Conservation Biology

Essay

Benefits of Studies of Overwintering Birds for Understanding Resident Bird Ecology and Promoting Development of Conservation Capacity

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Abstract: *Funding of ecological research and monitoring of Neotropical migratory birds on their overwintering grounds has benefited both migratory and permanent-resident species. Using examples from our work in Puerto Rico and the Dominican Republic, we demonstrate that ecological research of overwintering migrants often provides information about the ecology and demography of little-known tropical resident birds. Critically important long-term monitoring in Puerto Rico with a focus on winter residents has provided information on the relationships between annual rainfall and fluctuations in resident bird populations and survival rates. It also has alerted local biologists to declines in resident bird populations, including a decline apparently driven by the entry of a brood parasite. But migrant-focused research may also have had an underappreciated effect on the development of conservation capacity and conservation efforts in host countries. Investments in research on Neotropical migrants overwintering on Hispaniola have resulted in a huge increase in field training of students and wildlife professionals, promoted conservation awareness at local and national levels, played an important role in the growth and professionalization of key environmental organizations, spawned a growing ecotourism industry for bird-watching, and driven national park management planning and conservation efforts for all bird species. We encourage funding organizations and agencies to consider the broader impacts of funding migratory-bird research and monitoring efforts, and we encourage researchers in the tropics to use protocols that provide the most information about all the birds that use the study areas involved and to be aware of important opportunities that they may have to build capacity in host countries.*

Keywords: capacity building, ecotourism, funding priorities, monitoring, Neotropical migratory birds

Beneficios de los Estudios de Aves Invernantes para Entender la Ecología de Aves Residentes y Promover el Desarrollo del Potencial para Conservar

Resumen: *El financiamiento de investigación ecológica y el monitoreo de aves migratorias neotropicales en sus zonas de invernación ha beneficiado tanto a especies migratorias como residentes. Utilizando ejemplos de nuestro trabajo en Puerto Rico y República Dominicana, demostramos que la investigación ecológica de migratorias neotropicales a menudo proporciona información sobre la ecología y demografía de aves residentes tropicales poco conocidas. El monitoreo a largo plazo en Puerto Rico con enfoque en las residentes de invierno ha proporcionado información sobre las relaciones entre la precipitación anual y fluctuaciones en las poblaciones y tasas de supervivencia de aves residentes. También ha alertado a biólogos locales sobre declinaciones en las poblaciones de aves residentes, incluyendo una declinación provocada aparentemente por la entrada de un parásito de cría. Pero la investigación centrada en migratorias tuvo un efecto subestimado sobre el desarrollo del potencial para conservar y los esfuerzos de conservación de los países huésped. Las inversiones en investigación de migratorias neotropicales invernantes en Hispaniola han resultado en un enorme incremento del entrenamiento en campo de estudiantes y profesionales en vida silvestre, promovido*

Paper submitted April 25, 2008; revised manuscript accepted July 29, 2008.

Conservation Biology, Volume 23, No. 2, 286–293
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DOI: 10.1111/j.1523-1739.2008.01098.x

la percepción sobre la conservación a nivel local y nacional, jugado un papel importante en el crecimiento y profesionalización de organizaciones ambientales claves, generado una creciente industria de ecoturismo para la observación de aves y conducido la planificación del manejo de parques nacionales y los esfuerzos de conservación para todas las especies de aves. Exhortamos a las organizaciones y agencias financiadoras a que consideren los impactos más amplios del financiamiento de la investigación y esfuerzos de monitoreo de aves migratorias, y exhortamos a los investigadores en los trópicos a utilizar protocolos que proporciones la mayor información sobre todas las aves que utilizan sus áreas de estudio y que estén alertas de las oportunidades que puedan tener para desarrollar el potencial en los países huésped.

Palabras Clave: aves migratorias neotropicales, desarrollo del potencial, ecoturismo, prioridades de financiamiento, monitoreo

Introduction

The well-publicized decline of Neotropical migratory-bird populations during the 1980s (Robbins et al. 1989) led to development of the Neotropical Migratory Bird Conservation Plan, better known as Partners in Flight (PIF; Faaborg 2002; Rich et al. 2004), and spawned a number of important studies of the overwintering ecology of migratory birds in Latin America and the Caribbean. At this time the model of Sherry and Holmes (1996) showed how migratory-bird populations could be regulated by factors occurring on the breeding grounds, the overwintering grounds, or during migration between these sites. Faaborg et al. (2009*a*,*b*) made clear that modern approaches to the conservation of migratory birds must recognize that population limitation of migratory birds can occur on a variety of spatial and temporal scales and that understanding the complexity of habitat usage is necessary for management of wide-ranging species. Unfortunately, most research on migrant birds on their wintering grounds was done during the 1990s and focused on a few species in the West Indies; fewer studies of this nature have occurred since 2000 (Faaborg et al. 2009*a*). To effectively conserve and manage the many Neotropical migrant species, widespread assessments are needed of which species spend the winter in which habitats and what the habitat-specific consequences are of that habitat occupancy across the wintering range (Latta & Baltz 1997; Remsen 2001; Faaborg et al. 2007).

Research into the population consequences of habitat choice and the ecology of overwintering migrants is a low priority of nearly every source of funding for biodiversity conservation for Latin America and the Caribbean (Castro & Locker 2000). Their collaborative study surveyed 65 major donor organizations, including bilateral and multilateral institutions, governmental and nongovernmental organizations (NGOs), foundations, and research institutions, and showed a total investment from 1990 to 1997 of $3.26 billion in this region. Biodiversity conservation within large natural resources management projects and protected area management made up the bulk of funding (35.9% and 35.1% of total funds, respectively), whereas the least-funded types of projects included outreach (1.4%), ecosystem management (2.4%), capacity building (4.3%), and research (5.4%). The relative paucity of funding for research and capacity building exists despite the fact that these areas made up 40% of the projects, indicating that small amounts of funding for these activities supported a greater number of projects.

This pattern of scarce funding for research is illustrated in funding decisions made by U.S. government agencies concerned with the conservation of migratory birds. For example, the North American Wetlands Conservation Act provides grants for conservation projects in wetlands and associated upland habitats required by waterfowl and other migratory birds in the United States, Canada, and Mexico. Since 1991 the Mexico Program alone has supported 194 projects with $25.7 million (http://www.fws.gov/birdhabitat/grants/NAWCA). These grants supported habitat protection and enhancement, environmental education, capacity building, and monitoring, but not research. Similarly, the relatively modest Wings Across the Americas program of U.S. Forest Service International Programs directly supports migratory birds, bats, butterflies, and their habitats at approximately $1,250,000/year. Currently, approximately 40% of these monies are dedicated to avian research and monitoring, with the remainder of funds allotted to programs in habitat planning and management (20%), capacity building (15%), outreach and education (10%), support for multilateral bird conservation initiatives (10%), and conservation of bats and the monarch butterfly (*Danaus plexippus*) (5%; C. Lively, personal communication).

The U.S. Fish and Wildlife Service (USFWS) supports migratory birds in Latin America through its Wildlife Without Borders program. But this program, which has granted more than $9,600,000 to Latin America and the Caribbean from 1995 to 2007, has focused entirely on supporting capacity building, information exchange, and species and habitat conservation, and in 2008 refocused its mission and is now dedicated strictly to capacity building (http://www.fws.gov/international).

Finally, perhaps the most relevant funding program for Neotropical migratory-bird conservation is that provided

by the USFWS under the Neotropical Migratory Bird Conservation Act (NMBCA). Projects funded by NMBCA are almost always multifaceted and involve activities in populations, habitat conservation, research, monitoring, law enforcement, outreach, and education. The USFWS reports that from 2002 to 2006, 58% of projects funded with more than $21 million have included elements of research and monitoring. Nevertheless, a careful perusal of funded projects (birdhabitat.fws.gov/NMBCA/eng_neo.htm) suggests little funding of basic research (Faaborg et al. 2009*a*) and that purely research-oriented projects are not encouraged.

The low priority of research and monitoring in migratory-bird conservation results in part from a need to prioritize funding objectives and the perception that research is undertaken at the expense of other conservation-related needs, such as outreach and education, capacity building, habitat management, land acquisition, and law enforcement. Prioritization of needs is understandable, given the many threats to global diversity and the significant scope of the conservation crisis. Nevertheless, given the large sums of money invested in biodiversity conservation, there is also a critical need to understand where dollars are invested and the outcome of those expenditures (Ferraro & Pattanayak 2006). This sort of conservation accounting has traditionally been minimal in this field.

We argue that funding that targets ecological research and monitoring of Neotropical migratory birds on their wintering grounds benefits both overwintering migrants and permanent residents and that migrant-focused research has an underappreciated effect on capacity building and conservation efforts in host countries. Although we have done work of this nature in several locations in Latin America, we focus here on our studies in Puerto Rico and Hispaniola as examples. Research and monitoring in Puerto Rico have been active since 1972 and are excellent examples of how long-term monitoring provides many insights into the ecology of winter-resident migratory birds and permanent residents. Research on Hispaniola is of shorter duration, but its effects on related conservation activities are more profound. With these examples, we demonstrate that ecological research focused on overwintering migrants can result in a significant increase in understanding of the ecology, demography, and management needs of little-known tropical resident birds. We also show that relatively small investments focused on Neotropical migrants can have a cascading effect and result in a huge increase in field training of students and wildlife professionals; promote conservation awareness; play an important role in the professionalization of key environmental organizations; spawn ecotourism; and drive management planning in national parks and conservation efforts for all bird species.

Impacts on Knowledge of Resident Birds

One of the broad benefits of funding research focused on migratory birds in the nonbreeding season is that field studies can be done in ways that provide new information about resident species in a cost-efficient manner. For example, our research in Puerto Rico has focused on long-term monitoring of birds in midwinter in dry forest at Guánica. The Puerto Rico project has resulted in 31 publications since 1973, including 3 papers that describe the study in general terms (Faaborg et al. 2000). Nine of these papers deal only with winter-resident migratory birds, whereas 19 papers deal only with permanent residents, including 3 papers that discuss the status of the endemic Puerto Rican Vireo (*Vireo latimeri*), which has declined dramatically over the past 20 years due to the effects of an exotic brood parasite. Studies of resident bird species have focused on the relationship between rainfall patterns and demography, including population fluctuations and survival rates of birds (Dugger et al. 2000). Unfortunately, our data show that many resident populations are declining, with no apparent cause. Papers on winter residents focus on population declines in the 1980s (Faaborg & Arendt 1989, 1992) and factors affecting survival rates (Dugger et al. 2004). Future papers will document the sharp decline in winter-resident captures over the past 7 years. Because we had been monitoring populations for 25 years before and now 10 years after the devastation of hurricane Georges in 1998, we will be able to put any changes in bird populations due to that storm into the proper long-term perspective.

Funding for study of overwintering migratory birds on Hispaniola (Table 1) has resulted in 54 peer-reviewed journal articles and books. There have been more publications on the ecology of permanent residents (24) than migrants (19), which indicates how monies targeted for focal Neotropical migrants allows researchers to simultaneously address broader research and conservation objectives. For example, Latta et al. (2003) used mist-net capture and point-count data to quantify avian diversity in 4 habitats along an elevational gradient in the Dominican Republic. These habitats included desert thorn scrub, dry forest, pine forest, and montane broadleaf forest, which together comprise more than two-thirds of existing forest on Hispaniola. This quantitative record of avian abundance and distribution emphasizes the importance of montane broadleaf and pine forest habitats, in particular, to large numbers of Neotropical migrants and Hispaniolan endemics, some of which are narrowly restricted to these habitats. In another study, Latta et al. (2000) determined habitat needs for the threatened endemic Hispaniolan Crossbill (*Loxia megaplaga*) at the patch and landscape levels and suggest that uncontrolled fires are the most important threat to pine forests and the persistence of the crossbill. Studies such as these

Table 1. Funded Research and monitoring projects of overwintering Neotropical migratory birds in Dominican Republic (DR) and Haiti, 1990–2007.

Project title	*Principle investigator(s)*	*Years*
Migrant use of sun and shade coffee	Wunderle & Latta	1992–1996
Bicknell's Thrush distribution & habitat use – DR	Rimmer et al.	1995–1997
Long-term monitoring in the Sierra de Bahoruco	Rimmer & Latta	1995–present
Ecology of migrants along an elevational gradient	Latta	1996–1999
Ecology of migrants in regenerating forests	Latta	2001–2008
Monitoring of duck populations	Ducks Unlimited	2002–2007
Bicknell's Thrush distribution in Haiti	Rimmer et al.	2004–2005
Bicknell's Thrush overwinter ecology	Rimmer et al.	2005–2007
Mercury burdens in Bicknell's Thrush	Rimmer et al.	2006–2007

are invaluable for management and conservation decision making.

Because the Puerto Rico project is limited to 2 weeks every year, it is extremely cost-effective. A few thousand dollars annually covers the travel costs of researchers from the University of Missouri, who work with a federal employee on the island. These funds have come from the U.S. Forest Service for a number of years. Before that, funders included the USFWS and a host of small donors. Certainly, in this case the investment per publication is quite low.

Funding for research projects undertaken on Hispaniola was summarized for all years following publication of Robbins et al.'s (1989) analysis of migratory bird population trends and widespread concern over declines. Total funding for migratory bird research on Hispaniola from 1990 to 2007 was approximately $1.3 million (including salaries), with most funds focused on migrant use of coffee plantations, the overwintering ecology of Bicknell's Thrush (*Catharus bicknelli*), and the winter ecology and survival of migrants in natural and disturbed habitats (Table 1). Funding for research on migratory birds came from a variety of sources, including government agencies (U.S. Forest Service, U.S. Environmental Protection Agency), NGOs (e.g., National Fish and Wildlife Foundation, The Nature Conservancy, Wildlife Conservation Society, Ducks Unlimited), academic institutions (University of Missouri), and foundations (e.g., MacArthur Foundation, Stewart Foundation, Thomas Marshall Foundation). The extreme importance of these funds, nearly all of which originated from outside the Dominican Republic and Haiti, is seen when funding for migratory bird research is compared with all funding for avian research and monitoring on the island. Dominican and Haitian federal agencies contributed little to bird studies of migrants or residents (<$23,000), and other international sources for research on permanent residents (approximately $300,000) was very small compared with that provided for migratory species (>$1.3 million). Clearly, funding for migrants has been critically important in the Dominican Republic and Haiti to accomplish any avian research or monitoring.

The money invested in migratory bird research on Puerto Rico and Hispaniola has resulted in a great deal of new information on migratory and resident birds. The results from these studies and a few others elsewhere in the Caribbean (e.g., Marra & Holmes 2001, Jamaica) and Mesoamerica (e.g., Greenberg et al. 2000, Guatemala) have allowed a much more sophisticated view of what it takes to manage migratory songbirds on their wintering grounds. Some suggest that enough is known about wintering ecology to manage without further research; we suggest that such a thought is dangerous. First, long-term data from Puerto Rico show a sharp decline in captures over the past 7 years, whereas studies on Hispaniola show similar declines over a shorter duration (J. Faaborg, unpublished). But further monitoring must be done to document future changes and to try and understand the causes of these declines. Second, all of the work done on these islands has been confined to small areas, such that the variation in winter-resident ecology across any single island is not well known. Third, many of the studies have been of short duration. Faaborg et al. (2007) show that it takes 5 years to gain a good understanding of species abundances and dynamics at a location. Finally, in many cases, studies have either been species specific (i.e., work on Jamaica focused only on the American Redstart [*Setophaga ruticilla*] and Black-throated Blue Warbler [*Dendroica caerulescens*]; Holmes et al. 1989) or gathered sufficient data for only a few species. For example, in the Puerto Rico project 21 winter-resident species have been captured, but catches of only 3 species were sufficient to allow survival-rate analysis.

There are an unlimited number of important studies that need to be done on winter-resident birds so that management plans will be designed on the basis of valid scientific information. Studies done to date provide excellent models of how such work should be done, and they show that field protocols for winter-resident studies often provide excellent data about permanent residents. We are aware that other researchers have had similar impact on local information and infrastructure, as have researchers in other locations in Latin America, but because such effects are rarely published we limit our detailed discussion to our work on Puerto Rico and Hispaniola.

Impacts on Capacity Building

Funding of field research and monitoring of Neotropical migrants has been extremely important for local students and biologists because it has allowed them to develop expertise in avian field research and monitoring techniques and to develop careers in ornithology and biodiversity conservation. One of the primary conservation threats in countries such as the Dominican Republic and Haiti, where there are no professional ornithologists or professional degree programs offered in ecology or conservation biology, has been the lack of trained field personnel. Typical workshops that are popular with funding sources introduce individuals and local conservation organizations to the skills necessary to conduct standardized avian monitoring, including basic concepts in avian ecology and conservation biology, bird identification, census methodologies, and environmental sampling (Latta et al. 2005). Unfortunately, these workshops do little more than serve as an introduction. To be effective and to operate independently a minimum 3-month internship is needed in which participants can work alongside experienced professionals to learn these skills. Research and intensive monitoring programs are some of the few places where this experience can be gained (Latta et al. 2005), and providing such opportunities in-country is most cost-effective.

To determine the impact of previous training internships on biodiversity conservation efforts in the Dominican Republic and Haiti, we summarized intern experience and post-internship employment of trainees since 1990. Fifty-four of 73 (74%) interns served internships of 3 months or more, with interns receiving training in such skills as monitoring techniques (100% of trainees), banding (62%), point counting (62%), area searches (41%), radio telemetry (12%), and nest searching and monitoring (12%). In a country with few resources for graduate training, these internships are invaluable. Our follow-up survey of where these 73 trainees were in late 2007 and how their training affected biodiversity conservation on Hispaniola (Fig. 1) showed that more than 85% of trainees were still employed in a conservation-related field or were university students. Government employees were represented by 23% of trainees, and more than 20% of trainees were biologists with NGOs or were contract biologists.

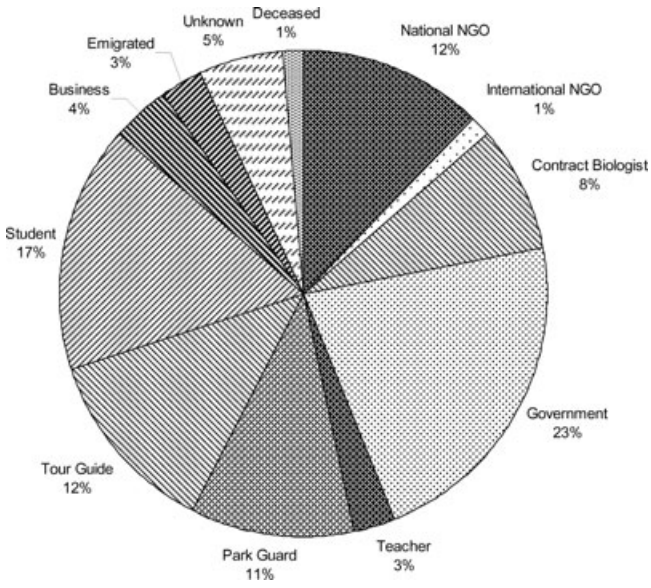

Figure 1. Current (late 2007) employment of 73 interns who received training in avian monitoring and field-research techniques, 1990–2007.

Impacts on Outreach and Education

Funding for Neotropical migratory bird research and monitoring has proven to be of high value in promoting conservation awareness at local and national levels in host countries. Beyond the publication of peer-reviewed articles, researchers are often the focus of the popular press, allowing for the conveyance of a conservation message. Researchers involved with migratory birds have been at the forefront of conservation actions as reflected in media stories on, for example, confrontations over illegal timber harvesting, development within national parks, clearing and burning of lands, and wildlife-trade issues. In the Dominican Republic, we used knowledge gained through research and monitoring to publish a guide to common birds of the island for free distribution in schools (Latta 2002), and we published the first comprehensive field guide to birds of the island (Latta et al. 2006*a*), which was translated into Spanish (Latta et al. 2006*b*) and French (Latta et al. 2006*c*) for local use. Local field guides are often the vehicle by which many individuals first become aware of the importance of conservation, and we expect these guides to have a similar impact on Hispaniola.

Education is also promoted through a process we call, "conservation by presence," which refers to the impact research ornithologists can have on a rural community just by living there for an extended time, integrating themselves into the community, sharing skills and experiences, and talking to people about the importance of conservation. What often results is a diffuse educational campaign that is a "reverse cascade"—meaning local children, who often spend days with the ornithologists, learn the importance of birds, take the initiative to form bird-watching and ecology clubs, and take the lessons they learn home to their parents and siblings. For example, in the Dominican Republic's Sierra de Bahoruco, one of the most critically important areas for endemic bird conservation (Latta 2005), a parrot conservation initiative grew out of local concern for parrot populations

that were being decimated by poachers destroying nest cavities to take nestlings for sale. With local input, an integrated campaign for community education and conservation of the Hispaniolan Parrot (*Amazona ventralis*) was developed that consisted of community-education tools and events, patrols of nest sites, and restoration of nesting cavities destroyed by poachers. Because of this community's location on the Dominican–Haitian border and the realization that conservation must extend across borders, the campaign was subsequently broadened to include multinational cooperation between Dominican and Haitian conservation organizations for parrot conservation.

A second example of conservation by presence evolved around the near elimination of hunting by children in the area. Hunting with slingshots and improvised traps is a frequent pastime of young boys, who give little thought to selectivity of targets or impact of this harvest. As a result of the presence of conservationists, children began to challenge one another's hunting practices, and the children themselves began promoting antihunting campaigns that were maintained by peer pressure. Slingshots and traps were collected by the dozens and turned over to the ornithologists or community leaders. As a result, hunting undoubtedly has been much reduced. We suggest that research and monitoring efforts, because of their long-term nature and focused interest in sites, are ideal vehicles for actually changing awareness and values and thus affecting conservation.

Impacts on Growth of Environmental Organizations

Another effect of investment in research on Neotropical migratory birds has been the growth of key conservation organizations. As pointed out, 13% of trainees from research and monitoring programs now work for NGOs involved in conservation. On Hispaniola 4 groups –3 Dominican and 1 Haitian—have a significant interest in avian conservation. Two of these groups are dedicated primarily to birds, and both were organized following a rapid growth in interest in bird conservation that coincided with migrant-bird research and the training of local biologists and activists in avian research and conservation. The other 2 groups previously worked only on coastal issues and broader conservation initiatives, but have since gravitated toward birds as public interest and local capacity increased. Taken together, these 4 conservation organizations employ 10 biologists, 7 of which have been trained in our migratory-bird research program. This expertise has allowed these groups to take a more active role in avian research programs and community education, with increasingly innovative and sophisticated programs. We suggest that this increasing professionalization of conservation organizations will be fundamentally important to addressing the many environmental challenges facing Hispaniola.

Impacts on Wildlife and Protected-Area Management

Another impact of migratory-bird research programs can be seen in the management of wildlife and protected areas by the Dominican government. Of 7 biologists currently employed in the wildlife division, 4 have received training in our migrant research program. Among other initiatives they have used their skills to develop and implement monitoring plans for waterfowl and doves, which have been used in turn to draft new legislation regulating hunting of these game species.

Data generated through migratory bird research were also instrumental in affecting management planning efforts in the critically important Sierra de Bahoruco National Park. The directorate of national parks went through an extensive management planning process for the park in 2004–2005 in which ornithologists lobbied for the expansion of the northern border of the park to include critical habitat for birds, especially the critically endangered Bay-breasted Cuckoo (*Coccyzus rufigularis*). Designers of the management plans responded to proposals generated by avian-monitoring trainees to endorse long-term monitoring of birds in the park, and to develop educational centers and interpretive trails at key locations in the park. The location of interpretive trails and sites for watching birds were selected because they were first identified by researchers as being important to birds or being in areas with high numbers of birds.

Impacts on Ecotourism

Finally, research focused on migratory birds has supported a budding ecotourism industry. This is evidenced by the growing number of bird-watching tours and locally based and locally trained bird guides for international tours. In the Dominican Republic, 6 guides are now trained and actively guiding high-end international bird watchers. All these guides have been associated with our migratory-bird research and monitoring program, and only rarely do tours *not* use our research sites as destinations. Research teams identified the importance of many of these sites for migratory, resident, and endemic species. Because of knowledge of the avian community and publicity generated by the research program, these study sites have become key locations in the bird-watching circuit.

Ecotourism has also developed at other diverse sites, with 12% of our trainees working at least part time as tour

guides. These tour guides are also frequently involved in local efforts to monitor bird populations, especially in a national waterfowl-monitoring program, which suggests there are multiple benefits to biodiversity conservation in the training of these guides. Thus, we suggest that migratory-bird research and monitoring programs and their trainees have supported ecotourism by increasing the availability of tours and broadening the possible experience of tourists through development of new ecotourism sites. In addition, researchers have participated in the development of local pictorial guides to common birds (mentioned above) and promoted the identification of new sites for watching wildlife. At present, many of these guides will be involved in describing and developing the region's first birding trail, a series of publicly identified and promoted sites for bird watching.

Discussion

Despite the amount of investment in biodiversity conservation to address the critical threats faced in Latin America and the Caribbean, degradation of habitats and loss of species continues. This includes dramatic declines in populations of Neotropical migratory birds (Rich et al. 2004). In facing these challenges, conservationists are obligated to understand the extent of biodiversity conservation funding and its impact on conservation measures in the region, and the efficient and strategic investment of financial resources is a key component of effective conservation (Castro & Locker 2000).

Migratory-bird research on the wintering grounds must focus on identifying sites that support high annual survival of both sexes in as high abundance as possible, and management of wintering habitat must focus on maintenance of these sites (Faaborg et al. 2009*b*), such that we avoid problems associated with low habitat quality that delay initiation of spring migration and potentially reduce reproductive success on the breeding grounds (Marra et al. 1998). Numerous studies are needed on the ecology of wintering migrants that equal the quality of those of Holmes et al. (1989) and Marra and colleagues (Marra & Holberton 1998; Marra et al. 1998; Marra & Holmes 2001) on the American Redstart, Latta and Faaborg on Cape May Warbler (*Dendroica tigrina*) and Prairie Warbler (*D. discolor*) (Latta & Faaborg 2001, 2002), Wunderle (Wunderle 1995; Wunderle & Latta 2000) on Black-throated Blue Warbler, and Greenberg et al. (1997, 2000) on bird use of coffee plantations, but they need to cover a broad range of species, habitats, and geography.

Such research requires an intensive investment of time and has been done for few species. The only mid- to long-term research and monitoring programs that are broadly focused on migratory birds in the Caribbean today are those of Faaborg, Arendt, and Dugger in Puerto Rico, Rimmer and McFarland's work in Bicknell's Thrush habitat in the Dominican Republic, Latta in a variety of natural and anthropogenic habitats in the Dominican Republic, and Wunderle's work with Kirtland's Warbler (*D. kirtlandii*) in the Bahama Islands. Intensive studies with color-marked birds have the potential to reveal much about the conservation value of many types of habitats and offer opportunities to simultaneously determine population trends for resident species that often also are of great concern (Latta et al. 2005).

Our results indicate that contrary to current funding patterns, funding for migratory-bird research and monitoring can provide broad benefits. This is critically important, because general budget reductions and changes in funding priorities have resulted in apparently little interest in the fundamental work that is important to expanding our understanding of migrant birds. Without consistent funding, advances in understanding the ecology and population trends of migratory birds will continue to be piecemeal. Although funding that targets key questions in migratory bird ecology and conservation would be preferred and would likely deliver significant advances in understanding in a relatively short time, in the near future management recommendations and conservation decisions may need to be made on the basis of incomplete knowledge.

In addition, we demonstrate here that ecological research on wintering migrants often involves methodologies that provide information about the ecology and demography of little-known tropical resident and endemic bird species, including new information on resident distributions, habitat requirements, community composition, and behavior. But research focused on migratory birds has also had a huge impact, especially in the Dominican Republic, on capacity building and conservation efforts. Investments for Neotropical migrants has resulted in a significant increase in field training, promoted conservation awareness, supported the growth and professionalization of environmental organizations and ecotourism, and driven park planning and conservation efforts. We encourage funding organizations and agencies to consider the broader impacts of funding migratory-bird research and monitoring efforts, and we encourage researchers in the tropics to use protocols that provide the most information about all the birds using the study areas and to be aware of important opportunities that they may have to help build capacity in host countries. We suggest that this approach supports the many recent calls that effective conservation demands an empirical evaluation of biodiversity conservation investments.

Acknowledgments

We thank T. Rich and C. Eberly for organizing the symposium on Conservation of Biodiversity through Actions Benefiting High Priority Landbirds at The Wildlife Society

(TWS) meeting in Tucson, AZ. We also thank the Biological Diversity Working Group of TWS for sponsoring the symposium, as well as fellow presenters for sharing their input and ideas. J. Wunderle Jr., D. Blockstein, G. Meffe, and an anonymous reviewer provided useful comments on an earlier draft of this paper. S.C.L. thanks the many current and former collaborators who helped collect the data described here, especially R. Lorenzo, K. McFarland, D. Mejía, M. Paulino, C. Rimmer, E. Vásquez, K. Wallace, and J. Wunderle.

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