Biological Objectives for Bird Populations[1]

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Introduction

This paper explores the development of population-based objectives for birds. The concept of population-based objectives for bird conservation lies at the core of planning in the North American Bird Conservation Initiative. Clear objectives are needed as a basis for partnership, and a basis for program evaluation in an adaptive context. In the case of waterfowl, species for which large demographic datasets provide a rich ground for analysis, there have been successes in formal, model-based scenarios for setting and tracking objectives. The approach used for waterfowl may allow uncontrollable environmental effects to be modeled, improving the evaluation of conservation actions. Setting such objectives for many landbirds seems difficult because data is often sparse and guidelines to avoid arbitrariness are few. A disciplined approach to setting objectives will be needed to achieve broad societal support for landbird conservation, and to provide a basis for the broad-scale conservation practices that most non-endangered landbird species need. We must set objectives for work on birds, but we will not want to expend the effort to set objectives for all birds in all areas - the current approach in identifying species for conservation priority will serve to provide a pool of candidate species for objective-setting.

Objectives for Managing Bird Populations

Many outcomes may be envisaged in a conservation plan for birds. They could include those usually anticipated for endangered species (establishing new populations, maintaining viable populations, accomplishing approved recovery plans) as well as efforts to keep common birds common. In some cases we may wish to reduce population numbers. The objectives can serve many functions such as marketing tools, as a basis for establishing other program objectives such as habitat objectives, or as agency performance indicators.

As is discussed in greater detail below for selected examples from work underway, bird conservation objectives should be achievable, communicable, understandable, consistent with other conservation plans, fit with the right scale for implementation, be measurable with current monitoring methodology, comparable among regions that share the species and across scales, quantitative, and robust to uncontrolled environmental variation. No system for bird conservation planning has all these desirable characteristics. Nevertheless, objective-setting should work towards these ideals.

The North American Bird Conservation Initiative envisages a hierarchy of objective-setting from the continental level down through a series of smaller scales. It sets a goal that "Populations and habitats of North America's birds [are]… protected, restored or enhanced through coordinated efforts at international, national, regional, state and local levels, guided by sound science and effective management."

This descent through scales to "step-down" continental population goals to regional population planning baselines greatly increases complexity. For example, model-based monitoring and comparison of predictions of models of population-environmental associations can be used to define local habitat targets and allow steps to implement conservation actions. However uncertainty is introduced throughout this process - Are the population models adequate? Will the habitat intervention have the predicted effect? Will local monitoring be adequate? Will environmental or social factors mask the intended effect? Is monitoring of treatment, response, regional habitat, regional populations, or range-wide populations accurate and precise? Are there threats to populations that we do not know about? Are there off-site effects that limit population growth? Can regional populations be linked reliably to the continental targets?

The three case studies provided below show how these problems are being tackled continentally for waterfowl and landbirds, and regionally in the Intermountain West Joint Venture for all bird species.

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Biological Objectives and the North American Waterfowl Management Plan

One hallmark of the 1986 North American Waterfowl Management Plan (NAWMP; U.S. Department of the Interior and Environment Canada 1986) was an unprecedented international agreement on objectives for selected North American waterfowl populations. Duck population objectives were derived largely from average breeding population levels of the 1970s in geographic areas and for species that had well-established duck population monitoring. The decade of the 1970s was chosen to reflect general societal acceptance of waterfowl population levels. That period exhibited a range of environmental conditions in the prairie-parkland region, an important breeding area characterized by dynamic habitat conditions. Goose and swan objectives reflected more recent changes in the distribution and abundance of these species and were consistent with objectives developed through consultations mostly within waterfowl management flyways. Population objectives for waterfowl were intended to meet both consumptive and non-consumptive societal interests.

As noted in the 2003 Update to the NAWMP (in prep.), waterfowl population objectives serve three important functions related to communications, planning, and evaluation. First, population objectives establish the NAWMP's purpose as the maintenance of waterfowl populations, and identify habitat conservation as a primary means to this end. Explicit objectives for species conservation facilitate the communication of Plan priorities with policy-makers, conservation partners, and the public. Second, waterfowl population objectives provide a basis for cohesive regional conservation planning and evaluation, of value for habitat programs as well as for harvest management. Third, population objectives provide a benchmark for assessment of the status of North American waterfowl. To fulfill these functions, NAWMP population objectives must be quantitative and comparable to the results of operational monitoring programs.

The continental population objectives of the NAWMP provide a foundation for cohesive regional waterfowl conservation planning through the geographic structure of Habitat Joint Ventures and Bird Conservation Regions (BCRs). Several methods have been used to apportion the continental population objectives to regional levels. Each of these methods requires assumptions about seasonal waterfowl redistribution and the relationship between regional and continental populations. Continental objectives, once apportioned at the regional level, can become the basis for the development of regional conservation objectives.

Regional habitat conservation objectives derive from the species population objectives. Regional habitat objectives are ultimately derived from conceptual or empirical models that describe the effects of habitat and weather variability on waterfowl populations. To accommodate knowledge or data gaps, planning models are based upon assumptions that may be explicit or implicit. To make a plan, conservation specialists develop a suite of strategies or actions believed to be cost efficient in attaining regional habitat objectives, and thereby contribute to the population management targets. In developing conservation strategies, planners consider the present condition and distribution of regional habitats and make predictions about proposed conservation measures and the circumstances under which to apply specific treatments. Assumptions made throughout the planning process, when explicitly stated, can be viewed as management hypotheses, and monitoring and research activities can be developed to assess their validity and adjust conservation priorities as required (Anderson et al. 1996, Williams et al. 1999).

The utility of population objectives as measures of NAWMP performance is limited if the confounding effects of environmental variation are not taken into account. Moreover, it is not always possible to enumerate Plan habitat accomplishments, particularly in the case of environmental policy successes (Williams et al. 1999). Regardless of these limitations, significant, long-term declines in waterfowl populations from NAWMP objectives indicate a cause for concern and indicate the need for increased management attention. The development of objectives that are scaled to reflect the effects of natural environmental variation on population size is one proposed method to improve the utility of NAWMP continental population objectives as performance measures (Williams et al. 1999).

Similarly, population objectives apportioned at smaller geographic scales serve a valuable planning function but exhibit increasingly troublesome controllability problems as measures of management performance. This is because annual variation in regional population abundance of highly migratory species is in part a function of processes unrelated to the condition and availability of habitats within a region. At least two approaches can be envisioned that would improve the utility of smaller regional population objectives as performance metrics. First, scalable regional objectives of the kind applied at larger scales could be developed to control for population changes resulting from natural variations such as short-term weather patterns. Secondly, local management objectives could be stated in terms of specified vital rates instead of abundance, thus isolating the effect of that regional habitat within the annual population cycle. Objectives at local scales reflect underlying population dynamics models, and

these incorporate the targeted vital rates as well as other concerns such as density dependence. The challenge in focusing in to smaller geographic and temporal scales is in understanding the appropriate demographic and environmental parameters. The correct formulation of these scale-dependent population-environmental relationships is not only important to the establishment of useful population-based performance metrics, but also in the setting of regional habitat objectives and conservation strategies which are predictably related to population objectives.

The PIF Process for Setting Biological Objectives

The Partners in Flight (PIF) Continental Plan (in prep.) includes range-wide population targets for a selection of the 448 landbird species included in the Plan. Species were selected either because of perceived risk to their sustainability (Watch List Species), or because they exhibited high value for regional stewardship (Stewardship Species). Targets are not provided for species listed under the Endangered Species Act (in the United States, ESA) or the Species at Risk Act (in Canada, SAR) because legislated targets undergo greater scrutiny and have greater weight than the general targets established in PIF. The general objective in the PIF plan is to maintain current populations, or to return declining species' numbers at least to their level in the late 1960s. This period was selected because the targets it implies were believed to be achievable and realistic for most of the species, because PIF recognized that extensive losses and modifications of habitat since the European settlement of North America were not likely to be reversed to a significant extent, and because reliable trend data does not exist for most landbirds prior to the mid-1960s when the Breeding Bird Survey (BBS) was initiated. The population objectives were based on degree of population change since 1966, according to the BBS where applicable and any available supplementary information elsewhere. The targets are expressed as desired proportional increases in population size. Four possible objectives were defined:

1. *Increase population size by 100 percent*: This objective was established for all species that have declined ≥50 percent during 30 years. It was the goal for nearly a third of the 100 Watch List Species and for four Stewardship Species not on the Watch List.

2. *Increase population size by 50 percent*: This objective was established for all species that have declined 15-50 percent during 30 years. It was the goal for 23 Watch List Species and for 17 Stewardship Species not on the Watch List.

3. *Maintain population size*: This objective was established for species with stable or increasing populations. It was the goal for 37 Watch List Species and more than half the Stewardship Species not on the Watch List.

Estimates of current population size were used to derive desired population sizes. For example, the estimated current Brewer's sparrow population size is 16 million, and the goal was to double population size. The numerical target was thus set at 32 million birds. The authors emphasized, however, that the biological objective was defined by the categories above, not by the specific numerical targets some of which will probably change as better information is obtained on current population sizes. While these large-scale targets are expected to help motivate regional planning, complexities will develop in efforts to step down to the Province, State, and Bird Conservation Region levels, just as has occurred for waterfowl. In many cases it is expected that new priorities will emerge, together with a shifting of objectives towards habitat quality and quantity and locally-influenced vital rates of birds. The challenge will remain to maintain relevant links to the larger scale population objectives. Results of this work will be posted on the PIF web site, http://www.partnersinflight.org.

Biological Objectives in General Conservation Programs

The Intermountain West Joint Venture (IWJV) provides a current example of regional planning. It is developing habitat conservation targets based on consideration of larger scale population objectives for all bird groups. Each State in the IWJV is setting its own habitat targets, and a simultaneous effort is being made to link these to compatible regionwide targets. The process thus has both step-up and step-down elements. The initial goals will be based on birds but results will be circulated to other conservation planning groups in the hope that agreement can be reached on westwide "conservation goals", not just bird conservation goals. The smaller the scale of planning becomes the more this broadening of species coverage makes sense, as we have seen how population objectives for species often shift to overall environmental factors at smaller scales. The report describing the analysis for IWJV birds is expected to have the following sections.

1. Introduction: review of conservation plans prepared by the Joint Ventures, bird initiatives, the agencies, and others, with emphasis on plans that

include quantitative conservation targets; summary, identifying gaps by taxon and region.

2. How the west has changed: summary of major changes in the western environment since settlement by people of European descent; emphasis on changes that have reduced the quality of bird habitats but also including discussion of how changes have affected other animals and plants.

3. Expected future trends: summary of the expected major changes in the next several decades emphasizing changes that will reduce the carrying capacity of the environment for natural communities, especially birds (e.g., grazing, fire, water shortage, invasive species, development); estimates of how much degradation will occur if current trends continue.

4. Opportunities for conservation: identification of the major opportunities to reverse the negative trends identified in #2 and avoid the threats identified in #3 (e.g., the Farm Bill; private donations to The Nature Conservancy, Ducks Unlimited and other groups; the ESA; actions by regulatory agencies such as Environmental Protection Agency); assessment of how much progress can be made by using these opportunities.

5. The westwide conservation goals: quantitative conservation targets, consistent with, and based on, targets in conservation plans but adding additional targets where none has been established to produce westwide goals; discussion of how the targets were derived (e.g., emphasizing habitat or ecological processes); identification of how success will be measured emphasizing birds (e.g., density, fraction of birds paired, productivity).

6. The westwide conservation strategy: suggestions for how the goals can best be met including coordination, research needed, and roles for major participants.

Biological objectives will be formulated from these habitat conservation goals for selected species by (1) describing which habitat the species uses, (2) assessing how dependent each species is thought to be on this habitat, and (3) estimating how much the species' habitat will change if the conservation goals are achieved. For example, if breeding habitat for the species is expected to double, and unless there are clear indications that the species is limited by nonbreeding habitat, then the predicted population response - and the biological objective for the species - will be a doubling of population size. These predicted outcomes will be compared to the population objectives set by individual bird initiatives as one way to describe the expected accomplishments of the proposed conservation plan.

This approach to setting biological objectives differs from the high-level ones above in two fundamental ways. First, the large-scale plan objectives are based solely on birds (including their use by people); they thus present desired integrated outcomes for birds but lack details of the highly complex delivery processes evident at smaller spatial and temporal scales. The targets described here, in contrast, are meant to be fully achievable at the implementation scale and, therefore, to include other considerations such as needs of species other than birds, costs, opportunities, and a more detailed analysis of effects on people (e.g., the plan might call for locating habitat close to human settlements to increase the economic benefits these communities receive). The westwide conservation goals are thus fundamentally about more than just birds, though bird population targets are certainly being heavily used in setting the conservation goals. Second, the large-scale, species-based population objectives of continental plans are linked to measures of success of the regional plans but cannot be the sole determinant of that success. Thus, if the goal is to double the population size of a species, but this does not occur despite the regional conservation goals being met, then an investigation should be undertaken to determine why the expected increase did not occur. The investigation might reveal that habitat quality was not as high as expected, which might lead to additional restoration efforts. Alternatively, it might turn out that the species was limited by events in the wintering range of the species outside the IWJV area, in which case the discrepancy between predicted and observed population response would not be viewed as indicating a failure of the conservation program.

Comparison of the Approaches and Suggestions for Future Work

In the examination of work now underway several conclusions are possible:

1. At the highest geographic planning scale, objectives are being set quantitatively for species of birds. These objectives coincide well with international obligations for migratory birds treaties and the resulting federal bird protection mandates.

2. Rangewide objectives may not be set for all species. Instead, a selection of species with high priority for conservation may be made to make the planning effort more tractable.

3. At smaller geographic scales greater planning detail is required, leading to increased complexity

and shifted emphasis in objective setting. New priorities may emerge, species coverage may broaden, and models may be used to convert species conservation objectives to habitat objectives, to isolate controllable population parameters, or to control for external environmental factors.

4. The problem remains to maintain linkages among objectives at all scales, to meet the requirements of program development, partnership building, communication, marketing, evaluation, and to ensure that the desired conservation results are achieved.

5. Further work is needed in many areas, notably development of adequate monitoring programs, research into the root causes of bird population change, and development of ways to link the annual population cycle of highly migratory species to the effects of local interventions.

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