

EXTINCTIONS AND NEW RECORDS OF BIRDS FROM HENDERSON ISLAND, PITCAIRN GROUP, SOUTH PACIFIC OCEAN*

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ABSTRACT

Archaeological and palaeontological excavations were conducted as part of the Pitcairn Islands Scientific Expedition (January 1991 to March 1992). In this preliminary analysis of the subfossil bird bones from Henderson Island (24°22' S, 128°18' E) we identified 29 taxa, which were divided into five groups: (1) four endemic extinctions, (2) five local extinctions, (3) a minimum of 12 breeding residents, (4) three non-breeding migrants, and (5) five birds of uncertain status. Over half of the landbird species known from Henderson Island are listed here for the first time, including one new genus and at least three new species. New listings for Henderson Island include: Henderson Archaic Pigeon (Columbidae new genus), Henderson Ducula Pigeon (*Ducula* new species), Henderson Ground-Dove (*Gallicolumba* new species), Henderson Sandpiper (*Prosobonia* new species), Royal Albatross, Little/Audubon's Shearwater, Bulwer's Petrel, Black-winged Petrel, Sooty Tern, cuckoo (*Eudynamys* sp.), and a swallow (*Hirundo* sp.). Most of the bird bones collected were associated with prehistoric Polynesian occupation sites dating from ca. AD 1000 to 1600. Humans may have caused the extinction of at least four of the eight endemic landbirds, which equates with similar extinction rates on other Pacific islands.

INTRODUCTION

Interdisciplinary study of remote Pacific islands offers unique opportunities for examining biogeographic principles, evolutionary theory, and the interaction and subsequent diversification of insular populations (Weisler *et al.* 1991:4). Of the 176 species and subspecies of birds which have become extinct worldwide since AD 1600, 93% have been island forms (King 1985:3). These bird extinctions were probably the result of overhunting, human-induced landscape alteration resulting from prehistoric agricultural practices, the introduction of mammalian predators and competitors, avian diseases, and habitat-destroying herbivores (Cassels 1984, Olson & James 1984, Atkinson 1985, Cheke 1987, Steadman 1989, Weisler & Gargett 1993).

The Pitcairn Islands Scientific Expedition, conducted from January 1991 to March 1992, was organized to provide the first long-term, comprehensive survey of the four islands of the group: volcanic Pitcairn Island, the elevated limestone island of Henderson, and the two atolls of Oeno and Ducie. The expedition included 37 field personnel from eight countries, who focused on the botany, geology, marine environment, modern and subfossil birds, insects, land snails, and archaeology. This paper presents the preliminary results of the bird bone identifications from archaeological and paleontological excavations on Henderson Island, while formal species descriptions and their biogeographic implications will be presented elsewhere.

* This is contribution number 10 of the Pitcairn Is. Scientific Expedition

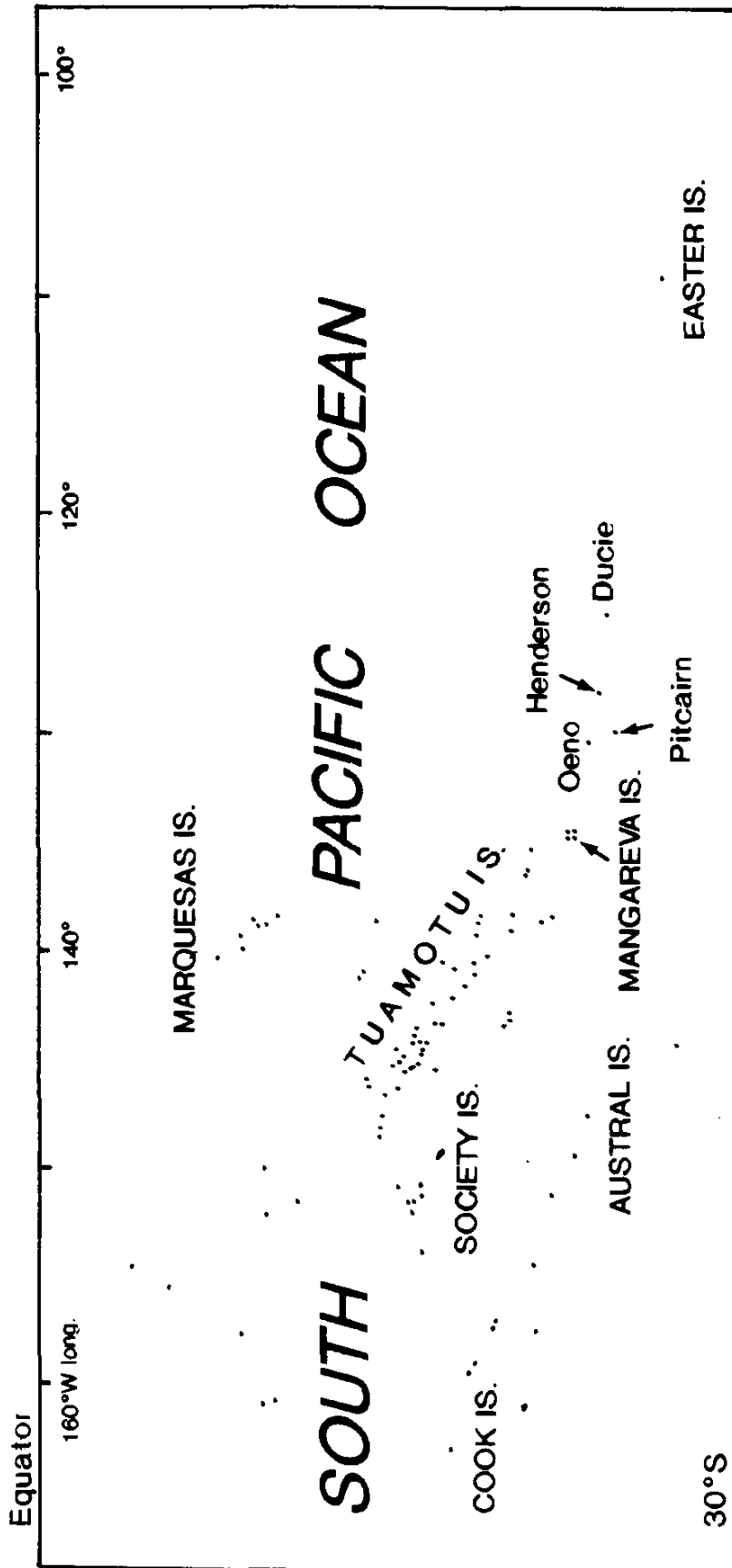


FIGURE 1 — Map of the South Pacific Ocean showing the location of Henderson Island

Henderson Island, a 37 km² raised limestone island, is among the most isolated islands in the South Pacific (Figure 1). Some 177 km ENE of the high volcanic island of Pitcairn, Henderson was uplifted 1 million years ago and is currently surrounded by 30 m cliffs. The island supports a large variety of endemic plants, insects, and birds and was listed in 1988 under the World Heritage convention.

Polynesians occupied Henderson Island from about AD 1000 to 1600 (Weisler 1993, 1994). The Portuguese explorer, Pedro Fernandes de Quiros, sighted the island in 1606. It was rediscovered 213 years later by Captain James Henderson of the *Hercules*.

Previous publications on the birds of Henderson Island include Bourne & David (1983) on the modern birds; Steadman & Olson (1985), which was an analysis of 303 bird bones from an excavation by Y. Sinoto in 1971; and Schubel & Steadman (1989), which was an analysis of 2795 bird bones from an excavation by S. Schubel in 1987.

METHODS

Archaeological and palaeontological excavations were conducted as part of the Pitcairn Islands Scientific Expedition. Excavations at prehistoric habitation sites, directed by Weisler, were conducted in a variety of ecological zones to provide a sound basis for investigating Polynesian subsistence practices and to determine the role of humans in causing bird extinctions. After initial archaeological testing of selected sites, we concentrated our excavations at early habitation sites, areas of particular interest for a detailed analysis of the impact of Polynesians on the Henderson Island bird fauna. About 42 m² test pits were excavated at 15 sites. All sediments were screened with 6.4 mm mesh sieves, while fine-screening (1.5 and 3.2 mm of selected samples) was used to recover small bird bones.

In the archaeology laboratory at the University of California at Berkeley, the bone was initially sorted into bird, fish, rat (*Rattus exulans*), turtle (cf. *Chelonia mydas*), pig, and human by Weisler during a 4 month period. The bird bone was identified to nearest taxon by Wragg using reference collections at the American Museum of Natural History, New York; the Museum of New Zealand, Wellington; the Museum of Vertebrate Zoology, Berkeley, California; and the National Museum of Natural History, Washington D.C.

After the bird bones were identified, the taxa were divided into five categories based on their breeding status:

1. Extinct endemics (birds that lived only on Henderson Island)
2. Local extinctions (birds that still breed elsewhere in the Pacific)
3. Breeding residents (birds that currently breed on Henderson Island)
4. Non-breeding migrants (migratory shorebirds that breed in the North Pacific)
5. Birds of uncertain status (no juvenile bone identified; breeding status indeterminate)

BIRD LIST

Extinct endemics**HENDERSON ARCHAIC PIGEON** (*Columbidae*, new genus), new listing

Thirty-three pigeon genera were examined. In overall similarity this bird is closest to the Nicobar Pigeon (*Caloenas nicobarica*), but has smaller wings (c. 20% to 40%) with more heavily constructed, same-length legs. The reduced ligament attachment points on the head of the humerus and the reduced cross-sectional area of the humeral shaft show a greatly reduced power of flight in this new genus of archaic pigeon.

HENDERSON DUCULA PIGEON (*Ducula* new species), new listing

Steadman & Olson (1985:6193-6194) reported two species of *Ducula* pigeon from archaeological excavations on Henderson Island (Sinoto 1983). The nine wing bones were considered inseparable from the Polynesian Pigeon (*Ducula aurorae*) or the Pacific Pigeon (*D. pacifica*). The remaining bill and two leg bones were referred to the Nukuhiva Pigeon (*D. galeata*) or a very closely related representative. Bourne & David (1986:302) considered that the report of two *Ducula* pigeons from Henderson (Steadman & Olson 1985:6193-6194) may have been a single species, which showed the reduced wings common in island forms.

The *Ducula* bone from our excavations suggests a single new species of *Ducula* pigeon characterized by its heavily constructed bill and legs relative to its small wings and body. This proportional size difference in body parts separates the Henderson *Ducula* Pigeon from other Pacific *Ducula* pigeons.

HENDERSON GROUND DOVE (*Gallicolumba* new species), new listing

Schubel & Steadman (1989:6) and Steadman (1992:342-343) reported an "unknown ground dove" from Henderson Island. The single leg bone (tarsometatarsus) was larger than the comparable element of the Polynesian Ground Dove (*G. erythroptera*) and much larger than the Marquesas Ground Dove (*G. rubescens*). We found the Henderson Ground Dove (Figure 2) at many sites. The heavily constructed bill and legs of this new species show specialization towards a more terrestrial life.

HENDERSON SANDPIPER (*Prosobonia* new species), new listing

The surviving member of the *Prosobonia* genus is the endangered Tuamotu Sandpiper (*Prosobonia cancellata*). Its behaviour includes feeding among the flowers of small trees (Seitre & Seitre 1992:219). Compared with the Tuamotu Sandpiper, the Henderson Island Sandpiper has reduced outer wing bones and longer leg bones, suggesting a reduced power of flight. This adaptation to terrestrial life is found in all the extinct endemic birds of Henderson Island.

Local extinctions**CHRISTMAS SHEARWATER** (*Puffinus nativitatis*)

This seabird is currently breeding on Ducie and Oeno. There are no modern breeding records for it from Henderson. The inability of this

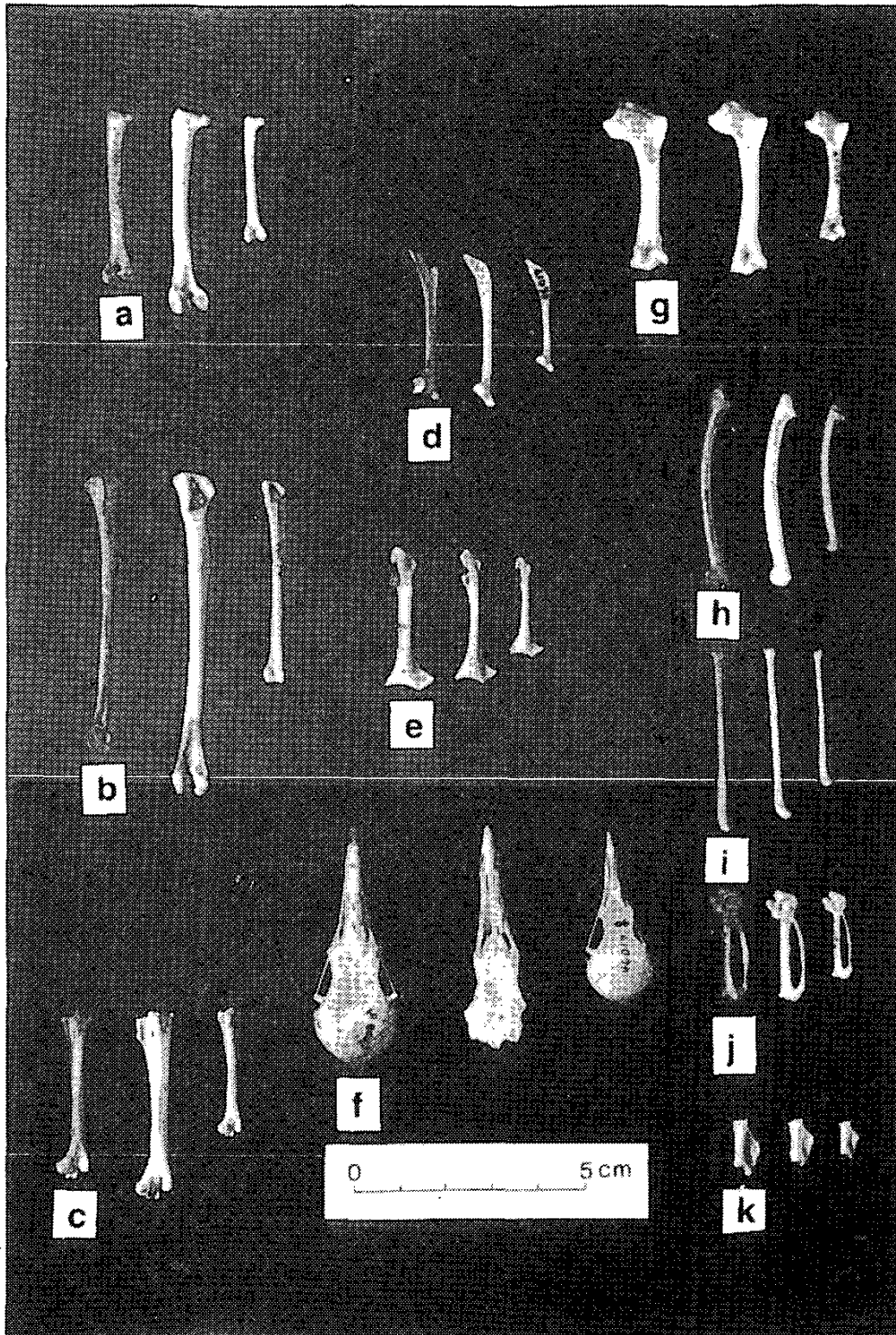


FIGURE 2 — A skeletal comparison of three Pacific ground-doves. Left element, Shy Ground Dove (*Gallicolumba stairii*), middle element, Henderson Island Ground Dove (*G. new species*), right element, Marquesas Ground Dove (*G. rubescens*). Leg: a, femora; b, tibiotarsi; c, tarsometatarsi. Body: d, scapulae; e, coracoids. Skull: f, mandibles with crania. Wing: g, humeri; h, ulnae; i, radii; j, carpometacarp; k, phalanges digitalis majoris.

medium-sized seabird to re-occupy Henderson is surprising as it is breeding in the presence of the Pacific rat (*Rattus exulans*) on many other Pacific islands. Adult and juvenile bones were found.

LITTLE/AUDUBON'S SHEARWATER (*Puffinus assimilis/therminieri*), new listing

Speciation of shearwaters on isolated islands is common (Walker *et al.* 1988). Adult and juvenile bones of this small shearwater were found.

BLACK-WINGED PETREL (*Pterodroma nigripennis*), new listing

The Black-winged Petrel has been expanding its range in the southwest Pacific (Jenkins & Cheshire 1982). The small *Pterodroma* bones collected during this study are consistent in overall size and body proportion with *P. nigripennis*. Characters useful in the separation of *P. nigripennis* from other *Cookilaria* group *Pterodroma* petrels (Fleming 1941) are its relatively short and wide bill and long wings. Adult and juvenile bones of this small petrel were found.

POLYNESIAN STORM PETREL (*Nesofregetta fuliginosa*)

Steadman & Olson (1985:6193) and Schubel & Steadman (1989:4) reported subfossil Polynesian Storm Petrel remains from Henderson Island. This species ranges throughout the central Pacific. Its small size may make it vulnerable to rat predation and could explain its absence from Henderson Island. Adult and juvenile bones were found.

SWALLOW (*Hirundo* sp.), new listing

Fine-screening of north beach cave sites produced numerous bones of this bird. The nearest known swallow breeding locality is 2300 km away in the Society Islands (Holyoak & Thibault 1984). The circumstances of its local extinction from Henderson requires careful consideration as its cliff nesting and aerial feeding habits greatly reduce its susceptibility to rat predation. Adult and juvenile bones were found.

Breeding residents

MEDIUM-SIZED GADFLY PETRELS (*Pterodroma* sp.)

Bourne & David (1986 and in press) express surprise that Steadman & Olson (1985) and Schubel & Steadman (1989) should have referred all their medium-sized gadfly petrel subfossil material from Henderson Island to the Phoenix Petrel, "when it and two closely allied forms, the Kermadec and Herald Petrels, have been collected alive there in the proportions of 1:20:78 respectively." The only modern record of Phoenix Petrel from Henderson Island is "a bird of uncertain status because it apparently occurred among a number of birds taken at sea" (Bourne & David 1983:237).

A preliminary review of our *Pterodroma* bone suggests that all the medium-sized gadfly petrels currently breeding on Henderson Island, e.g. Kermadec, Herald and Murphy's Petrels, are to be found in the subfossil record. A more detailed analysis is in progress.

Identification to species of individual petrel bones from within the same superspecies group, without the use of biochemical techniques, is often impossible. Difficulties include the highly conservative nature of petrel skeletons and the often suspect identification of reference material.

However, separation, and hence identification, of closely related taxa can be achieved by a comparison of body: limb: skull proportions (Wragg 1985). Body proportions can show rapid evolutionary change in small isolated populations (e.g. in the Henderson Island extinct endemics mentioned in this paper). A difficulty in identifying petrel bones collected in association with archeological sites is the fragmentary (broken and disarticulated) nature of the skeletons; only rarely can an estimate of skeletal ratios be made.

RED-TAILED TROPICBIRD (*Phaethon rubricauda*)

MASKED BOOBY (*Sula dactylatra*)

RED-FOOTED BOOBY (*Sula sula*)

GREAT FRIGATEBIRD (*Fregata minor*)

These four large tropical seabirds breed on Henderson Island today, and are found in the subfossil bone record. Other closely related species may be present, but a more detailed analysis of the subfossil bone is needed.

BROWN/BLACK NODDY (*Anous stolidus/minutus*)

The Black Noddy breeds in low numbers on Henderson Island and we did not attempt to separate it from its commoner relative, the Brown Noddy.

BLUE-GREY NODDY (*Procelsterna cerulea*)

This small tern is rare today and uncommon in the subfossil record.

FAIRY TERN (*Gygis alba*)

This small tern is widespread both today and in the subfossil record.

HENDERSON CRAKE (*Porzana atra*)

HENDERSON FRUIT DOVE (*Ptilinopus insularis*)

HENDERSON LORIKEET (*Vini stephensi*)

HENDERSON REED WARBLER (*Acrocephalus vaughani taiti*)

All four living endemic land birds occur in the subfossil record. Watling (1982:89) reported that in pre-European times Pacific people kept parrots as pets and that red feathers were highly valued status symbols. Kuhl's Lorikeets (*Vini kuhlii*) are kept as pets, and transported between the northern Line Islands by local people (Wragg, pers. obs. 1990). The presence of red in the plumage of fruit-doves and lorikeets would make these species potential targets for domestication and hence transportation by Polynesians. A careful analysis of their stratigraphic position may show their presence on Henderson Island before the arrival of Polynesians and hence rule out the possibility that they were introduced to the island by humans.

Non-breeding migrants

PACIFIC GOLDEN PLOVER (*Pluvialis fulva*)

WANDERING TATTLER (*Heteroscelus incanus*)

BRISTLE-THIGHED CURLEW (*Numenius tahitiensis*)

These shorebirds breed in the Arctic during the northern summer and spend their winter on South Pacific islands. Their bones are uncommon in the subfossil record.

Birds of uncertain status

ROYAL ALBATROSS (*Diomedea epomophora*), new listing

The three Royal Albatross bones (probably from a single bird) were found in a habitation cave on the east beach. The three other records of Royal Albatross from the tropical Pacific are a beach-wrecked banded bird in the Tuamotu Archipelago (Robertson 1972:91) a sight record just south of Tongan waters (Jenkins 1980:214), and an immature caught on a fishing line off Rarotonga, Cook Islands, in September 1990. (Hugh Robertson, pers. comm.).

WEDGE-TAILED SHEARWATER (*Puffinus pacificus*), first onshore record

BULWER'S PETREL (*Bulweria bulwerii*), new listing

SOOTY TERN (*Sterna fuscata*), new listing

These widespread tropical seabirds are not known to have bred on Henderson during modern times. No evidence of juvenile bone was found during our excavations. Each species is represented by fewer than five bones, possibly from one bird. Their status as vagrants, migrants, or extinct breeding birds is uncertain.

CUCKOO (*Eudynamys* sp.), new listing

Compared with the Long-tailed Cuckoo (*Eudynamys taitensis*), which breeds in New Zealand and winters in the tropical Pacific, the Henderson Island cuckoo leg bones are more heavily constructed with more pronounced sculpturing. This is the first record of a cuckoo from Henderson Island.

DISCUSSION

The substantial lowering of sea level during many ice ages (Gibbons & Clunie 1986) would have exposed many stepping-stone islands, ecologically similar to Henderson, and greatly facilitated the movement of landbirds across the Pacific. The remoteness of Henderson from potential source areas of plants and animals has allowed the development of numerous endemic biota, including most of the known landbirds. The arrival on Henderson Island of humans and rats had devastating consequences for the island's birds. More than half the endemic land birds became extinct. Many seabird species lost their local breeding populations, at least four of which have not re-established

on Henderson, even though prehistoric Polynesian occupation ended 350 years ago. The extinction of Henderson's endemic landbirds is part of a world-wide pattern in island extinctions. Archaeological evidence suggests that large bird species were probably hunted, and their naturally low population size and slow reproductive rate may have made them vulnerable to human impact. Flightless species have also been susceptible to pests associated with people (Diamond 1985:17). Today, the Pacific rat is having an impact on the island's birds, a process which began when it was introduced by Polynesians 600 years ago. The local extinction of the Christmas Shearwater, Little/Audubon's Shearwater, Black-winged Petrel, and swallow is interesting because of their survival on other Pacific Islands in the presence of humans and rats. Factors contributing to bird extinctions on Henderson may have been hunting by Polynesians, for which there is some archaeological evidence (cf. Weisler & Gargett 1993), human-induced habitat modification, and predation and competition with rats.

Before human colonisation, the isolation, small size, and lack of predators on Henderson allowed rapid evolutionary change to a more terrestrial lifestyle in the island's landbird fauna. After human settlement, these birds were subject to new predation and competition pressures from humans and their associated mammals. Consequently, at least four endemic birds went extinct with numerous others losing their local populations.

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