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Waterfowl research priorities in the northern Great Plains

Robert R. Cox, Jr., Douglas H. Johnson, Michael A. Johnson, Ronald E. Kirby, Jeffrey W. Nelson, and Ronald E. Reynolds

Abstract It is necessary periodically to identify research priorities so that future research will be directed toward the most pertinent issues in waterfowl ecology and management. To that end, Northern Prairie Wildlife Research Center convened a quorum of experts on the ecology of breeding waterfowl, the Waterfowl Working Group, to 1) develop a mission statement, 2) identify waterfowl research priorities in the northern Great Plains, and 3) determine the frequency for re-identifying research needs. Research needs (nonprioritized) identified by the group and described in detail herein included: 1) determine effects of landscape factors on demographics and recruitment of ducks in the Prairie Pothole Region; 2) develop, improve, or update estimates of important parameters used in existing models for management and planning; 3) evaluate waterfowl management activities at broad, regional scales; 4) direct studies at waterfowl species of concern; and 5) evaluate applicability of the bird-conservation-area concept to waterfowl. The Waterfowl Working Group will reconsider research priorities at 2-year intervals.

Key words breeding, northern Great Plains, Prairie Pothole Region, research needs, research priorities, waterfowl

The Northern Prairie Wildlife Research Center (hereafter, Northern Prairie) was established in 1965 to conduct research on management of migratory birds, primarily waterfowl (Nelson and Lee 1965). Along with several administrative changes came expansion of Northern Prairie's mission to include responsibility for ecological research and monitoring of the entire flora and fauna of the nation's northern and central grasslands, with emphasis on disseminating biological information to decision-makers and the public. Concurrent with these broadened objectives, Northern Prairie has maintained a strong waterfowl research program.

Its waterfowl research program has been guided by the expressed needs of the Department of the

Interior bureaus, states and provinces in the western half of the continent, Flyway Councils and other management organizations, and priorities set forth by Congress through annual appropriations legislation. It also has been guided by the judgment of Northern Prairie staff and numerous collaborators and partners in waterfowl research, who discuss needs at various forums such as professional meetings and who regularly work together to obtain necessary resources for research. In 1998, Northern Prairie formed working groups focusing on several research arenas, including waterfowl, to identify research priorities in a more structured fashion. Herein, we report recommendations of the Waterfowl Working Group (WWG), including a

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mission statement, research priorities, and the frequency at which the WWG should reconsider research priorities. We offer these recommendations in the spirit of other such reviews over the years (e.g., Barske 1968, Boyd 1974, Reinecke 1981, Anderson and Batt 1983), as a springboard to discuss and coordinate continent-wide efforts. We hope that waterfowl researchers, students, and resource agencies will find our recommendations useful for planning future studies.

Methods

Northern Prairie staff with waterfowl backgrounds, as well as several other professionals with expertise in breeding waterfowl ecology in the northern Great Plains, were invited to serve on the WWG (Table 1). The group encompassed individuals with: 1) current participation in research on waterfowl breeding ecology, with emphasis on developing management prescriptions for populations in the northern Great Plains; 2) affiliation with entities (government or private) that manage habi-

tat for waterfowl; 3) recent interaction with Northern Prairie; and 4) a personal interest in developing long-range research plans. The goal was to establish a quorum of experts rather than an all-inclusive group, because the latter would have been too large to be tractable.

Deliberations were conducted through a modified Delphi process (Helmer 1967). The Delphi technique "...is a group of related procedures for eliciting and refining the opinions of a group of people" (Weatherman and Swenson 1974:97). The technique involves distributing questionnaires through several refining iterations and produces predictions of the future based largely on personal insight of well-informed individuals rather than on current theory. The informed intuitive judgment of experts incorporated in this technique is particularly useful to develop action plans for research and development, with possibility for long-range planning and ultimately policy formulation. The method eliminates time-consuming committee activities and the influence on participants of certain psychological factors, such as specious persuasion, influence of

Table 1. Members and affiliations of the Waterfowl Working Group at Northern Prairie Wildlife Research Center, 1999.^a

Representative	Organization
Michael G. Anderson	Ducks Unlimited, Inc., Institute for Wetlands and Waterfowl Research
Todd W. Arnold ^b	Delta Waterfowl and Wetlands Research Station
Jane E. Austin	United States Geological Survey, Northern Prairie Wildlife Research Center
Robert R. Cox, Jr. ^{c, d}	United States Geological Survey, Northern Prairie Wildlife Research Center
James A. Dubovsky	United States Fish and Wildlife Service, Office of Migratory Bird Management
James H. Gammonley	Central Flyway Waterfowl Technical Committee
Diane A. Granfors	United States Geological Survey, Northern Prairie Wildlife Research Center
Dale D. Humburg	Mississippi Flyway Technical Section
Douglas H. Johnson ^c	U.S. Geological Survey, Northern Prairie Wildlife Research Center
Michael A. Johnson ^c	North Dakota Game and Fish Department
Ronald E. Kirby	United States Geological Survey, Northern Prairie Wildlife Research Center
Gary L. Krapu	United States Geological Survey, Northern Prairie Wildlife Research Center
Jeffrey W. Nelson ^c	Ducks Unlimited, Inc., Great Plains Regional Office
Pamela J. Pietz	United States Geological Survey, Northern Prairie Wildlife Research Center
Ronald E. Reynolds ^c	United States Fish and Wildlife Service, Habitat and Population Evaluation Team Office
James K. Ringelman	Ducks Unlimited, Inc., Great Plains Regional Office
Terry L. Shaffer	United States Geological Survey, Northern Prairie Wildlife Research Center
David E. Sharp	United States Fish and Wildlife Service, Central Flyway Representative
Marsha A. Sovada	United States Geological Survey, Northern Prairie Wildlife Research Center

^a In addition, comments were solicited from Northern Prairie Emeritus staff and other retired or active professionals including: P. M. Arnold, H. Boyd, H. H. Burgess, G. L. Buterbaugh, J. L. Cooper, L. M. Cowardin, H. A. Doty, R. J. Greenwood, J. C. Gritman, K. W. Harmon, A. S. Hawkins, D. L. Henegar (deceased), F. E. Hester, R. D. Jacobson, L. R. Jahn, H. A. Kantrud, F. B. Lee, J. T. Lokemoen, J. S. Marler, R. L. Meeks, H. K. Nelson, P. A. Opler, G. L. Pearson, A. Reed, H. M. Reeves, W. C. Reffalt, A. B. Sargeant, R. D. Sparrowe, J. Spinks, P. F. Springer, G. A. Swanson, and P. A. Vohs, Jr.

^b Current affiliation: Ducks Unlimited, Inc., Institute for Wetlands and Waterfowl Research

^c Waterfowl Working Group Committee member

^d Chairperson

group members with stature, and the “bandwagon effect” attached to seemingly popular opinion.

In the first iteration, the chairperson solicited via questionnaire each member's opinion on: 1) the mission statement for the WWG; 2) identification of 3 waterfowl research needs, listed in order of priority, with sufficient description to identify corollaries and dissimilarities in ideas among members; and 3) appropriate frequency for the WWG to reconsider research priorities. Because Northern Prairie has been a focal point for waterfowl research since 1965, the major constraint was that identified topics had to be appropriate for Northern Prairie to address directly, coordinate a response with others, or support work by another party in the northern Great Plains. Because our objectives were straightforward, we modified the Delphi technique after the first iteration by convening a subgroup, the Waterfowl Working Group Committee (WWGC), to assimilate, organize, and prioritize research needs identified by the WWG in the questionnaire. Results of the WWGC's deliberations then were sent back to the WWG for review and final comment. As a final iteration, we requested comment from Northern Prairie Emeritus staff and others including individuals retired or active in research and management positions in the United States Fish and Wildlife Service, the Canadian Wildlife Service, and state Departments of Natural Resources (Table 1).

Results

Mission statement

The WWG adopted the following: The mission of the Waterfowl Working Group is to identify and pri-

oritize research needs in the field of waterfowl ecology and management for developing budget initiatives and to help guide and evaluate waterfowl research programs at Northern Prairie Wildlife Research Center, potentially in partnerships with others with similar interests.

Research priorities

The WWGC compiled a nonranked list of topics of high priority for research by Northern Prairie; topics that failed to make this list were designated as low priority. High-priority topics were broad, inclusive, and considered to be best prognoses of the next generation of questions to be addressed by Northern Prairie. A brief synopsis of those needs that the WWGC agreed should be high priorities for Northern Prairie follows:

Determine the effects of landscape factors on demographics and recruitment of ducks in the Prairie Pothole Region. The Prairie Pothole Region (PPR) of the United States and Canada has been modified greatly by drainage of wetlands and conversion of native grasslands to agriculture. Although government-sponsored programs designed to set aside croplands, such as the Soil Bank Program and, more recently, the Conservation Reserve Program, have increased the amount of grassland in the United States, modern landscapes are commonly fragmented with respect to grassland habitats (e.g., Greenwood et al. 1995 and references therein). Nest success rates in many portions of the PPR are below levels thought necessary to sustain populations of upland-nesting ducks (Cowardin et al. 1985, Klett et al. 1988). High rates of mammalian and avian predation on duck nests are the proximate cause of low nest success (Greenwood et al. 1995). Recent advances in geographic information systems technology have provided new tools to relate settling patterns and recruitment of ducks to landscape factors (including wetlands of various sizes and classes and upland land use) at various spatial scales. Studies with sound experimental designs that seek to quantitatively assess how landscape characteristics influence breeding pair density, spring-summer survival of nesting females, and recruitment rates of ducks should be emphasized. An example of studies fitting this category would be those that seek to determine how upland habitat and wetlands interact to influence important components of recruitment (e.g., nest success, pre fledging survival), with emphasis on causal mechanisms, including predator



Understanding how landscape factors—such as upland land use and numbers, areas, and types of wetlands in an area—interact to influence demographics and recruitment of ducks was identified as a research priority.

community responses, temporal variation (particularly wet-dry cycles), cost-benefits of habitat manipulation, and assessment of landscape effects at various spatial scales.

Develop, improve, or update estimates of important parameters used in existing models for management and planning. Numerous models (e.g., Mallard Productivity Model [Johnson et al. 1987] and pair-wetland regression models [Cowardin et al. 1995, Reynolds et al. 1996]) are vital to planning and implementing waterfowl management activities in the United States portion of the PPR. However, parameter estimates for some components of the reproductive cycle of ducks were developed during the 1980s, when conditions generally were dry. Additionally, recent United States Department of Agriculture programs (Conservation Reserve Programs of 1985, 1990, and 1996) have resulted in significant alterations of the PPR landscape (i.e., conversion of millions of hectares of cropland to perennial grass cover). Consequently, reevaluation of important reproductive components may improve our ability to accurately estimate recruitment, develop management plans, and evaluate management treatments. Studies that seek to improve or update parameters for important components of the reproductive cycle (e.g., preference for various cover types by nesting dabbling ducks and corresponding nest success rates in specific cover types) should be a research priority. Further, studies that seek to concurrently estimate reproductive parameters for duck species other than mallards (*Anas platyrhynchos*) should be given preference over studies restricted to mallards.

Evaluate waterfowl management activities at broad, regional scales. Millions of dollars are spent annually to manage waterfowl, often under management plans written for broad regions—e.g., Prairie Pothole Joint Venture, Prairie Habitat Joint Venture, and North American Waterfowl Management Plan (Williams et al. 1999). However, most management actions are site-specific and are applied at small spatial scales. For greater efficacy, multiple or large-area application of treatments should be considered. Evaluation of large-area management activities comparable to those needed for planning, and possibly for implementation, is difficult and consequently has received little attention (Williams et al. 1999). Evaluation is needed to ensure that management dollars are spent effectively and efficiently. Studies that seek to develop



Studies directed at waterfowl species of concern, such as northern pintails (shown here) and lesser scaup, should be a research priority in the northern Great Plains.

innovative, efficient, and reliable measures or indices of vital recruitment components, including nest or hen success, hen survival, and brood survival, over relatively broad scales (i.e., townships or larger) fit well within Northern Prairie's historical area of expertise and scope and should be a research priority. Such measures would be invaluable in providing input into adaptive resource management of breeding waterfowl (Walters 1986).

Direct studies at waterfowl species of concern. Despite positive population responses by most duck species to improved wetland habitat conditions on major breeding areas beginning in 1993, some species, most notably northern pintails (*Anas acuta*) and lesser scaup (*Aythya affinis*), have shown little if any increase (Wilkins and Cooch 1999). Studies designed to identify factors limiting population growth of these species have strong management implications and should be a research priority. As a starting point, studies of breeding pintails should focus initially on nest-site selection, nest success, and other important components of reproduction, particularly in agricultural landscapes (Miller and Duncan 1999), and studies of lesser scaup should focus on addressing research priorities identified at the recent scaup workshop held at Northern Prairie (Austin et al. 2000).

Evaluate applicability of the bird-conservation-area concept to waterfowl. The bird-conservation-area concept postulates that core areas of excellent habitat in landscapes with little hostile habitat will maintain viable populations of breeding birds. Information is needed on the degree that this

concept applies to ducks in the PPR, including fates of ducks as they expand into less suitable habitat. Information also is needed on where excellent habitat should be developed relative to moderate or poor habitat to optimize duck recruitment. The goal of this research should be to identify population source and sink habitats and how they might be juxtaposed or otherwise manipulated to benefit waterfowl. Studies should strive to measure temporal variation in the degree to which particular habitats function as sources or sinks. Studies of this nature also should seek to investigate potential variations of the bird-conservation-area concept applicable to waterfowl and compare novel approaches to breeding waterfowl management with traditional approaches.

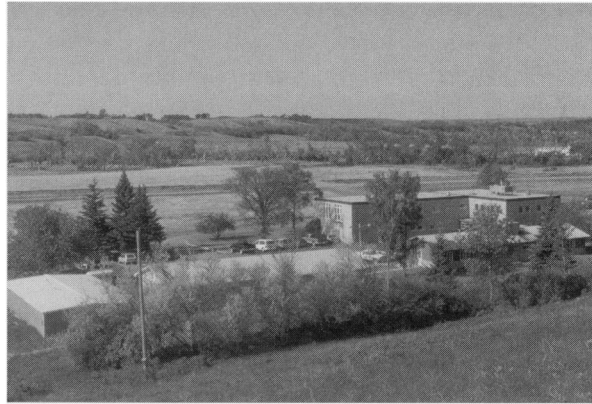
Low-priority topics

Although the committee agreed that several potential research priorities identified by the group had considerable merit from scientific or management perspectives, these topics were considered low priority because the committee believed they either were 1) cost-prohibitive, given Northern Prairie's and its collaborators' current and likely future operating budgets, or 2) were outside Northern Prairie's area of expertise and thus potentially would be addressed more appropriately by other research centers or agencies. These included:

- 1) cross-seasonal effects of winter-spring habitat conditions on waterfowl recruitment;
- 2) development of a land-use information base to encourage conversion of agriculture to perennial cover;
- 3) effects of hunting on waterfowl populations;
- 4) identification of subpopulations of mallards and northern pintails;
- 5) studies of waterfowl spring migration ecology and habitats;
- 6) studies of waterfowl disease;
- 7) development of low-maintenance, very efficient predator control techniques for use in intensive waterfowl management activities (e.g., nesting islands, electric fence enclosures, etc.).

Meeting frequency

The most popular response among group members, and the committee's consensus, was to revisit research needs at 2-year intervals. This schedule is nonsynchronous with the federal budget cycle, yet permits necessary fine-tuning without redundancy.



The Northern Prairie Wildlife Research Center was established in Jamestown, North Dakota, in 1965 to conduct research on management of migratory birds, primarily waterfowl.

Discussion

Because research needs were identified under the constraint that they relate to Northern Prairie's historical area of expertise and assigned area of geographic responsibility, they necessarily are more limited in scope (focusing primarily on waterfowl reproductive ecology in the northern Great Plains) than might be a list of needs identified on a continental scale. However, the resurgence of prairie-nesting ducks to record-high populations concurrent with the return of plentiful water conditions to portions of the PPR beginning in 1993 provides strong evidence that populations of most species are limited by breeding-ground conditions (e.g., Ankney 1996). Thus, although research priorities identified herein may be limited in scope, they are directed toward the most important period in the annual cycle of ducks from a population regulation perspective.

Several research priorities identified by the WWG involved improving our understanding of waterfowl responses to factors measured at a landscape scale. Such research was recommended earlier by Boyd (1974) and Wishart et al. (1984). Recent advances in geographic information systems technology have made this type of research more feasible and several such studies currently are underway in North America. Another commonality among research priorities identified herein was long-term studies. Much waterfowl research has been conducted on short time scales (i.e., 2 or 3 field seasons), often by graduate students. As our biological knowledge grows, questions that can be addressed only by long-term investigation become increasingly

important. United States Geological Survey biological research centers are suited for long-term research because of consistent base funding and permanent staff, and Northern Prairie has been coordinating successive graduate student programs to address sequential questions to complement those addressed by staff. Importantly, the model for maintaining an effective research program in the northern Great Plains has proven to be that of government and nongovernment partnerships to accomplish long-term, logistically difficult, multidisciplinary studies. Fostering such partnerships currently is a primary goal of Northern Prairie's research program.

Research priorities presented herein contain input from a broad spectrum of agencies involved in waterfowl research and management (federal, state, and nongovernment) and represent the collective opinion of a large panel of experts. These priorities will serve as a formal guideline to developing budget initiatives and study proposals at Northern Prairie. Additionally, Northern Prairie has begun to advocate the priorities put forth by the WWG in discussions with Department of the Interior bureaus, states, Flyway Councils, and nongovernment organizations. It is our intent to use this document as a catalyst for immediate and direct action to address the identified issues. Finally, we believe that re-examination of research priorities on a regular basis is critical to maintaining a quality waterfowl research program; we must be willing to objectively challenge assumptions, postulates, and paradigms on which waterfowl management is based and to constantly adapt future research directives in light of recent findings and technological advancements.

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interests focus on designing and implementing conservation programs in the Great Plains for waterfowl and other migratory birds. He has served on several advisory boards, including the Management Board of the Prairie Pothole Joint Venture. **Ronald E. Reynolds** (back row, right) is supervisor of the Habitat and Population Evaluation Team Office, United States Fish and Wildlife Service, Bismarck, North Dakota. Ron's interests center on investigating relationships between population parameters of waterfowl and other migratory birds and landscapes. Ron provided the duck calls for this photo.

