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HURRICANES AND THE FATE OF CARIBBEAN BIRDS—WHAT DO WE KNOW,
WHAT DO WE NEED TO KNOW, WHO IS VULNERABLE, HOW CAN WE PREPARE,
WHAT CAN WE DO, AND WHAT ARE THE MANAGEMENT OPTIONS?

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RECENT HURRICANES have raised concerns regarding the fate of many Caribbean birds, especially for rare, single island endemic species. Although Caribbean birds and their habitats have evolved in an area with a high hurricane frequency and are assumed to be relatively resilient to storm effects, habitat loss and degradation and various other human impacts may place certain species at risk to hurricanes. This symposium was designed to review knowledge regarding hurricane effects on birds and their habitats; dispel myths; identify information needs; review pre- and post-hurricane monitoring and census methods; and identify population and habitat management options to ameliorate storm effects. The symposium identified the species at greatest risk to hurricane impacts, the pre-hurricane information needs, and the potential post-hurricane management responses.

Review of hurricane effects.—The review of previous hurricane studies and the presentations in this symposium indicated that:

1. Direct effects of hurricanes, which occur during the storm (i.e., mortality due to exposure to the storm's winds, rains, or storm surge), are most evident in aquatic or seabirds.
2. Indirect effects, which occur in the storm's aftermath due to damage to the habitat are most evident in land birds.
3. Population declines of land birds are often related to diet – nectarivores and frugivore/seed eaters are most likely to decline, while insectivores and raptors are more resistant to storm effects.
4. Population declines are often most severe at high elevations, reflecting the fact that montane vegetation recovers more slowly than lowland vegetation.
5. Some population declines of land birds do occur as a result of mortality (e.g., Puerto Rican Parrot).
6. Some population declines of land birds represent habitat or location shifts and may include:

- a. Montane populations shift to the lowlands.
 - b. Canopy-dwellers shift to ground level.
 - c. Forest understory species shift to early-successional sites (e.g., pre-existing treefall gaps).
7. Some population declines of land birds and colonial water birds may result from loss of large trees for nesting or roosting.
 8. Reproduction may be initially curtailed or delayed in the breeding season immediately following a hurricane in terrestrial and aquatic species.
 9. Post-hurricane wandering or movements of some birds may bring them into conflict with humans, which may further contribute to bird mortality.
 10. Given the importance of indirect effects of hurricanes on land birds it may be possible to devise management strategies to ameliorate some negative hurricane effects.

Traits of birds that are likely to be at risk of population declines due to hurricanes, based on previous studies and the symposium studies include:

1. Nectarivores, frugivores and seed eating birds.
2. Tree cavity nesting species of birds.
3. Species confined to small habitat fragments on islands.
4. Species that require high elevation or montane habitats (> 1,000 m).
5. Colonial waterbirds (e.g., herons & egrets) requiring trees for nesting.
6. Species of open exposed habitats (e.g., aquatic birds).
7. Species with small (< 500) population size.

Potential management activities to ameliorate hurricane impacts on bird populations include:

1. Close hunting seasons on game birds for at least a year after the passage of a major hurricane.
2. Supplementary feeding might be possible if post-hurricane populations are concentrated in re-

stricted locations where provisioned food might be encountered.

3. Establish lowland reserves as post-hurricane refuges for high elevation or montane species, which move to the lowlands in search of food and shelter following hurricanes.

4. Encourage habitat corridors between forest reserves, which facilitate post-hurricane movement of displaced birds.

5. Plant or favor fruit or seed-bearing plants that are relatively resistant to hurricane damage or have rapid recovery rates after storm (e.g., some palms).

6. Provide artificial cavities for nest or roost sites for species at risk to loss of cavity trees.

7. Encourage wide geographic dispersion of habitat and populations to minimize risk of a strike to a small isolated population or habitat.

Questions.—Questions posed to the symposium contributors included:

1. What information would have been helpful to you prior to a hurricane, which might have allowed a more efficient post-hurricane response?

2. What recommendations do you have for those concerned with storm impacts on sensitive populations?

3. Can you make any management recommendations that might help limit the effects of hurricanes on birds?

General response of participants.—All participants reiterated the importance of having monitoring programs established to provide baseline studies well before the arrival of a hurricane. All studies presented in the symposium were based on comparisons of post-hurricane studies with baseline studies of populations conducted before the storm. All participants agreed that baseline data were absolutely essential to evaluate hurricane effects and López-Ortiz emphasized that without quantitative before and after data it would be difficult to persuade decision makers to respond to hurricane-induced population declines in bird populations. The presentations of Arendt and López-Ortiz were especially noteworthy in illustrating the value of long-term monitoring and other studies well before the arrival of hurricanes. Rusk's Grenada Dove studies suggest the possibility of substantial declines in an already critically endangered population (estimated at 180 doves before Hurricane Ivan). The Grenada work indicated that the doves shifted out of traditional sites and changed their calling behavior thereby making evaluation of the actual numbers of remain-

ing doves difficult. Thus the uncertainty of the dove counts may result in management actions such as captive breeding.

Bradley's experiences in response to the devastating effects of Hurricane Ivan (initially a class 5 storm when it struck Grand Cayman) were especially insightful. She noted the importance of public outreach after the storm to sensitize the public to the plight of birds after the storm. Artificially provisioning some sensitive bird populations (i.e., Cayman Parrots and West Indian Whistling-Ducks) was possible as birds wandered into human settlements in search of food handouts (as long as food supplies lasted on the island). However, wandering parrots were at risk when they came into farm yards in search of food where they were frequently shot. As documented elsewhere, the loss of cavity trees for nesting parrots and woodpeckers was a concern on Grand Cayman where Bradley and collaborators were providing nest boxes to speed the recovery of affected species. Unexpected storm surge contributed to substantial tree mortality on the island's coast in a forest reserve, which was believed (before the storm) to have been the most important forest site on the island - emphasizing the importance of widely scattered habitat reserves on an island. These experiences suggested that preparations for management of sensitive species should be initiated before a hurricane and should include having potential bird food supplies stored, nest boxes constructed, as well as plans in place for public education and outreach. Also, the storm damage to the major forest reserve on Grand Cayman emphasized the importance of considering hurricane effects when establishing nature reserves (i.e., storm surges can cause substantial tree mortality in coastal forest reserves).

Recommendations.—Discussions with participants and the audience indicated that there was a need for information relating to the effects of hurricanes on bird populations and potential management responses. Thus it was recommended that a publication summarizing information on hurricane effects on Caribbean bird populations and suggesting management responses before and after storms should be prepared for decision makers in both the public and private sector. The publication would also suggest ways in which to prepare for these storms in terms of bird conservation. The symposium organizer, J. Wunderle, volunteered to write the proposed publication, which would summarize results from the SCSCB symposium. The recommended work would be published as U.S. Forest Service Technical Report that would be sent to ap-

propriate officials throughout the region as well as provided to participants at SCSCB meetings. The

publication will also be translated into Spanish and French.

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CARIBBEAN WILDLIFE ART WORKING GROUP

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THE MISSION OF THE Caribbean Wildlife Art Working Group: To promote an artistic movement in the Caribbean based on Wildlife Art, to raise awareness and appreciation of the rich biodiversity of the region, and to join efforts among the artistic community to contribute to the financing of the SCSCB.

Our objectives are:

1. To promote the conservation of Caribbean biodiversity, especially birds, through the arts.
2. To create and develop a wildlife artist movement focused on the richness and endemism of Caribbean biodiversity.
3. To contribute to raising funds for the Society for the Conservation and Study of Caribbean Birds (SCSCB) through donations of artwork, limited edition prints, royalties, poster designs, paintings for auctions and raffles, on-line sales, illustrations of books and magazines, designs for T-Shirts and greeting cards, collective exhibitions, and establishing a wildlife photo reference library for artists, among other actions.
4. Design art activities that are related to environmental education and outreach: festivals, workshops, art competitions, and field trips.

Art possesses the capacity to inspire and to touch the hearts of many people. For this reason a group of artists and scientists was founded in the year 2003, the "Caribbean Wildlife Art Working Group," during the 14th Meeting of the Society for the Conservation and Study of the Caribbean Birds in the island of Tobago. Within two years of having been created, the Caribbean Wildlife Art Working Group (CWAAG) has carried out several actions with the objective of promoting the conservation of the biological diversity of the Caribbean, through the fine arts, as well as a movement of wildlife artists in the area.

The results obtained during the first two years (2003-2005) of work were presented in Nils Navarro's presentation to the plenary as a featured speaker: *Caribbean Wildlife Art and Conservation - Art's Capacity to Inspire and Raise Funds for Nature Conservation*. Among the more important actions of the WG: exhibitions of paintings, design of programs for teaching wildlife art in Academies of Fine Arts in Cuba, courses in wildlife art, art competitions for children, Festivals of Art and Nature, design of posters with a conservation message, book illustrations, auction of art to raise funds for conservation NGOs, donation of copyright, preparation of programs for environmental education on the radio and TV, and painting murals for cities (with the topic of the flora and fauna of the Caribbean). Nils also presented several proposals for obtaining funds for the SCSCB. During the meeting, the CWAAG donated T-shirts decorated with a Cuban Macaw painting and an original American Kestrel watercolour painting by Nils for the Silent Auction.

The meeting was a wonderful place to share experiences with other people and have contact with an organization that is enthusiastic about our project support. The needs and recommendations outlined below arose out of discussions with CWAAG members in Cuba prior to and following the Guadeloupe conference, and from discussions with colleagues at the CWAAG meeting, and with meeting delegates during the week.

Our needs include:

1. The project needs to be expanded to other islands in the Caribbean. To date most of the actions of the CWAAG have been carried out in the island of Cuba, including the training courses for young artists in the Academies of Fine Arts. The workshops and training courses should be organized in other countries in the region. This will enable new artists to join our efforts in bird conservation and through their work they will have the opportunity to