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MANAGEMENT, CONSERVATION, AND RESEARCH NEEDS—INTRODUCTION

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One of the primary goals of this volume is to provide information that will be useful in the management of Willow Flycatcher populations, especially the recovery of the federally endangered Southwestern subspecies *Empidonax traillii extimus*. Although the Southwestern Willow Flycatcher Recovery Plan (USFWS 2002) outlines a recovery strategy for *E. t. extimus*, the actual recovery of the Southwestern Willow Flycatcher is dependent on the actions of managers. These managers will need reliable and up-to-date information to achieve recovery goals. Three threats identified in the recovery plan are habitat loss and degradation, cowbird parasitism, and environmental contamination. This section brings together papers addressing each of these threats, as well as information relevant to research techniques used to study and monitor flycatchers.

HABITAT RESTORATION

A major part of the recovery plan addresses habitat restoration as a strategy to reverse widespread loss and degradation of riparian habitat. Compliance with the Endangered Species Act of 1973 has often provided the otherwise unavailable motivation and financial means to improve ecosystem function by protecting and restoring habitat. Conversely, in many cases, managers working to improve riparian ecosystems in the Southwest for reasons other than Endangered Species Act compliance, will also be improving flycatcher habitat.

Many past attempts at riparian habitat restoration have been costly and largely ineffective at creating suitable Willow Flycatcher habitat because they often lacked the natural processes needed to regenerate and maintain the habitat (Briggs 1996). Restoration methods and results need to be documented so that we may learn from successful and unsuccessful efforts.

Paul Boucher and colleagues provide an example of an approach that can benefit Southwestern Willow Flycatchers by creating breeding habitat in the process of achieving other goals. They describe how the Gila National Forest in southwestern New Mexico used a combination of managed and natural processes to stabilize banks and create riparian habitat. Retiring grazing, excavating the riverbank to the water table level, constructing a temporary berm, and planting native riparian tree cuttings set the stage for the naturally occurring flooding, sediment deposition, and revegetation that followed. Southwestern Willow Flycatchers colonized this site and a nearby site on private property managed in a similar way. The rapid colonization of these two restoration sites was due, in part, to their proximity to a large core population of flycatchers upstream in the Cliff-Gila Valley.

COWBIRD MANAGEMENT

Cowbirds were identified as a major threat to Southwestern Willow Flycatchers in the listing proposal (USFWS 1993), despite relatively little information on the actual ecological impacts that cowbirds have on local and regional flycatcher populations. The chapters in this section caution that managing cowbirds at a local scale may not result in increased flycatcher populations.

GRAZING MANAGEMENT

Some of the grazing management for the flycatcher has been based on assumptions about the relationship between cowbirds and livestock (Goguen and Mathews 1999, Robinson 1999). It is generally believed that livestock attracts cowbirds and that livestock removal will reduce cowbird density and, subsequently, the number of parasitized nests (Verner and Ritter 1983, Airola 1986, Young and Hutto 1999). Yet, there is much literature suggesting that local and landscape features such as habitat type, canopy cover, distance from edges, human development, agriculture, and host density also influence cowbird abundance and distribution (Chace and Cruz 1999, Donovan et al. 1997, Goguen and Mathews 1999, Robinson et al. 1995b, Rothstein 1994, Staab and Morrison 1999, Young and Hutto 1999). Throughout much of the western U.S. cowbirds are most abundant in riparian habitat, regardless of distance to foraging habitat (Robinson 1999). In landscapes where feeding areas are abundant and cowbirds saturate breeding habitat, parasitism may not decline with removal of livestock (Robinson 1999). Without multiscale and site-specific information on the relationship between cowbirds, landscape variables, and livestock, it is difficult to predict whether removing livestock alone will result in decreased cowbird densities.

Chapters by Juddson Sechrist and Darrell Ahlers, and Rinda Tisdale-Hein and Richard Knight reinforce this concern, and raise important questions that need to be considered regarding the effectiveness of cowbird control via cattle management. On the Rio Grande in New Mexico, they found no difference in daily distance traveled or density of cowbirds in habitat where cattle and anthropogenic activity were present vs. where cattle and anthropogenic activity were absent. Although they did not evaluate the direct impacts of grazing on habitat, they concluded that removing livestock may not benefit flycatchers if other local factors promote cowbird persistence. If adequate food is available within the commuting distance of cowbirds, then potential host densities likely determine local cowbird densities, regardless of cattle presence or absence. Thus, managers should carefully assess the relationship between cowbirds, livestock, and habitat across the landscape when considering management options. The approach used in these studies should be extended to a larger scale to determine whether riparian sites more distant from cattle support fewer cowbirds and lower parasitism rates.

Cowbird Trapping

Cowbird trapping is popular as a local and short-term management tool, but with concerns about its effectiveness in increasing host populations (Hall and Rothstein 1999, Smith 1999) it is not applied as systematically in some areas as it was a few years ago. Several papers in the 1997 cowbird symposium held in California (Morrison et al. 1999b) cautioned against using cowbird trapping as a permanent fix for reversing declining songbird populations.

Stephen Rothstein and co-authors provide a comprehensive overview of this issue, and provide guidance as to considerations about, and methods for, cowbird management relative to the flycatcher. For example, although cowbird control may reduce parasitism rates and increase the reproductive output of Southwestern Willow Flycatchers, giving the appearance that it is an effective management tool, increasing reproductive output does not necessarily equate to stabilized or increased flycatcher populations. Also, endangered passerines that are impacted at the population level by parasitism are also impacted by reduction or degradation of habitat due to anthropogenic factors; if the habitat in these areas were restored, these endangered birds may be able to coexist with cowbirds. Therefore, cowbird management alone will not increase flycatcher populations limited by habitat. Rothstein et al. also recommend that the decision to trap cowbirds should be based on whether the population in question is significantly parasitized, as determined by baseline data collection; to date, this has seldom been the case.

INVESTIGATING ENVIRONMENTAL CONTAMINANTS

Many of the potential threats to flycatchers have been studied and are understood well enough to develop management recommendations (Green et al. 2003, USFWS 2002). However, little is known about the potential effects of environmental contamination resulting from agriculture, mining, industry, and urban activities. Even less is known about contaminant levels toxic to birds, especially passerines. Birds may accumulate contaminants from one or more sources over broad geographic areas, including migration routes, so isolating the source and determining the effects on flycatchers requires substantial sampling and analyses in both the breeding and wintering grounds.

One chapter in this volume begins to fill this data void. Deformities observed in Willow Flycatchers across the Southwest (Sogge and Paxton 2000) prompted Miguel Mora and colleagues to assess environmental contaminants in central Arizona. Testing for inorganic and organic contaminants in surrogate bird species and potential insect prey, they did not find contaminant levels high enough to be implicated in the deformities. Thus, the physical deformities observed in flycatchers at these central Arizona sites may be due to other factors, including exposure to other contaminants that were not measured. A related study similarly concluded that organochlorine compound concentrations in flycatcher nestlings and eggs, surrogate birds, and insect prey at sites in Arizona and California were below known thresholds for adverse effects on birds (King et al. 2002).

Although results from these studies regarding excessive contaminant levels did not directly link contaminants and flycatcher deformities, the potential for contaminant impacts on flycatchers remains high. Mora et al. in this volume, and in a report based on the following year's data (Mora 2002), found elevated levels of selenium and strontium. Similarly, King et al. (2002) found some contaminants (selenium and possibly boron) above typical background levels. More research should be conducted on (1) the rates of bioaccumulation and sensitivity of Willow Flycatchers, surrogate species, and eggs to these and other potential contaminants, and (2) contaminant levels in surrogate species at additional flycatcher breeding sites (within and between drainages) and wintering sites.

RESEARCH TECHNIQUES

This section concludes with three papers addressing research techniques and approaches for future research. One paper tests the survey protocol in an attempt to improve measures of flycatcher abundance, another improves research methodology for color-banding, and the last explores radiotelemetry to quantify habitat use and home range.

Improving Measures of Flycatcher Abundance

Tracking recovery progress will be achieved partly through monitoring Southwestern Willow Flycatcher distribution and abundance (USFWS 2002). Adequate survey coverage across the broad range of this species can be a challenge, given the limited funding, volume of habitat needed to be surveyed, and narrow time frame to conduct surveys. As pointed out in papers in Section 1, most survey data collected to date have limited usefulness in determining population trends because of inconsistent coverage and effort across years. The current flycatcher protocol (Sogge et al. 1997a, with USFWS 2000 supplement) provides a standardized survey methodology and is widely used; a similar protocol is recommended for Sierran populations (Bombay et al. 2000). However, these tape playback-based survey protocols have not been extensively field tested, especially for use by nonexperts. Although the survey protocol was not designed to precisely determine flycatcher abundance at any given breeding site, it is often used this way, especially when time and financial resources are limited. Roland Shook and co-workers present information that will be useful in developing methods for measuring abundance. The field test they conducted reinforced that experienced surveyors familiar with all vocalizations are more likely to attain accurate counts than inexperienced surveyors. While this is an important first test of the methodology, additional and more extensive tests are needed to better determine the protocol's effectiveness of detecting populations of different sizes, in differing habitats, and during different parts of the breeding season.

In addition to response to tape-playback, other aspects of flycatcher behavior can affect survey results and population estimates. High polygyny rates, if undetected, can lead to underestimates of population size (Davidson and Allison *this volume*). Female song (Yard and Brown *this volume*) can result in overestimating local population size if surveyors make the common assumption that all singing birds are males. The presence of floaters (birds without territories) and unmated males may also affect population estimates. More data are also needed on how mating strategies and behavior can affect survey estimates, and how variable they are among populations.

Improving Research Methodology

While research generates information critical to conducting and evaluating management and conservation actions, it can also generate improved techniques that minimize impacts to the study species. Therefore, it is important to track and evaluate the effects that research may have on the target species. William Haas and Lori Hargrove present information on how to maximize the safety of a widely-used technique that provides otherwise unavailable data on individual animals. They describe banding injuries similar to those noted by Sedgwick and Klus (1997) and other researchers (M. Sogge and M. Whitfield, unpubl. data), and recommend techniques that have been successful in reducing these impacts.

Using Radiotelemetry to Determine Habitat Use and Home Range

Papers in Sections 1 and 2 of this volume indicate the need for quantitative habitat characteristics, use, and selection studies at different scales. Where data have been collected, habitat characteristics have been measured within nest sites, territories, and habitat patches (U.S. Fish and Wildlife Service 2002). Although it is typically assumed that the area most important to a flycatcher is that in which it is most frequently observed, the geographic extent of area used cannot be known if the bird travels beyond the territory or patch. A flycatcher's home range can be greater than its defended territory, and can change throughout the breeding season. Unfortunately, it is very difficult to visually track flycatchers as they move through dense habitats or across large distances, so determination of home range and habitats used is problematic. Knowing how flycatchers use a local area can be important in predicting impacts of potential projects.

Eben Paxton and colleagues tested the feasibility of using radiotelemetry techniques for studies on Willow Flycatcher home range, habitat use, and local movement. This pilot study documented frequent use of adjacent non-riparian habitat and local exploration forays, suggesting that flycatchers may regularly use larger areas than their defended territories. Future radiotelemetry studies of Willow Flycatchers will help determine the relative importance of nonriparian habitat types at breeding sites, and how landscape composition influences flycatcher home range size and habitat use at different sites.

OTHER RESEARCH NEEDS

The research needs presented here were largely generated from the studies published in this volume. More detailed research needs and guidelines can be found in the Sedgwick (2000), the Southwestern Willow Flycatcher Recovery Plan (USFWS 2002), and the U.S. Forest Service conservation assessments for the Southwestern Willow Flycatcher (Finch and Stoleson 2000), and those in the Sierra Nevada (Green et al. 2003). These resources, and the many Willow Flycatcher studies published elsewhere, have already contributed greatly to improved management for this species. We hope the papers in this section provide additional guidance towards achieving recovery and conservation of Willow Flycatcher populations.