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# The Birds of Nauru

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**Abstract:** Thirty-four species of birds are recorded from the isolated Pacific island of Nauru. Six are treated as hypothetical pending corroboration; 3 others are introductions. Eighteen of the 25 indigenous species are non-breeding visitors (mainly migrating seabirds and shorebirds). The 7 confirmed or probable resident breeders include only 2 land birds, the Micronesian pigeon (*Ducula oceanica*) and the endemic Nauru reed-warbler (*Acrocephalus rehsei*). The Australian pelican (*Pelecanus conspicillatus*) and white-winged tern (*Chlidonias leucopterus*) are reported as first records for Nauru. Hunting pressure and habitat degradation have contributed to reduced numbers of the Micronesian pigeon and the once abundant black noddy (*Anous minutus*), but the Nauru reed-warbler occurs commonly in degraded and modified habitats. Second-stage mining to recover phosphate deposits will likely reduce available habitat further for all resident breeding species, although land restoration is also planned. Bird band recoveries indicate that many seabirds, especially black noddies, reach Nauru thousands of kilometres from where they were fledged, but to what extent they are recruited into the local breeding population is unknown.

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## INTRODUCTION

Little is known of the birds of Nauru, a small, single-island republic in the western Pacific Ocean (Fig. 1). The avifauna has never been reviewed systematically, and the ornithological literature is limited to a scattering of older and briefly annotated locality records that have been restated in secondary lists, in some cases with additional but unsubstantiated records. The present study furnishes an annotated list of all the species recorded on Nauru, and is based on personal observations, gleanings from the literature, conversations with resident islanders, and information from specimen labels and catalogues; locality records that could not be traced to a primary, first-hand source are treated as hypothetical.

### Ornithological history

The first naturalist to have visited Nauru appears to have been Otto Finsch, who spent 6 hours ashore on 24 Jul 1880 while en route to the Solomon Islands from the Marshall Islands. Finsch (1881) remarked briefly on the 5 species he observed, including a reed-warbler that he initially reported as *Calamoherpe syrinx*, and which he (Finsch 1883) later described as a new species, *C. rehsei* (= *Acrocephalus rehsei*), endemic to Nauru.

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Ludwig Kaiser, a District Officer in the German Administration on Nauru from 1898 to 1906, provided information on plumage colour and measurements of 16 specimens of 12 species that he collected on Nauru in 1900 (Kaiser 1902). This collection (in the Museum für Naturkunde Berlin [ZMB]), and its little known associated publication (Kaiser 1902), have been largely overlooked until now. Frahnert & Buden (*in press*) provide a taxonomically updated account of this material along with collection dates and additional notes from specimen labels. North (1903) reported briefly on 5 fluid-preserved specimens of 4 species (but no new records) obtained by F. D. Power and A. E. Stephen on unspecified dates (specimens in the Australian Museum).

Father Alois Kayser, a Roman Catholic missionary, arrived on Nauru in 1904 and spent nearly 40 years on the island. He wrote extensively on Naruan life, including on the importance of frigatebirds (*Fregata* spp.) and noddies (*Anous* spp.) in Naruan culture and tradition (Kayser 2005--originally published in German, 1921-1924). Ernest Stephen, who spent most of his life on Nauru after being marooned during the 1870s, also commented on birds (Stephen 1936), but his use of colloquial names and vague descriptions makes it difficult to determine many of the species to which he was referring. His notes were written around 1902 or

1903, and were published posthumously (C. H. Wedgwood in Stephen 1936). Paul Hambruch spent 6 weeks on Nauru in 1910 as a member of the German South Seas Expedition 1908-1910, focusing largely on ethnography. In the faunal sections of his two-volume expedition report, Hambruch (1914, 1915) mentions most of the species recorded previously along with highly questionable records of a rail (ralle), honeyeater (honigsauger), and a flycatcher (fliegenschnäpper) of the genus *Rhipidura*, none of which is mentioned in any other source.

More recently, Pearson (1962) provided an annotated list of at least 16 species (18 if 2 species of *Fregata* and tattlers [*Tringa brevipes* and *T. incana*] were present) that he observed from January to July and 1 to 6 November 1961. His Nauru list was published in the same paper with his list of birds from Ocean Island and some of the latter records possibly were erroneously incorporated into Nauru bird lists by other authors, accounting in part for some otherwise unverifiable Nauru records. Owen's (1977) checklist of the birds of Micronesia lists 15 species for Nauru and is based almost entirely on Pearson's Nauru list. It excludes Pearson's records of an introduced finch and *Heteroscles* sp., and includes the addition of *Puffinus lherminieri*, citing Baker (1951) as a source. King (1967) provided a list of seabirds under the heading "Gilbert Islands including Ocean and Nauru Islands" but did not specify which records pertained to Nauru. Likewise, Garnett (1984), reporting on the distribution and status of seabirds in the South Pacific, treated Nauru and the Gilbert Islands together. These 2 articles also may account for some of the otherwise unverifiable Nauru locality records in more recently published lists, including Pratt *et al*. (1987) and online lists such as Avibase (Lepage 2007), Birds of the Pacific: a Birder's Checklist (Silcock 2007), and the Bird Data Project (Penhallurick 2007).

There have been no first hand survey reports of birds on Nauru since at least the early 1990s. BirdLife International (2007a) cited "B. Fletcher (*in litt*. 1995)" on the status of *Acrocephalus rehsei*, and a few other papers have commented on the status of some Nauru birds, including bird band recovery records. In this paper, I review the status of birds on Nauru, with a view to updating information on their distribution and abundance, and consolidating information obtained from a scattering of often obscure references.

## METHODS

### Study Area

Nauru is a small (21 km$^2$), raised atoll in the west-central Pacific Ocean (0°32'S, 166°56'E), approximately 2,100 km northeast of New Guinea; the nearest land is Ocean Island (Banaba), 300 km to the east. The climate is equatorial; the average monthly temperature ranges from 27° to 29°C, and the average annual rainfall is about 2,000 mm, with the wettest months being Dec to Apr. A 100-300 m-wide, semi-fertile coastal belt abuts a steep scarp that rises to approximately 30-40 m in most areas to form the edge of a central plateau, with a maximum elevation of 72 m. Approximately 10,000 islanders reside on Nauru, mainly along the coast and in a small settlement centered about the brackish Buada Lagoon in a low area of the plateau in the southwest part of the island. The coastal vegetation consists largely of strand, scrub, scattered coconut trees, and a variety of ornamentals and fruit trees. Much of the soil and the natural vegetation of the plateau have been stripped away during the mining of phosphate, leaving a largely barren landscape of coral limestone pinnacles rising 4-8 m, with some regenerating scrub, including both indigenous and exotic species. Manner *et al*. (1984) remarked that "although exotic ruderals are the initial colonizers of abandoned mined sites, they are rapidly displaced by indigenous species." Pockets of older, residual forest dominated by tomano trees (*Calophyllum inophyllum*) and strangler fig (*Ficus prolixa*) are found mainly on the gentler slopes of the scarp and at its base. In describing the impact of human activities on the environment of Nauru, Thaman (1992) stated "long habitation; almost a century of open-cast phosphate mining; continuous bombing, destruction, and displacement of the people during World War II; rapid urbanization; and the abandonment of agriculture and subsistence activities on Nauru have arguably produced one of the most severely modified natural and cultural floras on earth." Further descriptions of the physiognomy and vegetation of Nauru are provided by Manner *et al*. (1984), Thaman *et al*. (1994), and Morrison & Manner (2005).

Potential predators include introduced dogs (*Canis familiaris*) and cats (*Felis catus*), some now feral, and rats (*Rattus exulans* and *R. tanezumi*).

### Data collection and analysis

Only records from the island and its inshore waters are included; no attempt was made to include records at sea within the limits of the Nauru territorial waters (12 nm) or exclusive economic zone (200 nm). Field observations were made during 12-25 Dec 2006 and 29 Mar to 5 Apr 2007. *Acrocephalus rehsei* survey counts were made by recording all birds seen or heard calling during walks along roads and trails for unpredetermined distances measured by GPS tracking, and within an estimated 50-m wide zone. Shorebird surveys were done by counting all identified birds encountered during walks along beaches at low tide. Terms of abundance are: common (more than 15 sightings per day), fairly

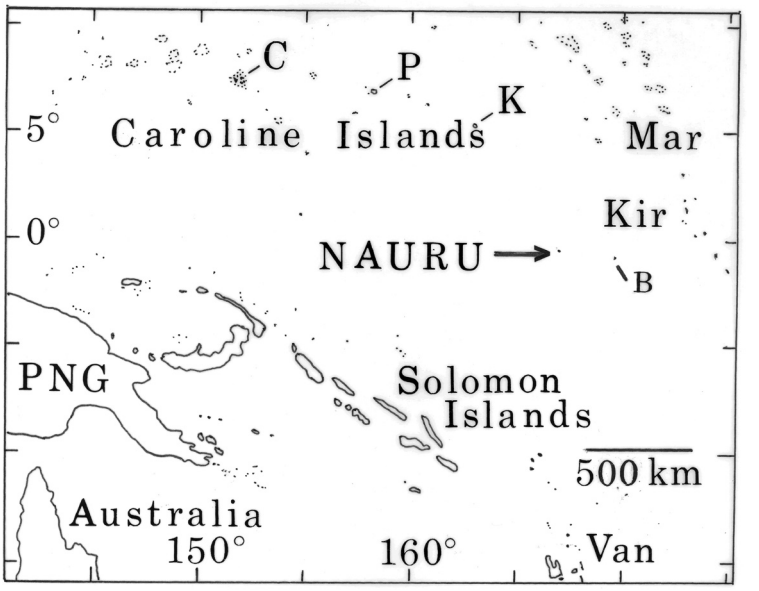


Fig. 1. Location map for Nauru and surrounding islands; B = Banaba (= Ocean Island), C = Chuuk, K = Kosrae, P = Pohnpei, Kir = Kiribati, Mar = Marshall Islands, Van = Vanuatu, PNG = Papua New Guinea.

common (5-15 sightings on most days), uncommon (fewer than 5 sightings per day and unrecorded on some days), scarce (observed occasionally and known only from few records, but not unexpected). Terms of status are: resident (present year-round and breeding confirmed or very probable), non-breeding visitor (passage migrant or non-breeding season visitor, some birds present throughout the year, but not breeding), vagrant (unexpected visitor and recorded only once or twice), and hypothetical (a record in need of corroboration).

All but 2 of the bird band recovery records are from the files of the Bird Banding Laboratory (BBL), Laurel, Maryland; the 2 exceptions are from literature sources. Names of banding locations were determined by using Google Earth and MapQuest online programs with the decimal coordinates provided by BBL. Birds recorded as BBL age class 4, defined as "local" and "young incapable of sustained flight" in the BBL online manual, are referred to here as flightless young.

**Nomenclature**

Scientific names and English names follow Clements (2007) unless indicated otherwise. Naruan names given immediately after the English name at the head of each species account, if available, are from Cain *et al.* (1997), except in the case of ederakui, a local name used by Kayser (2005) for a bird fitting the description of Audubon's shearwater (*Puffinus lherminieri*).

## SPECIES ACCOUNTS

**Audubon's shearwater**, Ederakui (*Puffinus lherminieri*), probably extirpated. Murphy (1927) remarked on "specimens [of *P. lherminieri dichrous*] in the Berlin Museum from Nauru and the Pelews." His Nauru material probably consisted of the 1 specimen collected by Kaiser (Kaiser 1902; Frahnert & Buden *in press*); I know of no others. Kayser (2005) described the "ederakui" as a shy night bird that lives in deep, narrow caves in cliffs during the day, searches for food at sea at night, has a peculiar cry e-de-ra-kui, e-de-ra-kui, for which it is named, and that it makes a running start from outside its lair before taking off. Almost certainly the ederakui is this species. Kayser (2005) stated that the bird is caught for "sport and fun," but it is not eaten because "the meat tastes very oily." Hambruch (1914) listed the ederakui as one of 2 species of "Movarten (*Sterna*)" on Nauru. Pearson (1962) did not encounter any shearwaters on Nauru during his 6 months on the island, but he heard them calling at night in mid-July on Banaba Island. I neither saw nor heard shearwaters during my visits and none of the Naruans I queried were familiar with a bird having such characteristics, or having the name ederakui.

**Red-tailed tropicbird** (*Phaethon rubricauda*), hypothetical. Pratt *et al*. (1987), Cain *et al*. (1997), Lepage (2007), Penhallurick (2007), and Silcock (2007) recorded the red-tailed tropicbird as occurring in Nauru, but did not cite the original source. Its inclusion in these lists possibly stems from earlier reports that combined records from Nauru and the Gilbert Islands (e.g. King 1967; Garnett 1984), or from Pearson (1962) who recorded it on Ocean Island, but not on Nauru. This species may occur on Nauru from time to time, but the record needs corroboration.

**White-tailed tropicbird**, Dedage (*Phaethon lepturus*), scarce or uncommon and probably resident, breeding not confirmed. Pearson (1962) observed white-tailed tropicbirds regularly in ones and twos, some flying into holes in the more inaccessible areas of the cliffs, possibly nesting. I saw none during my visits but many islanders told me of seeing tropic birds in the vicinity of the cliffs.

**Australian pelican** (*Pelecanus conspicillatus*), vagrant. Pratt *et al*. (1987) remarked that the Australian pelican breeds throughout Australia and disperses widely and in large numbers during droughts, reaching Palau and Fiji among the islands of the tropical Pacific; there are several records for the Solomon Islands immediately to the southwest of Nauru (Cain & Galbraith 1956). An Australian Pelican was observed on Nauru, first on 29 Aug 2002, and over a period of several days was resident at Buada Lagoon (Anonymous 2002, with accompanying photograph). This is a first record of *P. conspicillatus* for Nauru and an extralimital record for Micronesia. I was told the bird was caught and held in captivity for a time.

**Red-footed booby** (*Sula sula*), vagrant. One study skin of a red-footed booby in the Museum für Naturkunde Berlin and collected by Ludwig Kaiser on 3 Mar 1900 is the only record for Nauru (Kaiser 1902; Frahnert & Buden *in press*).

**Brown booby**, Gogora (*Sula leucogaster*), probably an uncommon non-breeeding visitor. A brown booby banded at Johnston Atoll, and another at Moku Manu, Hawaii were recovered on Nauru (Table 1). Pearson (1962) observed groups of up to 12 brown boobies (including juveniles) regularly on the southeastern side of the island, but found no evidence of nesting. I saw no *S. leucogaster* during my visits.

**Great frigatebird**, Itsi (*Fregata minor*) and **lesser frigatebird**, Itsi (*F. ariel*), non-breeding visitors. Much has been written about the importance of frigatebirds in Naruan culture and tradition (e.g. Finsch 1881; Stephen 1936; Earle 1941; Garnett 1987a, b). Kayser (2005) devoted more than 27 pages to this subject, and Earle (1941:20) wrote that "from time immemorial it has been the ambition of every youth to excel in the snaring of the "iti" or frigatebird [and that] in the old far-off days, before the coming of the white man, prowess in capture of the iti was one of the many strenuous tests which marked transition from youth into manhood, and failure to acquit oneself creditably meant disgrace." He went on to say that "this aspect of the sport has now been lost; it is now a harmless pastime for men of leisure…." Garnett (1987a) stated "the sport called *Ibon Itsi* is a competition between two groups of men who, two or three times a year, spend about a week to catch as many frigate-birds as possible." I observed numerous birds in captivity, some in cages and others trained to occupy roosts constructed along the beaches, but saw no games, and only a few wild birds in flight. Birds typically are captured by slinging the weighted end of a coil of line in front of an approaching bird attracted to previously captured birds used as decoys. In a successful toss, the line becomes entangled about the bird's wing and bringing it to ground.

Two species of frigatebirds are recorded from Nauru, both as non-breeding visitors: the great frigatebird, *F. minor* is scarce or uncommon, whereas the lesser frigatebird, *F. ariel,* although uncommon, is more numerous. The 2 species are sometimes difficult to distinguish in the field and sight records are not always reliable. The 49 I counted in cages and on roosts on beaches on 31 Mar 2007 appeared to be *F. ariel*, and mainly young birds. I saw none that I could positively identify as *F. minor*. One resident told me that some birds are painted black to make them more attractive as decoys. Pearson (1962) reported that frigatebirds (unidentified to species) "sometimes appear in large flocks, as when a flock of 30-40 appeared on 10 Mar [1961]." Five of the 6 band recoveries of frigatebirds I obtained for Nauru are *F. ariel* (Table 1), as are the 3 specimens collected by Kaiser (Kaiser 1902; Frahnert & Buden *in press*). Additionally, the somewhat grainy, still images of a frigatebird taken from a Cousteau Society film (Nauru: the island planet) produced in 1992 are very probably first year *F. ariel* (D. James, *pers. comm*.).

**Pacific reef heron**, Gogora (*Egretta sacra*), scarce, breeding status uncertain. The "white crane" and "blue crane" mentioned by Stephen (1936) probably are two different colour morphs of this species. Finsch (1881) expressed surprise at not encountering this species on Nauru, inasmuch as he saw it on most of the other islands he visited. Pearson (1962) saw only 6 in 6 months, all dark phase. I saw none.

**Feral fowl** (**domestic fowl**), Domo (*Gallus gallus*), introduced. Fowl are common throughout the coastal zone and roam freely in and around the settlements. I saw and heard only two or three feral fowl on the central plateau. The time of the initial introduction is unknown. However, as early as 1845, 1 visitor wrote of 8-10 islanders approaching in canoes and bringing "a few very small fowls, some cocoa-nuts, and 2 or 3 straw hats" for sale (Anonymous 1845), the fowls probably being this species.

**Pacific golden plover**, Iwyiyi (*Pluvialis fulva*), common non-breeding visitor. This species was first recorded on Nauru by Kaiser and there is a specimen in the Museum für Naturkunde Berlin

(Kaiser 1902; Frahnert & Buden *in press*). Pearson (1962) recorded "about 1000…in the early part of the year…[and] considerably fewer in June." I observed *P. fulva* on beaches and tidal flats regularly in Dec and during Mar/Apr), and less frequently in open areas on the central plateau.

**Grey** (**black-bellied**) **plover** (*Pluvialis squatarola*), vagrant. One seen by Pearson (1962) on 2 May 1961 is the only record.

**Lesser sandplover** (*Charadrius mongolus*) and **greater sandplover** (*C. leschenaultii*), hypothetical. The lesser and greater sandplovers both are recorded from Nauru in several recent checklists (Pratt *et al*. 1987; Lepage 2007; Penhallurick 2007; Silcock 2007) but without further details or any indication of the original source. Both species have been recorded from the Solomon Islands, immediately to the southwest (Bull 1948; French 1957; Buckingham *et al*. 1995). Both species are likely to occur as nonbreeding visitors, but I view the records as in need of corroboration. Several unidentified plovers I saw at a distance may have included one or both of these species.

**Bar-tailed godwit** (*Limosa lapponica*), hypothetical. This species is listed for Nauru by Pratt *et al*. (1987) and Lepage (2007), but without attribution. Pearson (1962) recorded it on Ocean Island but not on Nauru. It has been recorded from the Solomon Islands immediately to the southwest (e.g. Bull 1948; French 1957; Blaber 1990). I treat the Nauru record as hypothetical pending confirmation.

**Whimbrel**, Kiwoiy (*Numenius phaeopus*), non-breeding visitor. I observed whimbrels occasionally in Dec, but none during late Mar and early Apr. A male *N. p. variegatus* was collected by Kaiser on 3 Mar 1900 (Kaiser 1902; Frahnert & Buden *in press*). The whimbrel occurs widely throughout Micronesia during the non-breeding season (Pratt *et al*. 1987; Wiles 2005), and is probably more common on Nauru than the few records indicate. The subspecies *N. p. variegatus* breeds in northeastern Asia and migrates southward to Indo-Australia and the islands of Oceania (Cramp & Simmons 1983, Skeel & Mallory 1996).

**Bristle-thighed curlew** (*Numenius tahitiensis*), non-breeding visitor. BirdLife International (2007b) included Nauru in a long list of oceanic island localities for the bristle-thighed curlew, and Lepage (2007) included this species in the Avibase checklist for Nauru, but no specific source was cited in these accounts. BirdLife International data files hold no additional information on this record (S. Butchart *pers. comm.*). No records for Nauru were listed by Owen (1977) or by Pratt *et al*. (1987) in their respective checklists for the island. The range map for this species in Stickney (1943) includes Nauru within its boundaries, but the island republic is not included in the accompanying list of locality records.

The only confirmed record of the bristle-thighed curlew on Nauru is a male that was 1 of 15 adult birds satellite-tagged on their breeding grounds in the Yukon Delta Wildlife Refuge, western Alaska, in Jun 2007 (United States Geological Survey 2008). It was recorded last on Nauru on 27 Aug, before its transmitter went off the air. Of the 11 birds that were tracked as they left Alaska, beginning in early Aug 2007, and until their transmissions ceased, 7 were recorded in the Marshall Islands, and 1 each in Nauru and the Gilbert Islands (Kiribati); another ceased transmission in mid-air during migration and another traveled only as far as Lisianski, Northwestern Hawaiian Islands. This species has also been recorded from the Solomon Islands (Scofield 1994; Dutson 2001). In view of the relatively close proximity of the Marshalls, Gilberts, and Solomons to Nauru, the bristle-thighed curlew probably is a more frequent visitor to Nauru than the records indicate.

**Grey-tailed tattler** (*Tringa brevipes*) and **wandering tattler** (*T. incana*), non-breeding visitors. The 2 species of tattlers, *T. brevipes* and *T. incana*, are difficult to distinguish in the field and I treat them together. Both occur widely in Micronesia (Wiles 2005). The only records of the grey-tailed tattler (*T. brevipes*) from Nauru are the 3 or 4 I identified on the basis of their bisyllabic calls in Dec 2006 and in Apr 2007. Records of the wandering tattler (*T. incana*) include 1 specimen in the Australian Museum (reg. no. 0.12118) collected by F. D. Power and A. E. Stevens on an unspecified date (see North 1903), and another in the Kaiser collection in the Museum für Naturkunde Berlin (Kaiser 1902; Frahnert & Buden *in press*). Pearson (1962) recorded tattlers (unidentified to species) as "quite common in ones and twos…[and] with flocks of up to 20 birds on three occasions." I encountered them regularly on beaches and reef flats at low tide, usually as singles, and most of them being *T. incana*, based on their calls.

**Ruddy turnstone**, Dugudubwa, (*Arenaria interpres*), common non-breeding visitor. The ruddy turnstone has been recorded in all previous avifaunal lists of Nauru. Stephen (1936) and Kayser (2005) indicated the birds arrive each year in August and September and that they are often snared by residents, kept as pets in cages, and used for "cock fighting" games and whistling contests. Pearson (1962) reported seeing up to 40 on the shore and inland, beginning in March. I regularly saw ruddy turnstones usually in small groups of 5-10, but more frequently in mid-Dec than in early Apr, and with a maximum of 32

together on 20 Dec 2006.

**Sharp-tailed sandpiper** (*Calidris acuminata*), vagrant. One seen on the airstrip on 5 Nov 1961 is the only record (Pearson 1962).

**Brown noddy**, Doquae (*Anous stolidus*), fairly common to common breeding resident. Pearson (1962) considered the brown noddy "common everywhere," and he estimated approximately 3,000 on the island, breeding in coconut trees, on the shore terrace, and among the pinnacles on the plateau. I saw *A. stolidus* in small numbers regularly during my 2 visits but have no population estimates. The bands of 6 brown noddies banded at 4 different islands or island groups and recovered at Nauru (Table 1) indicate the possibility of recruitment from populations elsewhere in the Pacific.

**Black noddy**, Demererik (*Anous minutus*), fairly common to common breeding resident. The black noddy is encountered regularly throughout Nauru but in fewer numbers than in the past, and I never encountered long skeins returning to roosting sites at dusk (or departing at dawn) as I have on atoll islands elsewhere in Micronesia. That *A. minutus* is still resident on Nauru is surprising in view of continuous hunting pressure and loss of habitat through mining. Recruitment from breeding populations elsewhere in the Pacific may contribute to sustaining this population. Among the 31 bird bands recovered on Nauru (Table 1), 16 are from *A. minutus*, and 15 of them were fledged in the Northwest Hawaiian Islands, over 4,000 km to the north.

Mining operations have removed most of the large trees favored as nesting sites for this species. Kayser (2005) stated that "the small black gulls nest in the large *eaniji* trees [(*Pisonia grandis*)] in the interior of the island far from the native settlements." He (Kayser 2005) further stated that "one sees nests with eggs, with freshly hatched chicks, young birds preparing to fly, and others flattering in their nests testing their wings, all at the same time throughout the whole year." This forest has since been reduced to patches, and *Pisonia* trees are scarce. I saw only a few nests during my visits, but did not record the tree species in which they were found. Pearson (1962) recorded black noddies in the thousands, and nesting in *Calophyllum* trees almost entirely on the inland plateau.

I observed hundreds of noddy-catching stations throughout the interior, especially along the edges of the plateau. Each consists of a few square metres of cleared ground around a slightly elevated platform (e.g. box, crate or natural rock formation) on which the catcher stands. The birds are snared in long-handled nets as they fly by at night. In the past, birds were drawn in by the catchers imitating their calls, or by using live decoys. Now, many catchers use taped calls played through loud speakers. I participated in 1 such hunt with a resident on 23 Dec 2006, but only 1 bird was caught and no others came within range. Throughout my stay on Nauru, and particularly in the Buada Lagoon area, I often saw men on bicycles and motor bikes at dusk who were carrying nets and preparing to hunt. The gravel roads throughout the interior were often littered with the wings of noddies discarded by hunters. Noddies are a popular food among the Naruan community, and on 1 occasion I saw a sign posted advertising noddies for sale. Although the birds are caught for food, there are also occasions when the men participate in team contests as sporting events to see who can catch the most birds; prizes are awarded and rivalries can at times be heated, especially over the rights to prime station areas.

**White tern**, Dagigia (*Gygis alba*), common breeding resident. The white tern is encountered throughout the island, but is most numerous in the remnant forest, particularly at the edge of the central plateau. Pearson (1962) considered it "common everywhere," and he estimated a total population of 500-1,000 individuals. On 19 Dec 2006, I counted 260 in 5.7 km (45.6/km) along the western and northwestern section of the perimeter road, which has numerous open views of scarp forest, where many of the birds were perched; many others doubtless were not seen, hidden by vegetation. Extrapolation for the entire distance of the 17 km-long road yields an estimate of 775 birds on the coastal belt. On the plateau, the birds are again more frequently encountered in remnant forest along the perimeter, and with relatively few being seen in the more recently mined areas. I roughly estimate a population of 1,000 to 2,000 adults on Nauru. Pearson (1962) reported that "breeding was observed at all stages" throughout his stay. I observed pairs mating in Dec and during Mar/Apr, and saw 1 downy young on a tree branch on 16 Dec 2006, and Finsch (1881) was brought a recently hatched young on 24 Jul 1880.

**Sooty tern** (*Onychoprion fuscatus*), vagrant. One banded on Jarvis Island in 1966 and recovered on Nauru in 1973, after having struck some object (BBL How Obtained Code 54) is the only confirmed record (Table 1).

**White-winged tern** (*Chlidonias leucopterus*), vagrant. The white-winged tern breeds in temperate Eurasia and migrates southward to South Africa and Australia (Strange 2000). Pratt *et al*. (1987) recorded it in the tropical Pacific as "an uncommon visitor to Palau, and vagrant to the Marianas." A white-winged tern in breeding plumage that I saw at Buada Lagoon on several occasions from 30 Mar to 4 Apr 2007 is the first record for Nauru. It flew

**Table 1** Bird band recoveries from Nauru.

| Species | Banding location[ab] | Date Banded | Recovered | Age at banding |
|---|---|---|---|---|
| Brown booby | Moku Manu[c] | 10/38 | 03/42 | < 11 months |
| | Johnston Atoll | 07/66 | 12/66 | < 8 months |
| Great frigatebird | Phoenix Islands | 02/66 | 02/78[d] | ? |
| Lesser frigatebird | Howland Island | 10/64 | 03/65[e] | flightless young |
| | Howland Island | 10/64 | 04/65[e] | flightless young |
| | Howland Island | 10/64 | 02/78[f] | flightless young |
| | Phoenix Islands | 11/64 | 07/65 | flightless young |
| | Phoenix Islands | 11/64 | 09/65 | ? |
| Sooty tern | Jarvis Island | 08/66 | 04/73 | ? |
| Brown noddy | FFS (NWHI) | 09/98 | 09/99 | flightless young |
| | Johnston Atoll | 08/69 | 12/69 | flightless young |
| | Johnston Atoll | 07/88 | 12/97 | flightless young |
| | Eniwetok Atoll | 06/67 | 01/77[f] | flightless young |
| | Phoenix Islands | 11/63 | 11/65 | flightless young |
| | Phoenix Islands | 06/73 | 12/75[f] | flightless young |
| Black noddy | Kure (NWHI) | 05/66 | 01/74 | ? |
| | Midway (NWHI) | 02/64 | 02/73 | ? |
| | FFS (NWHI) | 04/81 | 07/86 | flightless young |
| | FFS (NWHI) | 06/88 | 02/89 | flightless young |
| | FFS (NWHI) | 07/88 | 11/89 | flightless young |
| | FFS (NWHI) | 07/93 | 03/94 | flightless young |
| | FFS (NWHI) | 10/83 | 05/84 | flightless young |
| | FFS (NWHI) | 03/84 | 06/87 | flightless young |
| | FFS (NWHI) | 06/86 | 06/87 | flightless young |
| | FFS (NWHI) | 07/80 | 06/81 | flightless young |
| | FFS (NWHI) | 07/80 | 10/81 | flightless young |
| | FFS (NWHI) | 06/98 | 09/99 | flightless young |
| | FFS (NWHI) | 07/99 | ?[g] | flightless young |
| | FFS (NWHI) | 07/99 | ?[g] | flightless young |
| | FFS (NWHI) | 06/03 | ?[h] | flightless young |
| | Eniwetok Atoll | 09/68 | 09/70 | flightless young |

[a] FFS (NWHI) = French Frigate Shoals (Northwestern Hawaiian Islands).
[b] Distances and direction from Nauru: Moku Manu 4,700 km NE; French Frigate Shoals 4,200 km NE; Kure Atoll 3,850 km NNE; Midway Atoll 3,850 km NNE; Jarvis Island 3,650 km E; Johnston Atoll 3,350 km NE; Phoenix Islands 2,400 km ESE; Howland Island 1,800 km E; Eniwetok Atoll 1,500 km NNW.
[c] An islet off the coast of Oahu, Hawaii; band recovery reported by Cooke (1943).
[d] Longitude for the recovery site is given as 1655 in the Bird Banding Laboratory computer files, placing it in a landless area of the Pacific far to the west of Nauru. The correct longitude should read 1665. BBL microfilm records state that the bird was lassoed (trapped) at Anabar District, Nauru, and that the band was removed from the dead bird on 2-6-1978 (K. Klimkiewicz, pers. comm.); no indication was given as to how long the bird may have been held in captivity, if at all, before its death.
[e] Recovery record initially reported by Sibley and Clapp (1967).
[f] The longitude code 1655 recorded in BBL computer files probably is a misprint for 1665 (see footnote "d" above); the original letter reporting the return, or other pertinent correspondence, has not been reexamined for confirmation.
[g] Band given to the author during December 2006 visit; actual date of recovery unknown.
[h] Band number given to the author during April 2007 visit; actual date of recovery unknown.

in a roughly circular pattern around the perimeter of the lagoon occasionally alighting in a tree or perching on a post in the middle of the lagoon. This was probably the same bird I observed at the same location and behaving in a similar way on several occasions in Dec 2006, but it was in winter plumage and recorded only as an unidentified tern.

**Black-naped tern** (*Sterna sumatrana*), hypothetical. Nauru is included among the locality records of *S. sumatrana* in several recent checklists (e.g. Pratt *et al*. 1987; Lepage 2007; Penhallurick 2007), but the original source is unstated in these accounts. Possibly they are based on Garnett's (1984) report that combines Gilbert Islands records with those of Nauru. I treat reports of this species on Nauru as hypothetical pending corroboration.

**Great crested Tern** (*Thalasseus bergii*), vagrant. This species breeds widely in Micronesia and the tropical South Pacific (Baker 1951; Wiles 2005) and may be expected on Nauru, but the only confirmed record is a specimen in the Museum für Naturkunde Berlin that was originally recorded by Kaiser (1902) as *Sterna media* (= *S. bengalensis*), the lesser crested tern (see Frahnert & Buden *in press*).

**Feral pigeon** (*Columba livia*), introduced. I observed feral pigeons regularly in small numbers (up to 10/day, maximum 6 together) on roadsides, roof tops, and ruderal habitats throughout the coastal belt, but rarely (only 2 sightings) in the interior of the central plateau. The species was introduced to Nauru sometime during the mid-1990s (A. Lauti *pers. comm*.). Breeding is not confirmed but very probable.

**Micronesian pigeon**, Tope (*Ducula oceanica*), uncommon breeding resident. Pearson (1962) considered the Micronesian pigeon (also known as Micronesian imperial pigeon) "widespread and common" on Nauru and estimated a population of about 500. He recorded 1 pair nesting in a *Poinciana* tree in his garden in mid-Mar, with 1 chick hatched and fledged, and a second brood begun in the same nest in Jun. BirdLife International (2007c) reported that the Micronesian pigeon is now probably extinct on Kiribati, and Nauru, and many or all of the Marshall Islands, and cited Gibbs *et al*. (2001) as a source. Many residents told me that they have not seen the tope in many years, but that some hunters still find them on the central plateau. I did not encounter any Micronesian pigeons in the coastal lowlands, but heard and saw them regularly during walks across the plateau in Dec 2006 – usually 5-6 per day, but as many as 15 on 21 Dec, with 10-12 of them in *Ficus* trees at the Topside Refugee Camp, an area that has been off-limits to the public for several years. They were much less vocal and detected less frequently during the Mar-Apr visit. I roughly estimate a population of 75-100, based largely on incidental observations.

Residents indicate that tope feed on a variety of fruits but are especially fond of *Muntingia calabura*. Breeding now probably takes place mainly in the inaccessible forest patches in the pinnacles, which are areas of deep, steep-sided pits and trenches with unstable footing and with scattered shrubs and vines hindering access (D. Deireragea *pers. comm*.).

Four subspecies of *D. oceanica* are recognized (Baker 1951): *D. o. monacha* (Momiyama) in Palau and Yap, *D. o. teraokai* (Momiyama) in Chuuk, *D. o. townsendi* (Wetmore) on Pohnpei, *D. o. oceanica* (Lesson and Garnot) on Kosrae and the Ralik Chain Islands, Marshall Islands, and *D. o. ratakensis* (Takatsukasa and Yamashina) in the Radak Chain, Marshall Islands. The subspecies on Nauru is unknown and is apparently unrepresented by specimens in museum collections.

**Long-tailed koel** or **long-tailed cuckoo** (*Eudynamys taitensis*), non-breeding visitor. The long-tailed koel breeds in New Zealand and spends the austral winter among the islands of the central Pacific Ocean, from the Bismark Archipelago and Micronesia eastward to the Marquesas and French Polynesia, with yearlings seemingly remaining in the wintering grounds during their first summer (Heather & Robertson 1996). It was unknown from Nauru at the time Bogert (1937) prepared a complete list of locality records for this species or when Owen (1977) compiled his checklist. Pearson (1962) recorded it on Ocean Island but not on Nauru. It is recorded for Nauru in several more recent lists (e.g. Pratt *et al*. 1987; Cain *et al*.1997; Lepage 2007), possibly based on the Ocean Island record in Pearson (1962). Cain *et al*. (1997) give the Naruan name as Derikui, but this may be a misapplication of a variation of the local name applied to Audubon's shearwater (Ederakui) for which these authors do not provide a local name. The only definitive records of which I am aware are one that I heard calling shortly after sunset on 23 Dec 2006 (confirmed by a description of the bird by an accompanying resident), and 1 that I observed at close range on 3 Apr 2007, both on the central plateau at the edge of remnant forest. None of the few islanders I queried could give me a local name, but they indicated that this species was a regular visitor to the island.

**Collared kingfisher** (*Todirhamphus chloris*), hypothetical. Pearson (1962) recorded 2 collared kingfishers frequently seen together between Apr and Jul 1961, but Pratt *et al*. (1987) regarded the sightings as more likely being of the similar sacred kingfisher (*T. sanctus*). Records of kingfisher species on Nauru require additional corroboration.

**Nauru reed-warbler**, Itsirir (*Acrocephalus rehsei*), common breeding resident, endemic. Little has been written about the Nauru reed-warbler since Finsch (1881) first remarked on its habits, and which he (Finsch 1883) later described as a new species. Finsch (1881) considered it to be "as common as the House-Sparrow in England," its song being heard "everywhere." Pearson (1962) also considered it "abundant everywhere," and B. Fletcher (in BirdLife International 2007a) found it to be "widely distributed throughout the island and relatively common" in 1993. Habitat degradation and loss of native forest via mining operations has apparently had no major adverse affects on the population. The Nauru reed-warbler appears to thrive in regenerating scrub, thickets, and remnant forest patches on the central plateau, as well as in gardens, yards and ruderal areas in the coastal zone (pers. obs.). However, my estimate of about 5,000 birds on the island is less than the 10,000 to 19,999 reported by BirdLife International (2007a), which is presumably based on Fletcher's 1993 data. *Acrocephalus rehsei* is classified as Vulnerable in the IUCN Red List of Threatened Species "because its very small range leaves it susceptible to chance events, such as cyclones and the introduction of alien predators" (BirdLife International 2004). Rats (*Rattus tanezumi*, *R. exulans*) and feral cats (*Felis cattus*) are potential predators.

Reed-warblers were very vocal during my visit in December, but less so during late Mar-early Apr. Recordings of songs and calls (the first for this species) made in Dec 2006 have been archived in the Macauley Library, Cornell Laboratory of Ornithology, Ithaca, New York, USA.

I did not encounter any active nests, but counted seven disused or presumed disused nests in Dec 2006. They consisted of cups of woven twigs and grasses, and some with the dried remains of *Cassytha filiformis* and needles of *Casuarina equisetifolia*, and they were 2-8 m high in shrubs and trees; Stephen (1936) reported this species nesting on the ground. One resident told me of finding a nest that contained 2 eggs early in Dec and 2 nestlings about a week later, but which was empty several days later, possibly because of predation by rats. Finsch (1881) mentioned obtaining eggs in Jul 1880, and the Kaiser collection contains a nest and 2 eggs (Frahnert & Buden *in press*). Pearson (1962) remarked that this species may nest throughout the year, and he recorded 2 nests each with 3 eggs, but did not specify dates.

Finsch (1881) stated that the Nauru reed-warbler was insectivorous and fed chiefly on dragonflies. I did not observe *A. rehsei* feeding on dragonflies, but did see reed-warblers often moving through shrubs and among the branches of small trees, apparently gleaning insects from foliage. Also, many were seen sallying from a low perch to pick up a prey item on the ground and return immediately to a perch, and others were seen hopping along the ground in open, sparsely vegetated areas occasionally grasping a presumed prey item.

**Zebra Finch** (*Taeniopygia guttata*), introduced but extirpated or never established. This species is included based on Pearson's (1962) comments regarding 4 birds introduced from Australia apparently during the 1950s, and at least 6 being observed several years later in 1961, but no subsequent sightings.

## DISCUSSION

### Composition of the avifauna

Excluding 6 species listed as hypothetical, 28 species of birds are recorded from Nauru (Table 2); three being introductions, 1 of which (Zebra Finch) is no longer extant. Of the 25 indigenous species, 7 (28%) are confirmed or probable resident breeders or former breeders. The 18 others are passage migrants, non-breeding season residents, vagrants and occasional visitors, and nearly all of them are seabirds (Phaethontidae 1, Pelecanidae 1, Sulidae 2, Fregatidae 2, Sternidae 2) and shorebirds (Charadriidae 2, Scolopacidae 6). The Pacific reef heron also is included in this group, though it possibly breeds on Nauru at times, and the long-tailed koel, a non-breeding season visitor from New Zealand, is the only land bird. The only indigenous, breeding land birds on Nauru are the Micronesian pigeon and the endemic Nauru reed-warbler.

### Hypothetical species and very doubtful records

The 6 hypothetical species include the 5 seabirds and shorebirds for which I have been unable to locate adequate documentation, along with a record of a kingfisher of disputed identification (see Pratt *et al*. 1987). All 6 may be expected to occur on Nauru at times but are treated as hypothetical pending corroboration or verification of the records. Hambruch's (1914, 1915) Nauru bird lists uniquely include a rail (ralle), honeyeater (honisauger), and flycatcher (fliegenschnäpper) in the genus *Rhipidura*. Hambruch was an ethnographer, not a biologist, and his chief source of information on Nauru birds was someone named Auuiyeda. Possibly Hambruch misinterpreted some of what he was told and misapplied names to birds described to him. Kayser (1917-1918 *fide* Dobbin and Hezel 1996) wrote a scathing review of Hambruch's work criticizing his knowledge of the local language. The possibility of a rail having been on Nauru is of interest, but these 3 records (rail, honeyeater, *Rhipidura* sp.) are questionable and are mentioned here only in passing. Similarly, magpies, snipe, and quail are mentioned in "The Island of Nauru

**Table 2** Status of birds recorded on Nauru.

| | |
|---|---|
| *Puffinus lherminieri* | FB? / E? |
| [*Phaethon rubricauda* | Hyp] |
| *Phaethon lepturus* | (B) / UC? |
| *Pelecanus conspicillatus* | V |
| *Sula sula* | V |
| *Sula leucogaster* | NBV? / S-UC |
| *Fregata minor* | NBV / S-UC |
| *Fregata ariel* | NBV / FC |
| *Egretta sacra* | NBV? / S |
| *Gallus gallus* | I / C |
| *Pluvialis fulva* | NBV / C |
| *Pluvialis squatarola* | V |
| [*Charadrius mongolus* | Hyp] |
| [*Charadrius leschenaultii* | Hyp] |
| [*Limosa lapponica* | Hyp] |
| *Numenius phaeopus* | NBV / ? |
| *Numenius tahitiensis* | NBV / ? |
| *Tringa brevipes* | NBV / UC-FC? |
| *Tringa incana* | NBV / FC-C? |
| *Arenaria interpres* | NBV / C |
| *Calidris acuminata* | V |
| *Anous stolidus* | B / FC-C |
| *Anous minutus* | B / C |
| *Gygis alba* | B / C |
| *Onychoprion fuscatus* | V |
| *Chlidonias leucopterus* | V |
| [*Sterna sumatrana* | Hyp] |
| *Thalasseus bergii* | V |
| *Columba livia* | I / FC |
| *Ducula oceanica* | B / UC |
| *Eudynamys taitensis* | NBV / UC |
| [*Todirhamphus chloris* | Hyp] |
| *Acrocephalus rehsei* | B / C |
| *Taeniopygia guttata* | I / E |

[a] B = resident year-round, breeding confirmed, (B) = resident year-round breeding not confirmed but very probable, FB = former breeder, [Hyp] = hypothetical, I = introduced and feral, NBV = nonbreeding visitor, V = vagrant; C= common, FC = fairly common, UC = uncommon, S = scarce

Wild Birds Preservation Ordinance 1937" (accessed online at http://www.paclii.org/nr/legis/num_act/wbpo193715), but to what taxa these names refer is uncertain. Additionally, several resident Naruans told me of kookaburras (*Dacelo novaguineae*) and budgies (*Melopsittacus undulatus*) that were brought to Nauru and released by expatriate mining staff when they left the island; none has been seen recently.

**Bird band recovery data**

Thirty-one bird band recoveries are reported for Nauru (Table 1), with many of the birds originating from remote islands of the Pacific visited by the Pacific Ocean Biological Survey Program (POBSP) of the 1960s, when "over 400,000 birds were banded by 1965, and a further 750,000 by 1968" (MacLeod 2001). The high incidence of black noddies among the Nauru recoveries (16 = 52%) doubtless is a reflection of the widespread practice of noddy-catching, an important island tradition (see species account). Many other bands (presumably also mainly black noddies) apparently were recovered on Nauru but never reported; several islanders told me of necklaces, bracelets, and earrings fashioned of bird bands that have since been lost. To what extent any of these arrivals from distant breeding grounds are recruited into the local breeding population is unknown. Responses to queries submitted to bird banding agencies in New Zealand, Australia, Russia, and Japan revealed no Nauru recoveries of birds banded in their respective countries.

**Conservation issues**

Because of the very small size of Nauru, the avifauna is especially vulnerable to environmental threats such as storms, droughts, hunting pressure, and anthropogenic habitat degradation. Of the 2 species of land birds, the Nauru reed-warbler has fared remarkably well in light of the marked habitat changes wrought by mining operations. It is seemingly able to adapt to a wide variety of habitats and is not averse to close proximity to human habitation. It is as common in yards and vacant lots in settled and semi-urban areas as it is in remote and uninhabited parts of the island. The Micronesian pigeon, on the other hand, has declined in numbers over the years, at least based on anecdotal information provided by local residents, many of whom claim not to have seen a tope in many years. But these are people who do not generally visit the central plateau, where there is a small, but viable population of *Ducula oceanica* probably breeding unmolested in the more inaccessible areas of the pinnacles. The birds continue to be hunted along roads and trails that traverse much of the interior. I was told that just prior to my arrival in Mar 2007, 1 hunter shot several birds but could not retrieve them as they fell into the pinnacles. Firearms have been banned on Nauru but some people still have shotguns or pellet guns with which they hunt the tope. The reed-warbler is listed as protected in the

Wild Birds Preservation Ordinance 1937 (though it is not hunted), but the Micronesian pigeon is not.

A second stage of phosphate mining to recover deposits left behind during the first stage is underway and will doubtless diminish available woodland habitats and deplete wildlife resources further. But restoration for "the gradual transformation of Nauru's wasteland back to tropical island" over the next 20 years is also planned (Radio Australia 2007). Although habitat restoration may bring the land closer to its original state, it will also likely increase hunter access into now nearly inaccessible areas. Only more rigid enforcement of wildlife protection laws than is now practiced can ensure the protection of local game birds and other wildlife resources.

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