

## Status and Conservation of Birds in the Mariana Islands, Micronesia

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**Abstract** There have been 163 bird species recorded in the Mariana Islands, but only 17 species of native land birds and 13 seabirds currently breed in the islands. The original prehistoric avifauna before the arrival of man may be double this number. The majority of species recorded are migrant or vagrant shorebirds, seabirds, or waterfowl. Many migrant species are recorded, but only *Pluvialis fulva*, *Arenaria interpres*, *Numenius phaeopus*, *Heteroscelus brevipes*, *Aythya fuligula*, and *Bubulcus ibis* can be considered common. Kuroda's 1961 observation that the Iwo and Ogasawara Islands seem to be the "main limit" of migrant herons and land birds in the western Pacific is true with a few exceptions. The legal status of wetlands and certain sanctuary islands protects most of the important habitats for migrants and seabirds. However, land birds face the immediate threat of brown tree snake (*Boiga irregularis*) introductions and the chronic impacts of feral domestic animals and other introduced species. Land bird conservation will require intensive research, species translocation and captive breeding programs to prevent additional extinctions.

**Key words:** birds, Mariana Islands, extinction, conservation.

The Mariana Islands form a 15 island archipelago in Micronesia. The northernmost, Uracus, is 590 km southeast of Minami-iwo. The past decade has seen advances in our knowledge of birds in the Mariana Islands (e.g., Reichel and Glass, 1991). At the same time the avifauna of oceanic islands is threatened by the introduction of predators and competitors like never before due to the tremendous increase in cargo with recent development (e.g., Reichel, 1991; Pratt *et al.*, 1987). Development also increases the threat to wetlands that are important to migrant birds. Though the Mariana Islands are not a major migration stopover or wintering site, migrant birds make up the vast majority of the avifauna that are recorded from the islands. Here I give an overview of the status and distribution of birds in the Commonwealth of the Northern Mariana Islands, and conclude with a discussion of their conservation. I have used, with minor exceptions, the taxonomy of Sibley and Monroe (1990).

### Status of Birds in the Mariana Islands, Micronesia

#### 1. Seabirds

13 species of seabird are known to breed in the Mariana Islands (Reichel, 1991).

Tropicbirds, including a few hundred pairs of Red-tailed Tropicbirds (*Phaethon rubricauda*) are known to nest on Rota, Pagan and Maug. White-tailed Tropicbirds (*Phaethon lepturus*) probably nest in small numbers on many of the islands, but this is actually documented only for Guguan.

Masked Boobies (*Sula dactylatra*) nest in significant numbers on Maug, Uracus, and Medinilla. Red-footed Boobies (*Sula sula*) nest in significant numbers on Maug, Guguan, and Rota. Brown Boobies (*Sula leucogaster*) nest on most of the islands, with up to 500 pairs reported on Medinilla.

Great Frigatebirds (*Fregata minor*) roost on a few of the islands, and nesting was documented on Maug during the expedition conducted by the Natural History Museum and Institute, Chiba, in cooperation with the CNMI and University of Guam.

Gray-backed Terns (*Sterna lunata*) breed on

Guguan and are seen there in May through July. Sooty Terns (*Sterna fuscata*) nest in colonies on a few islands, with up to 250,000 nests on Uracus, and perhaps 30,000 on Guguan. Juvenile sooties have a well defined migration across the Atlantic, but it is uncertain if a similar pattern exists in the Pacific. Band recoveries in the Mariana Islands include one banded on Laysan (Drahos, 1977), and one banded on Johnston Atoll (J. Engbring, unpubl.). Little Terns (*Sterna albifrons*) are present in small numbers from February through September. This species seems to be attempting to expand its breeding range to include Saipan where eggs were observed in 1988 and 1989 (Reichel *et al.*, 1989). Little Terns were not previously recorded to breed in Micronesia. White Terns (*Gygis alba*) nest in small numbers on all islands. Brown Noddies (*Anous stolidus*) nest on cliffs and offshore rocks of most islands, with several thousands on Maug. Black Noddies (*Anous minutus*) nest in significant numbers on Pagan and Guguan.

Nest burrows of Wedge-tailed Shearwaters (*Puffinus pacificus*) are found in small numbers. Matsudaira Storm-petrels (*Oceanodroma matsudairae*) are commonly sighted at sea, and a large number of Wedge-tailed and Short-tailed Shearwaters migrate through the area offshore. Eight additional seabirds, including the Bonin Petrel (*Pterodroma hypoleuca*), have been recorded (Stinson *et al.*, 1991). The most important threat to seabirds is probably the potential introduction of predators to important nesting islands.

## 2. Migrant Shorebirds

Large numbers of shorebirds migrate over the southwest Pacific between breeding grounds in northern Asia and wintering areas in the Australian region. Approximately 500,000 birds pass within 1000 km of Guam during autumn migration (Williams and Williams, 1988). Baker (1951) proposed the existence of a Japanese-Marianan Flyway, based on the migrants reported in the Mariana Islands compared to Palau. Some birds probably follow the Izu, Ogasawara and Iwo Islands south to the Mariana Islands. However, radar studies indicate that most migrants do not is-

land-hop, but make long flights over the open ocean (Williams and Ying, 1990). Some species, including the Bar-tailed Godwit and Great Knot, are believed to migrate non-stop between Australia and China (Barter and Hou, 1990).

The Pacific Golden Plover (*Pluvialis fulva*) is the most abundant migrant shorebird in the Mariana Islands where a few thousand winter and a few hundred non-breeders spend the summer. A double peak in autumn migrants may coincide with the arrival of adults in August, and the arrival of juveniles in September and October. Our data are consistent with other studies that indicate the Pacific Golden Plover is the most abundant migratory shorebird at islands in the western Pacific (Stinson *et al.*, in prep.).

The Whimbrel (*Numenius phaeopus*) is a common migrant consistently recorded in small numbers in all seasons. Flocks of 20–50 Whimbrels are observed just off Saipan during fall migration, but some flocks do not appear to stop on the island. The Grey-tailed Tattler (*Heteroscelus brevipes*) is common at tidal flats and are consistently present, summering here in small numbers. The Wandering Tattler (*Heteroscelus incanus*) is an uncommon migrant and winter visitor which prefers rocky shore habitats. The Common Sandpiper (*Actitis hypoleucos*) is an uncommon migrant and winter visitor, consistently recorded in small numbers on Saipan.

The Ruddy Turnstone (*Arenaria interpres*), along with the Pacific Golden Plover, is considered to be the predominant migratory shorebirds of central and western Pacific islands, but only a few hundred are tallied in the Mariana Islands during migration or winter. The Mongolian Plover (*Charadrius mongolus*) is an uncommon migrant consistently present during migration in small numbers. A Mongolian Plover seen on Guam in December 1991 had been wing tagged on northeastern Hokkaido in August (Shunkunitai, Nemuro-shi, Hokkaido; T. Mundkur, pers. comm.). A similarly marked bird was seen on Guam from September 1992 to January 1993.

The Wood Sandpiper (*Tringa glareola*), Rufous-necked Stint (*Calidris ruficollis*), and Grey Plover (*Pluvialis squatarola*) are uncommon mi-

grants recorded in small numbers. Rare, but regular migrants include Marsh Sandpiper (*Tringa stagnatilis*), Sharp-tailed Sandpiper (*Calidris acuminata*), Common Green-shank (*Tringa nebularia*), Black winged Stilt (*Himantopus himantopus*) and Snipe spp.

Approximately 45 species of shorebird have been reported (Reichel and Glass, 1991). Most of the shorebird species (30 of 37 species) that breed in eastern Asia or Alaska, and also winter in Micronesia or further south have been recorded (Hayman *et al.*, 1986, Stinson *et al.*, in prep.). An additional 11 species that winter on Asian coasts or further west have been recorded as vagrants.

The common and uncommon migrants in the Mariana Islands are all very common to abundant migrants in Japan and winter in small numbers in the Nansei Shoto. However, the Rufous-necked Stint, a very abundant migrant in Japan, is rare in the Mariana Islands. Also, several other species that are common or uncommon migrants in Japan including Dunlin (*Calidris alpina*), Eurasian and Far Eastern Curlews (*Numenius arquata*, *N. madagascariensis*), redshanks (*Tringa totanus*, *T. erythropus*), Green Sandpiper (*Tringa ochropus*), Great Knot (*Calidris tenuirostris*), Temminck's Stint (*Calidris temminckii*), are very rare in the Mariana Islands (Brazil, 1991; Stinson *et al.*, in prep).

### 3. Migrant land and waterbirds

Significant numbers of migrant ducks and Ardeids (herons and bitterns) are recorded in the Mariana Islands, but migrant land birds are rare (Stinson and Reichel, in prep.). The western Pacific is unlike the northwest Atlantic where large numbers of passerines make flights over the ocean. Records of vagrant landbirds on oceanic islands are of interest because of their potential for explaining the origins of endemic island fauna.

In 1961, Kuroda summarized over-sea crossings of land and water birds in the western Pacific, and suggested that the Ogasawara and Iwo Islands seem to be the "main limit" of migrant landbirds and herons. Kuroda listed only 6 north Asian ducks and no herons that had reached the Mariana Islands. He compared this to a list of 10 ducks and 10 herons that had

been recorded from the Ogasawara and Iwo Islands and he proposed that the Iwo Islands were the limit of southward migrating herons. I here re-examine Kuroda's hypothesis with the data from recent years.

The Cattle Egret (*Bubulcus ibis*) is the most abundant migratory ardeid in the Mariana Islands with as many as 800 recorded on Saipan and Tinian (Stinson and Reichel, in prep). The Cattle Egret is a common summer visitor in Japan and winters from central Honshu southwest (Brazil, 1991). The Little Egret (*Egretta garzetta*) is a rare migrant and winter visitor seen annually on Saipan in recent years (largest number: 6). The Little Egret is a common resident in Japan.

Other Ardeids recorded in the Mariana Islands as rare visitors include the Intermediate Egret, Striated Heron, Black-Crowned Night-Heron, Rufous Night-Heron, Great Egret, and Grey Heron (*Egretta intermedia*, *Butoroides striatus*, *Nycticorax nycticorax*, *Nycticorax caledonicus*, *Casmerodius albus*, *Ardea cinerea*) (Glass *et al.*, 1990).

The Tufted Duck (*Aythya fuligula*) is the most abundant migrant duck and appears in flocks of 80 or more at lakes. Micronesia appears to be the southeastern limit of the Tufted Duck's winter range (Madge and Burn, 1988). Tufted Ducks are a common migrant and winter visitor in Japan (Brazil, 1991; Kuroda, 1961). The Northern Pintail (*Anas acuta*) is an uncommon but regular migrant and winter visitor to the Mariana Islands. It is the most common dabbling duck with up to 35 birds recorded. The pintail is one of the most common ducks wintering in Japan (Brazil, 1991).

The Barn Swallow (*Hirundo rustica*) is an uncommon regular migrant in the Mariana Islands and occasional winter visitor. Flocks of up to 23 birds have been recorded as early as August in the fall, and as late as May in the spring. Barn Swallows are an abundant summer visitor and very common migrant throughout Japan (Brazil, 1991).

There is now broad similarity in the heron species recorded in the Iwo or Ogasawara Islands groups (14 species) and the Mariana Islands (11 species). Only the Black Bittern

(*Ixobrychus flavicollis*) of south Asia and Australia has been recorded in the Mariana Islands, but not in the Iwo or Ogasawara Islands. *Gorsachius goisagi*, *Ixobrychus erythmus*. *Ixobrychus cinnamomeus* have not been recorded in the Mariana Islands. Tufted Ducks and Northern Pintails occur annually in significant numbers as migrants or winter visitors. Common Teal (*Anas crecca*), Garganey (*Anas querquedula*), Northern Shoveller (*Anas clypeata*), and Eurasian Wigeon (*Anas penelope*) occur irregularly in small numbers, apparently at the southeast fringe of their winter range. An additional 9 species of waterfowl have been recorded as rare visitors or accidentals. Since Kuroda's paper, the total number of waterfowl recorded has increased to 16 for the Iwo/Ogasawara groups and 15 for the Mariana Islands. One difference, is that 3 geese (*Anser albifrons*, *Anser fabalis*, *Anser indicus*) have been recorded in the Iwo/Ogasawaras while none have been seen in the Marianas.

Nineteen species of migrant land birds have been recorded in the Mariana Islands Stinson (1994). The only passerine known to annually migrate through the Mariana Islands is the Barn Swallow, but 5 other passerines have occurred as vagrants. Kuroda (1961) listed these 6 among 28 passerines and 10 other land birds as northern migrants to the Ogasawara or Iwo Islands. An additional 15 species of migrant landbirds have been recorded in those islands since, or were not known to Kuroda (Brazil, 1991). Clearly, more vagrant landbirds are recorded in those islands than in the Mariana Islands. Only the shorebirds have more species recorded in the Mariana Islands, perhaps reflecting the absence of tidal flats like those found at Saipan and Guam.

It appears that Kuroda's proposal that the Iwo Islands are the "main limit" of southward migration in the Pacific is accurate for land birds though with the exception of modest numbers of Barn Swallows. It is also generally true for herons, with the exception of the Cattle Egret and a few other herons that are annual visitors to the Mariana Islands.

#### 4. Resident land and freshwater birds

As expected for Oceanic islands, the Mariana

Islands have few resident land and freshwater species, but a relatively high level of endemism. Baker (1951) examined Micronesian land-bird fauna and concluded that most was of Melanesian origins. However, he indicates that at least 3 species in the Mariana Islands, including the Common Moorhen, Mariana Mallard, and Nightingale Reed-warbler appear to have Palearctic origins and probably arrived via the Ogasawara Islands and Iwo Islands.

The Yellow Bittern (*Ixobrychus sinensis*) is a resident of the Mariana Islands from Saipan south to Guam. Yellow Bitterns have not been recorded as migrants, although the Philippines has a large seasonal influx and few of those breeding in Japan winter there (Brazil, 1991; Hancock and Kushlan, 1984).

The Mariana Common Moorhen (*Gallinula chloropus guami*) is an endemic subspecies found on Guam, Tinian, and Saipan. Its aquatic habitat may have been dramatically altered by the introduction of the exotic fishes *Gambusia* for mosquito control, and tilapia (*Oreochromis mossambicus*) for aquaculture. Both fishes are known to reduce the diversity of aquatic organisms and may compete with moorhens. Two lakes on Pagan supported a population of moorhens until recently, but the lakes have been affected by tilapia, habitat damage by domestic animals, and the volcanic eruption of Mt. Pagan in 1981. The moorhen is believed extinct there. The population is currently around 3–400, after a decline of perhaps 30–50% in this century (Stinson *et al.*, 1991b). However, Moorhens are opportunists and relatively prolific. The subspecies can probably continue to survive if their habitat is preserved.

The Mariana Mallard (*Anas oustaleti*) was a little known duck, believed to have been a hybrid of Mallard and Grey Duck (*Anas superciliosa*) (Yamashina, 1948). It was heavily hunted and was rare on Guam in the 1930s (Reichel and Lemke, 1994). There have been no reliable sightings since 1979 when a pair was captured for captive breeding. The captive breeding attempt failed, and the last known Mariana Mallard died in 1981. Overhunting is believed to have been the biggest factor in their decline, though they may also have been

affected by introduced predators and fishes.

Recent evidence suggests the Common Buzzard (*Buteo buteo*) is a breeding resident of Anatahan (Reichel *et al.*, 1994). The Common Buzzard is a common resident and migrant in Japan, with endemic forms in the Ogasawara Islands (*Buteo buteo toyoshimai*) and on Minamidaito jima Island (*Buteo buteo oshirai*) (Brazil, 1991).

The Megapodes of the Australasian region use external heat sources to incubate their eggs. The Micronesian Megapode, *Megapodius laperouse laperouse*, is endemic to the Mariana Islands. The chicks are super-precocial and able to make short flights upon emerging from the ground. Micronesian Megapodes are unusual in that they appear to use all 3 types of external heat sources for incubation (Stinson and Glass, 1992). They are known to bury eggs in solar-heated cinders and at geothermal sites. Historical records of megapodes from coral islands and our observation made on the Natural History Museum and Institute, Chiba expedition of a burrow at the base of a rotting coconut stump suggest that they also use the heat of decomposition. They are most abundant on Guguan where dark solar-heated cinder fields are available. Megapodes are also common on Sarigan and Maug. If these islands remain uninhabited, the species will survive, but protection of habitat, and perhaps predator control will be essential on inhabited islands.

The Mariana Crow (*Corvus kubaryi*), the only corvid in Micronesia, is found only in forests of Guam and Rota. Less than 100 crows remain on Guam as a result of the brown tree snake. They have remained relatively common on Rota, with recent estimates of several hundred to 1,000.

The Nightingale Reed-warbler (*Acrocephalus luscini*) is most commonly found in patchy forest and tall grass (Craig, 1992). Three subspecies are found in the Mariana Islands (Reichel *et al.*, 1992). Birds from Guam, Saipan, and Alamagan are included in the subspecies *luscini*. It is extinct on Guam, but still widespread on Saipan with a population of perhaps 3–4000. The endemic subspecies *nijoi* on Aguiguan is on the verge of extinction; we hypothesize that the destruction of the under-

story by feral goats is responsible. The endemic subspecies *yamashinae* on Pagan is said to have been restricted to the emergent vegetation at the 2 lakes. This subspecies appears to be extinct.

The Tinian Monarch (*Monarcha takatsukasa*) is a flycatcher found only on Tinian where it is abundant. 1982 surveys estimated the population at 39,000 (Engbring *et al.*, 1986). The Tinian Monarch has received almost no serious study.

The Island Swiftlet (*Aerodramus vanikoroensis*) is a widespread species in Micronesia, the Philippines, and New Guinea (Pratt *et al.*, 1987). The subspecies *bartschi* is described from Guam, Rota, Aguiguan, and Saipan. Swiftlets nest and roost in caves, but are airborne much of the day foraging on small insects. The species has seriously declined on Guam apparently as a result of snake predation.

The Saipan population was the subject of a 3 year study. Reichel (unpubl. data) investigated an apparent population decline, and noticed that many nests were lost due to cockroaches which eat the saliva glue and cause the nest to fall. The American cockroach (*Periplaneta americana*), which recently invaded the caves, were so abundant that nesting success was very low. Experimental cockroach control using poison baits resulted in a dramatic increase in nesting, and a prolonged nesting season. More birds fledged in 1989 than in 1987 and 1988 combined. Cockroach control is now routinely done in the remaining caves on Saipan.

The swiftlet was abundant on Rota but declined in recent decades and were last observed there in 1977 (Engbring *et al.*, 1986). The reason for decline is unknown; hypotheses include introduced disease, pesticides, and the Black Drongo (*Dicrurus macrocercus*). Their decline coincided with the decline of the Rota White-eye and extinction of the Sheath-tailed Bat (*Emballonura semicaudata*).

The Bridled White-eye (*Zosterops conspicillata saypani*) is abundant on Saipan, Tinian, and Aguiguan. The Rota subspecies *rotensis*, a more yellow form, appears to have declined markedly and is now restricted to higher elevations. The decline may be due to predation by the Black Drongo but confirm-

ation of this may require an intensive control experiment. The drongo was introduced in 1935 to control insect pests and is particularly abundant in open habitats at lower elevation. The drongo is aggressive and a reported predator on nests and small birds.

The Golden White-eye (*Cleptornis marchei*) once considered a honeyeater, is closely related to the large white-eyes of the genus *Rukia* found on Pohnpei, Yap, and Truk (Pratt *et al.*, 1987). The Golden White-eye is common on Saipan and Aguiguan. Subfossil remains were recently found on Tinian and a reintroduction project is under consideration. The Golden White-eye is a territorial omnivore common in all wooded habitats (Craig, 1990; Stinson and Stinson, 1994).

The Rufous Fantail (*Rhipidura rufifrons*) is a widespread species also found on Yap and Australia (Pratt *et al.*, 1987). The subspecies *saipanensis* is common in forests of Saipan, Tinian, and Aguiguan. Subspecies *mariae* is found on Rota. Subspecies *uraniae*, now extinct, was found on Guam.

The Micronesian Honeyeater (*Myzomela rubrata*) is widespread on the high islands of Micronesia including all the Mariana Islands except Uracus, and Medinilla, and it is probably extinct on Guam.

The Collared Kingfisher (*Halcyon* or *Todiramphus chloris*), a wide spread species of Asia, Australia, and the tropical Pacific, is found on most of the Mariana Islands except Uracus, Guguan, Medinilla, and Anatahan.

The Micronesian Starling (*Aplonis opaca*) is a widespread species found from Palau east to Kosrae. It is found on all the Mariana Islands except Uracus.

The Mariana Fruit Dove (*Ptilinopus roseicapilla*) is similar to other Pacific fruit doves. This endemic is found on the southern islands from Rota N to Saipan. Another endemic, the White-throated Ground Dove (*Gallicolumba xanthonura*) is found from Rota to Asuncion. Both endemic doves are probably extinct on Guam (Savidge, 1987). The Philippine Turtle-dove (*Streptopelia bitorquata*) was introduced in the 18th century and is common on the southern islands.

The Eurasian Tree Swallow (*Passer monta-*

*nus*), probably introduced in the 1940's, is common on the southern islands.

### Discussion: Extinctions and Conservation of Birds in the Mariana Islands

The Mariana Islands are going through an extinction crisis. The intentional or inadvertent introduction of species, particularly pigs, goats, cattle, rats, drongos, fishes and cockroaches, impact native species through predation, competition, and habitat alteration. Historic extinctions of populations on individual islands have occurred in 5 of 15 native land and freshwater bird species. This does not include 9 bird species that are recently extinct on Guam as a result of the introduced brown tree snake. This snake represents the gravest threat to Mariana birds.

In fact the extinction crisis of this century is the second wave of extinctions in the Mariana Islands. Recent discoveries in sub-fossil bone deposits have added 10 species to the list of known extinctions for Rota (Steadman, 1992). Extinctions of half of the native bird species after colonization by aboriginal man seems to be typical for Pacific islands (Steadman, 1989).

Conservation efforts must include minimizing risks of exotic introductions. One of the most difficult tasks is developing the techniques and procedures for detecting stow-away snakes in shipboard cargo. More effective trap lures, barriers, fumigants and the use of dogs need further investigation. Progress made in these areas may be applicable to any islands with vulnerable fauna. It is hoped that a pathogen or some other control agent is discovered to suppress brown tree snake populations.

Although it took about 40 years for the snake to cause extinctions on Guam, the problem was slow to be recognized (Jenkins, 1983). By that time, populations of several species were too low to capture for captive breeding. Only the Guam Rail and Micronesian Kingfisher were captured for breeding. Should the brown tree snake become firmly established on Saipan, a smaller island, extinctions may follow within 15–20 years. As part of a response to this threat, captive breeding programs for the crow, Rota White-eye and Mariana Fruit Dove are underway. Also, the CNMI

Division of Fish and Wildlife has begun an investigation of opportunities for translocations, or "marooning" of species on uninhabited islands. Opportunities for translocations will be limited due to the ecological differences between the limestone islands at risk, and the volcanic nature of the northern islands. Agui-guan is an uninhabited coral island that may offer the best possibilities.

It seems to be unknown if island birds are more vulnerable than birds in the native range of snakes due to differences in sleep physiology or behavior, or if the Guam extinctions are simply the result of abnormally high snake populations. If island birds are incapable of dealing with a snake predator, perhaps restoration efforts would be advised to use similar species that are adapted to dealing with snake predators. Native island avifauna would then need to be preserved on sanctuary islands where the threat of snake introductions is extremely low.

The future holds many challenges to the conservation of birds in the Mariana Islands and on all oceanic islands in general. If native island birds are to be preserved, it will require international attention and cooperation.

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## マリアナ諸島（ミクロネシア）における 鳥類の生息状況とその保護

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これまで、163種類の鳥類がマリアナ諸島から記録されているが、現在繁殖まで確認されているのは、17種類の陸鳥と13種類の海鳥にすぎない。しかし、人間が移り住んで来る以前はその倍の数が生息していたと、考えられる。大部分の鳥は、渡り鳥または旅鳥の渉禽類、海鳥、ガン・カモ類である。記録上には多くの渡り鳥の名前があるが、実際ふつうにみられるのは、ムナグロ、キョウジョシギ、チュウシャクシギ、キアシシギ、アオサギ、アマサギであると考えられる。黒田(1961)によれば、小笠原諸島と硫黄諸島は、サギ類と陸鳥の渡りの西部太平洋の主な南限であるとしているが、これをマリアナの鳥類の最新のデータと照らし合わせてみると、若干の例外はあるものの、概ね正しいといえる。法律的に湿地帯と鳥獣保護の島の地位を確保することにより、渡り鳥や海鳥の最も重要な生息地を保護してきたが、近年樹上性のヘビであるミナミオオガシラが持ち込まれたり、長年にわたる野生化した家畜の被害により、その生息が脅かされている。今後、陸鳥の保護のために、さらに詳細な調査、まだ荒されていない地域への移動、飼育環境下での繁殖などの努力が必要である。