Considerations for Establishing Bird Population and Habitat Objectives to Further Conservation within Habitat Joint Ventures

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Preface

In October 2009, the North American Bird Conservation Initiative (NABCI) held a workshop—*Developing Population Objectives for Regional Scales*—in St. Louis, Missouri. Coordinators and science staff of the various Bird Conservation Plan Partnerships and Joint Ventures came together with the goal of improving the Joint Venture/Bird Conservation Plan Partnership community's ability to develop coordinated regional population objectives and the habitat objectives needed to reach them. Participants discussed methods of setting both continental and regional population objectives and their relationship to one another; the roles and responsibilities of Joint Ventures and the Bird Conservation Plan Partnerships in developing them; data and methods used to estimate population sizes and link them to habitat quantity and quality; and approaches that can be used to improve bird population estimates and their associated habitat objectives in an adaptive framework.

The primary tangible outcome from the workshop was the formation of a writing team whose charge it was to distill the discussions, presentations, and lessons learned at the meeting. This document is the result of that team's efforts. Rather than include all the details on the wealth of information presented at the workshop and the ensuing discussions, the writing team opted to distill the meeting into a common set of themes, propose standards for the formulation of population objectives, highlight challenges to meeting the proposed standards, and identify strategies to overcome those challenges.

For a variety of incidental, inopportune, and unforeseen events, the document prepared by the writing team sunk below the wind-tossed surface of the sea of bird conservation planning and organizational change. When the present document resurfaced nearly a decade later, practicing conservationists recognized that there was still much wisdom in the 2010 perspective—despite the many advances in the community's thinking regarding population objectives and their impact on conservation delivery. Thus the Partners in Flight Science Committee has decided to publish the 2010 document as PIF Technical Series No. 9. The original writing team remains actively involved in implementing the strategies discussed herein.

Conservation Targets — Mission-based versus Activity-based Objectives

The process of setting conservation targets has been a difficult and contentious task for the conservation community over the last several decades (Soulé and Sanjayan 1998, Tear et al. 2005). There is general agreement, however, that objective-setting is an integral component of the adaptive practice of conservation (Conservation Measures Partnership 2007). Indeed, the U.S. Fish and Wildlife promotes objective-setting as one of the key initial steps in its Strategic Habitat Conservation (SHC) framework, stating:

> "Efficient conservation strategies can be developed only after unambiguous mission-based objectives are established" (U.S. Fish and Wildlife Service 2008:8).

Mission-based objectives reflect the fundamental objective of population sustainability and express targets as specific, desired population states or outcomes (e.g., "provide foraging habitat sufficient to sustain 1,000 Delmarva fox squirrels within the native forests of the Delmarva Peninsula"). In contrast, activity-based objectives are focused on a means to achieve a fundamental objective (e.g., "restore wetlands in the Chesapeake Bay watershed for bog turtles"). This misplaced attention on habitat rather than the population fails to promote accountability for agencies and organizations with a primary mission of sustaining wildlife populations, prevents assessment of progress toward population goals, and offers little justification for increased resource investment in conservation. Adaptive Resource Management (ARM), upon which SHC is based, offers an efficient means of achieving mission-based objectives. Limited knowledge regarding the state of the system, the relationship of species to specific environmental factors, and their response to management requires planners and managers to make informed assumptions to determine where and how management can most effectively remediate limiting factors. Targeted monitoring to reduce the uncertainties underlying these assumptions leads to improved management over time. Ideally, mission-based biological objectives defined explicitly within the context of factors suspected of constraining population growth provide the best means for entering the ARM cycle and should be pursued.

The Role of Population Objectives in Bird Conservation

Although the role of population objectives in bird conservation has been discussed and debated in numerous venues (e.g., North American Waterfowl Management Plan (NAWMP) Committee 2004, Bart et al. 2005, NAWMP Science Support Team 2006), three common themes consistently emerge from these discussions. Population objectives:

1) serve as the foundation for strategic conservation planning by establishing a biological target,
2) provide a performance metric for assessing conservation accomplishments, and
3) operate as a communication and marketing tool to demonstrate the need for conservation.

To effectively serve in these various roles, Bart et al. (2005) recommended population objectives be:

1) communicable and understandable,
2) consistent among appropriate conservation plans,
3) quantitative,
4) measurable with current monitoring methods,
5) meaningful as performance measures,
6) comparable and linked across scales, and
7) robust to environmental variation.

The currency of population objectives may be any demographic parameter (e.g., abundance, density, or vital rate); however, resource and information limitations in bird conservation typically restrict the expression of objectives to population abundance. Regardless of the parameter selected, formulation of any population objective requires a subjective decision on what constitutes an environmentally or socially desirable population level for a particular species. Conservationists often rely on historic baselines to guide these decisions. For example, the NAWMP established waterfowl objectives reflective of species numbers during the 1970s, when duck production varied from excellent to average and waterfowl numbers and habitats were at levels acceptable to the people who used and enjoyed them (U. S. Fish and Wildlife Service and Canadian Wildlife Service 1986). The criteria stakeholders might use to decide upon an appropriate baseline for non-harvested species are likely less obvious, however. For example, the birding public might have a difficult time quantifying how many individuals of a species they would like to see in an afternoon, and birding success is often judged by the rarity of observed species. The scientific community might argue that an ecologically appropriate population level is the only defensible objective approach to setting a population goal, yet members of the community would certainly have a difficult time coming to agreement on what comprises an ecologically appropriate target given the nuances of diversity in abundance, species interactions, and community structure. The North American Landbird Conservation Plan (Rich et al*.* 2004) established the late 1960s as a benchmark for population levels of Watch List species, and the U. S. Shorebird Conservation Plan (Brown et al. 2001) chose the mid-1970s as the basis for population targets. In both cases, the rationale was based on the availability of consistent data (the Breeding Bird Survey and the International Shorebird Survey) rather than on a profound analysis of landscape change and bird response over the last half century. The selection of data availability as a criterion was a subjective decision of both partnerships.

Population Objectives and the Joint Ventures

Recognizing the value and interrelationship of ARM, SHC, and population objectives, the Joint Venture (JV) community has assumed the responsibility of defining population objectives as a fundamental role and core competency of their partnerships. Indeed, within the self-defined "Desired Characteristics for Habitat Joint Venture Partnerships" (i.e., the "JV Matrix"), achieving comprehensive content for biological planning requires that JVs identify explicit population objectives and document the process for deriving those objectives. Furthermore, the development, description, and application of explicit bird population objectives are critical aspects of meeting the technical expectations associated with the comprehensive content for numerous other elements and sub-elements within the JV Matrix, including identifying limiting factors, modeling species-habitat relationships, assessing landscape condition, developing decision support tools, and establishing habitat objectives. Thus, there is a clear need to integrate population objectives, habitat models, landscape assessment, and habitat objectives within the JV conservation approach. While many established JVs have been successfully pursuing and applying this conservation business model for decades, others are only now initiating these efforts (due to the partner focus and novelty of individual JVs). Divergence of approaches among JVs has spawned innovation; however, the lack of agreed-upon standards for establishing ecoregional bird population and habitat objectives (or the models that link them) threatens the realization of a shared vision for conservation of sustainable populations of priority species at levels prescribed by bird conservation plan partnerships (namely, the NAWMP, Partners in Flight, U. S. Shorebird Conservation Plan, Waterbird Conservation for the Americas, and Northern Bobwhite Conservation Initiative).

Developing Standards for Setting Bird Population Objectives

Determination of the current state of bird populations and development of a transparent standard process for formulating population-level objectives are critical first steps in developing reliable ecoregional bird population objectives. Standards needed to effectively translate bird population objectives to ecoregional scales include 1) a consistent currency (but not necessarily methods) across ecoregional scales, and 2) cross-scale applicability and compatibility (i.e., transferability between continental and ecoregional scales).

While consistent currency ensures that ecoregional objectives can be summed to inform continental assessments, compatibility of objectives (i.e. similar purpose, accuracy, precision, and specificity) ensures those comparisons are meaningful. The significant differences that currently exist among JVs with regards to the development and use of population objectives are preventing informative evaluation of the contribution of collective objectives from individual JV to continental population sustainability. We identified four main areas where greater consistency and compatibility are needed and make the following recommendations for follow-up work.

Clarifying the purpose of the objective

Bird population objectives are alternatively viewed as an end and a means to an end. Much debate has revolved around how to set a bird population objective that balances the pragmatism of establishing an objective that reflects the current conservation estate's capacity (an end) and the optimism that a currently unachievable objective will mobilize resources towards meeting an identified deficit (a means to an end). This distinction is more than academic, as the resulting population objective can be widely different depending on the approach used. For example, setting a population objective that relies on only minor adjustments to current conservation strategies will likely produce a number substantially lower than setting a population objective that may require significant changes to the current conservation infrastructure through additional programs and initiatives or changes in management strategies. Both approaches have merit and may ultimately produce benefits for birds. However, the resultant objectives from these two approaches are not compatible as they are based on broadly different assumptions on what an objective fundamentally represents.

Acceptable levels of accuracy and precision

Whether models are based on empirical data or expert opinion, significant uncertainty surrounds most conservation decisions. To improve bird conservation, planners and managers must acknowledge this uncertainty and ensure it is addressed explicitly. Documenting the assumptions used in estimation of model parameters is only a first step; expressing accuracy and precision associated with those estimates is also necessary to facilitate sensitivity analyses, the identification of data needs, and an understanding of progress toward stated objectives. Compatible accuracy and precision estimates are necessary to ensure that comparisons across taxa and geographies are valid. For example, calculation of population and habitat objectives based on point count data corrected for detection probability would likely vary dramatically from those objectives calculated from an uncorrected dataset. Guidelines for establishing lower bounds on the level of accuracy used in creating a population objective are necessary. Additionally, documentation of assumptions and data sources used during the process of setting population objectives (complete with qualitative or quantitative assessments of accuracy and precision) is needed to ensure transparency, replicability, and defensibility. Ideally, stepping bird population objectives down to an ecoregion from the continental or range-wide scale requires methods that account for broad uncertainty that may potentially cascade across multiple data sources. At the minimum, documenting assumptions and the levels of uncertainty associated with individual parameter estimates provides direction for research that can reduce uncertainty through ARM.

Measuring and evaluating objectives

The issue of consistency in ecoregional bird population objectives is one of currency — the details of how population objectives are expressed and measured. A common currency allows objectives to be easily aggregated (or disaggregated) across scales (i.e. the summing ecoregional objectives to inform continental objectives or partitioning continental objectives across ecoregions). Working to achieve continental or range-wide population objectives requires that planners utilize the same demographic parameter to express population objectives among all ecoregions and within an ecoregion. However, the measure of bird response most useful for local management decisions may not always be the most appropriate for continental-scale evaluation. Ideally, bird and habitat monitoring programs with uniform metrics across space and scale should be developed and implemented to determine success towards attaining bird population objectives. At a minimum, conservation planners should account for alternative scales of inference in their modeling and ensure that consistent objectives can be derived straightforwardly (e.g., density estimates calculated from abundance and area).

Linking bird populations to specific habitat types

Management of bird populations is typically predicated on restoring, enhancing, or protecting habitat. Therefore, modeling that links populations to habitats is needed to predict the effects of habitat manipulations on priority species. While accurate and timely assessments of habitat (and, in turn, populations) are desirable, they are often difficult to obtain. Remote sensing data are often not available at a spatial or temporal resolution adequate for ecoregional-scale bird conservation planning. Cover classes to which birds are actually responding are often lumped into broad categories (e.g., shortgrass and tallgrass prairie identified simply as grassland). Fully processed data are often woefully outdated upon their release; for example, the National Land Cover Database 2006 was released in 2011, and the 2016 revision was released in 2019. Furthermore, some data may not be available at the ecoregional level of interest (e.g., SE-GAP ignores BCR and JV boundaries). Ideally, investment in high quality land cover data at ecoregional scales is needed to permit more precise assessment of bird population change to known, and predicted, habitat change. Minimally, information from multiple data sources should be cross-walked or stitched across dataset boundaries.

Recommended Standards for Minimum and Comprehensive Content

The workshop on regional bird population objectives held during October 2009 produced agreement among the attendees that consistency in the currencies used to express population objectives and clear description of the methods used to develop objectives are necessary to enable comparison of objectives across spatial scales. Instituting common methods across JVs for the development of population objectives was not considered necessary or practical given the differences in available resources and data available for conducting modeling and analyses in different JVs. However, individual approaches will need to produce results that can be combined to provide a continental or range-wide perspective. The following standards are the desired characteristics for ecoregional bird population objectives and the data sources and the modeling approaches used to develop them (Table 1). They are presented in terms of minimal and comprehensive content, following the form of the JV Matrix.

Table 1. Standards for desired characteristics of ecoregional bird population objectives.

Category	Minimal Content	Comprehensive Content
Goal	Mission-based population objectives established in coordination with delivery community.	Conservation delivery decisions driven by population objectives and the desire to strengthen the scientific foundation of conservation within an ARM context.
Population currency for breeding season objectives	Population objectives defined in terms of bird abundance for focal species.	Population objectives defined in terms of bird abundance and vital rates for focal species. Methods consistent across JVs.
Population currency for non-breeding season objectives	Population objectives defined in terms of total bird abundance over a specific time interval (e.g., duck-use-days).	Population objectives defined in terms of total bird abundance and vital rates for a specific time interval. Methods consistent across JVs.

Category	Minimal Content	Comprehensive Content
Documentation of process used to develop objectives	Data sources transparent, assumptions documented, metadata produced.	In addition to minimal content, all documentation formatted for comparison (e.g., standard vocabulary and structure). Process peer-reviewed; assumptions validated.
Bird abundance data	Population estimates derived from best available data; issues of bias and imperfect detection considered. Coarse adjustments may be applied.	Population estimates derived entirely from data collected and analyzed using methods that account for bias and imperfect detection.
Data coverage	All available data of adequate quality from relevant habitat types in JV used in generating population estimates.	Data for population estimates based on well-designed, comprehensive surveys within the JV.
Use of bird data collected from different methods/protocols	Rationale, process, and assumptions for combining different data types documented.	Bias-reducing methods applied to each data type to obtain an overall unbiased estimate. Overall estimate weighted by the uncertainty of each component dataset.
Assessment of uncertainty	Categorical and subjective (e.g., high, medium, low).	Quantitative reliability assessed (e.g., confidence intervals, CVs).
Parameters used in models for estimating bird population size and setting objectives	Bird abundance, geospatial, and habitat data acquired and organized.	In addition to minimal content, all pertinent ecological parameters (e.g., limiting factors), climate change projections, and social parameters (e.g., habitat loss to development) for optimizing population objectives based on future conditions included.
Optimization of population objectives across species-habitat suites	Population objectives defined for a set of priority focal species.	Complete landscape design analysis conducted to optimize population objectives across the full set of priority species and habitats. Undertake periodic assessments of landscape condition.
Link to management actions	Species occurrence associated with well-defined and manageable land cover classes (e.g., NLCD, NatureServe Ecological Systems).	Models identify limiting factors that can be targeted by management at appropriate spatial scales.
Evaluation of contribution to continental objectives	Current abundance estimated for focal species	Feasibility based on: 1) partner capacity and current species abundance, 2) predicted future conditions (e.g., habitat loss, climate change), and 3) an optimized landscape for multiple priority species.

Challenges Associated with Meeting Recommended Standards

Scientists, biologists, and conservation planners ideally would have unlimited time and resources to build robust models, develop defensible bird population objectives, target research at critical model assumptions, monitor bird populations and their response to management actions, and refine models and objectives based upon research and monitoring. Unfortunately, time and resources are limited, but the conservation challenges facing populations of priority bird species continue to grow. Biologists and conservation planners often are compelled to draft population objectives for priority bird species based on imperfect knowledge because of the combination of urgency and insufficient time and funds. However, if the limitations of models used to develop those population objectives are acknowledged and transparent, there is opportunity to improve models and objectives with targeted research and monitoring. Investments in improvements should consider the cost relative to the realized management and conservation benefits.

Considerable differences exist among the approaches used to set range-wide or continental bird population objectives. Although bird conservation plans provide estimates of many (but not all) species' populations, estimates are derived through significantly different methods, ranging from statistically-sound and scientifically-defensible empirical data to loosely collated and uncorroborated expert opinion. Furthermore, there are considerable differences between JVs relative to the methods by which continental population objectives have been partitioned to smaller geographic units (e.g., BCRs, states; Appendix 1). These differences offer significant challenges to the vision of coordinated conservation at a continental scale. Greater communication and coordination across JVs and Bird Plan Partnerships (as well as other potential partners) can reduce these challenges and help identify synergies where multi-JV efforts can provide benefits to achieving this vision. However, at the time there was no forum for nurturing these collaborations, either among JVs or between JVs and individual Bird Plan Partnerships.

Strategies for Overcoming Challenges

Formation of a group of JV Science Coordinators for other Bird Plan Partnerships similar to the NAWMP Science Support Team (NSST)

One mechanism for improving communication and coordination among JVs and the non-waterfowl Bird Plan Partnerships would be the formation of a technical body similar to the NSST, which would include representatives from each habitat JV and each non-waterfowl bird plan partnership. A parallel forum for birds other than waterfowl would facilitate discussions on technical issues pertaining to development of non-waterfowl conservation objectives across scales and implementation of conservation activities at the ecoregional scale. An initial meeting of JV Science Coordinators and bird plan partnership representatives was held in October 2010 to assess the potential value of such a forum for these discussions. Following positive feedback from this 2010 group, a proposal outlining the purpose and structure of the new forum was drafted, and the JV Coordinators provided provisional endorsement of the proposal at a December 2010 meeting. The result was the formation of the Tri-Initiative Science Team (TriST), which held its first meeting in June 2011. After a trial period of meeting in conjunction with the NSST beginning in October 2015 (as the Transitional Unified Science Team, TrUST), the collaborative group began formally meeting together as the Unified Science Team (UST) in May 2018 and initiated drafting a common work plan.

Strategically targeting capacity shortages

JVs vary widely in their abilities to address technical issues, such as the development of bird population and habitat objectives. Even those that are relatively advanced are limited in the depth of detail with which they can tackle more than one of these issues. Conducting analyses of ecoregional habitat carrying capacity and subsequent landscape-scale conservation design are resource-intensive activities, from both financial and human capital perspectives. Opportunities to fill technical and scientific needs through collaboration and cooperation with other entities should be sought. Landscape Conservation Cooperatives and Climate Science Centers are two emerging entities that operate at regional scales within national frameworks that provide new opportunities for collaboration in meeting regional and landscape-level conservation assessment and planning needs. The new Inventory and Monitoring Program of the National Wildlife Refuge System represents another emerging opportunity for assistance with acquiring bird monitoring data that could be useful in developing bird-habitat models and evaluating bird population responses to conservation activities. JV and Bird Plan Partnership staff should engage these new partner communities to ensure shared needs and mutual solutions are identified and pursued at the outset.

Data coordination and communication

The ability of diverse partnerships to collect, enter, analyze, communicate, and share data is a universal problem. Challenges of consistency, quality control, and complexity abound. The bird conservation plans, in partnership with the JVs, have an obligation to provide bird population objectives to individual partners in a manner that is transparent and facilitates targeted conservation. Shared databases (e.g., Avian Knowledge Network) offer the opportunity to think communally and strategically about the use and future of data. Several types of data are relevant to this discussion: data used to calculate objectives at the range-wide, continental, national, and ecoregional scales; the objectives themselves, and data regarding accomplishments from various implementation efforts. To effectively track all these elements, a common database with a common language, consistent conceptual models, and broad access should be pursued.

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Appendix 1: Comparison of Available Modeling Approaches

Numerous modeling approaches and methods are currently available to assist in the processes of determining current bird population levels, assessing current and future habitat conditions, and developing ecoregional bird population and habitat objectives. Different modeling approaches may be more appropriate or applicable depending on the data available within a given ecoregion and the resources available to implement specific modeling methods. Table 2 compares the purposes, advantages, limitations, and data requirements of different modeling approaches to help identify those that are likely to be most appropriate under different regional contexts.

Table 2. Overview of modeling approaches used by Joint Ventures to determine current bird populations, inform setting of population objectives, and translating them to habitat objectives.

Modeling Approach	Primary Purpose, Advantage & Limitation	Modeling Type	Minimal Data Needs		Example JV Experience
			Predictors	Response	
Theory-based	Purpose: Make predictions/decisions when observational data from the region of interest is limited (e.g., natural history descriptions) Advantage: Low cost and relatively quick Limitation: Low specificity	Expert System	Understanding of current conditions & how actions affect them	Understanding of desired/reference conditions	Desired Forest Conditions (LMV)
		Database	Spatial distribution of habitat types	Understanding of carrying capacity relationships	HABS Database (PL); HabPops Database (IMW)
		Index	Spatial distribution of factors affecting habitat condition	Understanding of carrying capacity relationships	HSI Models (CH, LMV); LSI Models (UMR&GLR)
		Hybrid	Spatial distribution of factors affecting response	Understanding of response relationships	Bayesian Belief Network (AC)
		Systems Analysis-Simulation Modeling	Understanding of current conditions & how actions affect them	Understanding of response relationships	Program STELLA (GC)
Data-driven	Purpose: Make predictions/decisions based on observational data from the region of interest Advantage: Specific to region	Statistical Theory	Spatial distribution of factors affecting response	Presence, Count, or Density	Hierarchical Spatial Count Models (UMR&GLR); Poisson Regression Models (PP); Time Removal Models (CH)
		Machine Learning	Spatial distribution of factors affecting response	Presence, Count, or Density	These are used at smaller scales, but uncertain of any current JV use

	Limitation: High cost of obtaining data	Bio-energetic Models	Population or Habitat Objective; habitat availability, distribution and foraging value	Population or Habitat Objective	Daily Ration Models (CV, SB, PC, IMW, PL, RB, LMV, UMR&GLR, GC)
		Population Models	Demographic parameters linked to habitat conditions	Population Growth	Mallard Productivity Model (PP, UMR&GLR)