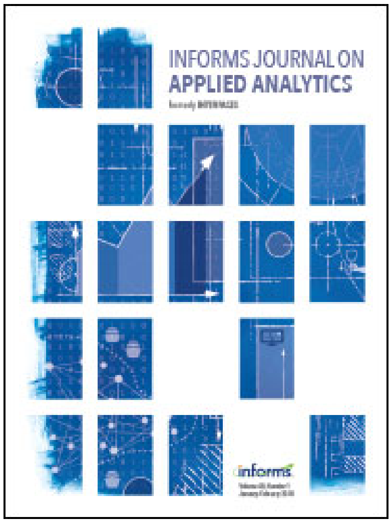

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Structured Decision Making to Prioritize Regional Bird Monitoring Needs

Auriel M. V. Fournier,[a,b,*] R. Randy Wilson,[c] Jeffrey S. Gleason,[d] Evan M. Adams,[e] Janell M. Brush,[f] Robert J. Cooper,[g] Stephen J. DeMaso,[h] Melanie J. L. Driscoll,[i] Peter C. Frederick,[j] Patrick G. R. Jodice,[k] Mary Ann Ottinger,[l] David B. Reeves,[m] Michael A. Seymour,[n] Stephanie M. Sharuga,[o] John M. Tirpak,[p] William G. Vermillion,[q] Theodore J. Zenzal Jr.,[r,s] James E. Lyons,[t] Mark S. Woodrey[a,u]

[a] Mississippi State University, Coastal Research and Extension Center, Biloxi, Mississippi 31532; [b] Forbes Biological Station–Bellrose Waterfowl Research Center, Illinois Natural History Survey, Prairie Research Institute, University of Illinois at Urbana-Champaign, Havana, Illinois 62644; [c] U.S. Fish and Wildlife Service, Migratory Bird Program, Southeast Region, Jackson, Mississippi 39213; [d] U.S. Fish and Wildlife Service, Gulf Restoration Team, Chiefland, Florida 32626; [e] Biodiversity Research Institute, Portland, Maine 04013; [f] Florida Fish and Wildlife Conservation Commission, Gainesville, Florida 32601; [g] Daniel B. Warnell School of Forestry and Natural Resources, University of Georgia, Athens, Georgia 30602; [h] U.S. Fish and Wildlife Service, Gulf Coast Joint Venture, National Wetlands Research Center, Lafayette, Louisiana 70506; [i] Phoenix Rising, LLC, Baton Rouge, Louisiana 70801; [j] Department of Wildlife Ecology and Conservation, University of Florida, Gainesville, Florida 31611; [k] U.S. Geological Survey, South Carolina Cooperative Fish and Wildlife Research Unit, Clemson University, Clemson, South Carolina 29631; [l] Department of Biology and Biochemistry, University of Houston, Houston, Texas 77204; [m] National Fish and Wildlife Foundation, Baton Rouge, Louisiana 70898; [n] Louisiana Department of Wildlife and Fisheries, Baton Rouge, Louisiana 70898; [o] Bureau of Ocean Energy Management, Sterling, Virginia 20166; [p] U.S. Fish and Wildlife Service, Wetland and Aquatic Research Center, Lafayette, Louisiana 70506; [q] U.S. Fish and Wildlife Service, Gulf Coast Joint Venture, Wetland and Aquatic Research Center, Lafayette, Louisiana 70506; [r] School of Biological, Environmental, and Earth Sciences, University of Southern Mississippi, Hattiesburg, Mississippi 39406; [s] U.S. Geological Survey, Wetland and Aquatic Research Center, Lafayette, Louisiana 70506; [t] U.S. Geological Survey, Eastern Ecological Science Center at the Patuxent Research Refuge, Laurel, Maryland 20708; [u] Grand Bay National Estuarine Research Reserve, Moss Point, Mississippi 39562;

*Corresponding author

Contact: auriel@illinois.edu, https://orcid.org/0000-0002-8530-9968 (AMVF); randy_wilson@fws.gov (RRW); jeffrey_gleason@fws.gov (JSG); evan.adams@briwildlife.org, https://orcid.org/0000-0002-4327-6926 (EMA); janell.brush@myfwc.com (JMB); rcooper@warnell.uga.edu (RJC); steve_demaso@fws.gov (SJD); melaniedriscoll3@gmail.com (MJLD); pfred@ufl.edu (PCF); pjodice@g.clemson.edu, https://orcid.org/0000-0001-8716-120X (PGRJ); maotting@central.uh.edu, https://orcid.org/0000-0002-5863-3252 (MAO); david.reeves@nfwf.org (DBR); mseymour@wlf.la.gov (MAS); stephanie.sharuga@boem.gov, https://orcid.org/0000-0002-3771-2525 (SMS); john_tirpak@fws.gov, https://orcid.org/0000-0003-1937-9754 (JMT); william_vermillion@fws.gov (WGV); tzenzal@usgs.gov, https://orcid.org/0000-0001-7342-1373 (TJZ); jelyons@usgs.gov, https://orcid.org/0000-0002-9810-8751 (JEL); msw103@msstate.edu, https://orcid.org/0000-0002-0243-0771 (MSW)

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Abstract. Conservation planning for large ecosystems has multiple benefits but is often challenging to implement because of the multiple jurisdictions, species, and habitats involved. In addition, decision making at large spatial scales can be hampered because many approaches do not explicitly incorporate potentially competing values and concerns of stakeholders. After the *Deepwater Horizon* oil spill, establishing baselines was challenging because of (1) variation in study designs, (2) inconsistent use of explicit objectives and hypotheses, (3) inconsistent use of standardized monitoring protocols, and (4) variation in spatial and temporal scope associated with avian monitoring projects before the spill. Herein, we show how the Gulf of Mexico Avian Monitoring Network members used structured decision making to identify bird monitoring priorities. We used multiple tools and techniques to clearly define the problem and stakeholder objectives and to identify bird monitoring priorities at the scale of the entire northern Gulf of Mexico region. Although our example is specific to the northern Gulf of Mexico, this approach provides an example of how stakeholder values can be incorporated into the coordination process of broad-scale monitoring programs to address management, restoration, and scientific questions in other ecosystems and for other taxa.

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Keywords: Gulf of Mexico • structured decision making • conservation strategy • birds • monitoring programs

Coordinated monitoring and conservation actions are required to address large-scale threats to biodiversity (Mace et al. 2000, Margules and Pressey 2000, Hostetler et al. 2015, Marra et al. 2015). Coordinating effective conservation across large scales requires engaging partners who may have a combination of complementary and competing objectives, priorities, and resources, while also working across political or other administrative boundaries (Sarkar et al. 2006, Pressey and Bottrill 2009, de Groot et al. 2010, Jodice and Suryan 2015, The National Academy of Sciences, Engineering, and Medicine 2017). Regional monitoring programs often use a variety of strategies to address these challenges. Some programs focus on standardizing data collection across projects and maximizing rigor (Lambert et al. 2009), whereas others focus on building technical infrastructure (Koch et al. 2010) or on data sharing to identify common issues (Currier et al. 2015, Taylor et al. 2017). One aspect often missing is transparency in ranking of priorities for future work, making it difficult for individuals and organizations to understand how their projects fit into the broader cooperative monitoring efforts. This is a critical issue because the resulting lack of understanding can translate into a loss of active participation. Repeatability of earlier efforts is also hindered by a lack of transparency for prioritization and other decisions that address multiple, competing objectives (Gregory et al. 2012, Runge et al. 2020), as practitioners are often forced to "reinvent the wheel."

The Gulf of Mexico Avian Monitoring Network (GoMAMN) was formed in response to the need for improved coordination of bird monitoring after the 2010 *Deepwater Horizon* oil spill (National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling 2011, DWHNRDAT 2016). Coastal habitats and offshore waters constituting the northern (U.S.) Gulf of Mexico represent some of the most ecologically and socioeconomically important ecosystems in the world (Adams et al. 2004). Collectively, the natural resources in the northern Gulf of Mexico produce approximately 30% of the U.S. gross domestic product through offshore oil and gas production, commercial and recreational fishing, and tourism (GCERTF 2011). Simultaneously, these coastal habitats and offshore waters are home to thousands of plant and animal species, including use by more than two billion birds that migrate through the region annually (Horton et al. 2019).

During the initial "response" phase of *Deepwater Horizon*, state and federal trustees initiated a Natural Resource Damage Assessment (Oil Pollution Act of 1990). A key step in this process is the development and implementation of taxa-based work plans to estimate the injury and damages to natural resources attributed to the spill. As plans developed, it was clear among avian working group members that region-wide, systematic, standardized bird survey data were largely absent. This lack of rigorous monitoring data was a glaring gap in our knowledge of bird populations across the Gulf of Mexico region, which would ultimately impact our ability to assess avian damages (e.g., Wiens and Parker 1995, Bjorndal et al. 2011). As a result, a group of individuals met to brainstorm a structure for a regional bird monitoring program. It quickly became clear to this group that region-wide, coordinated bird monitoring would require broad buy-in, support, participation, and resources from federal and state agency biologists and administrators, as well as not-for-profit conservation partners and research scientists. Furthermore, the habitat and bird species diversity in the region, and the variety of life history strategies for these species, would require a comprehensive, systematic, and transparent approach to monitoring designs. Thus, we applied a structured decision-making (Gregory et al. 2012) framework to use the values of the bird conservation community to develop ranked priorities for future monitoring while breaking complex issues into smaller and more manageable components. The bird monitoring priorities identified through the process described in this paper were published in the *Strategic Bird Monitoring Guidelines for the Northern Gulf of Mexico* (hereafter, *Guidelines*, Wilson et al. 2019, available at gomamn.org). The purpose of this paper is to document the process we used so it can be applied to other taxa (e.g., marine mammals, sea turtles) and regional conservation efforts.

Problem, Objectives, Alternatives, Consequences, Trade-offs

Structured decision making uses a set sequence of steps, known as Problem, Objectives, Alternatives, Consequences, Trade-offs (PrOACT) to guide the individual or group (Hammond et al. 2002). Problem framing is the essential first step of a structured decision-making process because without a common understanding of the problem, a solution that is in line with stakeholder values and objectives cannot be found (Keeney 1992). Problem framing for GoMAMN was unusual because there was not an impending decision (i.e., irrevocable allocation of resources) with a single decision maker. Rather, the *Deepwater Horizon* settlement created a "decision opportunity" to structure a future decision with multiple stakeholders (Keeney 1992, Haydt et al. 2013, Caballero et al. 2021). As stakeholders interested in the conservation and management of birds in the Gulf of Mexico, we used value-focused thinking and structured decision making to guide the regional prioritization of bird monitoring with a stakeholder value model (Keeney 1992, Keeney and von Winterfeldt 2007). Problem framing, including creating a problem statement, was an important first step to ensure each member of the bird conservation community could understand how their concerns were addressed.

Once a problem statement was developed, we identified our objectives, specifically assigning a value/ranking of possible solutions to our problem (Gregory et al. 2012). Objectives can be categorized either as fundamental objectives, which represent our values, or as means objectives, which represent methods to achieve our fundamental objectives (Keeney 1996). This step was vital for making explicit the different ways that members of the bird conservation community value monitoring. Through the development of an objectives hierarchy, those differences (e.g., interest in management actions versus status and trends) and areas of overlap (e.g., scientific rigor) were clearly laid out. Like many structured decision-making processes, there were several iterations through problem framing and objectives development (McGowan et al. 2015), and we will discuss those iterations later in this manuscript.

We used conceptual models—specifically, influence diagrams (Howard and Matheson 2005, Carriger and Newman 2012)—to assist in the development of alternative monitoring priorities (see the *Guidelines* for the final results). This allowed experts in each working group to create explicit linkages between management actions and the process by which those actions influence a given species. Whereas other structured decision-making exercises would then continue through the consequences and trade-off steps of PrOACT, our process ended at the ranking of alternatives (which were then published in the *Guidelines*), which successfully addressed our decision problem. Groups using structured decision making are often able to address a problem with a partial PrOACT process (Keeney 2004), where roughly 1,000 in 10,000 decisions are worth thinking about, only 40 of the 1,000 being worth investing systematic thought in; of those 40, 10 are solved by clarifying the problem, objectives, and alternatives the way we have.

Process for Developing *the Guidelines*

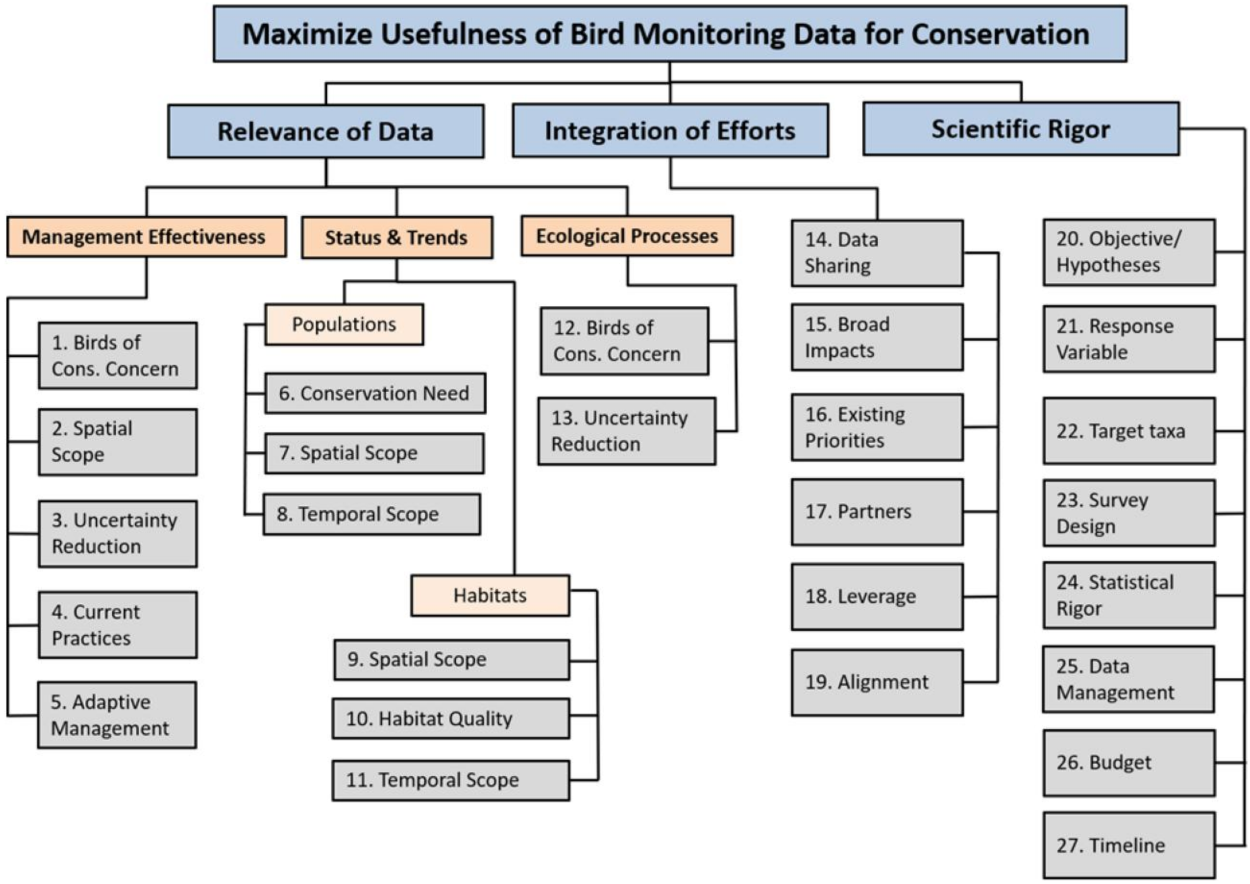
After initial conversations about the need for better coordinated bird monitoring in the Gulf of Mexico, we participated in a five-day facilitated structured decision-making workshop at the National Conservation Training Center (NCTC; Shepherdstown, West Virginia, U.S. Fish and Wildlife Service facility) in 2014. Our workshop team was paired with trained facilitators and coaches to take us through the full structured decision-making process on an accelerated timeline. NCTC workshop teams are usually limited to 10 people to maximize productivity (Nicolson et al. 2002), so considerable thought went into exactly who from the larger group (around 30 people) would attend to ensure the full range of stakeholder perspectives were represented, including federal and state resource managers, scientists from avian-focused nonprofits, and academics involved in applied avian research.

The NCTC workshop has the goal of leading the team through the PrOACT process in a prototype framework (Garrard et al. 2017), in which groups move quickly through each step to allow for time to revisit earlier steps as new information arises. This process always begins with a draft problem statement. For our group, each participant wrote out a problem statement to facilitate the focus on the common themes and perspectives among the participants to ensure each person's perspective was included at the starting point (Kaner et al. 2007). The workshop structure allows opportunities for individual reflection and group discussions, which allowed the statement to be revisited and revised as necessary as we moved through the other PrOACT steps, which is consistent with the iterative nature of this process (Kaner et al. 2007, Gregory et al. 2012, Smith 2020).

During the NCTC workshop, the group also worked on defining the fundamental objectives. Facilitation techniques were used to brainstorm initial ideas using sticky notes, with each note briefly describing what was important from the perspective of each individual and what the individual valued. This process and subsequent group discussion led to the development of fundamental values, or objectives, specifically about maximizing *integration* of monitoring efforts, *scientific rigor*, and *relevance* for decision making (Figure 1). Here, we further developed subobjectives under relevance that reflect its distinct components, specifically (1) understanding the impact of management actions, (2) assessing population status and trends, and (3) understanding the impact of ecological processes. At the end of the NCTC workshop, the draft objectives hierarchy only contained the fundamental objectives (Figure 1) (Wilson et al. 2014), and the rest of the hierarchy was developed after the workshop through a series of meetings with the broader bird conservation community involved in bird monitoring and conservation in the Gulf of Mexico (the "Community of Practice") (Figure 2).

The GoMAMN Community of Practice was open to anyone involved in bird monitoring or who used bird monitoring data for decision making. The meetings were widely advertised and attended by 30–100 people. Through the first few Community of Practice meetings, the problem statement and objectives hierarchy from the NCTC workshop were further developed with substantial input from the Community of Practice. This input was sought through additional exercises and discussions, via plenary and breakout groups, to further develop and refine specific sections and specific language. Taking the time for multiple meetings with the Community of Practice was a critically important step for two reasons. First, it allowed us to ensure our problem statement and objectives represented the full problem and values of the Community of Practice. Second, it also garnered greater buy-in from both individual stakeholders and organizations/agencies into the process.

Figure 1. (Color online) Objectives Hierarchy of the Gulf of Mexico Avian Monitoring Network to Address the Problem of Maximizing the Usefulness of Bird Monitoring Data for Conservation Decision Making



Source. Figure originally published in Fournier et al. (2021).
Note. The objectives hierarchy includes fundamental objectives (relevance of data, integration of efforts, and scientific rigor), subobjectives (management effectiveness, status and trends, and ecological processes), and performance metrics (numbered boxes).

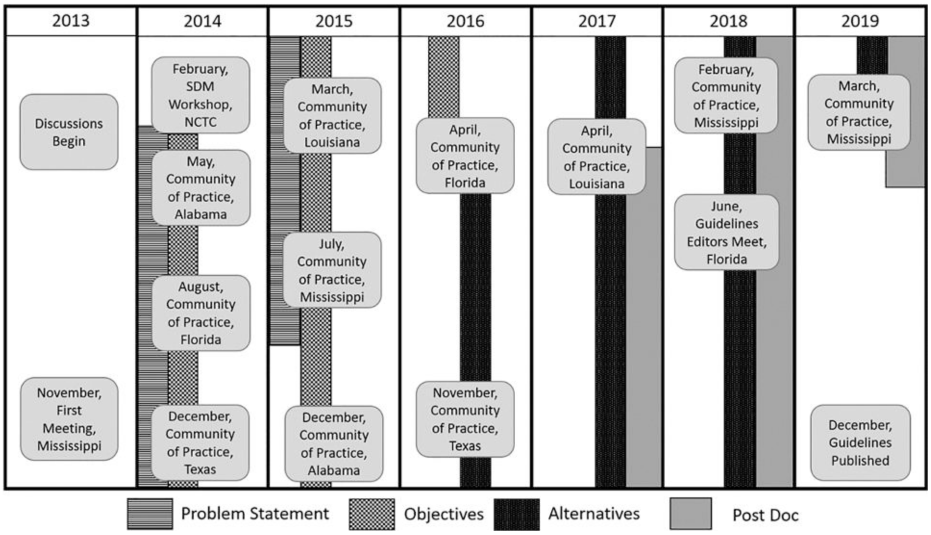
We intentionally rotated meetings among each state to ensure our meetings were accessible to the broader bird conservation community and that out-of-state travel restrictions did not prevent participation by interested individuals or groups. Developing our problem statement and objectives hierarchy over several meetings with different participants required us to go through several iterations between the initial draft products of the NCTC workshop and the final version.

After multiple Community of Practice meetings over 1.5 years (Figure 2), the GoMAMN Community of Practice agreed to the following problem statement: "How do we develop a cost-effective monitoring strategy for the Gulf Coast avian community and Gulf Coast ecosystem that evaluates on-going, chronic, and acute threats and conservation activities, maximizes learning, and is flexible and holistic enough to identify management triggers and to evaluate new and emerging conservation activities?" (Fournier et al. 2021, p. 1).

The problem statement is intentionally broad owing to the Community of Practice recognizing multiple decisions makers. This statement also recognizes the need for improved information regarding the effectiveness of various restoration techniques, including current and yet-to-be developed approaches. Thus, the GoMAMN Community of Practice deliberately framed the problem to focus on learning (in the sense of learning through adaptive management (Williams et al. 2007)) that would be most informative for decision makers versus a purely scientific endeavor in which all learning would be valued (Lyons et al. 2008). Furthermore, the problem statement acknowledges current threats to the birdlife of the Gulf of Mexico while noting current conservation efforts throughout the region. This problem statement anchored the Community of Practice and was referenced repeatedly to prevent "mission creep" as we moved into the development of objectives and alternatives.

The early meetings of the Community of Practice were not solely focused on revising the problem statement but also involved the development and refinement of our objectives hierarchy (Figure 1). Community

Figure 2. Timeline for the Formation of the Gulf of Mexico Avian Monitoring Network and the Development of the *Strategic Bird Monitoring Guidelines for the Northern Gulf of Mexico*, Showing Each In-Person Meeting, Its Audience, and Location



Notes. Background vertical bars show which part of the PrOACT cycle we were working on at which time. NCTC, National Conservation Training Center, Shepherdstown, West Virginia; SDM, structured decision making.

of Practice agendas were structured around facilitated breakout groups. Each group focused on one of the fundamental objectives (rigor, integration, and relevance). With the assistance of a skilled facilitator, each group developed and refined performance metrics, with each metric nested under its respective fundamental objective (Keeney and Gregory 2005, Keeney and von Winterfeldt 2007). The breakout format allowed for more directed group discussion, rather than a wide-ranging discussion among many individuals of the performance metrics, and maximized the expertise of workshop participants by allowing them to choose which group to participate in. After each breakout group developed proposed performance metrics, the groups reconvened in a plenary, where a spokesperson for each breakout team presented each metric to everyone in attendance for their feedback. As with our problem statement and fundamental objectives, our performance metrics were refined through several iterations, with the objectives hierarchy being finalized in April 2016 after just over two years of input from the Community of Practice (Figure 2).

Input collected from the series of in-person meetings ultimately resulted in our three fundamental objectives with 27 associated performance metrics arranged in an objectives hierarchy (Figure 1). Based on the elements in our objectives hierarchy, we clearly value monitoring data that are relevant to restoration decision makers and stakeholders. In part because restoration of damaged coastal habitats is a cornerstone of the recovery process for natural resources, as outlined in the Final Programmatic Damage Assessment and Restoration Plan (DWHNRDAT 2016) and the Strategic Framework for Bird Restoration Activities (DWHNRDAT 2017), our Community of Practice identified three objectives of monitoring related to Gulf of Mexico restoration:

1. Support evaluation of restoration and management actions
2. Establish population and habitat baselines
3. Understand ecological processes

There were instances when the distinction between management action (objective 1) and ecological process (objective 3) was difficult to discern. If a monitoring priority included an ecological process that had a clear connection back to a management action, then that monitoring priority was included in the *Guidelines* as a management action, not an ecological process. For example, if there is uncertainty around the relationship of salinity and food availability as related to freshwater inputs (controlled upstream by humans), it would be included as a management action, whereas if there is uncertainty around the influence of salinity on food availability as it relates to natural rainfall, storm events, etc., then it would be included as the uncertainty for an ecological process.

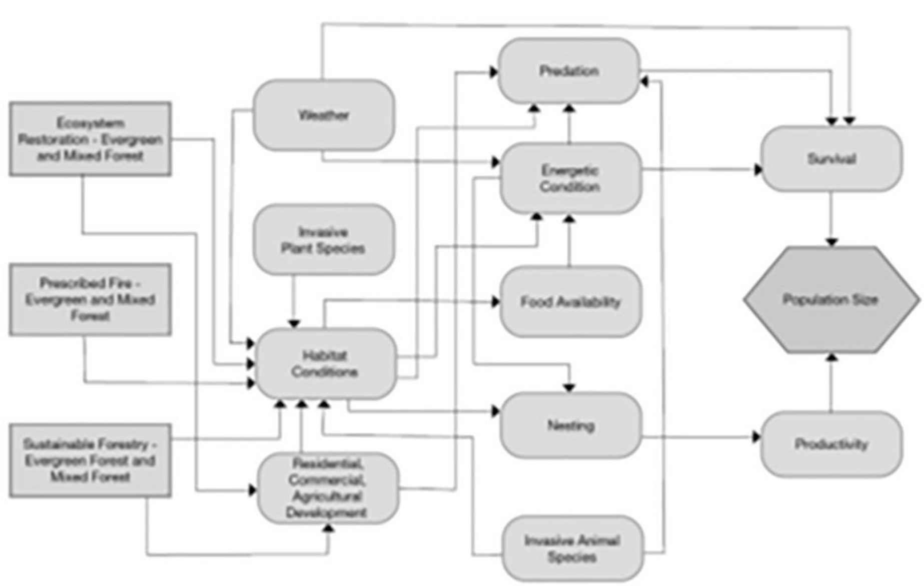
Once the objectives hierarchy was complete, we moved on to identifying alternative monitoring priorities—that is, specific monitoring needs that could be compared with one another. Our alternatives represent monitoring activities that target specific areas of uncertainty (uncertainty about the application of management actions, uncertainty about status and trends, or uncertainty about the impacts of an ecological process), along with recommendations on the specific end point to be monitored to address that uncertainty. To identify monitoring alternatives (detailed in each chapter of the *Guidelines*), we needed the input of experts in specific species, taxonomic groups, and subject areas, such as avian health. As a result, GoMAMN established one working group focused on avian health and seven working groups focused on different taxonomic groups of birds (i.e., land birds, marsh birds, raptors, shorebirds, seabirds, waterfowl, and wading birds).

To identify monitoring alternatives (specific uncertainties and end points for monitoring to inform decision making), we used conceptual models in the form of influence diagrams (Figure 3) (Robinson and Fuller 2017). Each working group created influence diagrams for a species or groups of species. The response metric, or end point, of these influence diagrams was most often population size, although this varied depending on the specific elements of a given diagram. On the opposite side of the influence diagram were the management actions thought to influence the response metric. Management actions were connected to the response metric via intermediate nodes, which were hypothesized to represent the biological relationships between management actions and the response metric.

The working groups initially made complex diagrams including many management actions and often with over 30 nodes in total, which limited their utility for defining monitoring alternatives. To increase their utility, each group reviewed and reduced the diagrams to four to six of the most critical management actions. The groups then used these "simplified" diagrams to define specific monitoring uncertainties with fully articulated uncertainty statements and specific end points for monitoring (i.e., what needed to be monitored, such as nest success of *X* species, abundance of *Y* species) as well as an estimated effect size and degree of uncertainty. The effect size and uncertainty evaluation were determined by expert opinion through working group consensus. Effect size was a categorical variable with possible values of high, low, or unknown. High effect size indicated the working group thought the effect of addressing that priority with future monitoring would have a high impact on future decisions, whereas low effect size reflected relatively little impact and unknown effect size indicated experts were unable to anticipate the magnitude of the effect given current information. Uncertainty was a categorical variable with a value of either high or low. High uncertainty indicated that the working group thought the uncertainty around the proposed mechanism or impact of the monitoring priority was high relative to other priorities. The effect size and uncertainty scores were combined into a five-category ranking (effect size–uncertainty: high-high = 1, unknown-high or unknown-low = 2, high-low = 3, low-high = 4, and low-low = 5). We choose high-high as the top ranking because those identified with both high effect size and high uncertainty will often benefit the most from additional monitoring to help reduce associated uncertainty.

The highest priorities, those in categories 1–3, for management actions and ecological processes were then described in detail in each working group's chapter in the *Guidelines* (Wilson et al. 2019). Each taxonomic working group prioritized status and trends monitoring of the GoMAMN Birds of Conservation Concern (appendix 1

Figure 3. Influence Diagram of the Relationship Between Management Actions (Rectangle Boxes), Intermediate Processes (Round-Corner Boxes), and Population Size (Hexagon) for the Chuck-Will's-Widow (*Antrostomus carolinensis*) Breeding Within the Gulf of Mexico Region



Source. Reproduced from Wilson et al. (2019).

of Wilson et al. 2019) by using the species' trend scores from the Partners in Flight Avian Conservation Assessment Database (Partners in Flight 2017). Birds with a more negative population trend score were assigned a higher priority because they are assumed to be of a greater conservation need. By prioritizing species that exhibit the greatest decline, we ensure that declining or rare species would receive increased monitoring attention.

Consider the example of land birds where Figure 3 shows an influence diagram with the following uncertainty identified: "What are the important forest stand characteristics (block size/shape, age, species composition, vertical structure, proximity to other forest blocks, etc.) for maintaining and/or increasing populations of forest landbirds? What are the appropriate silvicultural techniques for attaining those desired forest characteristics?" (Zenzal et al. 2019, p. 35). Paired with that uncertainty, the land bird working group identified the specific end point for monitoring of "survival, population size, breeding productivity, and body condition at spring migration departure." They also articulated the specific uncertainty of "how interactions among stand- and site-level vegetation characteristics, forest block size, shape and connectivity, fire history, and arthropod and fruit densities affect avian demography. The degree to which silvicultural practices and other management can replicate natural processes in creating habitat for bird species of concern is not clear, or varies by species" (Zenzal et al. 2019, p. 35). This alternative was rated as high uncertainty and high effect size.

Birds in the Gulf of Mexico have a high risk of acute and chronic exposure to oil, chemicals, fertilizers, herbicides, and pesticides because of the concentration of these industries in the region and the outflows of many major U.S. rivers (Ottinger et al. 2019). Thus, GoMAMN members also recognized the need to monitor avian health metrics, not only to understand the effects of threats and environmental stressors but also as a way of monitoring beneficial effects of restoration or management efforts (Ottinger et al. 2019). Unfortunately, baseline data for many of these avian health metrics are limited, if they exist at all. Thus, the monitoring priorities for avian health focus on establishing baselines from which we can measure the effects of contaminants across the region. Once data on health metrics in association with short- and long-term restoration projects are collected and made available, it will be possible to customize these measures for specific taxa and habitats as well as begin to model outcomes based on the data collected from monitoring and health metrics.

In addition to using our values to guide the prioritization of specific monitoring needs, we also practiced our fundamental value of integration. We adopted existing conservation and management tools and procedures established by the broader conservation community whenever possible (Salafsky et al. 2008, Bennett et al. 2009). Given the broad geography and diverse habitats found from south Florida west to south Texas, the Community of Practice identified a clear need for a regularly updated, standard land classification scheme across the entire region; we chose and have successfully applied the National Oceanic and Atmospheric Administration Coastal Change Analysis Program landcover data (Dobson et al. 1995). The importance of these standardized tools cannot be overstated—without these tools, the bird conservation community would continue to talk past one another, resulting in a continuation of the same piecemeal monitoring efforts that plagued our ability to more accurately assess the impacts of the *Deepwater Horizon* oil spill.

One challenge of ranking priorities across taxonomic groups is that the body of knowledge is not equal across groups. Some groups of birds in the Gulf of Mexico, such as seabirds, still have fundamental knowledge gaps about the presence and distribution of species (Jodice et al. 2019), whereas other bird groups, such as waterfowl (DeMaso et al. 2019), have had substantial resources invested in monitoring and research for decades (Anderson et al. 2018, Roberts et al. 2018). Ultimately, we ensured the ranking within each working group was done consistently, as rankings, especially of uncertainty, cannot be directly compared across groups because each group starts from a different baseline of knowledge and research, which informs how they approach relative uncertainty.

Ultimately, the *Guidelines* identify specific needs for future monitoring to inform the conservation, restoration, and management of birds and habitats in the Gulf of Mexico. Having these alternatives paired with effect sizes and uncertainties basically ended our decision process, as we did not need to further evaluate the consequences and trade-offs. Rather, we intended for these specific needs to be used by individuals writing grant proposals to ensure their proposed work has the greatest potential benefits to bird and bird conservation. The *Guidelines* could also be used by funding decision makers to craft future calls for proposals and ensure the work they are funding is addressing high-priority needs. If the *Guidelines* are successful, highly ranked uncertainties will be addressed in the future in a way that informs management and new uncertainties will rise to the top, and the process repeats.

Learning for Executing Large-Scale, Geographically Dispersed Decision Analysis Projects

Our prioritization process could be applied to other conservation monitoring problems. Here, we share several considerations for doing so effectively and perhaps more efficiently than in our case study. We strongly encourage patience in letting the process work, as the development of the problem statement and objectives hierarchy will be iterative (Garrard et al. 2017, Smith 2020); thus, participants may feel the process is taking too long. However, success is predicated on having those two foundational pieces reflect the values of the group, and time must be invested to ensure buy-in from the larger community (McGowan et al. 2015). Otherwise, any lack of stakeholder consensus around the problem statement and objectives will render any subsequent decisions ineffective.

Regular meetings help move the effort forward and maintain momentum. What regular meetings will mean for another group will depend on their respective decision context and, perhaps more importantly, whether there is a person or staff working full- or part-time on the problem or whether the effort is more collaborative in nature. Our experience clearly showed we made significant progress more quickly once we acquired funds and hired a full-time postdoctoral research associate to dedicate significant time toward coordination and management of our effort. In our attempt to engage the broadest community of stakeholders as possible, we likely slowed our progress, as we were always onboarding new people, which typically meant sharing progress to date and frequently led to discussing and revisiting previous decision points. The obvious outcome of this onboarding meant less time for moving the group forward. Much of this "rehashing" of the process was a result of moving each meeting from state to state. Nevertheless, multiple meetings across states provided a great opportunity for us to expand the Community of Practice and have more buy-in across the region—which is critical to the success of an effort such as this. As a group, we valued greater input and support despite a slower pace.

Regardless of the frequency of meeting virtually or in person, clear, frequent communication and documentation of decisions have multiple benefits (Nicolson et al. 2002, Wright et al. 2020). Any effort engaging a large stakeholder community will experience turnover within that community during this process, and decision documentation can help with onboarding new participants and prevent relitigating previous decision points. Depending on the amount of trust among stakeholders, similar efforts may find value in having this process led by a smaller, representative group, who regularly checks in with the larger group. The obvious downside to this approach is less buy-in from the larger group; this decision should be made on a case-by-case basis.

Based on our experience, in-person meetings are critical for steady progress and building and maintaining trust among group members (Nicolson et al. 2002), although we note all this work occurred before the COVID-19 pandemic, and the technologies widely available now have greatly improved the utility of virtual meetings. Thus, a combination of in-person and virtual meetings could be beneficial, particularly if in-person meetings are not financially and/or logistically feasible. The funding GoMAMN secured to support the postdoctoral research associate also included funding for invitational travel, which was instrumental in allowing many stakeholders to attend in-person meetings when many organizational budgets would not have allowed them to otherwise participate. In particular, state agency personnel and nongovernment conservation organization staff faced travel restrictions that were eased with the availability of invitational travel funds. We found in-person meetings especially useful for building trust between stakeholders who do not already have strong professional relationships (Carriger et al. 2015; Chee et al. 2017).

Finally, we would not have been successful in our effort had it not been for the availability and willingness of trained coaches experienced in leading structured decision-making groups. These coaches bring a wealth of experience and specialized expertise and training in the areas of facilitation, elicitation, etc. Strong structured decision making and facilitation skills are invaluable in successfully and effectively dealing with the diversity of backgrounds and personalities involved in a region-wide effort like this. In our effort, we were fortunate to have access to three different coaches, all of whom brought different experiences and expertise to our effort.

Addressing natural resource monitoring needs at regional scales is not without its challenges. Despite those challenges, we expect other regions will need to find new ways to coordinate monitoring in the future as we face ongoing and new challenges to natural resource management and conservation (Saunders et al. 2021). We were able to use the needs and values of a broad suite of stakeholders to prioritize monitoring needs in a way that each individual could see the connections and understand the values behind the rankings. We hope other efforts can learn from our process and achieve similar success in a shorter timeline as they work together across administrative, political, and organization boundaries toward transparent priorities for coordinated regional monitoring.

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Verification Letter

Peter Tuttle, Restoration Branch Manager, Gulf Restoration Office, Fish and Wildlife Service, 341 Greeno Road North, Suite A, Fairhope, Alabama 36532, writes:

"I am writing this letter in support of the *Journal of Applied Analytics* publication of a manuscript regarding the Strategic Bird Monitoring Guidelines for the Northern Gulf of Mexico developed by the Gulf of Mexico Avian Monitoring Network (GoMAMN). I am the U.S. Fish and Wildlife (USFWS) representative on the Monitoring and Adaptive Management (MAM) Working Group for the Deepwater Horizon Oil Spill Natural Resource Damage Assessment (NRDA). I am also the USFWS representative on the MAM Team for the Deepwater Horizon NRDA Open Ocean Trustee Implementation Group (TIG). GoMAMN's Strategic Bird Monitoring Guidelines have proven to be an invaluable resource for both of these group's efforts.

"The global settlement of the 2010 Deepwater Horizon Oil Spill provided State and Federal Natural Resource Trustees (Trustees) $8.8 billion dollars to restore natural resources and resource services injured by the spill. The Trustees include representatives from four Federal Departments and the five Gulf of Mexico States. The Programmatic Damage Assessment and Restoration Plan (PDARP) developed as part of the settlement provided a framework for restoring injured resources and services. The PDARP also committed the Trustees to a robust MAM program to facilitate the effective and efficient use of restoration funds. As part of the MAM program, the Trustees developed the Deepwater Horizon MAM Manual which, among other things, provided guidance to facilitate the collection of consistent and compatible monitoring data across the five Gulf of Mexico States impacted by the spill. The MAM Manual provides both project-level and resource-level monitoring. The Trustees relied heavily on GoMAMN's Strategic Bird Monitoring Guidelines for the development of guidance for monitoring the performance of bird restoration projects and resource-level monitoring for birds.

"The Deepwater Horizon NRDA settlement also allocated $200 million to the Open Ocean TIG for MAM activities. To facilitate the efficient use of the MAM funds, the Trustees developed the Open Ocean TIG MAM Strategy document which identified and prioritized information needs to enable more effective restoration of resource injured by the Deepwater Horizon Oil Spill. The Trustees again heavily relied on GoMAMN Strategic Bird Monitoring Guidelines, in particular, the influence diagrams and uncertainties table for management actions and ecological processes in the taxa chapters, to identify and prioritize MAM activities for birds.

"In summary, GoMAMN's Strategic Bird Monitoring Guidelines for the Northern Gulf of Mexico have proven to be an invaluable resource for the Deepwater Horizon NRDA Trustees in our efforts to restore natural resources injured by the Deepwater Horizon Oil Spill. The Guidelines have not only served to help us design monitoring efforts to evaluate restoration project success, but also to evaluate progress toward bird restoration goals. The Guidelines also have helped the Trustees to better enhance our effectiveness and efficiency in spending restoration funds. Accordingly, I offer my sincere endorsement of GoMAMN's Strategic Bird Monitoring Guidelines for the Northern Gulf of Mexico."

Auriel M. V. Fournier is the director of Forbes Biological Station within the Illinois Natural History Survey.

R. Randy Wilson is a wildlife biologist with the U.S. Fish and Wildlife Service.

Jeffrey S. Gleason is the Gulf of Mexico Migratory Bird Coordinator for the U.S. Fish and Wildlife Service.

Evan M. Adams is the director of the Quantitative Wildlife Ecology Research Laboratory at the Biodiversity Research Institute.

Janell M. Brush is an associate research scientist with the Florida Fish and Wildlife Conservation Commission.

Robert J. Cooper is a retired professor from the University of Georgia.

Stephen J. DeMaso is the monitoring and Coastal Grassland Restoration Incentive Program coordinator for the Gulf Coast Joint Venture.

Melanie J. L. Driscoll owns and operates Phoenix Rising, LLC.

Peter C. Frederick is professor emeritus at the University of Florida.

Patrick G. R. Jodice is a wildlife research biologist with the United States Geological Survey South Carolina Cooperative Fish and Wildlife Research Unit.

Mary Ann Ottinger is a retired professor from the University of Houston.

David B. Reeves is a coastal habitat restoration manager for the National Fish and Wildlife Foundation.

Michael A. Seymour is a biologist supervisor with the Louisiana Department of Wildlife and Fisheries.

Stephanie M. Sharuga is an interdisciplinary scientist with the Bureau of Ocean Energy Management.

John M. Tirpak is a deputy assistant regional director with the U.S. Fish and Wildlife Service.

William G. Vermillion is a bird conservation specialist with the Gulf Coast Joint Venture.

Theodore J. Zenzal Jr. is a research ecologist at the USGS Wetland and Aquatic Research Center.

James E. Lyons is a research ecologist with the U.S. Geological Survey at the Eastern Ecological Science Center.

Mark S. Woodrey is an assistant research professor of avian ecology at Mississippi State University.