Threatened Birds of Asia:
The BirdLife International Red Data Book

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BONIN WHITE-EYE
Apalopteron familiare

Critical □ —
Endangered □ —
Vulnerable ■ C1

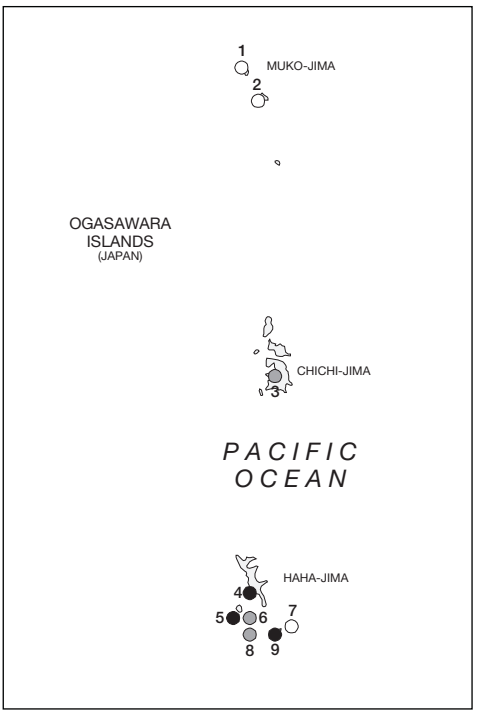
This species has a small, declining population as a result of historical clearance of primary forest and continued threats to secondary forest from tourism and infrastructure developments. It therefore qualifies as Vulnerable.

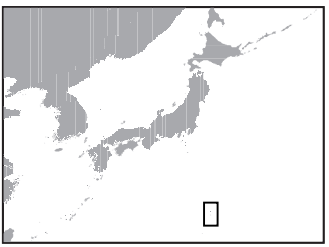
DISTRIBUTION The Bonin White-eye (see Remarks 1) is endemic to the Ogasawara islands (or Bonin islands, total area c.73 km^2: Stattersfield *et al.* 1998) in Japan. It has been recorded from a total of nine islands in the Muko-jima, Chichi-jima and Haha-jima island groups, but it appears to be extinct in the Muko-jima group and its current (and past) status in the Chichi-jima group is unclear. Its main stronghold is on Haha-jima island. Records are from:

■ ***JAPAN*** *Muko-shima* island, Muko-jima group, undated (Seebohm 1890a in Brazil 1991), January 1930 (Yamashina 1930c), apparently extinct by 1941–1942 (Brazil 1991);

Nakodo-jima island, Muko-jima group, in the late nineteenth century, but not found in January 1930 (Yamashina 1930c), and apparently extinct early on (Momiyama 1930);

Chichi-jima island, Chichi-jima group, two collected, 1910, and, although the origin of these skins was doubted as they were obtained through a taxidermist (Yamashina 1930c, Morioka and Sakane 1978), a small, probably re-introduced population (if the original one





The distribution of Bonin White-eye *Apalopteron familiare*: (1) Muko-jima; (2) Nakodo-jima; (3) Chichi-jima; (4) Haha-jima; (5) Muko-jima; (6) Hira-shima; (7) Mei-jima; (8) Ane-jima; (9) Imito-jima.

○ Historical (pre-1950) ◍ Fairly recent (1950–1979)
● Recent (1980–present) □ Undated

ever existed) was present, with sporadic sight records, during the late 1960s to the late 1970s (Morioka and Sakane 1978), with birds rumoured in 1987 still to exist there (Brazil 1991);

Haha-jima island, Haha-jima group, undated (Seebohm 1890a in Brazil 1991), July 1924 and February 1925 (two specimens in YPM), birds being widespread and common from the 1960s to the present (Higuchi *et al.* 1980, 1988, 1993, Kato *et al.* 1995, Suzuki *et al.* 1999);

Muko-jima island, Haha-jima group, the commonest bird on the island in 1979 (Higuchi *et al.* 1980), and still common in or shortly before 1990 (Suzuki 1991 in Suzuki *et al.* 1999; but see Population);

Hira-shima island, Haha-jima group, one record in 1976 (Morioka and Sakane 1978), but not found in 1979 (Higuchi *et al.* 1980);

Mei-jima island, January–February 1904 (Kiyosu 1965), not surveyed in 1979 (Higuchi *et al.* 1980);

Ane-jima island, Haha-jima group, one record in 1978 (Morioka and Sakane 1978, Higuchi *et al.* 1980);

Imoto-jima island, January–February 1925 (Kiyosu 1965), not surveyed in 1979 (Higuchi *et al.* 1980), but still common in or shortly before 1990 (Suzuki 1991 in Suzuki *et al.* 1999; but see Population).

POPULATION The population of this species on Haha-jima island (a little over 20 km^2: Stattersfield *et al.* 1998) was estimated at 3,000–4,000 birds in 1969 (Kato *et al.* 1995). In a 1980 survey on Haha-jima, 14.7 birds per km were encountered along transects, similar to the results of a census in 1974 (Higuchi *et al.* 1980), presumably indicating that the population had remained stable there (but habitat is unevenly distributed on the island and the transects used may not have reflected changes in habitat; densities *within* habitats may have remained stable, but if habitat area diminished so too would overall numbers). In 1983–1984 a study in a four-hectare patch of forest resulted in the ringing of 59 birds, 30 of which were not seen again and 16 of which were believed to be recently bred birds (Higuchi *et al.* 1993), but a core population of around nine pairs appeared to be able to survive and breed in around two hectares of this area, i.e. c.4.5 pairs per hectare (see Remarks 2); in 1995 and 1996 the density of singing males at this site was only 3.3–3.7 per hectare (Suzuki *et al.* 1999), but in apparently optimal habitat at a different site (Chibusa-yama) on the island in June 1996 it was (again) 4.5 males per hectare (Suzuki *et al.* 1999). However, it is extremely unclear what the total population might be today. Of the nine islands on which the species has been recorded, it was common very recently on one (Haha-jima), common 10 years ago on two (Muko-jima and Imoto-jima; but these are a mere 1.4 and 1.2 km^2 respectively: Suzuki *et al.* 1999), recorded in apparently very low numbers over 20 years ago on two (Ane-jima and Hira-shima; both similar in size to Muko-jima and Imoto-jima—see map in Morioka and Sakane 1978), unrecorded (but island unchecked) for almost 100 years on one (Mei-jima; tiny—see map in Morioka and Sakane 1978), entirely indeterminate on one (Chichi-jima), and extinct on two (Muko-shima and Nakodo-jima). This is not a comfortable circumstance, and a precautionary interpretation of this evidence might assume that the species is known from five or fewer locations with a total area of under 100 km^2, which—if any type of decline is in progress or anticipated—qualifies it for Endangered status.

ECOLOGY ***Habitat*** The original vegetation of the Ogasawara islands was subtropical forest, but this habitat has been almost entirely felled and the Bonin White-eye now inhabits low secondary forest, forest edge, bushes, plantations and gardens (Higuchi *et al.* 1980, Brazil 1991). On Haha-jima, it is found almost everywhere, near habitation, in roadside brush and scrub (notably *Leucaena glauca*), cultivated areas, pinewoods, mountain and valley forest (Morioka and Sakane 1978, Higuchi *et al.* 1980). It was suggested by Hasuo (1969) that an increase in the species's population on Haha-jima reflected an increase of its favoured open

secondary habitat with *Leucaena* scrub and evergreen shrubs such as *Raphiolepis*. However, this habitat is thought to be used mainly for foraging outside the breeding season, while birds nest chiefly in the best developed patches of native forest (probably their original habitat), i.e. on lower hillsides and in valleys, consisting of evergreen broadleaf forest dominated by *Schima mertensiana* and *Artisia sieboldii* growing up to 15 m and forming a dense canopy, with usually well developed but patchy undergrowth of bamboos, tall tree ferns and tangled shrubs (Morioka and Sakane 1978). Small numbers of birds are also recorded, but nesting has not been confirmed, in widespread and often densely tangled hillside stands of *Pandanus*, but the species is rare in dry, low shrubs on windy peaks and ridges (Morioka and Sakane 1978). Roosting birds (always two together) on Haha-jima perched in trees at 5–15 m; of 14 observations, March, August and November, 50% were in *Callophyllum inophyllum*, others in *Cassia siamea*, *Terminalia catappa* and *Ficus retusa* (Higuchi *et al.* 1984).

Food The species forages among twigs and leaves like white-eyes and tits *Parus*, on trunks and branches like nuthatches *Sitta* and woodpeckers (Picidae), and on the ground like small robins *Erithacus*, an ecological diversity that is probably the result of niche expansion associated with the absence of other small birds (Higuchi *et al.* 1995 in Springer *et al.* 1995). With its long tarsi and strong toes and claws, it is well adapted for both arboreal and terrestrial foraging (more arboreal in the breeding season, more terrrestrial at other times), and it is a skilful climber of tall grasses, saplings, vertical vines and (angled) tree-trunks (Morioka and Sakane 1978). It feeds mainly on the fruits of papaya, *Acacia farnesiana* and other flowers and fruits (Higuchi *et al.* 1980), and also on bananas and insects (Kiyosu 1965). It has also been seen to capture "juvenile" reptiles and feed them to its fledglings (Ueda 1990). Of six birds collected in July on Haha-jima, all had been eating adult ants, three contained beetles, two mulberry *Morus* seeds and one each a homopteran bug, neuropteran larvae, other insect fragments and a spider (Morioka and Sakane 1978). Birds feeding on the ground took larval beetles and caterpillars, small adult beetles including weevils (Curculionidae), crickets (Gryllidae), flies and ants (Morioka and Sakane 1978). Plant food is also important (c.50% of the diet), with at least 15 species (eight of them exotic) visited by foraging birds, these mostly taking fruits and berries (especially soft fruits such as papaya and mulberry) but also seen to peck at flowers, although what was consumed was not seen (Morioka and Sakane 1978).

Breeding In one study, nests were placed on branches at c.1–3 m above ground (Kiyosu 1965); in another, at 1.7–12 m (mean 6 m) (Morioka and Sakane 1978), and in a third, 2.5–10 m (again, mean 6 m) (Higuchi *et al.* 1993). In the second study 70% of nests were in *Schima mertensiana* (the dominant tree in the area), with some in the indigenous *Ardisia sieboldii* and *Raphiolepis integerrima/wrightiana* trees (Morioka and Sakane 1978); in the third the nests were in *Pandanus boninensis*, *Dendrocalamus latiflorus*, *Casuarina equesetifolia* and *Ficus microcarpa*, of which at least the last two are introduced (Higuchi *et al.* 1993). Nests described from Haha-jima were a crudely built, deep cup-shaped and virtually two-layered structure of dead leaves, coarse grasses, pine needles and moss, also some twigs, bark and plant down, the inner wall chiefly of long fibres, stems and rootlets (Morioka and Sakane 1978). On Muko-shima goat wool and albatross feathers are added to the nest (Yamashina 1930c). The breeding season is from March to June, with nests usually found in May, containing clutches of 1–2 (usually two) eggs (Kiyosu 1965, Morioka and Sakane 1978, Brazil 1991, Higuchi *et al.* 1984). Some variation occurs, however: on Haha-jima one study found no indication that breeding had started in March (Morioka and Sakane 1978), while another report referred to young still being fed there in July and August (Higuchi *et al.* 1984); on Muko-shima, May nests contained eggs or young, and a fledgling was recorded as early as 12 May (Yamashina 1930c). In 1984 further evidence was found of a long breeding season, evidently at least sometimes involving two broods (the same pair were with fledglings in March and July), and two nests were found with three eggs and three with four eggs, giving a mean clutch size of 3.6 (Higuchi *et al.* 1993). There is little information on the

mating system. Observations in various seasons of roosting birds (always two, perched close together and probably pairs) and allopreening (again, probably pairs) suggest a close, apparently year-round pair-bond (Higuchi *et al.* 1984); however, territorial and social behaviour need further study, as the species appears to lack a territorial song and birds are frequently observed in small parties in the breeding season (Morioka and Sakane 1978). Both sexes participate in nest building, incubation and feeding the young (Higuchi *et al.* 1993). Incubation and fledgling periods are unknown. The males have a remarkable diurnal rhythm of singing activity (season chiefly March–July), with the main period from 04h00 to 04h30 in the morning, but very little singing at other times of day (Suzuki 1993; also Morioka and Sakane 1978, Higuchi *et al.* 1984).

Migration There are unconfirmed reports by fishermen that birds move from Haha-jima to other islands in the group in autumn and winter (Morioka and Sakane 1978).

THREATS The Bonin White-eye is entirely restricted to the "Ogasawara Islands Endemic Bird Area", threats and conservation measures in which are profiled by Stattersfield *et al.* (1998).

Habitat loss Virtually all of the original subtropical forest has already been cleared from the Ogasawara islands (see Tomiyama and Susuki 1996), and the species is now extinct on several islands (see Distribution), presumably mainly as a result of the wholesale loss of its habitat, although the possibility that an introduced predator was responsible needs to be considered. Although the white-eye occurs in a variety of man-modified habitats on Haha-jima, economic development there (potentially including developments for tourism) and a consequent reduction of forest cover is the main threat to this species (Higuchi *et al.* 1980). Plans have recently been considered to construct a new airport on Ani-jima or the main island of Chichi-jima, which could lead to habitat loss and increase the chances of invasion of the islands by additional exotic species (Tomiyama and Susuki 1996, Stattersfield *et al.* 1998), although it is unclear whether the Bonin White-eye would be affected given that its current status on Chichi-jima is unknown and it has apparently never been recorded on Ani-jima (see Distribution).

Persecution In the past, this species "occurred in flocks large enough to be worth hunting for food" (Brazil 1991), implying that there may have been significant hunting pressure. Its use of papaya as a food could have led it to be treated as an agricultural pest (Higuchi *et al.* 1980).

Introduced predators There were originally at least three endemic bird species on the Ogasawara islands, but two of them (Bonin Wood-pigeon *Columba versicolor* and Bonin Thrush *Turdus terrestris*) became extinct in the nineteenth century, presumably because of the combined effects of habitat loss and predation by introduced cats and rats (see Stattersfield *et al.* 1998). It is possible that these predators also affected (and may continue to affect) the Bonin White-eye, particularly on some of the smaller islands, and they may have contributed to the extinction of some of its populations.

Introduced competitors The Japanese White-eye *Zosterops japonicus* is not native to the Ogasawara islands, but was introduced in c.1900–1910 and is now common there; it occurs (apparently naturally) on both the Izu islands and Iwo (Volcano) islands, north and south of the Ogasawara islands, reinforcing the view that the Bonin bird is itself a white-eye (see Remarks 1) since it would have replaced *Z. japonicus* on the Ogasawara islands. *Apalopteron* shares several ecological and behavioural characteristics with the typical *Zosterops* white-eyes (Springer *et al.* 1995), and it is possible—even probable—that competition with the introduced Japanese White-eye has been a factor in the extinction of the Bonin White-eye on some of the smaller islands in its former range. A study on Haha-jima indeed showed the diet and habitat of the two white-eyes to be similar; although they separate in part by certain structural adaptations and foraging behaviour, with Bonin White-eye capable of more

terrestrial foraging, both species feed on fruits, especially mulberries and papaya, leading to frequent supplanting attacks by one on the other, with no dominance hierarchy (Morioka and Sakane 1978). This latter niche overlap may place considerable strain on populations of the indigenous species and cause its numbers to diminish.

Stochastic events The tiny range of the Bonin White-eye, with most of its known population confined to the island of Haha-jima, means that it is potentially vulnerable to chance events, such as disease, typhoons, etc.

MEASURES TAKEN ***Legislation*** The Bonin White-eye was designated as a Natural Monument in 1969, and a Special Natural Monument in 1977 (Kato *et al.* 1995). It was designated as a "Special Bird" in 1972 (Environment Agency of Japan 1976), and has been protected as a National Endangered Species since 1993. It is on the Red List of Japan, which means that its conservation importance is recognised and it can be used as a reference species in environmental impact assessment for development projects (Environment Agency of Japan *in litt.* 1999).

Protected areas The Ogasawara islands (59 km^2 including 13 km^2 of Special Protection Area) are a National Wildlife Protection Area, established mainly for the conservation of the Bonin White-eye (Environment Agency of Japan *in litt.* 1999). An active conservation programme is under way there, including the propagation and re-introduction of threatened native plants (WWF/IUCN 1994–1995).

MEASURES PROPOSED ***Habitat protection*** The protection of the secondary forests on Haha-jima island, particularly the maintenance and enhancement of forest with the well developed undergrowth that it favours (see Higuchi *et al.* 1980), would presumably be of benefit to the conservation of what is perhaps the largest surviving population of this species. Habitat protection and restoration measures on the smaller islands where populations persist (or could be re-introduced) should almost certainly be implemented.

Research The health of the largest population on Haha-jima island should continue to be monitored. The species's current status on many smaller islands is poorly understood, and surveys are needed to determine which islands still support populations, what size these populations are (Suzuki *et al.* [1999] provided a method for estimating these), and whether they require conservation measures. Information should also be gathered on the islands where the Bonin White-eye is extinct, to try to determine whether it died out because of habitat loss or some other factor such as introduced predators or competition from the Japanese White-eye.

Re-introduction The fact that the species survives on only a handful of islands makes it vulnerable to chance events, so habitat restoration and other measures (e.g. the removal of introduced predators and/or competitors) on selected islands, followed by its re-introduction, is an important precautionary measure that should urgently be investigated.

REMARKS (1) The Bonin White-eye was, until recently, classified as a honeyeater Meliphagidae, but molecular analysis has shown it to be a member of the white-eye family Zosteropidae and closely related to the Golden White-eye *Cleptornis marchei* of the southern Mariana islands (Springer *et al.* 1995). This information was missed in Stattersfield *et al.* (1998) and BirdLife International (2000). Yamashina (1930c) separated the populations on the Chichi-jima and Haha-jima island groups as a distinct subspecies, *A. f. hahasima*, on the basis of clear morphological differences from the nominate subspecies, which was confined to the Muko-jima island group and is now extinct. (2) This statistic is based on a rough assessment of the Figure 5 in Higuchi *et al.* (1993), which maps nine territories with nests and provides a scale which indicates that they lie approximately within two hectares.