

Species Richness and Other Noteworthy Observations at an Important Bird Area in Palau.

ALAN R. OLSEN & MILANG EBERDONG
Natural History Section, Belau National Museum
P.O. Box 666, Koror, Palau 96940
bnm@palaunet.com

Abstract—A one-year survey of the species richness of birds at a study site in an Important Bird Area (IBA) in Ngaremlengui, Palau, found 38 species of birds including 30 resident species and 8 migratory species. Eight of the 30 resident species are not previously reported from the IBA. The survey results represent a comparatively rich and noteworthy diversity for a locality on Babeldaob Island in Palau. Field observations describe nesting and feeding behaviors as well as local range extensions including the first record of the endemic Giant White-eye (*Megazosterops palauensis*) on Babeldaob Island.

Introduction

In 2006, the Palau Conservation Society and BirdLife International proposed the establishment of Ngerutechei Important Bird Area (Ngerutechei IBA) (Gupta 2006) on Babeldaob Island, Palau in an area administered by the Ngaremlengui State Government as part of a National Heritage Site. The IBA proposal was based on the reports of the results of two population density surveys of Palau's forest birds (Engbring 1992, VanderWerf 2007) issued by the US Fish and Wildlife Service as part of a series of reports on population density surveys of Micronesian forest birds. While these surveys provide broad-scale estimates of regional populations of selected forest bird species, they admittedly lack the fine-scale detail that is needed to catalog the diversity of any specific locality. The administrators of the IBA expressed a need for a reliable site-specific inventory of the bird diversity under their care and an authoritative checklist for biodiversity conservation, education and eco-tourism applications.

The objectives of our research were to conduct a fine-scale inventory and develop a site-specific checklist to fill gap left by the previous IBA surveys. A species richness study was chosen to assure the completeness of the inventory and provide a valid basis for an authoritative checklist. Our prior (unpublished) species richness research had yielded unremarkable results that aligned with the results of previous surveys; however, the results of the survey of the Ngerutechei IBA revealed a species richness that, in our experience, represented an unusually high number of species at a single location. Comparisons with recent regional reports on bird diversity (see Discussion and Conclusions) confirmed that the bird diversity of the Ngerutechei site is exceptionally rich thereby prompting this

report on the species richness, behaviors and activities of the birds of this Palauan diversity “hotspot.”

Methods

Site Description. The 50-hectare site is located at 7° 31.461' N, 134° 32.923' E in the northeast quadrant of the Ngerutechei IBA at a bend in the lower reach of the Ngaremeskang River in Ngaremlengui State. The western and northern demarcations are the Ngaremeskang River. The eastern demarcation is a two-lane paved road known as the “COFA” or “Compact” Road. The southern demarcation is a dirt service road for electrical utility lines. The study site has a compact configuration of diverse habitats that we believe represents all the major habitat types present in the Ngerutechei area and central Babeldaob Island. The center of the site is a swamp forest wetland dominated by mature *Horsfieldia* trees. The site includes grassy flood plain and savanna north of the swamp forest; riparian forest along both banks of the river; and adjacent upland forest to the hill crests immediately beyond the demarcations.

Methodology. We conducted an area survey (*cf.* Ralph *et al.* 1993) along a 1.5 km circular route following the site demarcations. Between 9 March 2007 and 9 March 2008, twenty-six (26) samples were taken by walking along the entire survey route. The average hiking time per sample was 2 hours. For each sample, we recorded the presence of every species of bird observed by visual sighting and by vocalization. Sampling dates and times were randomized and included dawn, daylight, dusk and evening hours. A bird species was included in the final results only if both authors agreed on the sightings and identifications, and only if at least one visual sighting of the species occurred during the study period. The number of observers ranged from two (the authors) to twelve with an average of four observers per sample. The authors are solely responsible for identifications. Identification references are Engbring (1988), Pratt *et al.* (1987) and Robson (2000). Common and scientific names follow Wiles (2005).

Our statistical evaluation uses the mean values of the standard Chao2 and ICE (Incidence-based Coverage Estimator) indices to estimate species richness from presence/absence data. The Chao2 estimator is calculated as:

$$S^*_{chao2} = S_{obs} + \frac{L^2}{2M}$$

where S is the number of species; L is the number of uniques; and M is the number of duplicates (Colwell & Coddington 1994). The more complex ICE estimator performs similarly to the Chao2 estimator but is less sensitive to patchiness in the database. Chao2 and ICE mean values were calculated from raw sample data using EstimateS software (Colwell 2005).

Table 1. Species Checklist: Ngerutechei IBA Study Site. Migratory species are indicated by an asterisk (*).

Micronesian Megapode	<i>Megapodius laperouse</i>
White-tailed Tropicbird	<i>Phaethon lepturus</i>
Little Pied Cormorant	<i>Phalacrocorax melanoleucos</i>
Yellow Bittern	<i>Ixobrychus sinensis</i>
Intermediate Egret *	<i>Egretta intermedia</i>
Cattle Egret *	<i>Bubulcus ibis</i>
Rufous Night-Heron	<i>Nycticorax caledonicus</i>
Slaty-legged Crake	<i>Rallina eurizonoides</i>
Buff-banded Rail	<i>Gallirallus philippensis</i>
Black-bellied Plover *	<i>Pluvialis squatarola</i>
Black-winged Stilt *	<i>Himantopus himantopus</i>
Common Greenshank*	<i>Tringa nebularia</i>
Wood Sandpiper *	<i>Tringa glareola</i>
Common Sandpiper *	<i>Actitis hypoleucos</i>
Black-naped Tern	<i>Sterna sumatrana</i>
Brown Noddy	<i>Anous stolidus</i>
Black Noddy	<i>Anous minutus</i>
White Tern	<i>Gygis alba</i>
Nicobar Pigeon	<i>Caloenas nicobarica</i>
Palau Fruit-Dove	<i>Ptilinopus pelewensis</i>
Micronesian Imperial-Pigeon	<i>Ducula oceanica</i>
Palau Owl	<i>Pyrroglaux podargina</i>
Gray (Jungle) Nightjar	<i>Caprimulgus indicus</i>
Palau Swiftlet	<i>Aerodramus pelewensis</i>
Collared Kingfisher	<i>Todiramphus chloris</i>
Micronesian Kingfisher	<i>Todiramphus cinnamominus</i>
Micronesian Honeyeater	<i>Myzomela rubrata</i>
White-breasted Woodswallow	<i>Artamus leucorynchus</i>
Cicadabird	<i>Coracina tenuirostris</i>
Morningbird	<i>Colluricincla tenebrosa</i>
Palau Fantail	<i>Rhipidura lepida</i>
Palau Flycatcher	<i>Myiagra erythrops</i>
Barn Swallow *	<i>Hirunda rustica</i>
Palau Bush-Warbler	<i>Cettia annae</i>
Dusky White-eye	<i>Zosterops finschii</i>
Giant White-eye	<i>Megazosterops palauensis</i>
Citrine White-eye	<i>Zosterops semperi</i>

Results

A cumulative total of 38 bird species, including 30 resident species and 8 migratory species, were observed during the 26 visits to sample the study site. The number of species per sample ranged from 5 to 21, averaging 16 species per

Table 2: Cumulative Summary of Palau Resident (Non-migratory) Species by Sample (Ngerutechei IBA)

Common Name / Sample No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	
Morningbird	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	
Collared Kingfisher	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Micronesian Kingfisher	X	X		X	X		X	X		X	X	X		X				X	X					X		X	
Micronesian Starling	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Palau Fruit-Dove	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Palau Bush-Warbler		X	X	X		X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X
Micronesian Honeyeater		X	X		X	X	X	X		X		X		X	X		X		X	X	X	X	X	X	X	X	X
Palau Flycatcher		X	X	X	X	X		X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
White-breasted Woodswallow		X	X	X		X		X	X		X			X		X			X	X	X	X	X	X	X	X	
White-tailed Tropicbird		X	X					X	X		X	X		X	X		X	X	X	X		X	X		X		
Dusky White-eye		X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Micronesian Imperial-Pigeon		X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Citrine White-eye			X			X		X		X	X										X						
Cicadabird			X	X		X			X				X	X	X	X				X	X	X	X	X	X	X	
Brown Noddy			X		X			X	X	X	X		X		X			X	X	X	X		X				

sample. Table 1 lists the 38 species, including migratory species, observed during this survey.

Table 2 summarizes the species accumulation data for the 30 Palau resident species only. Excluding the 8 migratory species, which have been previously reported from Palau (VanderWerf *et al.* 2006), our survey found 30 resident species with an average of 16 resident species per sample, range 5 to 19 species per sample. Eight of these 30 species were not previously recorded from the IBA. Our survey confirmed 19 of the 20 resident bird species that were reported by the previous surveys (Engbring 1992, VanderWerf 2007) of the Ngerutechei IBA. The exception is the Palau Ground-Dove (*Gallicolumba canifrons*). The Engbring (1992) survey recorded the Palau Ground-Dove from the IBA area however; the VanderWerf (2007) survey and our survey did not confirm the presence of this rare species in the IBA.

Palau Resident Birds. Figure 1 depicts a species accumulation curve for the 30 resident species (Table 2) observed during the 26 visits to the survey site along with the mean values of the Chao2 and ICE estimators of species richness. The Chao2 endpoint value is 30.00 (SD < 0.01) and the ICE endpoint value is 30.00 (SD < 0.01).

Field Notes: Local Range Extensions (Ngerutechei IBA): The following field observations concern new records for the eight resident bird species that were *not* recorded by the previous surveys of the Ngerutechei IBA.

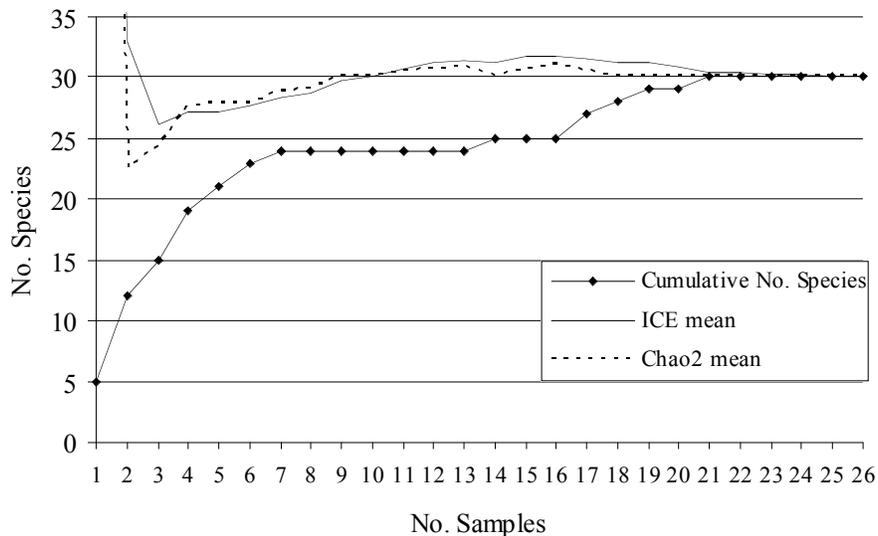


Figure 1. Palau Resident (Non-migratory) Bird Species Accumulation Curve

White-breasted Woodswallow. Infrequently observed in Palau, White-breasted Woodswallows were sighted on 16 of 26 occasions, usually from mid-morning to dusk. They were observed perching singly and in groups of two to five birds; or hawking insect prey along the river bank and above the flood plain. Prey included caterpillars, cicadas, dragonflies, grasshoppers and vespid wasps. The stocky black body, black head and throat, white belly and rump, triangular wings, and thick, slaty beak distinguished the woodswallows from other swallows and swiftlets known to occur in Palau. A juvenile woodswallow was observed in January 2008.

Giant White-eye. The distribution of this endemic species is reportedly restricted to two islands in the southern lagoon of Palau (Engbring 1988) however; on three separate occasions Giant White-eyes were observed at close range (5 - 10 meters) foraging at the study site in the riparian forest understory along the banks of the river, well north of their presumed restricted range. On one occasion a group of three Giant White-eyes was seen by twelve observers along the northern river bank demarcation of the study site. On another occasion a group of five was seen by four observers along the western river bank demarcation and on the final occasion, a group of three was seen by the authors in the same area. The combination of large size, brownish olive color, yellow beak, dark legs, light eyebrow and lack of white eyering distinguished this species from other white-eyes found in Palau and from the similar-appearing Palau Bush-Warbler. Bush-warblers are distinguished by bright yellow-orange legs and lack of eyebrow. These sightings represent the first published observations of Giant White-eyes on Babeldaob Island.

Gray Nightjar. Nightjars were seen at night in the swamp forest on five separate evenings using a portable floodlight to detect reflections from the birds' eyes. Previous surveys did not report the Gray Nightjar in the Ngerutechei IBA but these were not conducted a night when nightjars are active.

Slaty-legged Crake. Pairs of this rarely-seen crake were spotted twice in the flood plain area of the study site, where they quickly sought cover in the tall grass. This species was differentiated from other crakes and rails by the uniformly brown wings and back, chestnut head and chest, and no eyebrow. The soft "kok" calls of this species were heard on the same day as the second sighting but at a different location in the study site, indicating that there was more than one pair of Slaty-legged Crakes in the area.

Various Nomads. Four nomadic Palau residents were sighted in the swamp forest area of the study site: Little Pied Cormorant, Black-naped Tern, Rufous Night-Heron and Yellow Bittern. None of these were reported by the previous surveys of the IBA site. All are easily recognized local resident species.

Field Notes: Local Range Confirmations (Ngerutechei IBA): The following field observations concern four additional species that were recorded by only one

of the two previous surveys but whose occurrence in the Ngerutechei IBA was confirmed by our survey results.

Brown Noddy. The Brown Noddy was not detected in the Ngerutechei IBA during the survey by VanderWerf (2007) although Engbring (1992) recorded it in the area. Brown Noddies were observed on 13 of 26 occasions, confirming that the Brown Noddy frequents the IBA. The combination of size, plumage color, tail length and differences in the intensity of the white coloration of the crown served to distinguish Brown Noddies from Black Noddies. The crown of the Brown Noddy is typically dull white while the crown of the Black Noddy normally appears bright white.

Nicobar Pigeon. Engbring (1992) did not detect this near-threatened species in the IBA area however; VanderWerf (2007) lists the Nicobar Pigeon as present in the Ngerutechei IBA. We spotted Nicobar Pigeons in the swamp forest four times. The large size, black body and short white tail differentiate this species from other pigeons and doves.

Palau Owl. Engbring (1992) did not detect this endemic species in the Ngerutechei IBA however; VanderWerf (2007) lists it as present. We saw and heard Palau Owls on several evening visits to the site.

Micronesian Megapode. Engbring (1992) did not detect megapodes in the Ngerutechei IBA area however; VanderWerf (2007) lists this species as present in the IBA. This elusive endangered species was observed twice in the upland forest area south of the utility road demarcation.

The remaining 18 species listed in Table 2 (Morningbird, Collared Kingfisher, Micronesian Kingfisher, Micronesian Starling, Palau Fruit-Dove, Palau Bush-Warbler, Micronesian Honeyeater, Palau Flycatcher, White-tailed Tropicbird, Micronesian Imperial-Pigeon, Dusky White-eye, Citrine White-eye, Cicadabird, Black Noddy, Palau Swiftlet, Palau Fantail, Buff-banded Rail and White Tern) were reported by all three surveys.

Field Notes: Breeding. The following breeding or nesting behaviors were observed at the study site during the study period. It is likely that many of the other territorial species observed during this study also nest at this site.

Kingfishers. Resident pairs of adult Collared Kingfishers and adult Micronesian Kingfisher were observed at the study site, an indication of possible breeding (Kessler & Haig 2007) at the site (although no actual nests were located). Pairs of Collared Kingfishers were sighted in August 2007 and again in October 2007. A pair of Micronesian Kingfishers was seen in August 2007 and again at the end of the study. We frequently observed individuals of both species in the study area on the same day, apparently sharing the same territory to some degree. The only two resident kingfishers in Palau, Micronesian Kingfishers and Collared Kingfishers are blue with white breasts. They were differentiated by the color of the crown (cinnamon brown vs. dark blue-black respectively). Micronesian Kingfishers were seen feeding on grasshoppers.

Palau Flycatcher. On two occasions in January 2008 we observed Palau flycatchers gathering spider webbing for nest-building. The birds flew into the understory of the riparian forest with their nesting material. Flycatcher use of spider webs for nest-building was previously recorded by Pratt *et al.* (1980).

Black Noddy. Both Black Noddies and Brown Noddies were observed at the study site but only the Black Noddy was observed nesting there. A pair of Black Noddies was observed building and occupying a nest in a tree on the bank of the river during January - March 2008. A single juvenile hatched, fledging from the nest in mid-March 2008. The nesting Black Noddies were approached closely enough to confirm the characteristic bill, which is thin and somewhat longer than the head.

Field Notes: Other. The following are additional field observations.

Migratory Birds. Our records for migratory birds at this site (*cf.* Table 1) consist of singleton sightings only. No large groups of migrants were observed nor were any of the migrant species recorded more than once during the study. It appears that the study site is a convenient rest stop for lone migrants. We have, however, observed groups of Whimbrels and Common Sandpipers in the mangrove forest immediately downstream from the study site, opening the possibility that groups of migrants may assemble in the mangroves or other coastal areas and the individuals we observed at the study site strayed inland from downstream congregations.

Flying Fox. In addition to bird species, we recorded the presence of Micronesian Flying Foxes (*Pteropus mariannus*) during every visit to the study site. The bats were seen resting and feeding in tall trees, especially along the river bank. Vocalizations were heard from the interior of the swamp forest, at dusk and in the evening.

Discussion and Conclusions

The endpoint values of the ICE and Chao2 estimators (Figure 1) indicate that the observed cumulative total of 30 species is a realistic estimate of the resident bird species richness of the study site in the Ngerutechei IBA. This is the first statistically rigorous estimation of species richness to be reported for a locality on Babeldaob Island and it represents a higher level of resident bird diversity than was previously thought to occur in the Ngerutechei Important Bird Area or any other locality in Palau. For example, the most recent Important Bird Area survey (VanderWerf 2007) reported a total of 19 resident species occurring in the Ngerutechei IBA, while the earlier report by Engbring (1992) listed 18 resident species in Ngerutechei. According to Gupta (2006), the average observed number of resident species per IBA on Babeldaob ranged from 14 to 25 species. Our previous (unpublished) species richness research yielded unremarkable data that aligned with Gupta's characterizations of the species richness of IBA localities. Over a one-year period, we found cumulative totals of 22 species

in each of two typical upland forest sites on Babeldaob Island and 24 species in a typical limestone island forest in the southern lagoon.

On a regional scale, the most recent published account of Micronesian birds (Wiles 2005) recognizes only 32 resident land and wetland bird species throughout Palau. Excluding the six seabirds listed in Table 1 (tropicbird, cormorant, terns and noddies), the Ngerutechei study site tallied 75% (24 of 32 species) of the recognized species of land and wetland birds in Palau. In contrast, a recent review of bird surveys on Pohnpei Island in eastern Micronesia reported 29 resident bird species along 19 separate transects representing the entire island of Pohnpei (Buden 2000).

Our survey data emphasize the value of the study site as a species-rich refuge for resident land birds, including an endangered and rare species as well as local and regional endemic species. The noteworthy species richness of this site far exceeds expectations for localities in Palau. Our recommendations are: (1) preserve the Ngerutechei study site as a bird sanctuary to help conserve the site's exceptionally rich bird diversity; (2) establish sentinel stations at the study site for long-term monitoring of the bird diversity and other biodiversity at this ecologically valuable site and for evaluating impacts on that biodiversity from disturbances such as road-building and other development activities.

Acknowledgments

Funding was provided by David and Lucile Packard Foundation (Grant # 2005-29046) and Canada Fund (Project 60006002). We thank: Demei Otobed for manuscript review and comments; Faustina Rehuher (Belau National Museum), Ngaremlengui State Government and Palau Conservation Society for supporting this project; Les Christidis (Australian Museum) and the Pacific Islands Museum Association for technical support and guidance; Gary Wiles for encouragement and comments; companion birdwatchers Angie, Heather, Jesse, Kuniko, Mark, Melvin, Liz, Obichang, Scott, Umai and Yalap.

References

- Buden, D.W. 2000. A Comparison of 1983 and 1994 Bird Surveys of Pohnpei, Federated States of Micronesia. *Wilson Bulletin* 112: 403-410.
- Colwell, R.K. 2005. EstimateS: Statistical Estimation of Species Richness and Shared Species from Samples. Version 7.5. Persistent URL <purl.oclc.org/estimates>
- Colwell, R.K. & J.A. Coddington. 1994. Estimating Terrestrial Biodiversity through Extrapolation. *Philosophical Transactions of the Royal Society of London, Series B* 345: 101-118.
- Engbring, J. 1988. A Field Guide to the Birds of Palau. Bureau of Education. Koror. Palau. 92 pp.
- Engbring, J. 1992. A 1991 Survey of the Forest Birds of the Republic of Palau. US Fish and Wildlife Service. Honolulu HI. 81 pp.

- Gupta, A. 2006. Proposed Important Bird Areas in Palau: Using Birds as Indicators of Biodiversity. Palau Conservation Society. Koror, Palau. 64 pp.
- Kessler, D.C & S.M. Haig. 2007. Territoriality, Prospecting, and Dispersal among Cooperatively Breeding Micronesian Kingfishers (*Todiramphus cinnamominus reichenbachii*). *The Auk* 124: 381-395.
- Pratt, H.D., P.L. Bruner & D. Berrett. 1987. A Field Guide to the Birds of Hawaii and the Tropical Pacific. Princeton University Press. Princeton, NJ. 409 pp. + 45 pl.
- Pratt, H.D., J. Engbring, P. Brunner & D.G. Berrett. 1980. Notes on the Taxonomy, Natural History, and Status of the resident Birds of Palau. *The Condor* 82: 117-131.
- Ralph, C.J., G.R. Geupel, P. Pyle, T.E. Martin & D.F. DeSante, DF. 1993. Handbook of Field Methods for Monitoring Landbirds. Gen. Tech. Rep. PSW-GTR-144. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture. 99 pp.
- Robson, C. 2000. A Field Guide to the Birds of Thailand and South-east Asia. Asia Books. Bangkok. 504 pp.
- VanderWerf, E.A. 2007. 2005 Bird Surveys in the Republic of Palau. US Fish and Wildlife Service. Honolulu HI. 88 pp.
- VanderWerf, E.A. G.J. Wiles, A.P. Marshall & M. Knecht. 2006. Observations of Migrants and other Birds in Palau, April-May 2005, Including the First Micronesian Record of a Richard's Pipit. *Micronesica* 39: 11-29.
- Wiles, G.J. 2005. A Checklist of the Birds and Mammals of Micronesia. *Micronesica* 38: 141-189.

Received 26 March 2008, revised 1 July.

