

Evidence of Continuing Worldwide Declines in Bird Populations: Insights from an International Conference in New Zealand

Over the last 400 years, New Zealand and its surrounding islands have experienced 11 extinctions of bird species. Prior to that time, the most dramatic and tragic of all New Zealand's avian extinctions was the loss of the genus *Moa* a group comprised of as many as 24 species and ranging in size up to 300 kg. In a land historically without terrestrial mammals, they filled a niche unique among the world's birds. New Zealand's conservationists still face many challenges, including continuing habitat destruction and the increasing number of introduced predators. Today, 17 of the bird species in this area are threatened endemics, among them some of the world's rarest birds. Having always played a special part in New Zealand's culture, birds now symbolize the country's emerging conservation movement, and despite its problems, New Zealand is becoming a world leader in biological conservation.

With this history, New Zealand provided a poignant setting for last fall's international conference on bird conservation sponsored by the International Council for Bird Preservation (ICBP). On 21 November 1990, 380 conservationists from 56 nations- converged on Hamilton, N.Z., for ICBP's 20th World Conference. Thanks to generous grants from a number of foundations, many countries for the first time were

able to send representatives, making this the largest attendance at an ICBP conference. ICBP itself funded the attendance of 50 delegates, many from developing countries.

Themes of conference symposia included birds and tourism, management methods for recovery of threatened birds, conservation of biological diversity, and bird conservation problems in the South Pacific. Many of the offered papers focused on island ecosystems and applied their conclusions to insular habitats. Oceanic islands support only a small percentage of the world's avifauna but disproportionately account for the vast majority of avian extinctions. The dynamics of island populations provide useful models for insular populations of birds on fragmented continental land masses. Island systems and fragmented continental landscapes have similar characteristics that affect populations, including "island" size and shape, degree of isolation, sensitivity to a species' dispersal capabilities between islands, and the effects of small population sizes. The study of the dynamics of island populations thus provides insights into the effects of insularization of continental avifaunas.

However, given the degree of threat to island biotas, it is unclear for how much longer islands will serve as natural laboratories for the study of the extinction process. The

history of avian extinctions is sufficiently well documented since about 1600 to provide an estimate of the modern rate of species loss, a rate that is substantially in excess of the background rates characteristic of the early Pleistocene (King 1985). In addition, strong circumstantial evidence links almost all of the modern extinctions directly or indirectly to the effects of humans. Unfortunately, individual case studies presented in the symposium on conservation problems in the South Pacific indicated that the rates of loss are not declining. Several speakers pointed out that unless aggressive recovery and conservation efforts are made within the next decade, the almost complete loss of endemic and native bird species is assured on many islands and in many insular systems.

Varying with location, ecosystem type, and species, the major causes of avian endangerment and extinction are loss of habitat, predation, overhunting, competition, and disease (King 1985). For example, the role of introduced predators, particularly rats (*Rattus* spp.), in the demise of island populations of ground-nesting island birds is particularly well documented (Atkinson 1985) and continues to be a major source of loss of island species. One of the most tragic examples of predator-induced endangerment and extinction is the precipitous decline of

Guam's native forest birds coincident with the introduction and range expansion of the brown tree snake (*Boiga irregularis*) (Savidge 1987). Of 11 native forest birds extant at the time of the snake's introduction, 7 are now extinct and the remaining 4 are critically endangered (Haig et al. 1990). Island species not previously exposed to the selective pressures of predation lack predator avoidance behaviors and remain extremely vulnerable to introduced predators, including humans. The negative effects of human predation are dramatically illustrated in the eastern part of the Indonesian archipelago where recent declines in some seabird populations can be attributed directly to human exploitation of birds and eggs (de Korte 1989).

Most extinctions of species cannot be attributed to a single factor, but are a consequence of several factors working simultaneously, or sequentially. For example, Hawaiian bird populations have been subjected to waves of extinction-causing impacts beginning with habitat destruction, introduced predators, and hunting by Polynesians prior to European settlement of the islands. In the early 1990s, avian malaria was introduced to the archipelago. The extinction of many species since the turn of the century may have been proximally caused by the malaria epidemic (van Riper et al. 1986), but the ultimate historical impacts on Hawaiian populations may have weakened them to the point at which one more factor—in this case disease—could cause extinction. Several critically endangered species, for which conservation resolutions were developed at the ICBP meeting, similarly suffer from multifactorial threats. For example, Spix's macaw (*Cyanopsitta spixii*), a parrot that occupies riparian areas in the arid interior of northeast Brazil, has been severely exploited by trappers; by 1987 only three birds were known

in the wild. According to historical records, however, the bird was rare upon its discovery in 1819, probably due to its dependence upon riverine habitat, which even by 1819 had been cleared and degraded by grazing. As in these cases, the proximate factor that delivers the final blow to a species is often quite distinct from the ultimate factors that lead to the species' endangerment.

The slender-billed curlew (*Numenius tenuirostris*) also suffers from the synergistic effects of several adverse factors acting simultaneously. The proximate threat to the species' persistence is poaching. The species' recovery, however, will require not only the control of illegal hunting but also protection of breeding, wintering, and migration habitat throughout Europe and Asia. Many stopover areas critical to the curlew's successful migration are only a fraction of their former size. Habitat preserves on the breeding grounds in Siberia, wintering sites in Iraq and Iran, and stopover habitats such as the steppe in Hungary and Yugoslavia and wetlands in Romania, Greece, and Italy are all key components of a successful conservation strategy. The conservation problems facing the slender-billed curlew illustrate the complexity of conserving species that are long-distance migrants and require disparate, geographically separate habitats for breeding, migration, and wintering. Effective conservation requires the cooperation of many nations with vastly differing levels of concern for species conservation.

Though threats to a species often involve a complex of factors, the most pervasive and encompassing threat to birds and other taxa is loss of habitat. Of course, the amount and distribution of suitable habitat changes as a result of natural processes such as succession or large-scale natural disturbance events. Many threatened bird species, however, are currently experiencing rates of habitat loss far above

natural levels, a consequence of indirect degradation or direct destruction by humans. The following examples, drawn from conservation resolutions and action items of the ICBP, emphasize the significance of species endangerment due to habitat loss. These examples demonstrate that habitat loss is a threat to both temperate and tropical areas, affects populations on both oceanic islands and continental mainlands, is promoted by both Third World and industrialized nations, and is often most acute in areas of high avian endemism, that is, regions that historically have served as the key source areas of avian evolution and adaptive radiation.

The Danube Delta in Romania, one of Europe's most significant wetlands, supports some of the largest populations of bird species that are generally widespread across Europe. Over 160 bird species breed in the Danube Delta, among them populations of pelicans, herons, ibises, and terns. Direct threats to the Delta include reclamation and conversion of the wetland to agricultural land. In addition, river channelization, dam construction, pollution, and unregulated commodity exploitation have degraded the quality of the remaining habitat. Fortunately, the Delta has received at least a temporary reprieve; recent presidential decrees have halted for one year all agricultural and hydrological development and have designated the Danube Delta as a Biosphere Reserve.

Prior to their discovery by the Maoris in the fourteenth century, the Chatham Islands, 800 km east of New Zealand, had about 70 bird species and subspecies. When the islands were colonized by Europeans in the early nineteenth century, there remained only 48 species and subspecies, 20 of which are endemic. Since that time four species have gone extinct and eight species are currently endangered. Most of these extinctions can be attributed

to large-scale deforestation, hunting pressure, and introduced rats, cats, opossums, and livestock. Pressures from continuing deforestation and predation have restricted many species to offshore island populations and continue to threaten critically endangered species.

The Atlantic Forest of southeastern Brazil, the third largest distinct biogeographic zone within Brazil, originally occupied about 1,000,000 km². The area is characterized by an extremely high level of avian endemism: 214 of the 940 species of bird recorded in the forest are endemic and 80% of these are confined to the Atlantic Forest. In 1985 the region held 43% of Brazil's human population and the extent of forested land had declined to about 10% of its original area. The costs to avian biodiversity, measured by the association between rising human population and declining forest, have been extensive. Of the world's 1,029 threatened bird species, 121 are found in Brazil. Of these 121 species, 54 occur in the Atlantic Forest and 36 are confined to that area. Nearly all of these species are threatened by habitat loss and fragmentation.

The forests of Vietnam are thought to contain the highest diversity of bird species in Indochina. Yet many species are severely threatened because they exist as small populations isolated by habitat destruction resulting from the Vietnam wars and by continued deforestation due to logging, fuelwood cutting, and agriculture. The Vietnamese government has created a protected area system, but many of the reserves are too small or too isolated to support viable populations of most endangered birds. Meanwhile, options to increase the size and number of reserves are quickly being lost as deforestation continues unabated in the surrounding landscape. The parallel between populations on such fragmented mainland reserves and oceanic islands in their

shared vulnerability to demographic and environmental uncertainty is clear.

The weight of current evidence is sufficient to compel changes in the management of habitats threatened by reduction and fragmentation. This level of certainty is justified even though most descriptions of extinctions are little more than anecdotal accounts of species loss. The former occurrence of a species on an island, for example, is usually based on a qualitative historical account or, at best, fossil remains. The dynamics of the process itself are seldom documented, nor are the key factors that led to the loss of a species known with certainty. The lack of documented examples is not surprising given that the extinction process can be slow: Unavoidably, extinction "experiments" seldom lend themselves to the rigor of statistical inference if for no other reason than that they cannot be replicated. Those who attempt to dismiss the weight of circumstantial evidence and ignore the power of inductive inference would assert that many more "experiments" need to be conducted before a cause-effect relationship between human activities and species extinction becomes unclear. As scientists we acknowledge that individual case studies are seldom, by themselves, compelling; many possible explanations exist for the observed outcome. When many case studies suggest similar cause-effect relationships, however, their collective evidence can support strong inference. Despite the lack of controlled experimental studies of species declines and losses, the collective weight of island case studies argues strongly that no additional replications are needed. Current evidence calls for the immediate implementation of aggressive intervention, management, and restoration policies. This perspective was clearly demonstrated by the number of resolutions encouraging aggressive conservation action unani-

mously adopted at the New Zealand meeting.

Barry R Noon

U.S. Forest Service
Redwood Sciences Laboratory
1700 Bayview Drive
Arcata, CA 95521, USA.

Kimberley Young

International Council for Bird Preservation
c/o World Wildlife Fund-U.S.
1250 24th Street, N.W.
Washington, D.C. 20037, U.S.A.

Literature Cited

- Atkinson, I. A. E. 1985. The spread of commensal species of *Rattus* to oceanic islands and their effects on island avifaunas. Pages 35-81 in P. J. Moor, editor. Conservation of island birds: case studies for the management of threatened island species. ICBP Technical Publication No. 3.
- de Korte, J. 1989. Threats to Indonesian seabird colonies. *Conservation Biology* 3:336-337.
- Haig, S. M., J. D. Ballou, and S. R. Derrickson. 1990. Management options for preserving genetic diversity: reintroduction of Guam Rails to the wild. *Conservation Biology* 4:290-300, 464.
- King, W. B. 1985. Island birds: will the future repeat the past? Pages 3-15 in P. J. Moor, editor. Conservation of island birds: case studies for the management of threatened island species. ICBP Technical Publication No. 3.
- Savidge, J. A. 1987. Extinction of an island forest avifauna by an introduced snake. *Ecology* 68:660-668.
- van Riper, C., III., S. G. van Riper, M. L. Goff, and M. Laird. 1986. The epizootiology and ecological significance of malaria in Hawaiian avifauna. *Ecological Monographs* 56:327-344.