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CONSERVATION OF ENDANGERED WHITE-EYES (ZOSTEROPIDAE) IN THE TROPICAL PACIFIC

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Abstract. The family Zosteropidae is well represented on the tropical Pacific islands of Micronesia and Polynesia. Of the 13 species, six may be described reasonably as being endangered or having endangered populations. The rarest among these is the Rota subspecies of the Bridled White-eye. In March–April 1982 total populations, by then restricted to the Sabana plateau region, were estimated at 10,763, or ca 5% of the estimated population on the similarly sized island of Saipan. In September, 1995 an intensive effort to census the entire population of white-eyes was mounted, which yielded a total population estimate of 1167, or an 89% decline since 1982. Hypotheses accounting for the decline are examined. The most likely agent of decline is suggested to be predation and harassment from the introduced Black Drongo.

SPECIES REVIEW

The family Zosteropidae is well represented on the tropical Pacific islands of Micronesia and Polynesia, where at least (depending upon one's taxonomy) 13 species are extant (Pratt et al. 1987). Prehistorically, additional species were present, and at least certain surviving species had larger ranges than at present (Steadman 1992, 1993, 1994, Craig 1989). Of the 13 species, six may be described reasonably as being endangered or having endangered populations (i.e., threatened with extinction, although not necessarily with immediate extinction). The status of these endangered species may be summarized as follows:

Great Truk White-eye (*Rukia ruki*)— A poorly studied species, it is known from Polle, Onei, and Pata in the Chuuk (Truk) Islands, where it is rare. It is common only at the summit of Tol (Pratt et al. 1987).

Long-billed White-eye (*Rukia longirostris*)— Still another largely unstudied species, it is endemic to Pohnpei, where it is widespread but uncommon. It is less behaviorally conspicuous than many white-eye species, however, so its apparent rarity may be an artifact of its being easily overlooked (Pratt et al. 1987, J. Engbring pers. comm.).

Giant White-eye (*Megazosterops palauensis*)— This species is an astonishing vocalist and differs

behaviorally from more typical members of the family in that social units seem to consist of small family groups rather than large flocks (Engbring 1988, pers. obs.). It is restricted in occurrence to two widely separated islands in the Palau chain, Peleliu and Ngeruktabel. Based on paleontological work conducted elsewhere in the Pacific (e.g., Steadman 1992), this distribution is likely relictual and the consequence of prehistoric human activity. Its highest density is reached on Peleliu, where 664/km² are estimated, whereas on Ngeruktabel 92/km² are estimated (Engbring 1992). Although its populations presently appear stable, its inability to spread to nearby (hundreds of meters away) islands in a quiet lagoon is puzzling.

Golden White-eye (*Cleptornis marchei*)— A morphologically aberrant member of the Zosteropidae with no recognized close relatives (although taxonomic examination of the Bonin Islands Honeyeater, *Apalopteron familiare*, might prove interesting), this species was previously considered to be a honeyeater (Meliphagidae) by Baker (1951). Behaviorally, it has similarities with the Giant White-eye in that small family groups comprise the typical social unit (Craig 1990). It is presently known from two islands in the

Marianas, Saipan, and Aguiguan, and prehistorically it was present on at least Tinian (Steadman 1995), which lies between the former two islands. Within its present limited range, it remains extremely abundant, with forest densities on Saipan reported at a two-year average of 2015 birds/km² (Craig 1996). However, the Aguiguan population inhabits an island of only 718 ha. Direct impact on Aguiguan by a supertyphoon, a storm of frequent occurrence in this region, could decimate this population. Moreover, the Saipan population is probably now doomed to extinction as a consequence of the exotic Brown Tree Snake (*Boiga irregularis*) becoming established on this island (Brown Tree Snake Control Committee 1995). This snake has extirpated virtually the entire forest bird fauna of the southernmost Mariana island of Guam since it was accidentally introduced there in the 1940s (Savidge 1987, Wiles et al. 1995).

Samoan White-eye (*Zosterops samoensis*)— known only from Savaii in Western Samoa, where Pratt et al. (1987) report it as rare and restricted to mountaintops above 900 m. I am unaware of any literature concerning details of the present status of this species, although local government reports may exist.

Bridled White-eye (*Zosterops conspicillatus*)— This species is historically known from only the southernmost Mariana Islands, although it most likely was once more widely distributed. The subspecies *conspicillatus* of Guam is recently extinct as a consequence of depredation by Brown Tree Snakes (Savidge 1987). However, the subspecies *saypani* remains phenomenally abundant within its very limited range of Aguiguan, Tinian, and Saipan. Saipan populations were estimated at a two-year average of 5949 birds/km² (Craig 1996). Although still abundant, this subspecies is also now threatened by the potential for establishment of the Brown Tree Snake on all these islands.

Perhaps the most endangered of any white-eye population in the tropical Pacific is that of what is presently considered a distinctive subspecies, *Z. c. rotensis*. Endemic to Rota in the Marianas, some suspicion has been voiced that the population represents a separate species (review in Fancy and Snetsinger 1996). However, it is ecologically very similar to *Z. c. saypani* (Craig and Taisacan 1994), and *Zosterops* might simply diverge rapidly in superficial appearance when isolated. More definitive biochemical evidence is required to clarify the taxonomic status of this population.

Although *Z. c. rotensis* was historically common and widespread on Rota (Baker 1951), by the 1960s it had become uncommon. In March–April 1982 total populations, by then restricted to the Sabana plateau region, were estimated at 10,763, or ca 5% of the

estimated population on the similarly sized island of Saipan (Engbring et al. 1986). Surveys conducted in April five years later estimated a 26% drop in white-eye numbers, although poor weather during counts reduced the comparability of these and 1982 results (Engbring 1987). By 1991, qualitative observations by two active observers on the island yielded population estimates of 300 (G. Witteman)—1500 (E. Taisacan), or at best an 87% decline in numbers since 1982. Quantitative surveys conducted monthly from 1989 to 1991 found a 79% decline in the number of observation/ census station from 1982 (Craig and Taisacan 1994). If extrapolated to the entire range of the population (probably an overestimate because the 1989–1991 counts were conducted only in the heart of its range), the total population was by then 2260. In May, 1994 still another quantitative survey was initiated, which this time suggested a 27% decline in white-eye numbers from 1982 (Ramsey and Harrod 1995). Most recently, in September, 1995 an intensive effort to census the entire population of white-eyes was mounted, which yielded a total population estimate of 1167, or an 89% decline since 1982 (Fancy and Snetsinger 1996).

CASE STUDY: THE ROTA BRIDLED WHITE-EYE

These various efforts reported above for *Z. c. rotensis* lead to several observations. Surveying bird populations under the field conditions is notoriously difficult, which leads to the type of variation in results reported above. A compounding difficulty is that seasonal changes in counts of white-eyes occur (Craig 1996), which limits the comparability of some of the surveys. However, no matter which data one chooses to emphasize, all researchers concur that populations of the Bridled White-eye on Rota are declining, and probably declining precipitously. Another perhaps less obvious observation is that this little bird is being censused into oblivion. We have reached the point at which more surveys amount to little more than officiating at the extinction of a species. This scenario has already played itself out on Guam: marking the day and hour of the last sighting of a Bridled White-eye, noting the departure of the Guam Flycatcher (*Myiagra freyceneti*) into eternity, and on and on and on. I don't think this is quite the idea of conservation.

Causes of the decline. Engbring et al. (1986) was at a loss to explain the rarity of this population on Rota, although they noted that elevation was the principal variable associated with its distribution. Little evidence for Brown Tree Snake introduction existed, and native forest habitats similar to those occupied at high elevations on the Sabana plateau (ca above 400 m) were unoccupied at lower elevations. In investigating

possible agents of decline, Craig and Taisacan (1994) suggested that the predatory Black Drongo (*Dicrurus macrocerus*), introduced to Rota in 1935 to control agricultural pests, might be implicated in influencing white-eye populations. They noted that 1) the Black Drongo did not become abundant on Rota until the 1960s, the time when the decline in Bridled White-eye populations was first noted, 2) the present distribution of the Black Drongo on Rota shows an inverse relationship with that of the white-eye, with drongo populations being lowest on the Sabana plateau where white-eyes are still present, 3) Black Drongos are known avian predators in the Marianas, 4) Bridled White-eyes are particularly susceptible to drongo predation because of their small size (within the prey size range of drongos), because they feed in exposed microhabitats (upper tree canopy), and because of their habit of flying in flocks above the forest where drongos might seize them, 5) all birds too large for drongo predation remain abundant on Rota, with only the small Rufous Fantail (*Rhipidura rufifrons*), known to be preyed upon by Black Drongos, showing depressed and declining densities compared to other Mariana Islands. In this latter case, however, the Rufous Fantail inhabits forest interior, infrequently entered by drongos, so it is likely less susceptible to predation, and its distribution and densities have not been as severely impacted as those of the Bridled White-eye.

Other possible agents causing the decline of *Z. c. rotensis* have been reviewed by Fancy and Snetsinger (1996). They also reject Brown Tree Snake introduction as a factor based on the continuing lack of evidence of its presence on the Rota. Moreover, despite the resemblance of the present distribution of white-eyes to those of native Hawaiian birds, which have been restricted to high elevations by introduced mosquito-borne diseases, they reject avian disease as a likely factor based on studies that indicate no epidemics among native birds, no restriction of disease vectors to low elevations, and known resistance to such diseases as avian malaria in Bridled White-eyes. Similarly, they discount pesticide use in causing a decline, because only low levels of pesticides have been found in local birds, and pesticide use has been limited to those of short environmental duration for >20 years. They did not rule out rat predation as a causative agent, although they point out that rats have been present in Micronesia since prehistory. They fail to mention that high rat densities are found on all islands in the Marianas where white-eyes are abundant, and that white-eyes nest in outer, thin branches of trees where rat predation is unlikely to be major (pers. obs.). Finally, drongo predation is rejected as a principal cause of white-eye declines because a low proportion of birds have been reported in drongo stomach contents, because there are few field observations of drongos preying on birds in

the Marianas, and because no nest predation on white-eyes was observed. Instead, they promote habitat limitation as the principal cause of the decline. This view is held because there is evidence of recent habitat degradation, and because the present distribution of the species suggests that it specializes in inhabiting mature forest.

Consideration of the decline hypotheses. There is presently no proof for any factor being the principal cause of the decline of *Z. c. rotensis*. At this point, it is also unlikely that experimental data can be gathered that will definitively demonstrate the causative agent of the decline. Once a population has collapsed to a tiny remnant, all causes of decline become important, and any number of stochastic events having nothing to do with the initial cause of the decline may drive further declines (e.g., in North America, the Heath Hen (*Tympanuchus cupido*) had its range reduced by overhunting, but it became extinct because a fire eliminated most of the females in the remaining population). Only reasonable assessment of existing circumstantial patterns and developing a conservation program based on counteracting the most likely causes of decline hold much hope for keeping this white-eye from slipping into extinction.

In assessing the above hypotheses, I believe that not much evidence exists for disease, rats, pesticides, or snakes being involved in the decline. The case for habitat limitation is a bit stronger, simply because most birds are presently found in mature native forest only at high elevations. However, upon closer examination this explanation shows deficiencies. To begin, in the Mariana Islands and, in fact, throughout Micronesia, all species of *Zosterops* are habitat generalists. On Saipan, most land birds including white-eyes indeed reach higher densities in native forest, but they are versatile in their ability to exploit a variety of microenvironments and habitats (Craig 1996, Craig and Beal ms). This is not surprising in this periodically typhoon-ravaged island chain, where versatility is clearly an asset for long term survival. Moreover, like the Saipan population, white-eyes on Rota have been observed to be versatile foragers, to inhabit a variety of forest structures from stunted/open to tall/closed canopy, and to regularly exploit a range of native and exotic vegetation (Craig and Taisacan 1994, pers. obs.).

When in 1994 I performed a survey transect in extremely steep, largely undisturbed native forest from the Rota lowlands to the Sabana plateau, I found no white-eyes even in extensive areas of virtually pristine high elevation forest until I reached the summit, where I found birds inhabiting a grassy opening surrounded by stunted forest. This survey demonstrated that which Engbring et al. (1986) and others have previously noted: that white-eyes are far less numerous than they should be if prime forest habitat alone limited their

numbers. Even if native forest is preferred as it is on Saipan, this fact does not necessarily imply habitat limitation or habitat specialization. Alternative explanations that account for the present distribution are that the population has largely contracted to the heart of its *preferred habitat*, where its fecundity and survivorship are greatest (i.e. some other agent has caused it to recede into that habitat), or that it has contracted into the *geographic region* (plateau) where the agents of its decline have reduced effect. Hence, although habitat degradation as a consequence of typhoons may have exacerbated population declines, I find little evidence to support the notion that habitat limitation is the principal agent of decline for white-eyes on Rota.

The remaining hypothesis to explain the decline of *Z. c. rotensis*, predation by the Black Drongo, remains an attractive one despite reservations expressed by Fancy and Snetsinger (1996). They offer no alternative explanations for the coincident decline of white-eyes with drongo population expansion, the inverse population density gradient of drongos and white-eyes, or the parallel rarity of the only other likely avian prey species of the drongo, the Rufous Fantail. Basing a rejection of this hypothesis on there being limited predation data is tenuous. Birds, with a small fraction of the intrinsic rate of population increase of prey species like insects, may have populations impacted far in excess of their numerical proportion in the diets of their predator. Moreover, gathering field data on bird predation is at best a daunting task, and in the case of a rare bird species which now has limited overlap with its predator (because they have been eliminated elsewhere by drongos?), the probability of gathering meaningful predation data for adult or nestling white-eyes is remote.

Conservation action. Every endangered species needs a champion, especially if it is a little green one that few have heard of and less have seen. White-eyes are neither sexy nor macho, and all of the usually invoked reasons (by and large preposterous anyway) for preserving endangered species would not seem to apply here (i.e. white-eyes do not cure cancer). The only way that such species are likely to persist is through the action of motivated individuals. Fortunately for the Bridled White-eye on Rota, individuals have come to the forefront to make efforts on its behalf. Presently, several in the U.S. Fish and Wildlife Service has been preparing what they refer to as a habitat conservation plan for Rota. The principal thrust of this plan is to develop a strategy for preserving much of the Sabana Plateau region as a natural area (D. Grout pers. comm.). Notably, a white-eye defined as a habitat specialist that is restricted to this region neatly helps to make the case for the plan. Regardless how one views the specialist tendencies of white-eyes,

protecting their present range is clearly a *necessary* feature of any effort to preserve the population. Whether habitat protection alone is *sufficient* to ensure survival is another matter.

Another effort directed at controlling the other likely agent of decline, the Black Drongo, was mounted in 1991, and consisted of an ornery, determined, but skinny Scotsman (yours truly), an equally determined but skinny Mariana Islander (E. Taisacan), a twelve-year-old boy, two aging shotguns, a rusting truck, and 1350 rounds of ammunition. We also convinced the Rota Police Department to loan us four officers, who were assigned to shoot drongos as part of their firearms training. In this pilot study to determine if drongos were realistically controllable, we shot 6.1 birds/ man-hour, achieved a kill/ shot rate of 81%, and found that we could routinely shoot birds to >50 m. In four weeks (eight total mornings of shooting) we eliminated 1100 drongos, or 20% of the estimated (Engbring et al. 1986) population. Our efforts were concentrated on the Sabana plateau, where we preferentially removed drongos living near white-eye flocks. Moreover, we took advantage of the drongos' propensity for congregating at sites where large insects are numerous, and shot birds feeding at the island dump and birds feeding at the airport during grass mowing.

Based on our results and our assumption that shooting birds would become more difficult with time (due to greater difficulty finding targets), we estimated that intensive efforts (i.e., 40 mornings of shooting) over two months would be sufficient to reduce drongo populations below a level at which they likely posed a threat to white-eyes (ca 80–90%). Follow-up maintenance shooting was planned for preventing population buildups and eventually eliminating drongos from Rota. The relatively low cost of the program (<\$10,000) and the availability of necessary personnel appeared to make control efforts feasible. Even if control did not result in the recovery of white-eye populations, elimination of this alien species from the island ecosystem was in itself a valid goal. However, despite the early promise of this effort, the project was never initiated.

One last effort directed at protecting Rota white-eyes has been the initiation of a captive breeding program in 1993—the Marianas Archipelago Rescue Project (MARS). Initial goals were to establish 10 pairs of birds in captivity. Through funding provided by the U. S. Fish and Wildlife Service, the U. S. National Zoological Park obtained 21 wild caught white-eyes from Rota and as of 1996 16 of the original 21 remained alive. Three birds died of capture-related stress, and two died of bacterial infections. I have received no updates on the status of this program since 1996 (cc of letter from J. Groves, MARS Coordinator, to U. S. Fish and Wildlife Service.), when no birds had as yet bred.

This program provides some protection in the event of a complete population collapse by white-eyes on Rota, but it does not provide a permanent solution to the problems of this population. Ultimately, only securing the island of Rota as a habitable location for white-eyes will ensure their long-term survival.

Rationale. In order to survive, every endangered species may need a champion, but why bother? This is the unpleasant question that most of us consciously or unconsciously avoid, or choose instead to hide behind transparently weak dogma when we must think about it. Do we really believe that a few hundred tiny birds on some remote dot might hold the key to ecosystem stability? How many of us believe that within the bodies of white-eyes lies the undiscovered chemical that will cure all the ills of mankind? So why do we do it?

Probably like some of you, I am a great fan of music. For some peculiar reason, probably related to the reason that I so adore little green birds, I love especially rather obscure compositions like Handel's operas. Now, despite the fact that about as many people listen to these operas as have seen Rota White-eyes, it has occurred to me that if the last page of the last copy of one these operas were lost, it would break my heart. Popular or not, these works define our humanity. Their creation testifies to our sense of the aesthetic, of our capacity for being moved by the sublime. Intelligent, bright-eyed little beings like these birds, so filled with their exuberance for life, quite fall within the realm of the aesthetic. Certainly, the loss of any of these beings, who first conceived of melody and harmony, of counterpoint and fugue, would also be far more than enough to break my and likely your hearts. I do not think we need to look further for reasons to protect them.

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