2014 Demographic Monitoring Workshop
November 18-20, 2014
Shaw Center, Baton Rouge, Louisiana

WORKSHOP NOTES

PURPOSE: To bring together bird conservation and monitoring practitioners from throughout the western hemisphere to adopt a shared vision for a demographic monitoring network based on clear objectives, integrating existing programs, and prioritizing needs for future development.

BACKGROUND: During the Partners in Flight Fifth International Workshop (PIF V), a session on monitoring throughout the full annual cycle resulted in key recommendations for the bird monitoring community. One of the most pressing needs was improving and expanding demographic monitoring throughout the western hemisphere (i.e., MOSI, MAPS, and all other activities). The NABCI Monitoring Subcommittee has taken on this project and would like to help the bird monitoring community develop: 1) clear objectives, 2) a balanced approach for monitoring resident and migratory birds, 3) a networked approach that offers recommendations and guidance among programs, and 4) a resilient funding model for these activities (on-going and new).

WORKSHOP OBJECTIVES:

- Clarify objectives and definitions for demographic monitoring – how does this ultimately advance bird conservation?
- Review current monitoring programs and coordination networks in place (i.e., MAPS, MOSI, LaMNA, BBIRD, banding stations, regional bird monitoring networks), generated knowledge from these programs, and discuss how this knowledge can be used to inform bird conservation.
- Identify tools and organizations that can support development of and sustain monitoring programs (e.g., Avian Knowledge Network, North American Banding Council).
- Identify new opportunities or programs (e.g., Breeding Bird Atlas efforts) to integrate into a hemispheric demographic monitoring network.
- Explore alternative monitoring network structures and identify a preferred approach.
- Identify science needs, prioritize knowledge gaps, and develop strategies for addressing these gaps.
- Discuss the sustainability of these efforts, funding models, and institutions to support a demographic monitoring network.
- Discuss the role of the NABCI Monitoring Subcommittee in achieving a shared vision for demographic monitoring.

EXPECTED OUTCOMES:

- Develop a compelling story to demonstrate the need for a demographic monitoring network.
- A clear set of objectives for demographic monitoring throughout the Western hemisphere.
- Improve consistency in data collection methods to facilitate greater aggregation and sharing of datasets.
- An overview of our current and future needed capacity to address demographic monitoring needs.
- A road map for integrating demographic monitoring programs, including draft recommendations for existing monitoring programs and proposals for addressing gaps.
- Recommendations that will be published as a NABCI Monitoring Subcommittee document and possibly an additional academic monograph.

TUESDAY, NOVEMBER 18:

WELCOME AND INTRODUCTIONS

- David Pashley - Opening remarks, shared investment in demographic monitoring.

Shared vision for a demographic monitoring network – Ken Rosenberg, Cornell Lab of Ornithology

- Demographic monitoring is hitting the main stream.
- We often do conservation planning without knowing causes of decline.
    - What limits and regulates populations?
    - Why are some species declining and others increasing?
    - What data do we need and how can we collect them?
    - How do we apply results to on-the-ground conservation?
- Wicked challenges
    - How to aggregate and integrate across programs
    - Can we retro-fit existing programs?
    - How to integrate across geographic and temporal scales
    - How to expand monitoring and build capacity in Latin America
    - Understanding connectivity of linked populations
    - Where to invest scare conservation resources
- What will be our next mallard?
    - Enough information to model
    - Which species will be our model species (American Redstart, Orange-crowned Warbler, Wood Thrush, and Tree Swallow)?

WHAT IS DEMOGRAPHY?

Vital rates of North American Landbirds - Dave DeSante, Institute for Bird Populations

- Demographics has traditionally been relegated to having conversations in the hall, historically not a clear fit with monitoring or management
- Monitoring Avian Productivity and Survivorship (MAPS): goals, extent of data (628 stations, 189 species included, nearly 1.5m capture records, 15 years)
- Web page, selection from 189 species, provides temporal and spatial analysis of vital rates

including ability to run correlations (wood thrush example: population changes, recruitment, and adult apparent survival; driven by density independent mechanisms, weather).

- www.birdpop.org analysis available in January, summer for all.
- Summary points:
    - Adult apparent survival was more important as driver of population change (lambda) for:
        - Neotropical-wintering migrants than for temperate-wintering migrants or permanent residents
        - Declining or increasing species than for stable species
    - Adult apparent survival was important as a driver for both:
        - Spatial (BCR) and temporal (annual) variation in lambda
    - Productivity generally more important as a driver for:
        - Temporal (annual) variation in lambda than for spatial (BCR) variation in lambda
    - A substantial degree of density dependence was found for most species and species groups (generally strong temporal correlations between adult population density and lambda).
    - Population change was often driven by density-independent rather than density-dependent mechanisms (the vital rate that was most strongly positively correlated with lambda was not the vital rate that was most strongly negatively correlated with population density)

Demographic Monitoring in Britain - Rob Robinson, British Trust for Ornithology

- BTO founded in 1973, primary mission research and monitoring.
- Many schemes under one roof; allows for easy integration. (Robinson et al. 2010 PloS One 5:12215; Lawson et al 2012 Phil Trans Roy Soc B, 367:2852-63.)
- Species coverage: good information for some species, getting close for others, others will be harder, some impossible without dedicated effort.
- Need environmental, habitat data. Have climate data.
- www.Bto.org/birdtrends
- The state of the UK's birds 2014.

What is demography, an examination of the metrics to consider in monitoring avian demography: the value added in bird monitoring - CJ Ralph, US Forest Service Redwood Sciences Lab

- Need a basic understanding of a species' full life cycle, characteristics, timing and location of all life cycle events. Who, where, when, what, why, and how
- Move beyond trends of abundance. Monitoring needs to be retrospective…use historical changes to anticipate future changes under a variety of climate scenarios.
- Couple banding/marking data with other data to address questions
- Land bird monitoring network of the Americas www.klamathbird.org/lamna
- Demographic monitoring in human terms includes a number of factors. Bird demographics identify a number of strategies birds employ, important to know year round to understand limiting periods (especially migration and wintering).
- Estes Park monograph (9-2014): things we measure or sample, things we study, things we do to compile and promulgate data and analysis (recommendations from Baton Rouge meeting here).

Group Discussion:

- Importance of gathering correct age information, especially SY and ASY, to get true first year survival and immigration.
    - eBird, opportunistically at this time, people imbedding photographs with lists, use photos to age individuals.
    - Training for precision aging as we establish networks of banding stations. Role for North American Banding Council.
- Scope of Taxa for this discussion: for now, let's think in terms of NABCI (landbirds, shorebirds, waterfowl, waterbirds)
- Scope of methodology (e.g., are we only talking about banding)?
- **KEY POINTS:**
    - **BTO is based on citizen science.**
    - **Messaging the needs, objectives, results and relevance of the results for all.**

INTEGRATION OF KNOWLEDGE INTO MANAGEMENT DECISION FRAMEWORKS

Integrating demographic data into management decision frameworks - Katie Koch, US Fish and Wildlife Service

- What is the focus of this week's effort? Hemispheric scope.
- How do we design a network to capture demographic data for full life cycle of species? By species range, by stations in a grid?
- Why proposing to develop a hemispheric scale? Identify objectives.
- Problem statement: traditionally most conservation work has focused on the breeding season. Metrics: acres of habitat created/protected/restored; estimates of abundance.
- Objective: sustain bird populations or meet population objectives throughout their full annual cycle.
    - Value of this objective: legal mandate; need to bring metrics full circle, what organizations are doing on breeding grounds may not be enough.
- Metric: need context of larger scale to interpret findings into conservation design and management at more localized scales.
- Re-word objective: Manage bird populations for sustainability throughout their full annual cycles.
    - Metric: how manage landscape to have sustainable populations. Context of managing habitats for full life cycle.
    - Propose metric not just be an exact number. However, population size is a derived statistic, e.g., rails, ES +-80 individuals, place holders for something striving to attain. Waterfowl continental goals being revised, not about decisions around one number, however numbers used to garner support, but not best for making management decisions.
- Thinking about annual cycle conservation within smaller scales
    - E.g., Upper Miss JV identifying which species they have stewardship responsibility for during the winter season and thinking about landscape design to support species during this stage.
- We all recognize a need to move forward to identify limiting factors, infer causation for trends, and move from detecting change to understanding the causes of change.
- At what scale do we do this work?

    - Top down—identify limiting factors and framework for linking decision makers at different scales.
        - Challenges---incentivize agency investment in demographic monitoring stations/ network; integrate demographic data with other data already being collected; demonstrate real-world management application.
    - Work at the scales where decisions are being made
        - Local—habitat management, restoration, protection - are these working?
        - Regional – JV planning and conservation delivery; LCC science and conservation designs
        - National – selecting priorities and allocation of resources
        - Full life cycle level – Prioritize where we need to work now (triage)
- Case studies where this is work is being done, next set of presentations.

Waterfowl Management Case Study - Pat Devers, Black Duck Joint Venture

- Adaptive harvest management
    - For a number of species: MALL (Mid-continent, eastern and western), PINT, SCAU, ABDU
    - Adaptive harvest management framework based on balance equations. Demographic rates include annual and seasonal survival (cohort specific), annual productivity and continental (population scale). Monitoring programs are pre-season banding and encounters, harvest surveys, breeding population (BPOP; state variable).
    - Learn by comparing predictions to BPOP; no objective of learning in optimization routine. Learning passively and slowly. Key goal to optimize regulation package.
    - Basic framework is the same as what using in MAPS, but MAPS does not have a harvest framework to gather information to improve the models. Do not have a management action that is planned over an area. However, <u>harvest framework is being applied to other species (i.e., incidental take); need to think more broadly on how to apply AHM to non-game species</u>.
- Habitat management
    - 2012 NAWMP solidified approach to report accomplishments in terms of demographics, link JV efforts using annual life cycle approach, and facilitate roll up to continental scales.
- 3 ongoing independent efforts to link continental (i.e. population) dynamics to regional and local scale habitat conditions and management; goal is to increase continental carrying capacity via habitat conservation
    - Models need a lot of data to get at carrying capacity; there are mismatches because management happens at the local scale, but data are available at the continental scale.
- Issues that have come forward
    - Governance/programmatic – partial control
    - Who is the decision maker? Multiple partners with multiple objectives
    - How much do we have to allocate: multiple funding pots

Landbird Case Studies - John Alexander, Klamath Bird Observatory

- California PIF plans articulate measures of productivity, demographic objectives integrated into planning; some blanks in the full life cycle models.
- Least Bell's Vireo:

    - Determined through nest searching that nest concealment has a direct link to probability of fledging.
    - Made management recommendations for composition of understory.
    - Least Bell's Vireo work lead by Mark Dettling and Chrissy Howell. Mark showed that, for surrogate species that represent LBVI, as nest concealment increases, so does the probability of fledging young.
    - We interpreted this as concealment decreases the risk of predation, and we also asked which tree or shrub species had on average the nests with the greatest concealment. We used these results to make the following recommendations (page 41):
        - We recommend designing riparian restorations the Refuge to increase vegetation density and especially include and/or increase California blackberry, nettle, and mugwort in planting palettes.
        - We recommend evaluating the cover of forbs and shrubs in riparian forests throughout the Refuge, including both remnant and restored areas. Increasing vegetation density within the understory in these existing riparian areas can aid in reducing nest predation.
- WAVI productivity a problem in Point Reyes National Seashore - declining capture rate of juveniles (HYs). Adult survivorship (can be inferred simply from recapture rates) the same or even increasing.
- Conclusion: decline is a productivity problem on breeding grounds (MAPs great at identifying where populations are limited - full life cycle monitoring).
    - Nest monitoring data for SOSPs after Vision Fire at Pt Reyes showed higher nest success than other places.
    - And more WAVIs juveniles (HYs) were caught in mist nets.
    - These results were used to support a publically unpopular prescribed burning program in the park. Conclusion: restoring fire (managing for mosaics) in park is good for birds (both migrant and resident).

Golden-winged Warbler case study, poster compiled by Tom Will, US Fish and Wildlife Service

- Great conservation work occurring in absence of a full life cycle demographic model (they do have breeding season demographic data, connectivity data, etc.)
- Case study of doing the best they can with information they have at this time. Potential use of other species as surrogates to identify unknown pieces.
- Decisions being made:
    - Allocation of funds to restore breeding habitat and protection of wintering habitat.
    - Identifying best management practices at more localized scales.

Group Discussion:

- Need to keep these questions in mind during the rest of this workshop:
    - What decisions are we trying to inform?
    - Who are decision makers?
    - At what scale is the decision occurring? During which phase of the full life cycle?
- GWWA and sea ducks are both examples where we have sparse data but are moving forward developing models. Build a conceptual model as a hypothesis.
- With knowledge we can start making decisions. <u>Management efficiency gained vs resources diverted to get monitoring/demographic information</u>. Dilemma, not know where need to work

in some cases (where most limited).

- MAPS/MOSI have been opportunistic to gather data; enter phase to increase funding and target species of highest concern, etc.
- Many times we are unclear who the decision makers are. For example, even if we have a full life cycle model for GWWA, decision landscape varies by country.
- British approach uses information from common species (logistics easier) to identify common problems. Use demographics as an identification tool.
    - David DeSante urges us to exercise caution when using data from common species, (e.g., WOTH and OVEN), as something different is going on for these species on their wintering grounds.

RELATIONSHIP BETWEEN DEMOGRAPHIC MONITORING AND MODELING FULL LIFE CYCLE POPULATIONS

Demographic monitoring and full annual cycle population modeling - Clark Rushing, Smithsonian Migratory Bird Center

- Overview of full annual cycle models for American Redstart, Black-throated Blue Warbler, and Kirtland's Warbler.
- Limitations due to non-breeding season habitat quality and quantity had the strongest influence.
- What they learned:
    - To get estimates and develop FAC demographic estimates is time and labor intensive;
    - Estimates are site specific; replication for other species may not be feasible,
    - Understanding population limitations requires data from multiple sites to understand range wide variation
    - We need to understand migratory connectivity – need this context, knowledge of geographic linkages to quantify regional vital rates.
- Question: how do we parameterize range wide FAC models for species of conservation concern?
    - Tools available: large-scale monitoring data (e.g., MAPS but may need to refine objectives), remote sensing data, novel analytical techniques.
    - Smithsonian work on WOTH to understand declines as an example
- Need regional population estimates for each species. Abundance with trend. Dinger gram (pattern after micro biology) to determine regional populations, core areas of high abundance with stable trends.
- Conclusions
    - New FAC modeling approaches can provide insights into regional demographic rates and drivers of trends
    - Large scale monitoring data crucial to implementing FAC models – need improvement of monitoring objectives to fit into respective models.
    - Importance of migratory connectivity.

Modeling the effects of breeding versus winter habitat loss on the population dynamics of a Neotropical migratory songbird - Caz Taylor, Tulane University

- Migratory network models and application to Wood Thrush
- Assume habitat declines are the cause of observed population declines, identify where population loss will occur. Build demographic models on top of the networks. Taylor and Norris approach.

- Pattern of decline – identify connections.
- Could not determine direct parameter estimates with existing studies.

Group Discussion:

- We need a success story of where this approach has worked.
    - AMOY provides a great example; FAC model led to business plan and management; NFWF funding; and positive change in population
- Which species should we prioritize for data collection and FAC model development? Focus on priority species rather than solely common species.
    - Define structure and determine appropriateness for individual species, feasibility; which species fit into realm of the model.
    - If the objective to inform management, then select species where we have management concerns, etc.
    - Intermediate step, work up one or more species of concern to determine if we have developed a generalized integrated population model or not; identify data needed, information gaps, and what type of data is adequate.
        - Data are out there but need to be made available
    - Cost of data analysis needs to be considered, along with investment in analysis and modeling of existing data.
    - Life histories of each species are different, need expertise to tease out this information.
    - Identify information available for species we are concerned about, review monitoring data available, identify gaps, and prioritize future monitoring needed.

INTEGRATED POPULATION MODELS FROM NATIONAL MONITORING PROGRAMS

Questions for the session:

- Types of data needed for models to be used?
- Types of sampling needed to fill in information gaps?
- Outputs received from models and how can information inform management?

Broad scale bird banding and count data and integrated population models - Jim Saracco, Institute for Bird Populations

- Use of MAPS and MOSI capture recapture data to:
    - Estimate population size (index)
    - Estimate population change (trend)
    - Link population change to vital rates
    - Identify critical annual cycle stages
    - Link changes, vital rates to environment
    - Understand spatial linkages (migratory connectivity)
    - Predict future
    - Inform management
- www.vitalratesofnorthamericanlandbirds.org (coming in January)
- Limitations of demographic-only analysis: low precision, not all parameters of interest estimable, limited spatial/species coverage.
- Integrated population models use independent data sets (e.g., counts, capture, re-capture), unified model framework, and inference based on joint likelihood.

Projects driven by decision making processes to inform management: Rocky Mountain population of Sandhill cranes and crackling geese - Bill Kendall, Colorado Co-op Unit

- Integrated models are good if we have the right pieces of data and relation to environmental data.
- Geese model based on objectives of stake holders; generates information to make management decisions (in this case optimal policy).
- Need to have confidence that they have all of the pieces to estimate the parameters.
- Clearly define decision process to inform monitoring needed. Use simulation to determine cost benefits (channel the discussion).
- Discussion
    - A good model does not always apply to different species; want to get information to contrast vital rates. Use correction factors to incorporate existing data sources. In these examples, output has a purpose for management.
    - Number of equations match the number of unknowns; techniques out there to determine what is testable and what not. Vigilance needed to check to make sure model is working.
    - Audience is the decision process not the decision makers. Dispersed decisions, need to id types of decisions. Key to using these models in a management decision, need enough structure in model so management decision is incorporated, co-varieties identified.
    - Explicitly frame the decision in the model.
    - Make sure information is clear to different audiences.

Application of Bayesian integrated population models to national bird monitoring: a practical perspective - Rob Robinson, British Trust for Ornithology

- Caution: need to know linkage between populations where data are being gathered and used.
- General model not perfect for every species but capture most. Model for each species very time consuming (some species are quite easy and others are quite labor-intensive).
- Uncertainty identified: number of nesting attempts, post fledging survival, etc.
- No easy answers as all species are different; but can do broad scale comparisons to identify how they differ.
- Draw inferences about larger environment (JNCC)
- Challenge to interpret information for the various decision making audiences so they can understand and use it.
- State of the bird indicators to explain demographics; how does integrated population model inform this discussion? Suite of models that incorporate how environmental change influences populations.
- Level of effort for science needed; geography of UK is the size of Wyoming.

Session Discussion:

- Issues with handling different types of data, how to make models flexible to include covariates to optimize and make predictions.
- BTO data gathered by volunteers; 6 year funding cycle;
    - Lessons learned:
        - Provide information via a website so government can see value of data and you're providing input for overall conservation effort
        - Provide the interpretation instead of only the research details (data provides

solutions).
        - Use birds as a metric to address happiness of citizens.
    - Challenge: integrate data, programs, and interpretation. NABCI monitoring subcommittee work on the integration of interpretation, to show how MAPS and BBS are informing conservation. Make more than an ad hoc process; set of models inform SoTB grassland birds for example.
- Flyway non-game technical section meetings could be a good venue for discussion of increasing banding efforts; first need to determine objectives.
- Ability to build a sustainable model with MOSI protocol, argument for bird observatories, self-driven in country capacity driven effort.
    - Make effective business model for resident and wintering species. Conabio example to support existing efforts with a resident species component.
- How much data are needed?
    - We have data to inform integrated model with through the MAPS program.
- Identify new developments that are needed. <u>What are the statistical challenges, new methods needed</u>?
- End of meeting product:
    - Publication to capture technical details; CJ is capturing that information.
        - Specificity of protocols (monograph from Estes Park)
    - Product to Support new or existing monitoring schemes

<u>DAY 1 WRAP UP:</u>

- We need to keep many different metrics in mind when we think about demographic monitoring (e.g., body condition as a parameter for black ducks).
- Discussion of workshop products:
    - Monograph to capture technical details; with a short paper to highlight 3 key points that can be taken to general audiences (why is this approach needed)
- What do workshop participants want to see happen?
    - Continue to sustain/justify/fund long term programs,
    - Tie information to management decisions at varying scales
    - When we are developing FAC models, include parameters for decisions to be made along with other covariates.
- Why is this workshop important? For 25 years, WOTH showed a decline. The PIF community did work and decline has not changed, which suggests that we are working at wrong place and wrong time; need to identify where to work and what to do.
- Decisions being made at what scales is the place to start. First focus should not be on identifying data sets and models but on scales and decisions to inform what data and tools are needed.
- It can become a chicken and egg discussion. We want to know what is limiting populations so we can focus management and conservation efforts.

WEDNESDAY, NOVEMBER 19:

STRATEGIES FOR EFFECTIVE MONITORING IN LATIN AMERICA AND THE CARIBBEAN:

Strategies for effective monitoring in Latin America and the Caribbean – Viviana Ruiz-Gutierrez, Rocky Mountain Bird Observatory

- We are getting more information for state of wintering migrants in Latin America
    - We have little information on abundance and distribution of wintering migrants, despite recent advances in eBird
- We have data on overwintering persistence (26 species) and survival (19 species)
- Critical stopover habitats — still need more
- Information is not well-organized among partners and networks and not well coordinated
- Information exists but is not available — hence need to build networks
- Example of Integrated Population Modeling Program and its dissemination of useful decision support tools
- Excellent example for populating the Full Life Cycle model with information through Integrated Population Models — what information is needed and how do we get it?

Session Discussion:

- Why is connectivity information important? Highest priority birds have limited winter ranges—why do we need more?
    - For a more widely distributed species (e.g. Wood Thrush, Golden-winged Warbler), could have spatially-structured survival dynamics. Even relatively small differences could lead to insights about resource availability and potential management solutions.
    - Connectivity at finer scales may be important—e.g., where are the females going? What habitats are they using? What about migratory funneling and concentration, e.g. with Veery.
    - Connectivity will tell us about spatial relationships that are not apparent in broad analyses that mismatch temporal and spatial variables.
    - May not be able, however, to estimate population-level processes using nanotag samples, etc. So connectivity info is needed.
    - Spatial connectivity information leads to strategic selection of conservation priority areas and critical management issues.
    - Stable isotope tools are cheap—so feather sampling is good money in the bank—and when paired with other info, despite resolution problems, can be quite powerful. Resolution need depends on the strength of migratory connectivity. For species that mix extensively on the wintering grounds, do not need high resolution (but we still need to know that they are mixing).
    - Need to get all the tools on the table and then go back to the key questions that we need to answer. Job here is not to select tools, but to decide on questions, objectives, and priorities and then select the appropriate tools.
- Integrated Population Monitoring Model is a conceptual scheme for coordinating and integrating information, not necessarily model building.
    - Genetic analyses also very powerful—can reveal information about birds that don't necessarily go to the best places. Need to know more about molt migration.
    - Need to accommodate widely divergent life history strategies among species—life history understanding needs to be applied to all the questions we are asking. Movement

and fidelity on wintering ground. Genetic work has been powerful in revealing not just where birds are going but when they get there and how long they are staying (see recent publication on Wilson's Warbler).

- Need to coordinate among existing banding stations in Latin America— there are many stations, but they are often functioning without protocols, without clear objectives (other than putting on bands).
    - Established framework and network creates opportunity for value-added efforts and projects.
    - Population trends, distribution, and abundance are important parameters needed by Latin American partners.
    - One solution: structured protocols in eBird, to avoid the cost of in-country storage; AKN another possibility, except that AKN=eBird. [John Sauer cheers inwardly when he hears talk of structured data in eBird.]
    - Geographic gaps in monitoring coverage. How do we expand, sustain, and improve MoSI? How to make it more relevant to resident birds?
    - How to improve capacity for data storage and management in Latin America?
    - Need in-country information to support management
- What is the political context of Latin American conservation work? Varies enormously from country to country. Latin America is an uneven conservation surface.
    - Main drivers of deforestation as identified by CA partners: drug trafficking, poverty, inequality, and corruption. Remaining highly forested areas are abandoned by the government. Little capacity to enforce protected areas, so IUCN now abandoning protected areas as a strategy. Now moving toward empowering indigenous or local communities to protect their lands against illegal use—e.g., create forestry management plans.
    - Stakeholders in Latin America—government, academia, NGOs. Need to balance NA and La partners—e.g., government officials matched with feds, academics paired with academics
    - What happened to some of the big international NGOs in Central America—CI, WWF, WCS, etc. Many closed their offices in CA or work only with particular projects that have been established internally.
- Of the key question list Viviana presented, which key question do we begin with (in this workshop)? As the NABCI monitoring subcommittee, what do we do within this context?
    - Focus on a building monitoring framework that engages new partners and stakeholders, strengthens and coordinates existing efforts (i.e., Central American Joint Ventures)
    - Need to keep asking partners what they need, and then find common ground. Space to do this is demographic monitoring framework (Viv's opinion).
        - At the first MoSI meeting in Mexico (Morelos), key government officials were present, but once the station was established, no feedback was given to those officials… (we) failed on this one.
        - Bander certification program has been successful in generating interest of government officials, but follow-up has been difficult (so we need to put more emphasis on this). Models for capacity building exist.
        - Good at training field biologists in Latin America, but not so good at building capacity at higher levels.

AGGREGATING INFORMATION AND KNOWLEDGE ACROSS SITES AND SCALES:

Aggregating information and knowledge across sites and scales – Leo Salas, Point Blue Conservation Science

- Costs and logistics of scaling up or down. Why, how to monitor. Many taxonomies about how and why.
- Hutto and Belote 2012 outlines four categories of monitoring; today we'll focus on two:
    - Surveillance
        - Economical
        - Not focused
        - Large, long-term changes
    - Effectiveness
        - Narrow-focus
- Surveillance Monitoring - BBS—question of footprint, how much of an effect is needed to detect a change with BBS data?
    - e.g. West Nile virus effects
    - Randomizing is costly, so this presents a problem about where and when you sample, surveillance has a problem in this regard
    - Thogmartin et al 2006 - A review of the population estimation approach of the north American landbird conservation plan
- Large-scale vs local scale: How can we tell if local scale effects aggregate to regional patterns?
    - How do we determine the most appropriate scale for management action?
    - Example of scale effects (Linden and Roleff 2013 Forest Ecology & Mgmt)
    - Decisions for local management may not be applicable at larger scales depending on mgmt. objectives
- Aggregation of data from local to landscape must be purpose driven.
    - Data mining models (DMMs) use messy local info, seek patterns
    - DMMs can be biased (i.e., models specific to the training data)
    - If landscape is homogeneous, less data are required. Greater heterogeneity (e.g. Rockies) requires more sampling.
- Management footprint---dictated by monitoring data?
    - Use covariates of ecological significance
    - Landscape model results
    - Predict abundance based on varying proportion of plant species
    - SDM example Le Conte's Thrasher
        - No specific mgmt. question (surveillance)
        - Used hierarchical imperfect detection model
        - Shaded areas show predicted presence and species was found there
    - What kind of question can you ask of this? Inform land acquisition decisions, habitat restoration, timing of protection throughout the life-cycle
- To answer the original question (local effects aggregate to regional patterns?): NPLCC tool example.

    - Data from CA, OR, WA from 133 projects, 47 protocols
    - Put "ontoloty" on the data, ask database for data with specific criteria/characteristics
- Demographic Monitoring
    - Intensive, costly but no necessarily implied effectiveness monitoring
    - Scale considerations apply to demographic monitoring
    - New methods to integrate demographic monitoring data with population monitoring data
- Integrated trend and demography models (Zipkin et al 2014)
    - Used color banded birds in Hubbard Brook,
    - They knew age, identity, fit a state space model, track survival productivity through life stage
    - Three plots, look at scale effects
    - Seems to have all the elements of information to look at scale effects using trend data aggregated
    - This methodology had a lot of promise

Session Discussion:

- Vision for monitoring network, top-down is very difficult
- Some generality needs to exist at the cost of footprint becoming bigger
- Valuable on both sides (bottom up, top down)
- Come up with a statement on what is our goal and how do we strike a balance
- One of the challenges to overcome is addressing this. What are the common denominators? (e.g. Point count protocol, great to identify basic standards)
- Fundamental questions that could be asked with more specific protocols
- What are the priority modeling needs?

SCALE OF DECISIONS – WHO MAKES DECISIONS AT EACH SCALE? WHAT ARE SOURCES OF UNCERTAINTY AND CONFIDENCE IN MODEL OUTPUTS?

Accommodating Geographic Scale in the Analysis of Bird Monitoring Data: Extensive Data Sets, Multi-scale Needs – John Sauer, USGS

- Another issue of interest to the discussion of scale:
    - estimating population trends at regional scales
    - habitat modeling, association bird populations with specific mgmt. actions
- Observations on MAPS and BBS:
    - site-selection issues (sampled is not target)
    - both detectability issues
    - the unbalanced… sites and routes come and go
    - spatially stratified, complex in that cover the entire US
    - analyses have to accommodate these issues (Hierarchical models)

    - Very natural model for surveys that collect information at different scales
    - GLM framework
    - Multiple levels of random effects
- BBS analyses focus on inference on multiple scales
    - Standard regional analyses (BCRs, States)
    - Spatial analysis (grid)
- Two general applications of modeling
    - Aggregate information from sample sites to regional (or grid- based summaries)
    - Use points to develop models to extrapolate
    - Problem is no one really knows what a BBS point is!
- Alternative approaches, competing (or Complementary?) Paradigms
- What are the regions we want to group (WOTH life-cycle model example)
- What's the difference?
    - SDM model selection is more exploratory (not hypothesis-driven)
    - Gripe: many think implementation of SDM take very naïve view of BBS data
    - STEM modeling used for eBird adds value to the dataset, takes the role of covariate modeling and sets it up for a level playing field
- Should we be concerned with effects of scale in the context of FAC modeling? What approach to take (surveillance, bottom up?)
- To what extent now do we have the ability to make corrections in analysis? Are we are at the point where we can put checklists into models and that is sufficient? Shifting the burden to the analysis and modeling in order to accommodate different protocols, methods, etc.?
    - Taking complexity from one point and put it somewhere else, benefit is you are getting orders of magnitude MORE data.
    - Need a clearer idea of how we can really take advantage of eBird, make it more useful for models
    - Comment: You'll always to better with good design than trying to model problems away.
    - It might depend on the data you're collecting (e.g., Survival data… need more structure in the data collection)
    - Need to think about data delivery structures.
- All BBS analyses are model based. We can do increasingly sophisticated techniques, but that's controversial. Other extreme is raw data. Need a hybrid approach.

Discussion: What are the sources of uncertainty and confidence in model outputs? – Leo Salas

- Are we measuring things that are actually relevant to bird conservation, in a consistent manner?
    - Big problem—things that we measure on the ground may not be relevant at the scales of analysis.
    - One of our challenges is to tie our analyses to management decisions. Sometimes statistical uncertainty masks the emerging biological truth…. the biological signal often outweighs the statistical results, so it becomes a delicate balance to mediate.

Detectability considerations may not change the analysis. Perhaps look at a series of studies where the detectability effects do/do not outweigh the biological signal.
    - Partnership between those who organize and run the surveys, people who do the modelling, and people who define the management issues/questions we are interested in. Need to recognize how to manage the interactions. Are data streams telling you consistent things?
    - Detectability—ability to distinguish signal from noise. If you think detectability matters, then your analysis should reflect detectability because it serves to measure your sense of uncertainty.
- The best data may never be available… sometimes one needs to act with imperfect data. (e.g., waterfowl harvest regulations which previously were based on current year survey now use previous year spring survey due to decision event timing (August))
- In waterfowl world, question is clear—sustainable harvest. In nongame world, we think the question is reversing declines—not an immediate mandate. Are we talking a different language?
- **Maintaining sustainable populations of birds may be the common over-riding goal—for both game and nongame**. Have we described that goal and the contributing decisions leading to solving that goal?
    - Should not try to shoehorn this into the harvest management box. Nevertheless, the waterfowl community faces the same analytic problems—repeated decisions, where are they limited, scale issues, uncertainty, etc. But it is going to involve different tools.
    - Does the SHC framework offer enough of a common framework? What are the planning objectives, how to distribute these on the landscape… etc.
    - We still need a basic tool to direct focus—where in the life cycle, using what management tool?
    - Similar process—portfolios of actions, where applied—recruitment problem, survival problem, fecundity problem? Where does $$ get directed and at what scale? Adaptive harvest management is a special case of Structured Decision Making—"a formal process for applying common sense for problems that are too complex for informal common sense."
- Identifying scale of management interest—start with basic demographics, expand to influencing factors and scale where management actions can affect the influencing factors. Scale of action defines the types of decisions and management actions that are appropriate. The same basic model applies to each scale, recognizing the influence of larger scales.
    - Expertise and experience can sometimes substitute for data.
    - Where to get started to have an effect. May need to just select one decision context and wrap your heads around it.
    - Where and when to do something appropriate—but just what is the appropriate action? We are just looking at a portion of the conservation problem. Understanding natural history of species is essential.
    - Where and when to do something, what portion of the life cycle to apportion effort? Where should NMBCA $$ be directed, for example.
- Scientists, managers, stakeholders are part of the picture within which the SDM/SHC paradigms are executed. Monitoring should be the center of the SHC wheel, not just one of the nodes. How does monitoring influence biological planning? How does monitoring influence implementation and its evaluation? We need to redraw the adaptive management wheel with monitoring as the centerpiece.

- Problem—hard to just bite off a chunk when we are dealing with 500 different species—and 500 different life histories. Maybe just start with a few model systems… start with one or two species and create a model example… that's the bitable chunk.
- Set a hypothesis, e.g. Wood Thrush: combination of weather and [?] survival. Develop some management actions to address hypothesis, set of monitoring scheme to evaluate success. What's the first step in (1) monitoring and (2) management to test the hypothesis?
- We now know what the decisions might be, so what refinements of monitoring do we need to make to better enable the execution and evaluation of the decision?

DAY 2 WRAP UP:

- What is the problem? What would be the objectives for a coordinated network for informing an integrated monitoring framework for implementing conservation actions? What do we need to build? How should we define the chunk we are working with?
    - This is a demographic monitoring workshop—so aren't we trying to identify how to get the few simple demographic parameters we need to inform full life cycle management?
    - Link to continental business plans—identify the management actions necessary to implement those business plans.
    - Tie to an existing decision analysis framework—which?
        - We have yet to identify the decision framework for implementing deforestation actions—but they are probably outside the realm of this group. We may not know what decision framework we are operating under.
        - Our job is not to identify the actions necessary. Stakeholders are or should be responsible for this. We contribute missing information… there are already people trying to solve the problem, we just need to provide relevant information.
        - Grassland SDM example—conceptual framework for pulling in biology in order to put grass on the landscape in a private lands context. Could then project how different policies would influence private landowners decisions and ultimately landscape composition (and grassland bird populations at different stages of the annual cycle)
- Focus: Delineate the demographic monitoring framework (for all species)—that can produce hypotheses for future decisions—that can inform full life cycle models. Still needs to be tied to decisions. (We've come full circle—but we now have also articulated generally the overall conservation context in which the demographic modeling effort is embedded. That context conversation had value.
    - There is a decision (at least an incipient decision)—**where and when to allocate conservation resources**. Framework (hypothesis) for future management decisions.
- Results of a well-designed monitoring framework will reveal the management decisions to be made in the future—e.g., how many Eastern Deciduous Forest birds are being limited by juvenile survival through the first year? That might lead to a very specific decision framework. The monitoring framework needs to identify limiting factors to make future decisions efficient.
    - May need separate monitoring frameworks (for informing management decisions) for landbirds, shorebirds, waterbirds.
    - Here, at this meeting, our objective should be to: ***Outline a monitoring framework to inform the models that will identify the limiting factors that (once identified) can be addressed by our conservation decisions.***

THURSDAY, NOVEMBER 20:

WORKSHOP SYNTHESIS:

- We recognize that we have a diverse set of experts around the table and appreciate your contributions these last two days.
- We explored different objectives for and aspects of demographic monitoring and bird conservation.
- Today, we wish to come back to the original set of outcomes for the workshop.
- We converged around the following overarching goal for future activities:
    - **Develop a framework that guides collective and use of demographic data to inform full life cycle models to identify which limiting factors are most important, where and when they might most effectively be addressed, and what decision making processes and conservation actions are necessary to conserve (all) birds.**
- 2007 NABC I document was very impactful:
    - Made space for both status and effectiveness monitoring
    - Provided a roadmap for bird monitoring world (where we are going, where our priorities are)
    - Advanced science and practice of bird monitoring
- Next NABCI document – One product from this workshop
    - Focus monitoring community on demographic monitoring and FAC.
    - Why important – marketing, funding, catalyzing action, educating
    - Four issues/objectives for this document (are these the right ones):
        - Develop conceptual framework (overarching ideas, BTO example, other examples from the workshop) (**Start with Viviana's diagram)**
            - The conceptual framework is a visual diagram that shows all the pieces and how they connect or relate to each other (how the technical pieces relate to management and conservation).
        - Technical piece (models, data needed, and collecting/aggregating data – and how we pay for it) – review and refine
            - Developing the structure, getting the right people together (spatial and political structuring)
            - Model provides results at spatial scales that provide info for management (models and data needed)
            - Available data (migration data – body condition, connectivity, survival)
            - Use of data
            - Existing and new tools
            - **Detach from individual programs – focus on what we need to know – rather than the tools to get the information**
        - Develop decision management framework (decision context, list management questions)

        - Decision context (Wed discussion), questions, decision makers/stakeholders, use of data, scales for information
        - **Assuming we have a lot of good information (demographics, limiting factors identified), how will we use that information to influence management, etc. to reduce threats to birds. What will we do with this great information? Use as much of the machinery as exists in an efficient way.**
    - Integrating knowledge and activities hemispherically (and how do we pay for it)
        - Increase capacity to do this
        - How do we think about getting together the necessary entities to make this work at the FAC scale?
        - Outline a roadmap for defining stakeholders and integrating the first three components.

TASK – Workshop participants broke into four groups organized around issues/objectives for this document to begin developing an outline for a chapter (content, issues, questions, what is needed). More refined outlines are due to David Pashley by **December 15, 2014.**

TASK – Katie will compile the notes and send them out to workshop participants. Presentations will be made electronically available shortly thereafter.

TASK – David Pashley and Katie Koch will schedule a next NABCI Monitoring Subcommittee call in December 2014.