tailed Tropicbirds and Black Noddies. Great Frigatebirds commonly soar above the island, but are not known to nest on Pulo Anna. Migratory shorebirds regularly use the swamp, which provides an excellent resting and feeding area despite its limited size.

Merir; 4° 19' N, 132° 19' E

Merir (90 ha) is moderately elongated, just over 2 km from the northern to southern tip. A typhoon in the mid-1960's destroyed much of the vegetation, and a thick growth of medium-sized trees has since grown. Numerous large, dead trees still extend above the post-typhoon canopy. A shallow, heavily overgrown swamp is present on the southern, interior portion of the island, but because it is overgrown by shrubs, few shorebirds utilize it. Merir is riddled with mosquitos, and this, along with the dense understory, makes the interior generally inhospitable. In recent years only one family of fewer than ten people has resided on the island.

Brown Noddies are the most abundant species on the island, with lesser numbers of White Terns and White-tailed Tropicbirds. King et al. (1980) recorded Black Noddies in moderate numbers in 1979. Frigatebirds, mostly Great but a few Lesser, regularly soar above and roost on the island, but are not known to nest.

Tobi; 3° 01' N, 131° 11' E

With about 70 people, Tobi (60 ha) is the most heavily populated of all the Southwest Islands. Much of the triangular island is covered with tall coconut groves that are relatively well manicured and have open understories. A shallow, centrally located swamp, which is partly planted with taro (*Colocasia esculenta*), is largely the result of pre-war phosphate mining by the Japanese. The small amount of open water provides good but limited habitat for migratory shorebirds. Scattered throughout the swamp area are large earthen mounds, also the result of mining activities. The limited amount of native forest on the island contains several massive specimens of *Ficus* and *Calophyllum*.

Seabird densities on Tobi are similar to those on Pulo Anna, with healthy populations of Brown Noddies and White Terns, and many fewer White-tailed Tropicbirds and Black Noddies. Great Frigatebirds are commonly seen soaring overhead.

Helen; 2° 59' N, 131° 49' E

Unlike the other Southwest Islands, Helen is an atoll and consists of a large reef that encircles an open lagoon (100 km^2). The only dry land, which is at the northern tip of the reef, is low and small (approximately 25 ha), and is mostly sand. At low tide, conspicuous sand spits extend to the north and south of the crescent shaped island. Though the island was historically uninhabited, residents of Tobi, nearly 75 km away, made occasional forays to Helen. When this study was made, fewer than ten people lived on Helen, but the population varies depending on the number of "visitors" from Tobi or other Southwest Islands. The vegetation consists almost exclusively of large coconut trees, medium-sized *Tournefortia* trees, and a few sparse clumps of grass.

Impressive numbers of seabirds reside on Helen, and seabird density is greater here than on any other Southwest Island. The superb quality of Helen as a nesting site is probably due to its isolation, its beaches which are protected from large waves by the outer reef, and its lagoon which supplies an abundant food supply. There are sizable colonies of Crested Terns, Black Noddies, Sooty Terns, and Red-footed Boobies, and moderate numbers of Brown Boobies and Black-naped Terns (*Sterna sumatrana*). White Terns recently began nesting on Helen in small numbers. Both Great and Lesser Frigatebirds commonly soar near the island and roost in the tall coconut trees. Neither species is thought to nest regularly on Helen, but a male Lesser Frigatebird was recorded on a nest in 1969 (Owen 1977).

AVIFAUNA

Forty-seven species of birds have been recorded from the Southwest Islands (Table 1), of which 14 are resident and 33 are migrant or vagrant. Four additional genera have been recorded that are not identified to species (Table 1). Out of the 14 resident species, 11 are seabirds and three are land birds. The 11 species of resident seabirds represent four families: Phaethontidae (one species), Sulidae (two species), Fregatidae (two species), and Laridae (six species). Conspicuously absent is the family Procellariidae. Most nonresidents are migratory shorebirds. Several recent new bird records for Palau (Engbring and Owen 1981, King et al. 1980) were nonresidents recorded from the Southwest Islands. These are the Red-tailed Tropicbird, Masked Booby, Chinese Goshawk, Bush Hen, Brown Shrike, and Lanceolated Warbler.

Nonresident Birds

Though a number of vagrant and migratory species have been recorded from the Southwest Islands (Table 1), the list is no doubt incomplete. Any of the migratory species already recorded from the Palau Archipelago (Engbring 1981, Owen 1977c) are likely to occur in the Southwest Islands as well. The majority of migrants are shorebirds from the Eastern Eurasian Region that are moving south during the boreal winter; a few are birds from New Guinea or Australia that are traveling north during the austral winter; and a small number are probably east-west migrants from Southeast Asia, the Philippines, or Indonesia (Baker 1951). The most common shorebirds (5-20 regularly seen at any one time on each island during migration) include Lesser Golden Plover, Ruddy Turnstone, Whimbrel, and Gray-tailed Tattler. Important habitat types utilized by shorebirds include the small inland swamps on Pulo Anna and Tobi, reef flats, and sandy beaches.

Unidentified Species

A number of birds were observed that were not positively identified:

Shearwater - Puffinus sp.: One all dark shearwater was seen about 80 km north of Sonsorol on 26 May 1979. Its size and color matched that of the dark phase of the Wedge-tailed Shearwater, Puffinus pacificus, but there are several all dark shearwaters in the Pacific with which the bird could have been confused. This was the only Procellarid that I saw in 18 days at sea.

Tattler - Heteroscelus sp.: Tattlers were regularly observed on most of the islands. On the basis of call, I identified Gray-tailed Tattlers on Merir and Tobi. King et al. (1980) identified Gray-tailed Tattlers on Helen and Merir. Unidentified Tattlers could possibly be the Wandering Tattler, Heteroscelus incanus, a migrant in Palau which is less common than the Gray-tailed Tattler.

Table 1. Distribution and status of Southwest Island birds. Common and scientific names follow the American Ornithologists' Union (1982) check-list whenever possible. Other names are from Owen (1977c) and King *et al*. (1975).

Status Symbols

R - Resident; nests within the Southwest Islands and is generally present year-round. Different classes of resident birds are indicated with lower case letters as follows:

b - Breeding species on the island; nests, eggs, or young recorded.

p - Probable nester on the island, but nests, eggs, or young not recorded.

t - Transient; recorded near (generally within sight of) land, but is not thought to nest on the island. May or may not roost on the island.

M - Migrant; migratory species not resident in the Southwest Islands.

V - Vagrant; accidental occurrence of a normally non-migratory species.

Abundance Symbols

S - Single individual recorded on one or more occasions.

U - Uncommon; 2-10 birds recorded on at least one visit.

C - Common; 11-50 birds recorded on at least one visit.

N - Numerous; 50-1,000 birds recorded on at least one visit.

A - Abundant; over 1,000 birds recorded on at least one visit.

Island Symbols

FA - Fanna.

SO - Sonsorol.

PU - Pulo Anna.

ME - Merir.

TO - Tobi.

HE - Helen.

Table 1, continued

Species		Island					
		FA	SO	PU	ME	TO	HE
Shearwater genus (M)	*Puffinus* sp.		S				
White-tailed Tropicbird (R)	*Phaethon lepturus*		Up	Up	Up	Up	
Red-tailed Tropicbird (M)	*Phaethon rubricauda*		S		S*		
Masked Booby (V)	*Sula dactylatra*						S
Brown Booby (R)	*Sula leucogaster*	Sp	St		St		Nb
Red-footed Booby (R)	*Sula sula*	Ab	Nt		St*	Ut	Ab
Great Frigatebird (R)	*Fregata minor*	Nb	Nt	Ct	Nt	Ct	Nt
Lesser Frigatebird (R)	*Fregata ariel*				Ct*		Cp
Cattle Egret (M)	*Bubulcus ibis*		S	U	S	S	
Pacific Reef Heron (R)	*Egretta sacra*	Up	Up	Sp	Up	Up	Cp
Little Egret (M)	*Egretta garzetta*[1]					U	
Plumed Egret (M)	*Egretta intermedia*					S	
Chinese Goshawk (M)	*Accipiter soloensis*				S*		
Red Junglefowl (R)	*Gallus gallus*		Ub	Ub	Ub	Cb	
Bush Hen (V)	*Amaurornis olivaceus*			S			
Black-bellied Plover (M)	*Pluvialis squatarola*				S	S	
Lesser Golden Plover (M)	*Pluvialis dominica*	U	U	C	U	C	C
Mongolian Plover (M)	*Charadrius mongolus*[2]			U	U	U	S
Little Ringed Plover (M)	*Charadrius dubius*				U*		S*
Oriental Plover (M)	*Charadrius veredus*[3]				S*		U*
Common Greenshank (M)	*Tringa nebularia*					U	
Wood Sandpiper (M)	*Tringa glareola*			S		S	
Gray-tailed Tattler (M)	*Heteroscelus brevipes*				U	C	U

Table 1, continued

Species		Island					
		FA	SO	PU	ME	TO	HE
Tattler genus (M)	*Heteroscelus* sp.		U	S	U	C	U
Common Sandpiper (M)	*Actitis hypoleucos*	S		S	U	U	S*
Little Curlew (M)	*Numenius minutus*					S	
Whimbrel (M)	*Numenius phaeopus*		U	U	U*	C	S*
Black-tailed Godwit (M)	*Limosa limosa*			S			
Bar-tailed Godwit (M)	*Limosa lapponica*				U*		U
Ruddy Turnstone (M)	*Arenaria interpres*			S	C	C	C
Rufous-necked Stint (M)	*Calidris ruficollis*[4]						S
Stint genus (M)	*Calidris* sp.			S			S
Curlew Sandpiper (M)	*Calidris ferruginea*						S
Snipe genus (M)	*Gallinago* sp.					U	S*
Common Tern (M)	*Sterna hirundo*					S	
Black-naped Tern (R)	*Sterna sumatrana*						Nb
Sooty Tern (R)	*Sterna fuscata*						Ab
Little Tern (M)	*Sterna albifrons*			U			
Crested Tern (R)	*Thalasseus bergii*			Ut	Ct	Ut	Ab
Brown Noddy (R)	*Anous stolidus*	Cp	Ab	Nb	Ab	Ab	
Black Noddy (R)	*Anous minutus*	Ab	Nb	Cb	Cp*	Cp	Ab
White Tern (R)	*Gygis alba*	Ab	Ab	Nb	Cp	Np	Cb
Nicobar Pigeon (V)	*Caloenas nicobarica*						S
Oriental Cuckoo (M)	*Cuculus saturatus*						S*
Cuckoo genus (M)	*Cuculus* sp.					S	
Hawk-Owl genus (M)	*Ninox* sp.						S

Table 1, continued

Species		Island					
		FA	SO	PU	ME	TO	HE
Collared Kingfisher (R)	*Halcyon chloris*	Sp	Up	Sp	Up	Up	Up
Bee-eater genus (M)	*Merops* sp.					U	
Dollar bird (M)	*Eurystomus orientalis*			U			
Barn Swallow (M)	*Hirundo rustica*		C	C	U	C	U
Yellow Wagtail (M)	*Motacilla flava*		U	S	U	U	U*
Brown Shrike (M)	*Lanius cristatus*					U	
Lanceolated Warbler (M)	*Locustella lanceolata*						S*
Gray-streaked Flycatcher (M)	*Muscicapa griseisticta*					S	S

[1] It is not certain whether the Little Egret can be separated from the Snowy Egret (*E. thula*), which has not been recorded from Palau. I saw two white egrets wading on reef flats along the shore at Tobi on 15 November 1977. Both were alike, with narrow plumes on the nape, black beaks, orange-yellow lores, black legs (with a greenish tinge), and greenish-yellow toes.

[2] The Mongolian Plover is similar to the Greater Sand Plover (*C. leschenaultii*). Prior to my visit to the Southwest Islands I regularly observed both species in Koror, Palau, and considered the two separable on the basis of size, leg length, and leg color, among other field traits.

[3] Some consider this as two species, *C. veredus* and *C. asiaticus*.

[4] The Rufous-necked Stint is similar to two other small Calidrids, the Little Stint (*C. minuta*) and the Semipalmated Sandpiper (*C. pusilla*), and would be difficult to separate from them in winter plumage. The individual I observed on Helen on 22 May 1979 was entering breeding plumage, and had an even wash of reddish color on the breast and neck. I used this trait to separate it from the other two species, neither of which have been recorded from Palau.

* Recorded by King *et al*. (1980).

Snipe - Gallinago sp.: I flushed three snipe on Tobi on 14 November 1977, and King et al. (1980) observed one on Helen on 18 October 1979. None of these individuals were identified to species, though it is likely that one or more were Swinhoe Snipe, Gallinago megala, the only species of snipe collected from Palau.

Stint - Calidris sp.: I observed two stints in winter plumage, one on Helen on 13 November 1977, and one on Tobi on 17 November 1977. These appeared to be and most likely were Rufous-necked Stints, Calidris ruficollis. However, they could not be safely separated from the winter plumage Little Stint, Calidris minuta, or Semipalmated Sandpiper, Calidris pusilla, neither of which has been recorded from Palau.

Hawk-owl - Ninox sp.: An unidentified, small brown owl was first reported from Helen on 28 November 1978 (Bright 1978). On 18 October 1979, another owl was observed that was identified as the Brown Hawk-Owl, Ninox scutulata (King et al. 1980). The owl was most likely the Brown Hawk-Owl, as it is a widespread species in Southeast Asia that migrates to the Philippines. However, there are several other Ninox spp. that reside on nearby islands with which the Brown Hawk-owl could conceivably be confused.

Cuckoo - Cuculus sp.: I observed one cuckoo on Tobi which was either the Oriental Cuckoo, Cuculus saturatus, or the Common Cuckoo, Cuculus canoris.

Bee-eater - Merops sp.: I observed a flock of eight bee-eaters on Tobi on 21 May 1979. Tentatively these have been identified as the Rainbowbird, Merops ornatus, an Australian species. All the birds were in immature plumage, however, and further comparison of the Australian species and two Philippine bee-eaters should be made.

In addition to the above unidentified birds, Bright (1978) observed an all black bird with a long tail on Tobi on 29 November 1978. The individual was at least 36 cm long, and had dark legs, but a lighter bill. It perched in a small tree near the edge of the swamp. The bird was probably a male Common Koel, Eudynamys scolopacea.

Resident Land Birds

Pacific Reef Heron - Egretta sacra. The reef heron is resident on all of the Southwest Islands, and is conspicuous as it feeds on reef flats at low tide. The population on each island probably numbers no more than 15-20 individuals. No nests have been recorded. Based on its widespread insular distribution one can assume that the reef heron is a capable overseas wanderer, but no patterns of movement are evident in the Southwest Islands. On Helen, records indicate a variation in population size; one bird was recorded in September 1969 (Owen, field notes), eight birds in November 1977 (this study), three birds in May 1979 (this study), and eleven birds in October 1979 (King et al. 1980).

This population fluctuation could be due to ingress/egress, reproduction, or simply counts of varying completeness. It is unlikely that reef herons are overlooked on Helen, but birds may be roosting on derelict ships on the surrounding reef, and thus missed during a count. White and dark phase birds are represented in about equal proportions on all the islands.

Red Junglefowl - Gallus gallus. Domestic junglefowl are regularly heard and seen on Sonsorol, Pulo Anna, Merir, and Tobi. The species is commonly raised by residents, and is likely to be found on any of the Southwest Islands, particularly near villages. The species was probably introduced by early island settlers. A few birds are probably feral, but this is difficult to determine. Early reports indicate that the junglefowl was valued more for its feathers, which were used for fishing lures, than for its flesh (Johannes 1981).

Collared Kingfisher - Halcyon chloris. A few, evenly dispersed individuals or pairs can be located on any of the Southwest Islands. The population is estimated at 20 or fewer on each island. I assume the species is resident, but found no nests. On Helen, only one or two birds have been recorded at any time, and these are possibly vagrants from other Southwest Islands, New Guinea, or Indonesia.

Resident Seabirds

Estimates of the size of nesting colonies are summarized in Table 2, and species accounts are as follows:

White-tailed Tropicbird - Phaethon lepturus. Although nowhere abundant, individuals and small groups can be found commonly on all of the Southwest Islands but Helen. Population size is estimated at under 50 individuals at any one time on each of the islands of occurrence. The tropicbird's absence from Helen can probably be explained by the limited amount of forest, which serves as nesting habitat. Though I recorded no birds from Fanna, the species is probably resident here. Birds were found in equal numbers in spring and fall, indicating negligible variation in nesting season and no definite migratory pattern. Though no nests have been recorded, the species presumably nests in the Southwest Islands. Elsewhere in Micronesia, the tropicbird has been found to nest throughout the year (Brandt 1962), as is probably the case in the Southwest Islands.

Red-footed Booby - Sula sula. The Red-footed Booby is abundant on the two islands on which it nests, Fanna and Helen, and sightings are possible near any of the other Southwest Islands. Boobies generally spend the day foraging over the open ocean, and population estimates are best made in early morning or at dusk as the birds leave or return to land. On Helen, it was possible to spend two evenings on the island and estimate numbers as the birds returned to roost. On Fanna, the population estimate is derived from a count of active nests. The total adult population (flying birds) is around 5,000 on Fanna and 2,500 on

Table 2. Population estimates for resident seabird colonies in the Southwest Islands

	Fanna	Sonsorol	Pulo Anna	Merir	Tobi	Helen
White-tailed Tropicbird		20-50	30-50	25-50	25-50	
Red-footed Booby	5,000					2-3,000
Brown Booby	10-25					500-1,000
Great Frigatebird	400-500					
Lesser Frigatebird	?					?
Black-naped Tern						200-500
Sooty Tern						80,000
Crested Tern						5-7,000
Brown Noddy	50-100	1-3,000	300-700	2-3,000	1,000	
Black Noddy	20,000	100-200	50-100	100-300	50-100	3-4,000
White Tern	3-5,000	1-2,000	200-500	1-2,000	500-1,000	20-50

Helen. Nearly all birds (over 90%) are of the white rather than dark color phase.

The Red-footed Booby is a colonial nester, and constructs nests of leaves, grass and twigs. On Fanna, the booby nests high in trees along the perimeter of the island, and to lesser extent in the interior. Favorite nest trees are Tournefortia and Artocarpus. Residents of Sonsorol state that the booby roosts so profusely at times that nest trees are injured, and indeed, several trees were conspicuously defoliated in May 1979. There were at least ten distinct sites in May 1979, each with nearly 100 active nests. Thus, there were about 1,000 active nests on the island. Young were at all stages of development. On Fanna, peak nesting activity occurs during spring months, and there is little or no nesting in the fall. A nesting cycle was apparently beginning in November 1977, when adult birds were on the ground picking up twigs and sitting on nests up in trees. However, I could see no young or eggs from below.

On Helen, the colony is smaller, but density is greater. Birds nest in the relatively low Tournefortia trees, and on rare occasions in the much taller coconut trees (both Tournefortia and coconut trees are utilized for roosting). About 265 downy young, along with a few nearly fledged birds, were counted in May 1979. In October 1979, 91 young at all stages of development were counted (King et al. 1980), and in November 1977, 25 young were found (this study). The pattern indicates nesting throughout the year, with a probable peak in spring months.

Brown Booby - Sula leucogaster. The Brown Booby is known to nest only on Helen and, in very limited numbers, on Fanna. On Helen, the colony numbers from 500 to 1,000, but on Fanna, fewer than 25 are present. The species can probably be sighted near or possibly roosting on any of the other Southwest Islands.

On Helen, pairs nest in shallow lined scrapes in the sand, often just above the high tide line. Concentrations of nesting birds are located under Tournefortia trees on the northern and southern portions of the island. A few young are raised throughout the year, but the peak nesting season is in spring months. In November 1977, I counted 10 downy young and saw no incubating adults. Likewise, there was only minor nesting activity in November 1978, when only one nest was found (Bright 1978) and in October 1979, when 11 active nests were located (King et al. 1980). In May 1979, the peak of the presumed nesting season, I counted 60 downy young of all sizes, along with at least 20 incubating adults. Large numbers of birds returned at dusk to roost on the Island.

Residents of Sonsorol informed me of a small colony of fewer than 25 birds that recently began nesting on Fanna. Although I visited Fanna in both fall and spring and observed Brown Boobies in the area, I discovered no nests. This new colony may succeed provided it is not unduly disturbed by humans, and provided the relatively exposed beaches

prove suitable as nesting sites. It is possible that only Helen, whose beaches are protected by an outer reef, is capable of sustaining a stable colony of nesting Brown Boobies.

Great Frigatebird - Fregata minor, and Lesser Frigatebird - Fregata ariel. Frigatebirds occur uncommonly but widely on the oceans around Palau, and can characteristically be seen soaring above any of the Southwest Islands. Great Frigatebirds roost on all of the Southwest Islands. Lesser Frigatebirds have been recorded from Merir and Helen, but no doubt frequent the other Southwest Islands as well. Discussion of these two species is combined partly because of the incomplete information regarding relative numbers of each species. Out of 400 frigatebirds at Fanna in May 1979, I identified nearly 150 individuals, all of which were Great Frigatebirds. Only a few individuals, all Great, were identified at Pulo Anna, Merir, and Tobi. Thus, the great majority of frigatebirds on these islands appears to be Great Frigatebirds. At Helen, I found approximately equal numbers of the two species in May 1979, as did King et al. (1980) in October 1979. In May 1969, however, Owen (1977a) found 25 to 30 Great and over 100 Lesser Frigatebirds on Helen.

Although Great Frigatebirds roost on all the Southwest Islands, only Fanna is reported to have a nesting colony. Residents informed me that the birds nest high in the trees in the spring of the year. In May 1979 when about 400 frigatebirds were present, I observed birds entering tall trees during the day, but I could locate no nests. Occasional sporadic nesting may occur on other Southwest Islands as well. Residents have reported nesting on Merir, and in May 1969, Owen (1977a) recorded one male Lesser Frigatebird on a nest at Helen Island.

The following number of frigatebirds was recorded during several trips to the region:

	May 1969 (Owen 1977)	Nov. 1977 (this report)	Nov. 1978 (Bright 1978)	May 1979 (this report)	Oct. 1979 (King et al. 1980)
Fanna		over 100		400	
Pulo Anna		60		15	
Merir		34	over 150	10	moderate numbers
Tobi		26		1	
Helen	over 130	300		25	moderate numbers

The largest concentrations are found throughout the year on Fanna and Helen. The number of birds on each island varies, suggesting that birds travel from one island to another. The data also indicate that birds concentrate to nest at Fanna during the spring months. Frigatebirds are highly mobile, and much of the population may originate from or move to areas outside Palau. For example, Lesser Frigatebirds that nest on the Line Islands have been recorded in the vicinity of the Southwest Islands and beyond, a distance of over 6,000 km (Sibley and Clapp 1967).

Black-naped Tern - Sterna sumatrana. This species occurs only on Helen, where the population is 200-500 birds. It roosts and nests on shipwrecks on the surrounding reef. In May 1979, the species was conspicuous, and small groups could be seen foraging above the lagoon or circling near shipwrecks. Only a few were seen near the island itself, either resting on sand spits at low tide or circling overhead. On this same trip I visited an abandoned ship east of the island, where about 50 terns perched on and circled the ship. One chick and about 20 eggs were found on the deck. Sabino Zacharias, a resident of the island, informed me that greater numbers of birds resided at the other three shipwrecks on the reef. The nesting season appears to be in spring months only. Despite the relative abundance of Black-naped Terns in May 1979 and the apparently well established nesting population, there are no records of sightings during the fall. The disappearance of the population outside the breeding season is puzzling, since they are relatively sedentary elsewhere in the Palau Archipelago.

Sooty Tern - Sterna fuscata. Helen harbors the only colony of Sooty Terns in the Southwest Islands. This highly pelagic species returns to land only to nest, and, depending on the reproductive cycle, numbers fluctuate from a few hundred to tens of thousands on Helen. Despite the occasional abundance of birds at Helen, sightings of Sooty Terns near the other Southwest Islands are rare. During my two trips through the region, I heard and saw Sooty Terns only at Helen.

At Helen, eggs are located in shallow scrapes on the ground, usually within the interior of the island well above the high tide line. The major nesting colony is located in the central and eastern portion of the island, which is a relatively open area interspersed with small grass clumps. This colony extends to well within the interior of the island during a peak nesting season. Another small colony, possibly a distinct population, is located on the beach on the southwest side of the island. Birds appear to avoid nesting under the trees. The nesting of Sooty Terns on Helen appears to follow no distinct annual cycle. On several trips, the following estimated numbers of nests and young were recorded:

Nov. 1977 (this report)	Nov. 1978 (Bright 1978)	May 1979 (this report)	Oct. 1979 (King *et al.* 1980)
five nests and 15 nearly grown young	500 nests	10 nearly grown young	37,876 eggs and small chicks and 3,000 nearly grown young
150 to 200 adults	no estimate of adults	50 adults	82,000 adults
(east side)	(southwest side)	(southwest side)	(east side)

From this limited data, it appears that the only concentration of nesting birds during this 2-year period was in the fall of 1979. This is in contrast to the normal spring breeding peak for most seabirds of the region. Elsewhere in Micronesia, the species seems to have several different nesting seasons, but these are poorly described (Brandt 1962).

Crested Tern - *Thalassius bergii*. The Crested Tern nests only at Helen, where it can regularly be observed in large numbers resting on sand spits or foraging within or near the lagoon. During the nesting season, the adult population is estimated at around 7,000. Uncommon visits are made to other Southwest Islands as well, and I recorded small groups near Pulo Anna, Merir, and Tobi.

The Crested Tern exhibits a distinct nesting season, with peak activity in spring and little or no nesting activity during the remainder of the year. The following numbers illustrate the pattern:

Nov. 1977 (this report)	Nov. 1978 (Bright 1978)	May 1979 (this report)	Oct. 1979 (King *et al.* 1980)
12 chicks	No chicks	No chicks	10 small chicks
No eggs	No eggs	3,250 eggs incubated	20 eggs being incubated
2-3,000 adults	Adults not estimated	7,000 adults	440 adults

In May 1979, the birds were at or near the height of their breeding cycle. The colony was located on the northern tip of the island on a level, open, sandy area just above the high tide line. Single eggs were deposited directly on the sand with no nest being made. By pacing, I estimated the size of the colony at 425 m^2, there being about 240 eggs in every 25 m^2 or about 4,080 total eggs. It appeared that nearly a fifth of these eggs were abandoned, and I thus estimated a total of 3,250 active nests. According to King et al. (1980) this is probably the largest nesting colony of Crested Terns in Micronesia. A small amount of nesting occurs outside the spring breeding season. In October 1979 King et al. (1980) noted a small colony (about 20 eggs) on the eastern side of the island between the Sooty Tern colony and the beach.

Although the Crested Tern is fairly sedentary in Palau and large numbers can generally be found roosting and feeding at Helen throughout the year, they apparently wander from Helen Island outside of the nesting season. King et al. (1980) observed only 440 roosting adults in October 1979, a marked decrease from the 7,000 or more that were present in spring of the same year. During their absence from Helen, the birds possibly disperse to the northern coast of New Guinea.

Brown Noddy - Anous stolidus. The Brown Noddy is widespread, and can be found on all the Southwest Islands except Helen. On Sonsorol, Pulo Anna, and Tobi, Brown Noddies reside at approximately the same densities. On each of these islands, I estimate the nesting population to number in the high hundreds or low thousands. At Merir, the population is slightly larger, and on Fanna, it is smaller, at least during spring months. The small size of the population on Fanna may be due in part to interspecies competition for nesting sites with Black Noddies, which nest in profusion on Fanna in spring. The Brown Noddy breeds moderately throughout the year, with a decided peak during spring months. Nests are placed in trees, frequently in the crown of a coconut or pandanus. The bird is relatively solitary in its nesting habits, and generally only one nest is placed in a tree.

Certain populations of Brown Noddies apparently indulge in seasonal migrations in the Southwest Islands, though in the main Palau Archipelago, numbers are similar throughout the year. In November 1977, I recorded no Brown Noddies from Pulo Anna or Tobi, yet in May 1979, the species was nesting in abundance on both islands. On Merir and Sonsorol, however, birds were present in both fall and spring. Possibly the Pulo Anna and Tobi birds migrate to Sonsorol or Merir during the fall, but they may also journey to regions outside of the Southwest Islands. It was suggested by a resident of Tobi that the complete absence of noddies in November 1977 was the result of overharvesting the birds with a gun, rather than a natural phenomenon.

Black Noddy - Anous minutus. A colonial and abundant nester on Fanna and Helen, the species occurs in much lesser numbers on the other Southwest Islands. Peak nesting occurs in spring on Fanna, but on

Helen nesting activity continues throughout the year. At Fanna in November 1977, the species was abundant, but I found no nests. In May 1979, the colony was nesting profusely around the perimeter of the island up to 100 m inland. Nests, placed in branch crotches, were constructed of twigs, leaves, and other debris, and were heavily caked with excrement. They were placed at all levels in medium-sized trees. Counts at ten random points within the colony revealed an average of 64 active nests within a 20 m radius of each point. I estimated the total area of the colony at nearly 20 ha, and the total number of active nests at 10,000. At any time during the day a dense cloud of several hundred to several thousand birds could be seen foraging within sight of the island.

In contrast to Fanna, the colony on Helen did not exhibit such marked seasonality in nesting. On all trips that I or other visitors have made to the island, a large number of birds was nesting regardless of the season. On Helen, the Black Noddy nests nearly exclusively in the low Tournefortia trees. In November 1977, I estimated 1,700 active nests at all stages of development, from eggs to fully fledged young. In May 1979, I recorded about 1,000 nests. King et al. (1980) in October 1979, recorded roughly 1,200 nests.

Outside of Fanna and Helen, there are no large colonies of Black Noddies in the Southwest Islands. In November 1979, I saw none at Pulo Anna, Merir, or Tobi. In May 1979, a very few were present at Sonsorol, Pulo Anna, and Tobi, but in all cases they were vastly outnumbered by Brown Noddies. King et al. (1980) observed moderate numbers on Merir in October 1979, but they were outnumbered by Brown Noddies 20 or 30 to one. Presumably a few birds nest on other Southwest Islands, although it remains to be documented. From the limited information I have from the Southwest Islands, I detected no major movement patterns.

Wherever Black Noddies are abundant there were no or few Brown Noddies, and superficially it appears that some form of interspecific competition exists. However, I feel that more is involved than mutual exclusion due to competition for food, nest sites, or other habitat parameters. A possible partial explanation is the influence of man on the two species of noddies. The Black Noddy may be susceptible to disruption by humans, as they are abundant on the traditionally uninhabited islands of Fanna and Helen. The Brown Noddy, however, may be more tolerant of human disruption, and has persisted on islands inhabited by man.

White Tern - Gygis alba. The White Tern is common to abundant on all the Southwest Islands except Helen, where a recently established colony of under 50 birds resides. The largest concentration is on Fanna, where several thousand birds nest. Lesser numbers, in the hundreds or low thousands, are found in the forests of Sonsorol, Pulo Anna, Merir, and Tobi.

Unlike most other seabirds, the White Tern is not strongly averse to humans, and frequently resides within or near villages. Individuals or pairs forage far out over the ocean, and are usually not seen feeding near land. Birds do not return nightly to roost, as individuals and small groups can occasionally be seen or heard flying over water after dark. Birds roost and nest in trees, usually high in large spreading trees such as Ficus, Calophyllum, or Artocarpus. When over land, birds are raucous and conspicuous, especially during morning hours.

The White Tern nests throughout the year in Micronesia (Baker 1951), and presumably does so within the Southwest Islands as well. Though the tern is not a highly colonial nester, several pairs usually occupy the larger, more desirable trees. A peak in nesting activity may occur in spring. On Fanna, Pulo Anna, and Tobi in May 1979, numerous birds repeatedly landed and lingered in the foliage of the upper canopy, and were noisy and active as if defending territories. Birds were evenly distributed throughout the forest except on Fanna, where the colony of White Terns did not overlap with the dense and extensive colony of Black Noddies. Though I could not locate eggs or young, a few individuals perched on branches and appeared to be incubating. A nesting cycle had apparently begun or was just beginning. In November 1977, White Terns on these islands were decidedly less active. Though a peak in nesting may occur in spring, nesting activity has been recorded in other months as well. In November 1977 on Sonsorol, I noted White Terns carrying small fish, possibly for feeding young. In October 1979, an incubating bird was observed on Helen (King et al. 1980).

The small colony of White Terns on Helen became established in 1978. In November 1977, no White Terns nested or roosted on Helen. A year later, Bright (1978) found at least 20 terns on the island, and nesting was reported by residents. The colony has remained on the island at least through the fall of 1979, as I found birds in May 1979, and King et al. (1980) found a few in October of the same year.

CONCLUSION

Though perhaps depauperate from a worldwide perspective, species diversity of seabirds in the Southwest Islands is comparable to other Micronesian island groups: there are eleven resident seabirds in the Southwest Islands, about nine in Yap, ten in the Marianas, nine in Truk, ten in Ponape, sixteen in the Marshalls, and ten in the Gilberts (Fisher 1950, Baker 1951, Brandt 1962, Amerson 1969, pers. observ.). The Marshall Islands group has a species diversity noticeably greater than the other island groups. The Marshalls, however, cover a relatively vast area on the northeastern edge of Micronesia, where components of the Hawaiian avifaunal community are represented. The seabirds of the Southwest Islands are almost exclusively tree-nesters, suggesting that humans or other predators have excluded certain

ground-nesting species. Micronesia, on the other hand, might simply not provide the nesting habitat or food required for many seabirds. The Southwest Islands are heavily vegetated, a condition that certain ground nesting species avoid, and waters may be infertile, a likely case for offshore tropical waters where there are no major upwellings (King 1967).

Seabirds of the Southwest Islands presently survive under relatively undisturbed conditions, though in the past there might have been considerable human pressure on the resource. Introduced predators appear to be a minor problem, as I saw no rats, cats, or dogs while on the islands. Rats are almost certainly present, as they are on most Pacific islands, but they are apparently not abundant. Pigs were raised on Sonsorol and Tobi, but those that I saw were penned or tethered. The only actual predation I witnessed was on Fanna, where a land crab was eating a Black Noddy downy young. A locally catastrophic event occurred on Helen in May 1979, when a gravid green sea turtle (Chelonia mydas) wandered through the Crested Tern colony, destroying a swath of eggs nearly a meter wide.

Seabirds are well adapted to such natural disturbances, but most of man's activities are more destructive. It is perhaps no coincidence that the two largest concentrations of seabirds occur on Fanna and Helen, islands that have both been historically uninhabited or otherwise protected from excessive human intrusion. It is probable that only a few birds could exist on islands that sustained high human populations. On Tobi in the 1800's, 3-400 Micronesians resided in a continual state of near famine (Holden 1836) and any bird that lingered on the island was no doubt quickly consumed. From 1832-1834, Holden (1836) was a castaway on Tobi, and states that "during our stay there, scarcely a solitary sea-fowl was known to have alighted on the island." Many of the Southwest Islanders now reside in the capital of Koror, and the pressure of large human populations has somewhat diminished. Threats from outside harvesting still remain. Korean fishermen recently devastated seabird colonies in the Southwest Islands (Johannes 1981). In May 1979, two Taiwanese vessels were apprehended for illegal harvesting of birds, fish, and turtles. A Taiwanese vessel was in Helen Lagoon when the Lindblad Explorer visited Helen in 1979 (W. King, pers. comm.). Pillaging by outside boats is a common occurrence.

With greater public awareness and more education, Palauans are expressing increasing concern for their unique natural resources. On past trips to the Southwest Islands, eggs and birds have been occasionally taken by field trip members. These incursions are more the result of unbounded curiosity than any real subsistence needs; an educational lecture would do much to minimize disturbances. Disruption of colonies is particularly damaging during nesting, when incubating adults are easily frightened off their nests and eggs and young are lost. Because of their high densities, birds on Helen are especially susceptible to such losses. On Helen, a warden has been designated to assist in the protection of seabird colonies; positive actions such as these will assure the continued existence of Palau's seabird colonies.

Acknowledgments

I would like to first thank Robert P. Owen, who initiated this project and supported it throughout its duration. Warren King's timely contribution of his, Dennis Puleston's, and Thomas Ritchie's observations is much appreciated. Greg Bright helpfully offered his observations of the islands. Storrs Olson and John Farrand, Jr., kindly aided in the handling of specimens. Helpful comments on the manuscript were contributed by Dr. Cameron Kepler, Kay Kepler, Roger Clapp, and Warren King. Dr. Derral Herbst contributed much of the botanical information. Funding for the field work was supplied in part by the National Audubon Society through the efforts of C. John Ralph and George Peyton, Jr. A number of Palauans cheerfully offered information and assistance, and I would especially like to thank Sabino Zacharias, Marianos Carlos, and Antonio Andres.

References

American Ornithologists' Union. 1982. Thirty-fourth supplement to the American Ornithologists' Union check-list of North American birds. Auk (Supplement) 99(3): 16p.

Amerson, A. J. Jr. 1969. Ornithology of the Marshall and Gilbert Islands. Atoll Res. Bull. No. 127: 348p.

Baker, R. H. 1951. The avifauna of Micronesia, its origin, evolution, and distribution. Univ. Kan. Pub. Mus. Nat. His. 3(1): 359p.

Brandt, J. H. 1962. Nests and eggs of the birds of the Truk Islands. Condor 64(5):416-437.

Bright, G. 1978. Ornithological notes from the Southwest Islands, 24 November to 2 December 1978. Unpubl. report, Office of the Chief Conservationist, Koror, Palau. 2p.

Bryan, E. H., Jr. 1971. Guide to place names in the Trust Territory of the Pacific Islands. Pac. Sc. Inf. Center, Bernice P. Bishop Museum, Honolulu. (pages not numbered)

Sibley, F. C., and R. B. Clapp. 1967. Distribution and dispersal of Central Pacific Lesser Frigatebirds _Fregata ariel_. Ibis 109:328-337.

Eilers, A. 1935. Westkarolinen, 1. Halbband: Songosor, Pur, Merir. _In_ G. Thilenius (ed.), Ergebnisse der Südsee-Expedition 1908-1910. _II_, B, IX, part 1. Friederichsen, De Gruyter, Hamburg.

_____. 1936. Westkarolinen, 2. Halbband: Tobi, Ngulu. _In_ G. Thilenius (ed.), Ergebnisse der Südsee-Expedition 1908-1910. II, B, IX, part 2. Friederichsen, De Gruyter, Hamburg.

Engbring, J. 1981. A field guide to the birds of Palau. Unpubl. report, Office of the Chief Conservationist, Koror, Palau. 113p.

Engbring, J. and R. P. Owen. 1981. New records of birds in Micronesia. Micronesica 17(1&2):186-192.

Fisher, H. I. 1950. The birds of Yap, Western Caroline Islands. Pacific Science IV(1):55-62.

Holden, H. 1836. A narrative of the shipwreck, captivity, and suffering of Horace Holden and Benjamin Nute. Weeks, Jordan and Co., Boston.

Hutchinson, G. E. 1950. Survey of existing knowledge of biogeochemistry, 3. The biogeochemistry of vertebrate excretion. Bull. Amer. Mus. Nat. Hist. 96:232-233.

Johannes, R. E. 1981. Words of the lagoon; fishing and marine lore in the Palau District of Micronesia. Univ. of California Press, Berkeley. 245p.

King, B. F., E. C. Dickinson, and M. W. Woodcock. 1975. A field guide to the birds of South-East Asia. Collins, London. 480p.

King, W. B. 1967. Preliminary Smithsonian identification manual; seabirds of the tropical Pacific Ocean. U.S. Nat. Mus., Smithsonian Institution, Washington, D.C. 126p.

King, W. B., D. Puleston, and T. L. Ritchie. Ms dated 1980. Bird populations of Helen and Merir Islands, Southwestern Palau. Unpublished. 7p.

Owen, R. P. 1977a. New bird records for Micronesia and major island groups in Micronesia. Micronesica 13(1):57-63.

_____ 1977b. Terrestrial vertebrate fauna of the Palau Islands. Unpubl. report, Office of the Chief Conservationist, Koror, Palau. 15p.

_____ 1977c. A checklist of the birds of Micronesia. Micronesica 13(1):65-81.

Yamashina, Y. 1940. Some additions to the list of the birds of Micronesia. Tori 10:673-679.