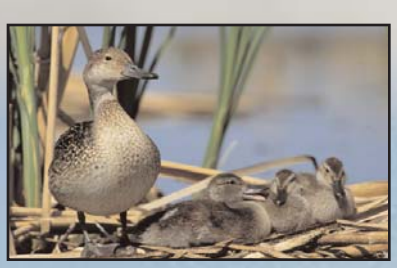

NORTH AMERICAN
WATERFOWL
MANAGEMENT PLAN

STRENGTHENING the BIOLOGICAL FOUNDATION

2004 Implementation Framework

North American Waterfowl Management Plan
Plan nord-américain de gestion de la sauvagine
Plan de Manejo de Aves Acuáticas de Norteamérica

Notes

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Canadian Wildlife Service | Service canadien de la faune

U.S. Department of the Interior,
Fish and Wildlife Service

National Overviews

Canada

In a prairie slough a mallard sets down at the end of her flight north. For Canadians she represents the return of spring, heralding a natural rebirth across the country. Prairie ducks live and reproduce in an environment that has been greatly modified by people. Nevertheless, when managed under principles of conservation, the land can provide economic benefit through agriculture while it continues to sustain waterfowl.

That is the essential thrust of Canadian environmental policy; sustaining natural values while achieving human well-being and economic progress. For example the Canadian commitment to the Kyoto Protocol on Climate Change reflects a desire to protect future environments, but to do so in a way that is integrated with sustainable economic activity. The habitat joint ventures established in Canada under the North American Waterfowl Management Plan have become leaders in such approaches. By working to instil waterfowl conservation alongside agriculture, forestry, and other undertakings, the Canadian joint ventures ensure that ducks will continue to fly south. In doing so, they support an environmental agenda in harmony with local economies, and so gain allies for nature. In the modified and managed landscape, healthy, stable populations of waterfowl and other migratory birds are more resistant to the inevitable pressures and upsets caused by human activities than are populations that are at the brink.

When the ducks are old enough to fly and hunting seasons begin along the migratory flyway, the take of birds is coordinated and managed among jurisdictions so that breeding birds survive in sufficient abundance to carry on. Coordination implies a concept of co-management, which applies to habitat stewardship as well as harvest management. In Canada, aboriginal communities are playing a growing role as stewards of the environment. In some areas, notably in northern regions where land claims have been completed, wildlife management boards have been established, including members from government and land claim beneficiaries. These management boards lead development of wildlife and habitat management programs in their areas. Sea ducks and brant are typical high-profile waterfowl species in those parts of Canada where the northern wildlife management boards operate. For some such year-round holarctic bird species, we also need to be including other nations than those included in this update, notably Greenland and Russia, in our waterfowl co-management strategies.

The partnership for waterfowl has been so successful that Canadians are now expanding these concepts for other bird species, and for biodiversity more generally, in a broad vision for habitat joint ventures under the North American Bird Conservation Initiative. With no reduction in the commitment to provide for the requirements of waterfowl that breed in Canada, the joint ventures are now working to attract more partners, widen their coverage, and attract new resources so that they can ensure that the habitat requirements of all bird species are met, in all their habitats. The boreal forest, which covers a vast portion of Canada, will be an important region for this expansion.

While the North American Bird Conservation Initiative takes root, Canadians expect the North American Waterfowl Management Plan to maintain its strength, conserve waterfowl, and continue to lead the way for wildlife conservation. With this update, Canadian, U.S. and Mexican partners are poised to carry out a comprehensive, science-based assessment to help reshape investments and activities so that future habitat conservation efforts through the joint ventures will provide even greater returns for waterfowl and ultimately for all nature.

United States

The seasonal ebb and flow of waterfowl is one of the most complex and compelling dramas in the natural world. Driven by a genetic memory millions of years in the making, these birds embark twice each year on long-distance journeys between their breeding areas and wintering grounds. Their travels traverse mountains, deserts, prairies, forests, and oceans throughout the northern hemisphere linking the countries, peoples, and ecosystems they visit. The conservation and management of animals capable of such impressive mobility requires strong federal leadership to foster effective partnerships among the many nations, states, provinces, tribes and organizations that are woven together by the flight paths of these remarkable species.

The U.S. Fish and Wildlife Service (Service) is the principal agency charged with protecting and enhancing the populations and habitats of migratory birds that spend all or part of their lives in the United States. Accordingly, the North American Waterfowl Management Plan (Plan) will continue to be a major focus for Service efforts. Cooperation and coordination with partners and stakeholders are essential to successfully protect and conserve waterfowl and to ensure their continued enjoyment by hunters, birders, aboriginal groups and the general public. State wildlife agencies, tribal organizations, and subsistence users play special roles by working with the Service to assume co-management responsibilities for waterfowl harvest and management. These and other partners, including other government agencies, conservation organizations, private industry, landowners and managers at every scale, must be included in Plan activities to achieve its goals.

For more than a century, conservationists have endeavored to sustain abundant waterfowl populations. These efforts have resulted, for example, in the creation of more than 540 national wildlife refuges and wetland management districts as havens for waterfowl and other birds. Canadian and U.S. partners developed and continue to carry out the longest operating and most comprehensive survey of animal abundance, the Waterfowl Breeding Population and Habitat Survey. The North American Wetlands Conservation Act, now the premier partnership-based habitat conservation effort on the continent, was enacted to support goals of the 1986 Plan. Through these accomplishments, the Service and its partners established a legacy of conservation leadership in the 20th century. However, despite these and other successes, we now face a host of challenges to the future of waterfowl. Compared to a century ago, society today faces a more complex set of environmental problems that occur across the entire ranges of waterfowl. Reductions in habitat quantity and quality are the primary threats to many species.

To surmount the escalating challenges of the 21st century and meet public expectations for waterfowl conservation and management, a clear, well-defined blueprint is needed to guide our collective actions. The Plan is a strategy to engage new and existing partners in a comprehensive approach to waterfowl conservation that coordinates and integrates efforts across North America. We must work with other countries, public and private organizations, and individuals to attain the Plan's vision and secure a bright future for waterfowl. The American people expect and deserve nothing less.

Mexico

The coastal and interior wetlands of Mexico are important habitats during the winter season for a significant proportion of the migratory waterfowl population in North America, as well as for numerous resident and endemic wildlife and plant species.

For our nation, wetlands and waterfowl are a resource of enormous ecological, cultural, and economical importance. Consequently, during the second part of the 20th century Mexico signed several international commitments and cooperation agreements to improve and foster the conservation and management of these birds and their habitats. One of the most relevant and effective programs has been the North American Waterfowl Management Plan. On the basis of these and other legal and policy instruments, the Mexican Government has been supporting and implementing short, medium, and long-term programs and projects throughout the country.

Since the inception of the Plan in 1986, Mexico has been active in its design and implementation. Mexico was initially an "invitee", but in 1994 signed on as a full partner. Ever since, Mexico has played a dynamic role in the conservation of the wintering grounds of waterfowl populations and resident species, identifying priority habitats, as well as promoting the implementation of sustainable management practices and modern hunting regulations.

In 2000, Mexican Congress passed a law for the conservation and sustainable use of wildlife. This law and its associated policies promote both the habitat and species approach for conservation, giving particular attention to sustainable use and habitat and population management, and to the development of specific recovery programs for priority species or groups of species, particularly waterfowl.

In the past few years the General Directorate of Wildlife of SEMARNAT (DGVS) has established numerous fora, committees, and consultation bodies to improve and promote communications and public participation for the development of specific conservation, management, and recovery programs, and to facilitate technical advice in the decision-making process.

To further develop the national capacity for wetland and waterfowl conservation, the General Directorate of Wildlife in coordination with other federal agencies, nongovernmental agencies, and academic groups is currently working at the local, national, and international levels. These efforts are working toward the integration and long-term planning and implementation of bird and habitat-related conservation initiatives, agreements, and conventions, such as the North American Bird Conservation Initiative, the Ramsar Convention on Wetlands, the Trilateral Committee for the Conservation and Sustainable Use of Wildlife, and the North American Commission for Environmental Cooperation's Biodiversity Conservation Strategy. These efforts will help guarantee wise and efficient use of the limited resources needed to conserve North American avifauna.

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Foreword

The 1986 North American Waterfowl Management Plan (Plan) transformed cooperative wildlife conservation. The Plan pioneered the shift in waterfowl management from an era dominated by harvest management and site-specific habitat protection into one where waterfowl managers are important participants in making decisions about how to effectively use the working landscapes of North America.

The 1986 Plan was the collective product of a talented team of conservation administrators and biologists who recognized the need to reinvent waterfowl conservation. They began their quest to restore and sustain North America's waterfowl with a commitment to construct a biological foundation capable of supporting a continental program, and they took nothing else in the conservation status quo for granted. They looked beyond what could be done, to focus on what should be done. International borders were no more a constraint than were current organizational and financial capabilities or national legislation.

The genius of the Plan is in its straightforward framework for action and its shared implementation. The founders established a continental vision and a set of principles grounded in strong waterfowl and habitat science. They recognized that waterfowl habitat conservation had to extend beyond refuges and sanctuaries to include vast areas of privately owned and managed lands. Consequently, the Plan called for the establishment of habitat joint ventures where multisector partners could plan and implement locally relevant habitat conservation programs that met this challenge.

It was issues concerning waterfowl that drew Canada, the United States, and later, Mexico, into a continental conservation effort through the Plan and fostered conservation partnerships encompassing diverse sociological, economic, and environmental interests. Following the Plan model, managers of other bird groups, such as shorebirds, landbirds, and waterbirds, have developed their own geographically based plans with population goals that can be translated into conservation actions on the ground. The Plan community, which is defined as all the agencies, organizations, groups, and individuals involved in Plan activities, must now reaffirm its basic commitment to the science and conservation of waterfowl and their habitats while participating in broader stewardship efforts for other birds and the global environment.

Plan habitat and waterfowl accomplishments have exceeded many expectations from 1986, though much vital work remains. In the face of globalization and complex environmental issues, the information, challenges, and opportunities for conservation continue to evolve. Thus, it is essential that the Plan builds on its successes, recognizes change, and redefines, recommits, and guides waterfowl conservation into the 21st century.

— Rollin Sparrowe, Wildlife Management Institute, and
James Patterson, Canadian Wildlife Service (deceased)

Preface

The North American Waterfowl Management Plan (Plan) was originally written in 1986 and envisioned a 15-year effort to achieve landscape conditions that could sustain waterfowl populations. The Plan Committee (representatives from Canada, the United States, and Mexico) has made two previous modifications to the 1986 Plan to account for biological, sociological, and economic changes that influence the status of waterfowl and the conduct of cooperative habitat conservation. Eighteen years on, as we celebrate the accomplishments of Plan partners it is also clear that we must renew our commitment to the Plan.

Our intent in preparing the 2004 Plan is to define the needs, priorities, and strategies for the next 15 years, increase stakeholder confidence in the direction of Plan actions, and guide partners in strengthening the biological foundation of North American waterfowl conservation.

To most effectively convey goals, priorities, and strategies, the 2004 Plan is presented in two separate documents. This document, *Implementation Framework*, provides detailed discussion of the Plan's themes and includes much supporting technical information for use by biologists and land managers. The companion document, *Strategic Guidance*, is comparable in length and scope to the 1986 Plan and the updates of 1994 and 1998. It is directed to all Plan partners, agency administrators, and policy makers who set the direction and priorities for conservation in our three countries. We hope that the thousands of partners involved in the conservation of our natural resources will find these documents useful for continuing their vital work.

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George Arsenault
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Steve Wendt

United States
Co-Chair: David E. Smith
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Composition of the 2004 North American Waterfowl Management Plan began in June 2001. Since then, many individuals and organizations in Canada, the United States, and Mexico have contributed their ideas, time, and support to this effort. The Plan Committee gratefully acknowledges all who have participated in the process, especially those individuals listed below.

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I. Strengthening Foundations, Building Partnerships

The 1986 North American Waterfowl Management Plan (Plan) initiated a new era in conservation. Building upon decades of experience, the Plan authors captured a growing consensus that a broad-scale, cooperative conservation effort was necessary. The originators of the Plan could not have foreseen the broad effects that it and subsequent Plan Updates would have. Plan joint ventures (see p. 8) have become the standard template for planning and delivering regional conservation programs. Many of the goals in the original 1986 Plan have been achieved and transcended for numbers of some waterfowl species, acres of habitat conserved, dollars raised, and dollars expended. Yet, at the end of the initial 15-year planning horizon, the job is far from done.

Today, various pressures continue to threaten the quantity and quality of waterfowl habitats and the conservation gains made under the Plan. Wildlife interests compete with powerful economic forces such as agriculture, energy development, and urban expansion. New threats continue to emerge: invasive species, competing demands for water, environmental contaminants, global climate change, and others. To meet these challenges, conservation efforts must continue to be aggressive across the entire range of waterfowl habitats in North America.

Beyond sustaining past accomplishments, we must move forward. We still lack basic knowledge of population dynamics for some waterfowl species. We need to better understand the linkages between habitat characteristics and waterfowl population responses. We need to address the persistent deficits in breeding habitat in the midcontinent prairie region. We need to act on the recognition that the boreal forest has emerged as a high priority area. We need to identify the conservation needs and geographic focus for sea ducks, scaup, northern pintails, and other species requiring special attention. We need to explore new alliances with nontraditional conservation partners, such as agricultural producer groups, consumer groups, the forest industry, and water development interests. Finally, we need to ensure greater coordination between species and habitat joint ventures, among related habitat joint ventures, and between national and regional institutions.

The 2004 Plan is the first comprehensive Plan document since 1986. It calls for a strong recommitment to the foundations of waterfowl conservation, even as it provides a fresh synthesis of the core elements of the 1986 Plan and previous updates (1994 and 1998).

The Plan retains its commitment to a landscape approach, grounded in the broad collaborative partnerships defined in the 1998 update, *Expanding the Vision*. With the advent of the North American Bird Conservation Initiative and common adoption of a landscape approach to conservation planning and delivery, the Plan community now needs to turn increased attention to the scientific work needed to support waterfowl conservation. Hence the subtitle of the 2004 Plan: *Strengthening the Biological Foundation*.

The Plan's past successes are attributable, in part, to a strong historical biological foundation. This foundation has enabled partners to focus efforts objectively and make science-based decisions about where and how to conserve waterfowl habitats. Monitoring and assessing the impacts of Plan actions have demonstrably improved effectiveness. As joint venture partnerships diversify, as the Plan's geographic reach expands to places where we know less about the birds, and as regional conservation programs are developed for multiple suites of wildlife species, a stronger and broader scientific base will be even more important. Recognizing these challenges, the Plan Committee formed the North American Waterfowl Management Plan Science Support Team (NSST) in 2000. The mission of the NSST is to help strengthen the biological foundation of the Plan and facilitate continuous improvement of Plan conservation programs. The NSST works with joint ventures and other Plan partners to identify methods for biological planning and to link regional scale evaluations to assess overall Plan performance at the continental scale. The NSST was also responsible for preparing the technical information and recommendations contained in this update.

The Plan's success to date and the evolution of joint ventures into significant conservation forces present their own ongoing challenge. Our Plan community[1] must continue to review the appropriate working relationships among the various national-level institutions, joint ventures, the NSST, and the Plan Committee. The Plan Committee is committed to providing leadership within the North American waterfowl community and to working with Plan partners to assure the quality of Plan activities. The Plan Committee will play a more proactive role in the years between updates, seeking the latest scientific information, promoting adaptive management, assessing results of Plan activities, and facilitating communication throughout the entire waterfowl conservation community and beyond.

1 The Plan community is defined as all the agencies, organizations, groups, and individuals involved in Plan activities.

II. Background

Historical Perspective

As the North American Waterfowl Management Plan enters a new phase with this Update, it is important to recognize that the original 1986 Plan was the fruition of a series of events in the evolution of migratory bird management in North America. Organized efforts to conserve waterfowl and other migratory birds began in the late 19th century in response to the growing commercialization of wildlife, especially through market hunting for food and feathers. Early conservationists soon realized that even federal laws were insufficient to fully protect birds that routinely crossed international borders. The migratory bird treaties and conventions between Canada and the United States in 1916, and in 1946 with Mexico, provided the foundation for the development of cooperative migratory bird management.

These early treaties and subsequent legislation focused on specific regulatory measures to prevent overexploitation. It was not until the drought of the 1930s that more direct management actions were taken. During that time, wetland and grassland habitats were decimated, and duck populations underwent precipitous declines. Recognizing the plight of ducks and wetlands and the lack of specific information to drive management efforts, the U.S. Bureau of Biological Survey sent field crews to Canada in 1934 to 1936 to learn more about waterfowl population levels and nesting conditions in the prairie and parkland regions. At the same time, Canadian biologists were studying the natural history and distributions of birds in Canada. These early investigations highlighted the need to establish systematic population surveys, obtain habitat and productivity data, and conduct annual banding operations. The first aerial winter survey in Mexico was conducted along the Gulf of Mexico Coast in 1938. Private conservation organizations, notably the precursors to today's Ducks Unlimited and Delta Waterfowl Foundation, were formed by concerned sportsmen to support waterfowl conservation measures.

The first cooperative waterfowl breeding survey in the Canadian and U.S. prairies was launched in 1947. The first flyway councils were formed in 1948, followed by the flyway technical sections. Both aggressively promoted waterfowl management and research. By the late 1950s, Flyway Management Plans were developed in all four flyways with specific objectives and strategies outlined to achieve desired population levels and to protect critical habitats. In the 1960s, flyway plans were followed by the preparation of species management plans for some ducks and Canada geese.

Cooperative Flyway Management Plans containing specific population objectives were initially developed in the 1970s. Regional Habitat Concept Plans were also developed in the late 1970s, and they identified continentally important waterfowl habitats that were threatened. In the United States, a National Waterfowl Management Plan developed in 1982 was intended to provide the basis for cooperative management of waterfowl and to provide guidance for the development of more detailed flyway plans. Meanwhile, Canadian waterfowl managers were becoming convinced that traditional conservation measures could never adequately meet the challenges within that country and that a new approach was needed. A 7-year internal planning process involving the Canadian Wildlife Service and provincial governments was initiated. Efforts in Mexico were to begin later. Though the national plans in Canada and the United States provided guidelines for expanding waterfowl programs and were good coordination vehicles, they were never fully implemented. It soon became obvious that a broader continental initiative was needed.

The idea of developing an international waterfowl management plan was explored further by U.S. and Canadian officials, and it was determined that this document would not be an international treaty but would instead be considered "an International Agreement in Principle for joint resource management purposes." Thus, it would not require Senate approval in the United States or Parliamentary approval in Canada. Mexico was invited to join but delayed participation until a better understanding of the Mexican role and commitment required could be determined.

The North American Wetlands Conservation Act

The 1986 Plan recognized that a higher level of funding support was necessary to implement the Plan's habitat objectives. It also concluded that acceptable procedures had to be developed for the United States to provide financial support for the Plan joint ventures in Canada. These needs resulted in passage of the North American Wetlands Conservation Act (NAWCA) in 1989, with strong support from Plan partners. The NAWCA provides matching grants to private or public organizations and to individuals to carry out wetlands and associated uplands conservation projects in the United States, Canada, and Mexico. This was a significant accomplishment in that it provided secure, long-term funding for habitat conservation projects and affirmed a partnership approach to achieving the Plan's goals in all three countries. Since 1989, NAWCA has supported more than 1,100 projects with $520 million in grants. Matching funds from partners has exceeded $1.5 billion.

It was recognized that a set of principles on the future needs of waterfowl management should be prepared to guide this long-range planning process and agreed that the proposed plan should be based on a 15-year horizon with updates at 5-year intervals. The initial intent of the Plan was to focus on the seasonal habitat requirements of the 32 principal species of ducks, geese, and swans that were shared by Canada and the United States, with priority given to breeding habitat. Habitat goals and objectives were established based on the original habitat concept plans and other similar documents. Likewise, the Plan set population goals and objectives for the principal species of ducks, geese, and swans, largely based on what was known about the relatively high population levels of the mid-1950s and the late 1970s. A realistic goal for most duck populations was determined to be the average breeding populations recorded during the decade of the 1970s. It was acknowledged that, for some species, data were insufficient to establish population goals and conservation strategies. Joint ventures and partnerships were proposed as the means to achieve cooperative efforts to meet the ambitious objectives.

In addition, it was recommended that the planning process provide data on population status and habitat conditions but not become engaged in the annual hunting regulation setting process in each country. With these guidelines, a drafting committee was established in 1985. Following review throughout the waterfowl community, the final draft was completed in 1986 and signed on May 14 by the U.S. Secretary of the Interior and the Canadian Minister of the Environment.

The Waterfowl of North America

North America's wetlands support a rich abundance and diversity of waterfowl. From subtropical whistling ducks to the hardy spectacled eiders of the Bering Sea, ducks, geese, and swans occupy every type of wetland habitat on the continent. From coastal marsh and southern hardwood swamps; to mountain meadows, rivers and prairie potholes; to rocky intertidal shores, beaver ponds, and arctic tundra—waterfowl flourish wherever healthy wetland ecosystems are found.

North America hosts seven of the nine tribes of the family *Anatidae*; two species of whistling ducks; numerous species and subspecies of the true geese; three species of swans; 13 species of dabbling ducks (which include most of the abundant and heavily hunted species) and two species of perching ducks; five species of pochards, or diving ducks; two species of stifftail ducks; and more sea duck species (15) than any other continent (Appendix E).

Waterfowl exploit a wide variety of habitat niches. Swans are mainly aquatic herbivores, utilizing fairly shallow freshwater and estuarine habitats as well as flooded agricultural fields. Geese are mainly terrestrial grazers in arctic to midlatitude regions, although some species (e.g., snow geese) grub rhizomes extensively in wetlands and others graze aquatic plants in shallow marine systems (e.g., brant). Many species also exploit farm fields at some point during their annual cycles. Dabbling ducks exhibit the widest array of habitat preferences: from generalists like mallards to specialized filter feeders,

like northern shovelers, to grazers like American wigeon. The pochards include shallow-water plant eaters of fresh to brackish waters (such as ring-necked duck and canvasback) and invertebrate predators in open water and marine habitats (lesser and greater scaup). And finally, sea ducks occupy the most northerly climes in winter, some diving deeply for bottom-dwelling bivalves.

Waterfowl populations are strongly affected by rainfall and related environmental variation. During the late 1990s, most species of prairie-breeding ducks responded to a decade of above average rainfall and unprecedented wetland conditions by recovering to near or above Plan goal levels. But these conditions are cyclic, and with the inevitable return of dry conditions across the prairie pothole region, breeding populations in the midcontinent area will again decline. In Mexico, 9 years of drought in the Central Highlands have drastically reduced surface water resources. This drought has concentrated both waterfowl and humans around remaining wetland areas, increasing the risk of botulism, cholera, and other pathogens.

Some species, however, have persistently remained well below objective levels. Northern pintails did not respond as expected during the recent wet period on the prairies, perhaps because of the variability of wetland conditions within the prairie pothole region and changing agricultural practices. Scaup populations have been declining for more than 20 years, and it is not clear why. Other birds that share the scaup's remote northern breeding grounds, such as white-winged scoters and surf scoters, have been in similar steep decline. Many sea ducks are believed to be declining, but in some cases data are inadequate to be certain. For other sea duck species declining trends are clear, but the causes are elusive. Certain goose populations continue to pose management challenges, either because of overabundance (e.g., lesser snow geese) or under abundance (e.g., dusky Canada geese). These persistent problems provide an important context for this revision of the North American Waterfowl Management Plan and the Plan community's rededication to its vision and principles.

The 1986 Plan identified prairie pothole breeding habitat in Canada and the United States as "the top priority for protection." In the future, Plan success or failure will continue to be linked to long-term trends in waterfowl habitat conditions in the prairie pothole region. The 1986 Plan also identified other regions with critical habitat conservation needs for waterfowl. As the biological foundation for waterfowl conservation has improved, and as Plan horizons have expanded to embrace the full spectrum of North American waterfowl, additional priority areas in all three countries have been recognized as critical to the continued maintenance of ducks, geese, and swans throughout the annual cycle. While habitat conservation, or monitoring, is important in every area of the continent, these areas require special attention and resources.

Plan Visions, Purpose, and Guiding Principles

The 1998 update, Expanding the Vision, established three broad visions for the future of waterfowl conservation. Today, these visions guide the actions of the Plan's partners: the Plan Committee, Science Support Team, joint ventures, and the many agencies, organizations and individuals working to achieve Plan objectives.

- Plan partners define and attain the landscape conditions needed to sustain waterfowl populations;
- Plan partners forge broad alliances with other conservation efforts and communities to achieve Plan objectives;
- Plan partners continually improve the biological foundations of waterfowl conservation.

The purpose of the Plan is to sustain abundant waterfowl populations by conserving landscapes, through partnerships that are guided by sound science. The 2004 Plan establishes a new 15-year horizon for waterfowl conservation in North America by assessing and defining the needs, priorities, and strategies required to guide waterfowl conservation in the 21st century.

The purpose of the Plan is to sustain abundant waterfowl populations by conserving landscapes, through partnerships that are guided by sound science.

Figure 1. Areas of continental significance to North American ducks, geese, and swans.

1. Prairie Pothole Region
2. Western Boreal Forest
3. South Interlakes Marshes
4. Northern Great Plains
5. Sandhills
6. Rainwater Basin
7. Central Kansas Marshes
8. Playa Lakes
9. Central Mississippi and Illinois River
10. Lower Mississippi Alluvial Valley
11. Gulf Coastal Prairie
12. East Gulf Coast
13. Saint John's River
14. Central Valley
15. San Francisco Bay
16. Costa del Pacifico
17. Baja California
18. Tierras Altas Norte
19. Lagos y Lagunas Centro
20. Humedales del Valle de Mexico
21. Costa del Golfo
22. Pacific Coast
23. Klamath Basin
24. Malheur Basin
25. Carson Sink
26. Ruby Lake
27. Great Salt Lake and Bear River Marshes
28. Yellowstone-Intermountain Wetlands
29. Columbia Basin
30. Bitterroot Intermountain
31. BC Central Plateau
32. Mid-Atlantic Coast
33. Northeast Atlantic Coast
34. Nova Scotian Coast
35. Prince Edward Island
36. Chaleur Bay
37. Gulf of St. Lawrence
38. Coastal Newfoundland
39. Ottawa Valley
40. Lower Great Lakes
41. Saginaw Bay
42. James Bay Lowlands
43. West Coast of Hudson Bay
44. West Ungava Penninsula
45. East Ungava Penninsula
46. South Labrador Coast
47. North Labrador Coast
48. East Bay-Harry Gibbons
49. Dewey Soper
50. Central Baffin-Spicer-Prince Charles-Airforce Islands Complex
51. Bylot-NW Baffin Islands
52. Arctic Bay-NW Baffin Island
53. Queen Maud Gulf
54. Lambert Channel Polynya
55. Banks Island
56. Old Crow Flats-Anderson River Delta-Bathurst Polynya
57. North Slope-Beaufort Sea
58. Yukon Flats
59. Selawik NWR
60. Bering Sea Ice Leads
61. Yukon-Kuskokwim Delta
62. Innoko NWR
63. Copper River Delta
64. Upper Cook Inlet
65. Bristol Bay-Kvichak Bay
66. Izembek Lagoon-Alaska Penninsula
67. Aleutian Islands

The following principles, many carried forward since the inception of the Plan, provide structure to the 2004 Plan and should guide any actions undertaken in its support:

- Waterfowl are among North America's most highly valued natural resources.
- Waterfowl populations should be sustained at objective levels across their natural ranges to provide both ecological and socioeconomic benefits.
- Protection of North American waterfowl populations and their habitats requires long-term planning and close cooperation and coordination of management activities in Canada, the United States, and Mexico, and other countries important to North American waterfowl.
- Resident and endemic species are important components of each nation's waterfowl heritage and deserve significant attention and resources from within the jurisdictions where they occur.
- Managed harvests of the renewable waterfowl resource are desirable and consistent with its conservation.
- Habitat joint ventures, which are partnerships among private organizations, individuals, and government agencies, are the primary vehicle for accomplishing Plan objectives. Species joint ventures further scientific understanding that is necessary to effectively manage specific waterfowl species.
- Long-term protection, restoration, and management of waterfowl habitats requires that Plan partners collaborate with other conservation and community efforts in the development of conservation, economic, and social policies and programs that sustain the ecological health of landscapes.
- Plan implementation is founded on sound science and guided by biologically based planning, both of which are, in turn, refined with increased knowledge gained through research and evaluation.

An Evolving Conservation Strategy

Since 1986, Plan partners have devoted billions of dollars to conserving waterfowl. Many millions of acres throughout North America have been secured, protected, restored, or otherwise enhanced, and important advancements in waterfowl science have been made.

The essence of the original Plan was ambitious and innovative: waterfowl populations could only recover through habitat conservation at a continental scale. Previously, waterfowl habitat projects were targeted at individual wetlands or wetland complexes with the hope that their cumulative effects would positively influence duck populations. The 1986 Plan recognized that wide-ranging degradations to wetlands and their associated uplands required a comprehensive response. That comprehensive response focused on landscapes and utilized public policies, agricultural programs, and partnership development, as well as traditional habitat conservation programs.

The Plan identified general objectives for habitat conservation in five key priority regions, with the acknowledgement that each region would convert the objectives into local action plans. Joint ventures were formed to prepare and implement action plans. Elaborating on the original habitat protection goals, these plans included habitat protection, restoration, enhancement, and management. They were based on assumptions of waterfowl limiting factors in specific landscapes. By evaluating these assumptions and the management actions designed to address them, scientists continued to learn about interactions between waterfowl and habitat. Through increased recognition of the benefits of sustainability and a landscape approach—including the necessity to work with diverse stakeholders—Plan partners have integrated waterfowl conservation into broader conservation contexts and other social needs.

Joint Ventures, A Key Plan Element

The first joint ventures (JVs) were formed following the signing of the North American Waterfowl Management Plan in 1986 as a means for governments and private organizations to cooperate in the planning, funding, and implementation of waterfowl conservation projects. The first habitat JVs quickly developed "flagship" projects in the high priority landscapes identified in the Plan, while two species JVs were formed to address gaps in the scientific understanding needed to develop effective management strategies for black ducks and Arctic-nesting geese. Over time, additional JVs were organized by partners to address other habitat and population concerns identified in the Plan and its updates.

By 2003, JVs had exceeded original expectations in number, scope, and funding leveraged for conservation action. Today's JVs are regional-scale, self-directed partnerships involving federal, state, provincial, and local government agencies, aboriginal tribes, corporations, individuals, and a wide range of private groups and organizations. The JVs are successful models for planning and delivering cooperative, science-based, on-the-ground projects to conserve habitat for waterfowl and other fish and wildlife species. Two key facets for continuing conservation success of the JVs are a commitment to a strong biological foundation, continually improved through an adaptive approach to management, and the development of effective regional partnerships that coordinate delivery of conservation resources on mutually accepted objectives.

The JV habitat objectives in 1986 were based on the Plan's population objectives and simple assumptions of how habitat quantity, quality, and distribution affect continental waterfowl populations. Since then, JVs have accepted the responsibility for evaluating these assumptions through the response of waterfowl to habitat changes at regional scales. Much has been learned from these evaluations, improving both our biological foundation and the strategies and mechanics of JV conservation programs. This adaptive approach ensures that JVs are both biologically effective and cost-efficient. In the future, JVs must continue to improve their understanding of these regional-scale relationships by clearly stating their biological assumptions, setting quantifiable conservation objectives, and establishing vigorous monitoring and evaluation programs.

The impetus for JV partnerships was the recognition that no single agency or organization could afford the Plan's anticipated costs. Indeed, the proven ability of JVs to leverage funding from multiple sources is their prominent asset; however, the greatest strengths and achievements of JVs stem from their partnership structures and nonregulatory, cooperative approach to natural resource management. The JVs embrace the diverse values of their members, focus attention on communally defined goals, and provide a forum for the constructive resolution of potential natural resource management conflicts.

The original Plan introduced the concept of mobilizing cooperative partnerships under a set of continental objectives. This vision has been realized, as evidenced by the stable, diverse, highly productive, and growing number of joint ventures. Each joint venture is a unique collection of partners, reflecting local and regional interests. While most joint ventures focus on habitat concerns, Plan partners recognize that a significant lack of biological information limits management of some species. To address these gaps, species joint ventures are formed where a coalition of partners emerge with the resources, capabilities, and expertise to carry out necessary research and monitoring.

The 1986 Plan established a clear demarcation between its advisory role in waterfowl conservation on the one hand, and the role of existing regulatory authorities and the functions of the flyway councils on the other. All, however, rely on sound science and an adaptive approach to management. Waterfowl surveys, banding studies, species working groups, and other efforts sponsored by flyway councils have greatly contributed to the knowledge of waterfowl biology and population dynamics. The NAWMP Science Support Team (NSST) was formed in 2000 to create a partnership with the joint ventures and the flyway councils for improving the Plan's biological foundation. Further development and strengthening of this partnership will be essential for the Plan's future success.

Stimulated in part by the 1994 and 1998 updates, regional partnerships are striving towards "integrated bird conservation," that is, strategic conservation that considers the habitat requirements of all bird species based on spatially explicit, biologically driven, regional-scale conservation plans. The planning process uses biological models that relate priority species to their habitats and that identify the management actions necessary to support stated population objectives. A model-based, spatially explicit process is an effective and efficient approach to integrated avian conservation at regional or focus-area scales because it:

- Accommodates heterogeneity in habitat potential across regions and landscapes;
- Integrates the best biological information to assess the potential of each acre of the landscape;
- Identifies priority landscapes where single species or groups of species will benefit most from management actions;

- Explicitly targets areas where management can significantly impact multiple species or groups, and provides a basis for selecting among conflicting management options in these areas; and
- Provides for the strategic refinement of the biological foundation through monitoring, assessment, and directed research.

Plan successes have hinged on the ability of diverse interests to create and sustain relationships flexible enough to invent improved approaches to conserving waterfowl. These partnerships are the Plan's living legacy and may be the Plan's most important contribution to natural resource conservation. Plan partners have expanded beyond waterfowl and other wildlife interests to include soil and water conservationists, land and water resource development interests, and, most importantly, local communities and private landowners.

Cumulative Joint Venture Habitat Accomplishments — 1986-2002

Joint Venture	Acres	Dollars ($US)
Atlantic Coast	1,261,908	360,036,000
Central Valley	575,192	248,831,000
Eastern Habitat	787,829	266,692,200
Gulf Coast	1,086,891	205,328,000
Intermountain West	163,991	14,819,000
Lower Mississippi Valley	1,018,749	204,945,000
Pacific Coast (U.S.)	218,908	433,909,000
Pacific Coast (Canada)	124,220	45,642,196
Playa Lakes	105,942	50,425,399
Prairie Habitat	3,468,992	687,711,938
Prairie Pothole	3,772,025	455,130,842
Rainwater Basin	18,307	12,776,984
San Francisco Bay	36,573	148,828,393
Upper Mississippi /Great Lakes	492,227	123,382,783
TOTAL:	**13,131,754**	**3,258,458,735**

Institutional Relationships

The Plan is a cooperative, international endeavor involving governments at all levels, nongovernment organizations, corporations, and individuals. The Plan leads by providing a compelling blueprint for action and by empowering partners to work within that scientific and organizational framework. The Plan's continentally oriented but locally controlled model is designed to ensure that collective waterfowl conservation impacts exceed the sum of the accomplishments of its individual partners. Individual partners, in turn, contribute effectively by uniting in support of the Plan's scientific basis and an understanding of each player's roles and responsibilities. The Plan has thrived under the local entrepreneurship that this model has unleashed, evolving into a highly effective alliance of diverse agencies, authorities, organizations, and interests. Its "business model" has been adopted by other continental bird initiatives, such as Partners in Flight and the U.S. Shorebird Conservation Plan. The Plan may be thought of as a nested system, which facilitates both internal and external networks.

Externally, the Plan operates within each country's laws and regulations, consistent with international treaties and agreements. Government wildlife officials have the authority and responsibility to ensure Plan actions are in compliance with applicable laws, regulations, and policies. The Plan also seeks opportunities to work through other large-scale conservation initiatives such as the Convention on Wetlands of International Importance (Ramsar), the Western Hemisphere Shorebird Reserve Network, and the U.S. Farm Security and Rural Investment Act of 2002 ("Farm Bill") conservation programs. The Plan Committee maintains close ties with the four flyway councils, the North American Wetlands Conservation Council, the International Association of Fish and Wildlife Agencies, and the North American Bird Conservation Initiative, through close communication and concurrent memberships. Individual joint ventures enlist other groups and land management players as partners where appropriate to local conservation strategies and opportunities.

The Plan's continentally oriented but locally controlled model is designed to ensure that collective waterfowl conservation impacts exceed the sum of the accomplishments of its individual partners.

A More Proactive Plan Committee

Historically, the Plan Committee has shaped the course of North American waterfowl management efforts through the objectives and recommendations included in Plan updates and through its role in endorsing joint ventures. Conservation has flourished under this level of engagement. However, the growth of the joint ventures, the increased availability and diversification of funding sources, the need for improved biological planning and assessment, and dynamic socioeconomic trends, all point to the need for a Plan Committee that provides active leadership 365 days a year—not just during the 5-year Plan updates. There is also a growing consensus that the Plan Committee needs to move beyond articulating vision to playing a much more active role in promoting improved management on the ground.

With this document the Plan Committee increases its leadership activities by providing regional geographic species priorities to help guide future conservation investments (detailed in Appendix B) and commits to undertaking the following, on a continual basis:

- Providing a forum for important waterfowl issues
- Influencing appropriate government agencies to support Plan needs, as articulated by joint ventures and the NSST
- Integrating science into targeted waterfowl-related policy debates
- Improving linkages with joint ventures, the NSST, flyway councils, and the North American Wetlands Conservation Council.

The Plan Committee will also be more directly involved in supporting enhancement of the effectiveness of Plan partners through:

- Conducting a comprehensive assessment of progress toward Plan goals and objectives in 2004-2005
- Preparing periodic reports on the status of Plan implementation for the three federal wildlife agencies using input from the joint ventures and the NSST.
- Providing specific recommendations to government agencies, flyway councils, wetland councils, and other bodies to further Plan implementation.

Finally, the Committee will:

- Annually solicit input from joint ventures and other Plan partners on the status of Plan implementation and issues to be addressed by the Plan Committee.
- Consult with partners to periodically review the Plan Committee's own effectiveness and consider structural, relational, and management approaches to enhance Committee impact.

Federal, state, provincial, and territorial wildlife agencies, regional committees, and the four flyway councils work closely in managing the sport harvest of waterfowl. Demographic models developed by the NSST to assist Plan decision-making incorporate harvest levels projected by those agencies. Analyses by the NSST are also shared with wildlife agencies and flyway councils to ensure that the best possible science is considered in harvest management decisions.

Internally, the Plan Committee provides oversight of the Plan, scientific learning is documented and shared continentally by the NSST, and implementation is led by the joint ventures. The Plan Committee has no authority to dictate actions to joint ventures and other partners. It fosters cooperation and synergy through active leadership, lucid guidance, and meaningful assessments of waterfowl conservation actions conducted under the aegis of the Plan. Structure within the Plan environment is described in greater detail in Appendix C.

III. Waterfowl Conservation in a Changing World

Waterfowl have long been the centerpiece for migratory bird conservation in North America. Their status as highly sought-after gamebirds led to many of North America's greatest conservation successes, such as the 1916 Migratory Bird Treaty, the Migratory Bird Hunting Stamp Act of 1934, and the North American Wetland Conservation Act of 1989. The hunters' commitment to conservation spurred legislation to protect waterfowl from the effects of habitat destruction and unregulated harvest and, later, to restore lost habitats.

To effectively prepare for the future, Plan partners must be cognizant of ecological and sociological trends that significantly affect their abilities to manage waterfowl habitats and populations, to involve new conservation partners, and to focus government and agency resources on waterfowl conservation. Managers need to ensure that the Plan remains relevant to both policy and decision makers and to the broadest possible segment of society.

Waterfowl Uses and Values

From the beginning Plan authors and managers have considered the range of waterfowl uses to be chiefly subsistence and recreational hunting and nonconsumptive activities such as photography and viewing. Hunting remains an important part of the social fabric of North America. Harvest by indigenous groups, although a small proportion of the continental waterfowl harvest, is also nutritionally and culturally important in parts of Canada and Alaska. In addition, commercial or indigenous harvest may be a significant factor for individual waterfowl populations, e.g., eider harvest in Greenland or goose harvest on the Yukon-Kuskokwim Delta.

Hunting accounts for the vast majority of waterfowl harvest and remains tremendously important at national, regional, and local levels. There have been short-term fluctuations in waterfowl hunter numbers, from a high of approximately 2.8 million in 1970 to a low of 1.56 million in 1992, with over 1.84 million waterfowl hunters in the United States and Canada in 2001, 18% higher than in 1992. Regional trends have varied; migratory bird hunting permits in Canada have steadily declined to only 181,000 in 2001 from a peak of nearly 525,000 in 1978, a 72% decrease during a period when more U.S. hunters were traveling to Canada than ever before. In the United States, waterfowl hunter numbers in 2001 (1.66 million) were 30% higher than in 1992 (1.28 million). In Mexico, a long-standing tradition of waterfowl hunting by mostly local groups has changed over the past 30 years with the development of waterfowl hunting services which focus on the international tourism market, primarily U.S. hunters. Today, foreign hunters make up almost 80% of the waterfowl hunters in Mexico, producing an estimated $10 million (U.S.) in annual economic benefits. Fluctuations in hunter numbers correlate to some degree with waterfowl populations; however, the long-term decline in waterfowl hunters is more likely related to demographic, socioeconomic, and cultural trends.

Hunters are long-standing supporters of conservation and contribute substantial resources for waterfowl habitat conservation. They have traditionally been the primary supporters of the Plan's mission and remain committed partners. In Canada, revenue from the annual purchase of the Wildlife Habitat Canada Stamp is used to support wetland conservation. Sale of federal duck stamps in the United States generated $25 million (U.S.) for the purchase of wetland habitat in 2001. The economic impact of waterfowl hunting is significant and continues to grow. In the United States, almost 3 million migratory bird hunters, including 1.66 million duck hunters, expended approximately $1.4 billion (U.S.) in 2001. In Canada, hunters have contributed $335 million and 14 million hours of volunteer work to habitat conservation over the past 15 years.

Mechanisms must be developed to allow waterfowl viewers to more directly and effectively contribute to waterfowl habitat conservation.

The number of people active in other forms of related outdoor recreation, such as waterfowl viewing, continues to grow. Close to 14 million people participated in watching waterfowl in 2001. This group clearly benefits from robust waterfowl populations and represents a largely untapped resource for Plan activities. If conservation efforts are going to grow over time, the associated costs must be distributed across all user groups. Mechanisms must be developed to allow waterfowl viewers to more directly and effectively contribute to waterfowl habitat conservation.

Waterfowl in a Complex Environmental Agenda: Challenges and Opportunities

In North America, the array of wildlife and environmental issues continues to expand. There are now conservation initiatives associated with species groups as diverse as bats, butterflies, amphibians, and reptiles. In general, however, the resources and staffing levels currently available to conservation agencies have not grown in proportion to the new demands and in many cases have even declined. The increasing public awareness is overwhelming the capabilities of many of these agencies.

Greater efficiencies, broader partnerships, and increased financial and human resources will be essential to meet the growing demands of the environmental agenda. The Plan community must continue both to capitalize upon opportunities for greater communication and cooperation and to proactively create them. Efforts such as the North American Bird Conservation Initiative present such opportunities, and Plan partners have been among the leaders of this emerging context. While initial progress with new partnerships might require significant effort, the potential for long-term benefit is great. The increased breadth and potential strength of these relationships carry the promise of expanding the resources for waterfowl conservation.

The socioeconomic and environmental contexts of waterfowl conservation have changed in many ways since 1986. Change will continue as a result of driving forces such as human population growth; growing demands for water, energy, food, and fiber; and urban expansion. The Plan faces continued wetland loss and degradation, increased problems with invasive species, increased levels of atmospheric greenhouse gases, and society's conflicting demands on the landscape. The extent to which Plan partners are able to respond creatively to challenges such as human population growth or climate change will be critical to future success.

Despite the natural tendency to focus on the negative consequences of change, novel conservation opportunities will also arise. For example, shared concerns over adequate supplies of clean water have already led to synergies between Plan partners and local governments, highlighting the potential for Plan activities to provide multiple benefits to society.

Although not an all-inclusive list, the following categories of broad socioeconomic forces include examples of driving trends relevant to the future of waterfowl conservation. They are areas which have seen significant changes since the 1970s (the baseline period for the Plan's initial objectives). These brief reviews highlight the types of issues that Plan partners must monitor to manage waterfowl successfully into the future.

Continuing Human Population Growth and Urban Expansion

The world's population grew from 3.7 billion in 1970 to 5.9 billion in 1998 and is projected to reach 9.1 billion by 2050. In North America, the population was 42% higher in 1998 than in 1970, and it is projected to increase over 50% by 2050.

This population growth adds enormous pressures to the landscape that will result in significant ramifications for waterfowl conservation. In the Northeast, the average population density is 767 people per square mile. By 2010, the population density in the coastal parts of California will reach 1,050 people per square mile. Increase in population is already resulting in significant pressures on waterfowl, as observed in the declines in the habitat and waterfowl use of Chesapeake Bay. To effectively secure waterfowl habitats, we must assess the location and likely impacts of future population growth.

As the North American population continues to increase and shift from farms and rural environments to cities and suburban centers, there is likely to be an erosion of public understanding of conservation issues. Ultimately, this could result in reduced legislative support for Plan objectives. The Plan's future success will depend upon strategic efforts to work within the context of these inevitable societal changes. As natural habitats become scarcer, their relative values to society increase and Plan partners will need to engage a broader audience to achieve waterfowl conservation goals.

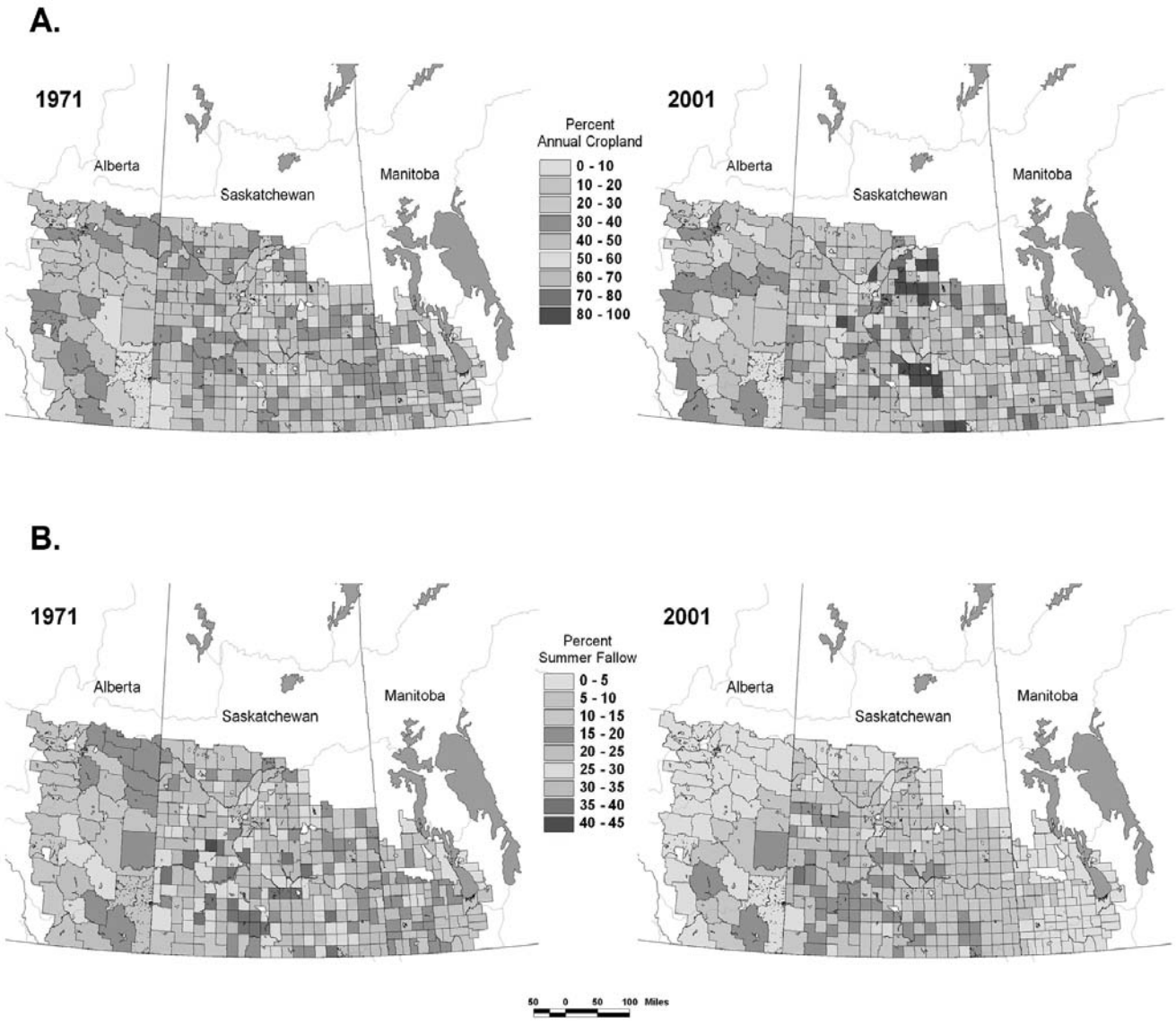
Demands for Food and Fiber

With human population increase comes increased demand for food and fiber, with attendant expectations for agriculture, aquaculture, and forestry. For example, Figure 2A depicts the significant increase of cropland in the southern portions of the Canadian prairie provinces. This trend has primarily been driven by the drastic reduction in the practice of summer fallow (Figure 2B). Many waterfowl scientists believe that one of the principal reasons for the decline of pintail populations and their lack of positive response during the 1990s was this loss of grassland and summer fallowed nesting habitat.

On the positive side, conservation titles within U.S. farm bills have produced habitat gains and illustrate that engaging with agricultural policy development can create benefits for waterfowl. For example, as of February 2003 the Conservation Reserve Program had enrolled 11.75 million acres in the prairie pothole states of North and South Dakota, Minnesota, Montana, and Iowa. Grassland, which provides important waterfowl nesting habitat, was established in much of this acreage. Farm legislation also implemented the Wetland Reserve Program, which has restored over 1.25 million acres of wetlands and associated habitats. More than 400,000 of those acres are in the Mississippi River alluvial valley, one of the most important waterfowl wintering areas on the continent. Neither of these important programs existed when the 1986 Plan was authored, illustrating the enormous reach of agricultural policy and the extent to which it can alter landscapes that support waterfowl populations.

Continued involvement by waterfowlers and other conservation interests will be necessary to uphold these gains, many of which derive from programs with limited time frames. International trade agreements and environmental accords such as the North American Free Trade Agreement will continue to influence global market forces in ways that will, in turn, affect intensity and patterns of agricultural practices. Other changes in land use patterns, such as the expansion of aquaculture along both coasts of the northern United States and Canada and in the mangrove swamps of Mexico, can detrimentally affect waterfowl habitat and populations.

Figure 2. A. Cropland in prairie Canada, 1971 and 2001.
B. Summer fallow in prairie Canada, 1971 and 2001.



Similarly, the introduction of more intensive forestry into new regions, such as the western boreal forest of Canada, may bring new pressures on habitats that have long been thought relatively secure. The western boreal forest is the second-most important region on the continent to breeding ducks, and expanding forestry and agriculture are rapidly having major impacts on this forest ecosystem.

Plan partners must strive to anticipate the trajectory and effects of these kinds of trends and seize opportunities to influence agricultural and other policy to enhance waterfowl benefits and minimize negative impacts.

Demands on Wetlands and Water Systems

Society's growing demands for water are reducing waterfowl habitats. Demands in the United States for fresh water increased by approximately 42% from 1960 to 1995. In areas of high profile water battles, allocation of water resources has long required significant compromise, and many of these areas are critically important for waterfowl conservation. Nowhere is this more evident than in the Central Valley of California where the needs of sharply rising human populations are already conflicting with agricultural and wildlife needs. Water shortages are also now occuring in areas previously considered to have abundant resources. For example, it is predicted that parts of eastern Arkansas will exhaust their groundwater supplies by 2015 despite approximately 50 inches of annual rainfall. This expected water shortage has resulted in proposals for diverting significant amounts of surface water to irrigation, which will have a potential impact on thousands of acres of wetland habitats.

Effective conservation of wetlands and other waterfowl habitat can provide society with vital ecological services such as water quality improvement and flood control. For example, the agricultural community and waterfowl interest groups have worked together in California's Central Valley to provide wintering waterfowl habitat while contributing to the weed control and clean air objectives of farmers and other citizens. The city of Boston is acquiring 5,000 acres of wetlands in the Charles River watershed in order to avoid constructing a $100 million (U.S.) flood control structure. New York City has initiated a $250 million (U.S.) program to acquire and protect up to 350,000 acres of wetlands and riparian lands to protect the quality of its water supply rather than construct water treatment plants at a cost of $6-8 billion (U.S.).

Public opinion surveys have repeatedly documented that an overwhelming majority of the public places a very high priority on water and wetland issues. A recent national survey in the United States documented that the number of citizens who believed there were too few wetlands was 15 times greater than the number who thought there were too many. This awareness provides a significant opportunity for the Plan community. With ample lead time and strategic planning, management actions can provide the broader benefits desired by the public and simultaneously generate significant nontraditional support for Plan objectives.

Conservation efforts related to waterfowl are in many cases inextricably linked to other important uses of water and wetlands in coastal areas. In many coastal areas, agriculture, aquaculture, and tourism development threaten coastal areas, particularly mangrove swamps and inshore reefs. Conservation of such fragile ecosystems not only provides critical waterfowl habitat but also aids in stabilizing rural economies based on fish, shellfish, and ecotourism activities.

Energy Demand and Use

With a burgeoning human population, North America's demands for energy will continue to grow. There are significant relationships between waterfowl habitats and all aspects of energy production and use, and managers must consider these relationships while planning for the future. Initial exploration for energy resources can significantly impact important habitats such as the western boreal forest of Canada.

The conversion of fossil fuels to energy adds carbon dioxide and other greenhouse gases to the atmosphere. There is now scientific consensus that global climate change is occurring, although debate continues regarding the extent to which these gases and energy use contribute to this change. Research cited in the United Nation's Intergovernmental Panel on Climate Change[2] and the U.S. National Assessment of the Potential Consequences of Climate Variability and Change has predicted changes to many of North America's most important waterfowl habitats. For example, warming and increased soil moisture deficits are predicted for the midcontinent prairie pothole region, with the likelihood of significant decreases in average wetland abundance by the 2080s. Sea-level rise caused by thermal expansion of the oceans and melting ice formations will most likely continue and could accelerate loss of important waterfowl habitats along the Gulf of Mexico and Atlantic coasts. Louisiana, with 40% of the coastal marshes in the continental United States, loses about 24 square miles of wetlands every year to land subsidence and rising water levels. This loss could have significant implications for species such as scaup and pintail. Relative sea-level rise, a product of rising oceans and changing land levels, is most severe along the Gulf of Mexico and Atlantic coasts and some Arctic areas. In general, the problem is less threatening along the Pacific coast except in heavily developed estuaries like San Francisco Bay where areas of significant coastal wetlands may be impacted. In places like Chesapeake Bay, benthic anoxia may worsen, affecting important diving duck food resources, but this outcome will be affected by patterns of precipitation in the watershed, something that varies among competing climate models. The western boreal forest is predicted to have warmer and dryer conditions which could result in widespread habitat changes, associated range shifts of plants and animals, and melting of permafrost with subsequent land subsidence. We cannot anticipate with confidence what effects ecological changes in the breeding range of sea ducks may have, but because many sea duck populations are already in decline, this requires better monitoring. Over-abundance and associated habitat degradation are concerns for Arctic-nesting white geese, and warmer springs could enhance breeding success and work against efforts to control these populations. On the other hand, goose and swan species whose numbers currently are limited because of short growing seasons may benefit from warmer springs.

Although some uncertainty remains about the extent and nature of the coming changes, Plan partners must begin considering these factors. As climate change models improve and uncertainties diminish, these issues should become an explicit component of long-term planning and implementation. Initial government and industry responses to climate change have already presented conservation opportunities to Plan partners such as the restoration of forested wetland and grassland habitats. In addition, some maintain that the commodity trading of "carbon credits" produced within these ecosystems could ultimately rival the magnitude of the U.S. farm bill impacts. The involvement of the waterfowl management community in the initial development of this strategy has already led to carbon sequestration projects explicitly designed to provide benefits in critical waterfowl habitats such as the prairie potholes and Lower Mississippi River valley. Furthermore, Plan partners are participating in a broader discussion to help lay a long-term framework to generate significant benefits for waterfowl habitats.

2 Intergovernmental Panel on Climate Change. 2001. Summary for Policymakers, Working Group I, Third Assessment Report. [online] URL:http://www.ipcc.ch/pub/spm22-01.pdf.

Contaminants, Invasive Species, and Disease Concerns

Disease mortality is a chronic concern of waterfowl managers, particularly in areas where molting, migrating, and wintering birds congregate. For most widespread waterfowl populations numbering in the hundreds of thousands to millions, most disease outbreaks alone are unlikely to affect continental population status. However, diseases such as avian botulism, cholera, or duck viral enteritis may accelerate population declines, affect human use, and place significant personnel, equipment, and monetary burdens on responding agencies. Recent experiments in prairie Canada showed that on large, shallow, heavily vegetated lakes, traditional carcass clean-up in response to botulism outbreaks was ineffective for reducing duck mortality. Researchers continue to seek other methods for managing this serious disease.

Multiple uses of remaining water sources and wetlands may degrade habitat quality and be detrimental to waterfowl health. Agricultural and urban runoff and sewage effluent carry heavy metals, industrial compounds, pesticides, and pharmaceuticals, the effects of which are not fully understood. Such contaminants may result in direct losses and reductions in productivity and contribute to increased susceptibility to disease. With continued agricultural and urban expansion, influxes of chemicals are not likely to abate.

Exotics Linked to Waterfowl Disease

Introduction of nonnative species of birds, fish, invertebrates, and mammals may be accompanied by simultaneous introductions of invasive pathogens. Botulism type E, which is associated with fish and has caused both human and bird mortality, is an emerging disease problem in the Great Lakes. Although documented since the 1960s, mortality was relatively low and sporadic until 1998. Since that year, annual outbreaks have occurred in fish- and mollusk-eating birds in Lakes Huron and Erie. In 2002, estimated losses of long-tail ducks exceeded 12,000 birds in New York Lake Erie waters alone, with additional losses along Canada's shores. Many dead birds had ingested round gobies or dreissenid mussels, which are introduced species. Although the mussels have been in the lakes for a number of years, the round goby is a recent introduction. There appear to be correlations between the spread of the goby through the Great Lakes and the locations of botulism type E outbreaks, and research is underway to better understand the relationship. While small wetlands and ponds can be made unattractive to waterfowl, or managed to provide unfavorable conditions for toxin production, the options on Lake Erie and the other Great Lakes are more limited. The introduction of these nonnative species may have set the scene for large-scale losses for many years to come.

An emerging threat to many bird species is West Nile virus (WNV). The virus has spread across North America with remarkable speed since its emergence in New York in 1999. Although WNV has been identified in a number of waterfowl species, it is still uncertain to what extent the virus poses a threat to North American waterfowl populations. In the first 3 years after the virus was reported in North America, bird mortality was concentrated on crows and jays. Beginning in 2002, significant mortality was recorded in hawk and owl populations from the Upper Midwest to Louisiana, which corresponded to a dramatic rise in the number of human cases and deaths from WNV. The virus has undergone a number of genetic mutations since its arrival in North America in 1999, and mutations can be expected to continue. Since future mutations could make the virus more virulent to ducks, geese, and swans, monitoring waterfowl populations for future impacts of WNV is warranted. Furthermore, increased mobility of people and global trade raises the potential for introduction of other exotic pathogens to North America, which may also adversely affect waterfowl populations.

In response to human health concerns, there has been growing demand to eliminate breeding habitat for mosquitoes, especially near urban centers. Unfortunately, the efforts pose an immediate threat to waterfowl habitat as local communities seek to drain wetlands for mosquito control. Plan partners should keep abreast of research on the ecology of WNV and its hosts and help inform public discussions about management options.

Change is inevitable. The context for waterfowl management has altered over the Plan's first 18 years and it will continue to change. Achieving Plan objectives will ultimately depend on our awareness of these trends and understanding of their potential impacts. The challenge is to respond creatively to change and develop opportunities from it.

IV. Waterfowl Population Objectives and Status

North America, defined here as the jurisdictional areas of Canada, the United States, and Mexico, has 50 species of ducks, geese, and swans, most of which depend on habitats in two or more countries during their annual cycles. Forty species are shared among two or more North American countries. A few species are shared between one signatory country and other nations. For example, the masked duck and muscovy duck are found in Mexico and in Latin American and Caribbean nations; the emperor goose lives in both the United States and Russia; and various sea duck species migrate between Alaska, Russia, other Asian nations, or between Arctic Canada and Greenland. Five species are nonmigratory endemics of the Hawaiian archipelago or the West Indies. Population objectives have been established for many species, subspecies, and populations of waterfowl. Because many waterfowl species rely on dynamic habitats, Plan population objectives reflect average population sizes corresponding to a normal range of environmental conditions.

Population objectives ground the Plan's wetland conservation goals in explicit terms of species conservation.

Purpose of Population Objectives

Waterfowl population objectives in the Plan serve three important functions. First, population objectives move the Plan beyond a mere concept for wetland conservation by grounding it in the explicit terms of species conservation. Second, explicit population objectives provide a framework for regional planning and for gauging the success of conservation actions. Third, comparison of monitoring results with population objectives provides an objective assessment of the status of North American waterfowl.

Waterfowl objectives provide a framework for regional planning and for gauging the success of conservation actions.

The effect of natural environmental variation complicates the assessment of Plan impacts at large geographic scales. There are also difficulties in unambiguously attributing habitat changes to Plan and non-Plan activities. Nevertheless, substantial, sustained deviations from the Plan's population objectives should be cause for concern and may indicate that habitat change has affected the capability of landscapes to meet waterfowl needs.

Characteristics of Population Objectives

The Plan's population objectives are intended to be simple and easy to communicate. They have been reviewed for consistency with other North American waterfowl management objectives, such as those developed by the flyway councils. Finally, all Plan population objectives are quantitative and can be compared to the results of operational monitoring programs.

Some waterfowl species exhibit population fluctuations in response to natural environmental variation. Because Plan goals reflect average population size associated with a range of environmental conditions, it is difficult to compare them with annual estimates derived from monitoring programs. To provide more meaningful comparisons, the NSST is investigating historical and contemporary relationships between waterfowl populations and uncontrollable natural environmental variation. Initial efforts have been directed towards several species whose populations fluctuate naturally in response to dynamic wetland conditions in the prairie-parkland region of the United States and Canada. The NSST will continue this work to provide a more meaningful basis for assessment of population status.

General Principles Related to Objectives

A general objective of the Plan since its inception in 1986 has been to maintain or restore traditional distributions of waterfowl in North America, consistent with long-standing patterns of waterfowl utilization. It is recognized, however, that broad-scale land cover and agricultural changes have resulted in changes in the distributions of some waterfowl in recent decades, and that many of these factors are largely beyond the control of waterfowl managers.

The Plan seeks to maintain or restore traditional distributions of waterfowl in North America, consistent with long-standing patterns of waterfowl utilization.

It is also recognized that managed harvest of waterfowl is desirable and consistent with their conservation. Waterfowl harvest management and habitat conservation are interrelated pursuits, and their successes are mutually reinforcing. Thus, they should be guided by complementary objectives consistent with long-term population viability and human use of the waterfowl resource. Adaptive Harvest Management, now being pursued in the management of several duck populations, offers many options for explicitly linking harvest and habitat management efforts under the Plan. Many more options exist and will be explored in the future.

Waterfowl harvest management and habitat conservation … should be guided by complementary objectives consistent with long-term population viability and human use of the waterfowl resource.

Definitions

It is important to define two terms for the purposes of this Plan.

Population: a nonspecific term for a group of birds distinguished for management purposes. A population may consist of one or more species (e.g., the North American scaup population refers to the continental population of both greater and lesser scaup) and/or subspecies. Management does not necessarily imply harvest management and may refer solely to habitat conservation planning and implementation.

Subspecies: refers to a taxonomically distinct race (information on the taxonomy of North American waterfowl can be found in Appendix E).

The term population is sometimes used to refer to a subsegment of a continental population (i.e., subpopulation). Subpopulations described in this Plan may be allopatric or sympatric. In the case of ducks, only allopatric subpopulations within a species are recognized (Tables 1 and 2) since these population segments may be exposed to widely divergent sets of factors affecting abundance. Geese and swans exhibit strong philopatry to breeding, wintering, and migratory routes and thus it is common for population segments to be exposed to differing risks. For this reason, numerous populations (i.e., subpopulations) may be identified for a particular species (Tables 3 and 4). These populations may be completely allopatric or sympatric at certain times during the year.

Duck Population Objectives

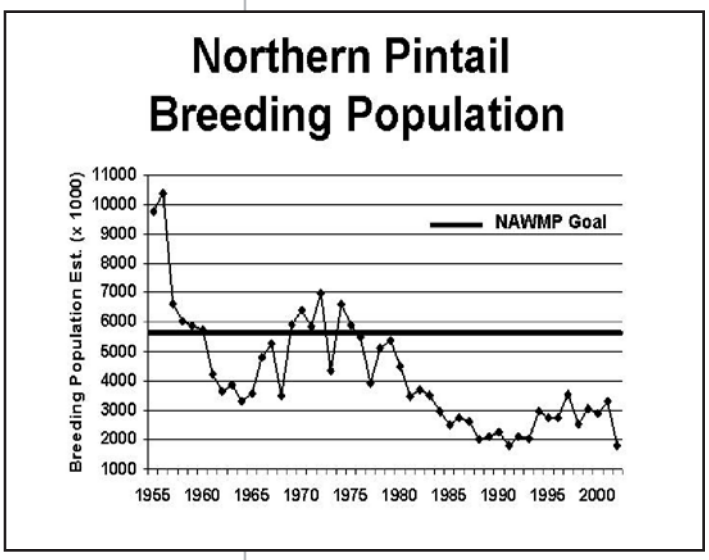
Breeding duck population objectives are derived from average breeding population levels of the 1970s or species-specific management plans (Table 1). The decade of the 1970s experienced wetland conditions in the prairie-parkland region that ranged from good to fair. Duck populations during this decade were thought to meet the demands of both consumptive and nonconsumptive users. Of the 14 species, species groups, or subspecies for which goals have been established, 11 have stable or increasing long-term trends in abundance. Population objectives have not been established for other ducks because of inadequate monitoring programs or a lack of international consensus on desired population levels.

Status of Dabbling Ducks, Perching Ducks, and Whistling Ducks

Dabbling ducks are the most abundant and widespread group of ducks in North America and are the most important for hunting and viewing. They include the mallard, American black duck, mottled duck, American wigeon, northern pintail, gadwall, green-winged teal, blue-winged teal, cinnamon teal, northern shoveler, white-cheeked pintail, Hawaiian duck, and the Laysan duck. North American perching ducks include the wood duck and muscovy duck. Three species of whistling ducks, black-bellied, fulvous, and West Indian, also breed in North America (as defined jurisdictionally in this Plan). Present status and long-term population trends are presented for all ducks in Table 2.

The highest breeding densities of dabbling ducks are found on the prairies. Boreal habitats also support large populations at generally lower densities, although some regions in Alaska support breeding densities comparable to those of the prairie pothole region. Losses of upland nesting habitat on the prairies particularly affect early nesting species such as mallards and northern pintails. Intensive agricultural land use on the prairie breeding grounds, combined with a sustained drought in the 1980s until the early 1990s, adversely affected large segments of breeding habitat. Abundant precipitation returned to the prairies in the early 1990s, and wetland conditions remained good through 2001, particularly in the U.S. portion of the pothole region. Wetland conditions in the Canadian prairies were more variable during this time period.

Many dabbling and diving ducks breeding in the prairie pothole region exhibited population growth through the 1990s, particularly in the United States. There, abundant wet basins and large tracts of nesting cover (provided through the Conservation Reserve Program and Plan habitat enhancements) resulted in excellent duck production. The populations of six species of dabblers that breed in the midcontinent region increased to high levels over those years. These included mallard, gadwall, American wigeon, green-winged teal, blue-winged teal, and northern shoveler; however, not all dabbling duck species that breed in the prairie pothole region responded to the improved habitat conditions. Northern pintails, which historically nested in the highest densities in western portions of the Canadian prairies, exhibited no population growth during the 1990s. There is emerging evidence that pintails may be particularly sensitive to recent changes in agricultural cropping practices, especially in the Canadian prairies although it is important to note that wetland conditions in primary pintail breeding areas did not undergo the dramatic improvement that occurred in other prairie areas.



Research by Plan partners indicates that nest success and survival of nesting hens are critical factors affecting upland nesting midcontinent duck populations. In areas like the prairie pothole region, agricultural intensification and the addition of rock piles, culverts, shelterbelts, and abandoned buildings to the landscape have enhanced habitats for some species of predators. It is clear that landscape degradation and corresponding changes in predator communities are the ultimate causes of low nest success and hen survival.

The American black duck population in eastern North America has decreased over the last four decades. Annual winter surveys that were used to index the size of the black duck population reported an average of 491,000 birds during the 1960s, falling to 285,000 during the 1990s. Although black ducks have declined in both the Atlantic and Mississippi Flyways, the proportional decrease has been far greater in the Mississippi Flyway. Breeding waterfowl surveys initiated by the Black Duck Joint Venture

in 1990 in eastern Canada indicated that the breeding black duck population has increased, particularly in the Atlantic Provinces and eastern Quebec, and is currently stable in the western portions of its breeding range. Although the population of breeding black ducks has increased overall during the past decade, long-term threats to black duck abundance remain. These threats include habitat loss, interactions with mallards, and hunting mortality. To improve both harvest management and habitat conservation planning, the Black Duck Joint Venture will continue developing demographic models, coordinating research, and monitoring.

The wood duck breeds primarily in eastern North America, although a small west coast population breeds from California to British Columbia. Once severely depressed as a result of habitat loss and over-harvest, the wood duck made a dramatic comeback during the 20th century largely in response to harvest restrictions. Nesting boxes also played an important, though secondary, role in the recovery of this species. Wood ducks are now a large proportion of the waterfowl harvest in the Atlantic and Mississippi Flyways. This species generally inhabits areas with dense overhead cover, a fact which makes broad-scale aerial surveys impractical. Ground-based point counts from the North American Breeding Bird Survey and harvest statistics suggest both short- and long-term population trends are increasing.

Table 1. Breeding population objectives, recent status, and long-term trends for ducks (1,000s of ducks).

Species/Species Group/Subspecies	Objective[a]	Average Population Size (1994-2003)[b]	Long-term Trend (1970 – 2003)
Mallard	8,200	8,640	No trend
Northern pintail	5,600	2,815	Decreasing
American black duck	640[c]	533[c]	Decreasing[d]
Mottled duck, Florida subspecies[e]	9.4[f]	11[f]	Increasing[g]
Gadwall	1,500	2,963	Increasing
American wigeon	3,000	2,628	No trend
Green-winged teal	1,900	2,485	Increasing
Blue-winged and cinnamon teal	4,700	5,875	No trend
Northern shoveler	2,000	3,318	Increasing
Hawaiian duck[e]	5	2.5[h]	No trend
Laysan duck[e]	10.5	0.3[h]	No trend
Redhead	640	811	No trend
Canvasback	540	657	No trend
Lesser and greater scaup	6,300	4,017	Decreasing

a Duck objectives are based on the Waterfowl Breeding Population and Habitat Survey, Traditional Survey Area (WBPHS-TSA) strata 1-18, 20-50, 75-77 and represent average population estimates from 1970-1979, unless otherwise noted.
b Average population size estimates are for the WBPHS-TSA unless otherwise noted.
c The American black duck population objective was developed from the predictions of a model relating Mid-winter Waterfowl Survey counts to population estimates derived from the Breeding Waterfowl Plot Survey (BWPS) of Eastern Canada. The objective, and average population size, correspond to that portion of the black duck breeding range sampled during the BWPS. For management purposes, the black duck objective has been partitioned for three portions of the breeding range: eastern, central, and western. In the future, combined estimates from fixed-wing and helicopter surveys may be evaluated for monitoring and objective setting for this species.
d Based on Mid-winter Survey data.
e Not shared between two or more signatory nations. Management is the responsibility of that nation whose boundary coincides with the range of the species, population, or subspecies.
f The mottled duck, Florida subspecies objective corresponds to that portion of the breeding range of this subspecies sampled by the Florida Mottled Duck Survey (FMDS). The objective for the Florida subspecies of mottled duck is based on average population size estimates from 1985-1989. Reported average population size is for the time period 1994-2000.
g 1994-2000.
h Hawaiian species are monitored by the Annual Hawaiian Waterbird Survey. Mean population estimates correspond to the years 2001-2002.

Table 2. Breeding duck population estimates and trends in North America (1,000s of ducks).

	1994 – 2003 Mean Population Estimates[a]			
Species/ Subspecies/Population[b]	Continental	Traditional Survey Area[c]	Other Survey Areas[c]	Long-Term Trend (1970– 2003)
Mallard	13,000	8,640	3,380	No trend
Mexican subspecies[d]	56	Not Applicable	Not Applicable	Increasing[e]
Northern pintail	3,600	2,815	169	Decreasing
American black duck	910	31	625	Decreasing[e]
Mottled duck	660	Not Applicable	11	No trend[e]
Florida subspecies[d]	30	Not Applicable	11[f]	Increasing[f]
Western Gulf Coast subspecies	630[g]	Not Applicable	Not Applicable	No trend[e]
Gadwall	3,900	2,963	456	Increasing
American wigeon	3,100	2,628	382	No trend
Green-winged teal	3,900	2,485	633	Increasing
Blue-winged and cinnamon teal	7,500	5,875	798	No trend
Blue-winged teal	7,240	Not Differentiated	543	No trend
Cinnamon teal	260	Not Differentiated	30	No trend[e]
Northern shoveler	3,800	3,318	284	Increasing
Hawaiian duck[d]	2.5	Not Applicable	2.5	No trend
Laysan duck[d]	0.3	Not Applicable	0.3	No trend
White-cheeked pintail[d]	1.4[h]	Not Applicable	1.4[h]	No trend
Wood duck	4,600	Not Applicable	653	Increasing[e]
Eastern population	4,400	Not Applicable	629	Increasing[e]
Western population	200	Not Applicable	24	Increasing[e]
Muscovy duck[d]	30	Not Applicable	Not Applicable	Decreasing[e]
Whistling ducks	215	Not Applicable	Not Applicable	Increasing[e]
Fulvous whistling duck	Unknown	Not Applicable	Not Applicable	Increasing[e]
Black-bellied whistling duck	Unknown	Not Applicable	Not Applicable	Increasing[e]
West Indian whistling duck[d]	0.1[h]	Not Applicable	0.1[h]	Unknown
Redhead	1,200	811	216	No trend
Canvasback	740	657	51	No trend
Scaup	5,200	4,017	535	Decreasing
Lesser scaup	4,400	3,502[i]	535	Decreasing[e]
Greater scaup	800	515[i]	Not Applicable	No trend[e]
Ring-necked duck	2,000	1,101	683	Increasing
Ruddy duck	1,102	566	192	Increasing
West Indian subspecies[d]	1.5[h]	Not Applicable	1.5h	Increasing
Continental subspecies	1,100			Increasing
Masked duck[d]	6	Not Applicable	Not Applicable	Unknown
Harlequin duck	254	Not Applicable	25	No trend[e]
Eastern population	4	Not Applicable	Not Applicable	No trend[e]
Western population	250	Not Applicable	25	No trend[e]
Long-tailed duck	1,000	170	112	Decreasing[e]

Table 2 continued

	1994 – 2003 Mean Population Estimates[a]			
Species/ Subspecies/Population[b]	Continental	Traditional Survey Area[c]	Other Survey Areas[c]	Long-Term Trend (1970– 2003)
Eiders	1,643	13	27	Decreasing[e]
King eider	575	Not Differentiated	Not Applicable	Decreasing[e]
Common eider	1,050	Not Differentiated	Not Applicable	Decreasing[e]
American subspecies	300	Not Differentiated	Not Applicable	No trend[e]
Northern subspecies[d]	550	Not Differentiated	Not Applicable	Decreasing[e]
Hudson Bay subspecies[d]	100	Not Differentiated	Not Applicable	Decreasing[e]
Pacific subspecies	100	Not Differentiated	5	Decreasing[e]
Steller's eider[d]	1	Not Differentiated	1	Decreasing[e]
Spectacled eider[d]	17	Not Differentiated	17	Decreasing
Scoters	1,600	911	15	Decreasing
Black scoter	400	Not Differentiated	Not Applicable	Decreasing[e]
Surf scoter	600	Not Differentiated	1	Decreasing[e]
White-wing scoter	600	Not Differentiated	14	Decreasing[e]
Goldeneyes	1,600	766	794	No trend
Common goldeneye	1,345	Not Differentiated	610	No trend
Barrow's goldeneye	255	Not Differentiated	184	No trend[e]
Eastern population	5	Not Differentiated	Not Differentiated	No trend[e]
Western population	250	Not Differentiated	184	No trend[e]
Bufflehead	1,400	953	359	Increasing
Mergansers	1,600	750	844	Increasing
Hooded merganser	350	Not Differentiated	241	Increasing[e]
Red-breasted merganser	250	Not Differentiated	10	Increasing[e]
Common merganser	1,000	Not Differentiated	257	Increasing[e]

a Traditional Survey Area estimates were derived from the Waterfowl Breeding Population and Habitat Survey (WBPHS), strata 1-18, 20-50, 75-77. Other Surveyed Area estimates were derived from some combination of WBPHS strata (51-57, 62-69), the Breeding Waterfowl Plot Survey also conducted in eastern Canada, and concurrent state, provincial, or regional breeding waterfowl surveys in British Columbia, California, Colorado, Connecticut, Delaware, Florida, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Nebraska, Nevada, New Hampshire, New Jersey, New York, Oregon, Pennsylvania, Rhode Island, Utah, Vermont, Virginia, Washington, Wisconsin, and Wyoming. In cases where a survey was not completed every year between 1993 and 2002, or when data were unavailable, mean estimates were computed by using available estimates for that time period. Continental estimates include the surveyed area estimates as well as rough estimates of populations outside of surveyed areas based on harvest derivation studies, expert opinion, winter survey data, or special purpose research surveys. Continental estimates for species such as the muscovy, whistling ducks, masked duck, and many sea ducks are based on few data and are particularly speculative.

b Subpopulations are identified distinctly when there is significant evidence for allopatry. Subspecies are also distinguished according to current taxonomic classification. The taxonomic delineation presented in this table is intended to aid in development of regional habitat conservation strategies and is not intended to supercede other international agreements regarding the appropriate organizational level for species management.

c An entry of "Not differentiated" in these fields indicates that the survey protocol does not enable discrimination to a particular taxonomic level. "Not applicable" indicates that the species, subspecies, or subpopulation is not recorded in the WBPHS Traditional Survey Area or in the surveys represented by the "Other Surveyed Area" category.

d Not shared among two or more signatory nations. Management is the responsibility of that nation whose boundary coincides with the range of the species, subpopulation, or subspecies.

e Trend assessments are based on data sources (e.g., Mid-winter Survey, Breeding Bird Survey, published accounts) other than breeding population estimates from the WBPHS. In general, less confidence is attributed to these values.

f 1994-2000.

g Winter population.

h Data available from Puerto Rico only.

i Estimate of lesser scaup in the traditional survey area was computed from nontundra WBPHS strata 1-7, 12, 14-18, 20-50, 75-77. Estimate of greater scaup in the traditional survey area was computed from tundra strata 8-11 and 13. These can be considered only crude estimates since some mixing of lesser and greater scaup occurs in tundra and northern boreal strata.

The Mysterious Decline of Scaup

The Decline North America's scaup populations have been plummeting at a rate of about 2-3% a year for the past 24 years, and no one knows why. Two species of scaup occur in North America. Most greater scaup, a circumpolar species, breed beyond the tree line in northwestern Canada, and in western and northern Alaska. Lesser scaup, by far the more abundant of the two species, is found only in North America, nesting from the prairie pothole region to the Pacific Northwest, north through Canada to central Alaska. The most dramatic declines have occurred in their core breeding area, the wetland-rich region lying between the Rocky Mountains and the Canadian Shield. Wintering scaup also have declined in all four flyways, with the steepest decline in the Mississippi Flyway.

The Problem Information from hunter-killed birds reveals more troubling trends. The proportion of young birds in the harvest has been declining gradually since the early 1960s, indicating declining reproductive success. Likewise, especially in the Mississippi Flyway, the proportion of males to females has been increasing, likely the product of poorer survival for adult hens than for drakes.

Searching for the Explanation What has gone wrong? Deteriorating habitat quality for migrating and wintering scaup may have resulted in reduced breeding success or survival. This effect of habitat deterioration might have come about either because of chemical contamination or loss of food supplies leading to poorer body condition. Recent evidence is consistent with both possibilities. A second hypothesis is that reduced reproductive success or hen survival might have resulted from some as yet unidentified large-scale ecological change in the Western Boreal Forest. Two recent studies have provided estimates of reproductive success that are lower than required to sustain local breeding populations. Another intriguing finding is that scoter populations in the Northwest Territories have declined largely in parallel with scaup over the last 20-25 years. Scoters are also carnivorous diving ducks, but they winter at sea, in very different places than mid-continent scaup. The concordance between scoter and scaup declines is consistent with a boreal forest cause, but the signposts remain unclear. In simple terms, we are still uncertain if the problem is up north during breeding, on migration and wintering areas, or both.

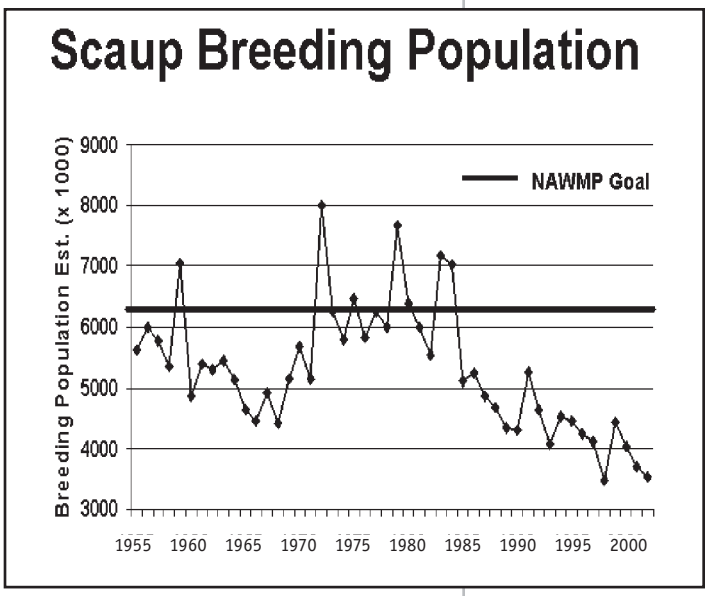
Consequently, the first step in remedying the situation must be to understand what factors are responsible for limiting scaup numbers. Only then might it be possible to take steps to help the species recover.

Several dabbling, perching, and whistling duck species occur only in the southern United States and Mexico. Mexican ducks, once considered a distinct species, are now classified as a subspecies of mallards. The range of Mexican ducks once overlapped with mallards in extreme south-central and south-western United States. Today, because of hybridization with mallards, it is unlikely that pure Mexican ducks exist north of the United States-Mexico border. Mottled ducks and muscovy ducks are primarily nonmigratory. The Florida (Nominate) subspecies of mottled duck has exhibited a short-term increasing trend, but interbreeding with feral mallards is a cause for concern. Also, rapid changes in Florida's landscape, mostly from agricultural and urban development, raise concerns about the status of the wetland and upland habitats upon which the Florida mottled duck depends. Limited data for the Western Gulf of Mexico Coast subspecies of mottled ducks has shown no trend. Muscovy ducks and the fulvous and black-bellied whistling ducks are recorded during the Mexican mid-winter survey. The whistling ducks tend to be nomadic, exhibiting unpredictable movements. The limited data that exist for the whistling ducks suggest a trend of long-term increases for both species. Some Mexican biologists believe the muscovy has declined in abundance since the 1970s.

Two resident endemic ducks inhabit the Hawaiian archipelago. The Hawaiian duck utilizes freshwater habitats and is relatively widespread across the island chain. Wetland loss, mortality from nonnative predators, over-hunting, and interbreeding with feral mallards pose challenges to this species conservation. The Laysan duck is resident to the small island of Laysan, approximately 225 km northwest of the primary Hawaiian chain as well as other islands in the archipelago. This species utilizes a broad range of habitats from inland areas to brackish lagoons. A combination of over-hunting and vegetative changes caused by introduced rabbits had nearly extirpated this species from Laysan Island by the early 1900s. Declaration of the island as a bird reservation and eventual eradication of the nonnative rabbit population allowed the population to increase to its present size of around 300 individuals.

Two resident dabbling or whistling ducks inhabit Puerto Rico. The West Indian whistling duck, listed as critically endangered by the Puerto Rico Department of Natural Resources, utilizes woody swamps and freshwater lagoons. Threats to this species in Puerto Rico are equivocal because of a paucity of data; however, it is suspected that habitat loss and hunting are primary threats. The white-cheeked pintail is also listed as vulnerable in Puerto Rico. This species inhabits mangrove swamps and coastal freshwater and brackish lagoons. Primary threats to this species in Puerto Rico are thought to include habitat loss and duckling predation.

Status of Diving Ducks, Stifftails, and Sea Ducks



North American diving ducks include the canvasback, redhead, ring-necked duck, greater scaup, and lesser scaup. Stifftails in North America include the ruddy duck and masked duck. The West Indian subspecies of the ruddy duck occurs in Puerto Rico and is listed as vulnerable by the Puerto Rico Department of Natural and Environmental Resources. Highest breeding densities of diving ducks and stifftails occur on the prairie-parklands, although the ring-necked duck and lesser scaup are more widely spread, and the greater scaup breeds mainly in the sub-Arctic. Masked ducks occur from central Mexico and the Caribbean into South America. Diving ducks tend to use deeper inland marshes, rivers, and lakes for breeding and migration, and they use coastal bays, estuaries, and offshore waters for wintering. Canvasbacks and redheads exhibited increasing population trends in the mid-continent region during the late 1990s but have been variable in more recent years. The long-term trend for both redheads and canvasbacks is stable (Table 2). The status of the individual scaup species is difficult to discern because the two species cannot be reliably distinguished during aerial surveys. The size of the entire scaup population (primarily composed of lesser scaup, see Table 2) has declined over the past decade, continuing a long-term decline that has heightened concerns about these species. Public management agencies and nongovernmental organizations have allocated additional resources to address the problem.

Estimates for breeding populations of ring-necked ducks and ruddy ducks in the midcontinent region are not considered as reliable as those for other diving duck species. Nevertheless, these species appear to have increased in abundance over the long term. No data are available to assess the status of masked ducks.

Sea ducks are the least understood group of North American waterfowl because basic biological information and reliable population indices and trends are limited.

North American sea ducks include the harlequin duck, long-tailed duck, bufflehead, common eider, king eider, spectacled eider, Stellar's eider, white-winged scoter, surf scoter, black scoter, common merganser, red-breasted merganser, hooded merganser, common goldeneye, and Barrow's goldeneye. These birds breed primarily throughout the northern regions of the continent. Sea ducks are the least understood group of North American waterfowl because basic biological information and reliable population indices and trends are limited. Available information suggests that all three merganser species and buffleheads have exhibited long-term population increases, whereas goldeneyes have exhibited no apparent trend. There are indications of declines in at least half of all sea duck species, and spectacled and Steller's eiders are listed as threatened in Alaska, while harlequin duck and Barrow's goldeneye are listed as species of special concern in eastern Canada. Available data indicate possible significant declines for long-tailed duck, king and common eiders, and all three species of scoters.

Breeding habitat conditions for most sea duck species have not changed markedly in recent years; however, logging in the boreal forest may limit nest site availability for cavity nesting sea ducks (e.g., goldeneye, bufflehead). Many traditional wintering areas have been degraded by industrial and urban development on both coasts, and threats are continuing. The effects of habitat degradation on sea ducks are unknown, and the harvest of sea ducks remains poorly quantified.

An international Sea Duck Joint Venture was established in 1999 to facilitate and coordinate the acquisition of knowledge in order to better understand the reasons for observed declines in sea duck populations and formulate restoration strategies.

Goose Population Objectives

The Plan addresses the seven species of geese that commonly occur in North America. Geese show strong philopatry to traditional breeding, migration, and wintering areas, subjecting different groups to distinct environmental factors and variation in reproductive and mortality rates. This philopatry has given rise to the delineation of separate subspecies and populations, and to population-specific management planning. Consequently, the Plan recognizes 35 managed goose populations and includes population goals for 28 of them.

Snow geese, Ross's geese, white-fronted geese, emperor geese, brant, and many populations of Canada geese all nest in the northernmost reaches of North America and along the shore of the Hudson and James Bays. Several Arctic-nesting goose populations have reached record-high abundances and are considered overabundant. Such large populations have been attributed to high adult survival resulting from the abundance of forage in agricultural fields and the availability of refuges on wintering and migratory ranges.

The Arctic Goose Joint Venture… has helped identify factors that have contributed to the overabundance of some populations and limited the growth of others.

Other Arctic and sub-Arctic nesting goose populations have failed to achieve Plan objectives. The Arctic Goose Joint Venture (AGJV) was established to improve both monitoring and coordinated research of Arctic and sub-Arctic nesting goose populations. This joint venture has helped identify factors that have contributed to the overabundance of some populations and limited the growth of others. Several public management agencies have adopted recommendations developed through this joint venture.

Among many other management applications, AGJV projects have resulted in the redefinition of several Arctic goose populations. AGJV partners are working effectively to support a sound biological foundation for Arctic goose management by continuing to generate significant new information. This information will help decision makers refine regulations and take action to support management of Arctic goose populations.

Status of Canada Geese

There are 11 recognized subspecies of Canada geese in North America (Appendix E). These subspecies are further subdivided into 20 populations for management purposes, and some of those populations are composed of more than one subspecies. Of the 14 populations for which goals have been established, 11 currently exceed Plan objectives. Of these, the Atlantic Flyway Resident, Mississippi Flyway Giant, Western Prairie and Great Plains (two populations presently managed jointly), Rocky Mountain, Dusky, Aleutian, and Hi-Line populations have increasing trends. The Short Grass Prairie population of Canada geese is currently showing decline; however, this population remains above the Plan goal. The Southern James Bay and Cackling populations are presently below Plan objectives (Table 3). Dusky Canada geese remain a particular concern, despite an increasing trend over the last decade. Increased predation during nesting and brood-rearing periods may be limiting population growth of Dusky

Canada geese. Habitat changes following a major earthquake in 1964 may be largely responsible for the increased predation. Hunting mortality may also play a role in limiting Dusky Canada geese, although a strict quota system has been implemented to prevent over-harvest of this population.

Several populations of the large subspecies of Canada geese that nest in the temperate regions of the United States (resident Canada geese) have far surpassed numerical goals. In some areas they have caused significant nuisance problems, financial losses to agricultural and commercial interests, or personal injury and are considered overabundant. Management agencies are striving to limit population growth of certain populations to reduce the negative impacts of these geese.

Status of Snow Geese and Ross's Geese

There are two subspecies of snow goose in North America (Appendix E). The lesser subspecies has been subdivided into four managed populations, while the larger greater subspecies is managed as a single population. There are no recognized subspecies of Ross's geese, and this species is managed as a single population. Some wintering Ross's geese are included in the wintering goal of the Western Central Flyway Population of snow geese since they are difficult to distinguish during surveys. All snow and Ross's goose populations, except the Wrangel Island lesser snow goose population, have reached or exceed Plan objectives. Several light goose (snow and Ross's geese) populations far exceed population objectives, and are contributing to habitat degradation in portions of their ranges. In some cases, populations have been declared overabundant by Canada, the United States, and Mexico.

Foraging snow geese and Ross's geese degrade Arctic and subarctic breeding areas and surrounding landscapes. Impacts to tundra habitats have been particularly acute along a 1,900-km band of salt marsh on the western coast of Hudson and James Bays. The combined foraging pressures exerted by lesser snow and Ross's geese have destroyed an estimated one-third of the salt marsh in this region and damaged or overgrazed much of the remaining habitat. Negative impacts on these sensitive habitats, on other Arctic bird species, and increased risk of avian cholera losses to bird communities are major concerns associated with unchecked growth of light geese in the Mississippi and Central Flyways. Combined winter estimates of Mid-continent and Western Central Flyway populations of light geese grew at an annual rate of 3.7% from1955 to 1998, reaching a peak estimate of 3.1 million. Since 1999, when management agencies implemented special regulations to reduce numeric growth of these populations, winter counts have been reduced, and the 10-year trend is now stable, but the Mid-continent Population remains 66%-149% above goal thresholds and the Western Central Flyway is 50% above goal. Ross's geese exceeded the Plan objective by over 500% in 1998 and still appear to be expanding their breeding range and numbers.

Large numbers of greater snow geese have caused degradation of coastal marshes at staging areas along the St. Lawrence River in Quebec and the Atlantic coast of the United States, and large agricultural losses in Canada. Studies conducted at a major breeding colony of greater snow geese on Bylot Island, Canada, indicated high levels of grazing and suggested reduced plant productivity; however, there did appear to be re-growth following grazing. The greater snow goose population had been increasing 8.9% per year from 1965 to its peak count in the spring of 2001. Since special regulations to reduce greater snow goose population growth were implemented in the Atlantic Flyway, the spring population index has declined towards the population objective and now shows a stable trend for the last 10-years.

Strategies for checking future growth of these populations are currently being implemented and their success evaluated. Challenges associated with the overabundance of the Mid-continent Population of lesser snow geese remain particularly acute. Despite the encouraging results of initial remedial measures aimed at greatly increasing harvest, the Mid-winter Index for this population still exceeds Plan objectives by nearly a million and a half birds. It is uncertain whether harvest alone will be sufficient to reduce the size of this population to the Plan objective or if additional control measures will be necessary.

Status of White-fronted Geese

Two subspecies of white-fronted geese occur in North America (Appendix E) and three managed populations have been delineated: the Mid-continent, Pacific, and Tule Populations. Previously, Plan objectives divided white-fronted geese that migrate through the Central Flyway to winter along the Gulf of Mexico into Eastern and Western Populations. Analysis of neck collar data demonstrated that mid-continent white-fronted geese are better described as a single population for management purposes. Accordingly, Table 3 lists a single Mid-continent Population. Autumn surveys for this population began in 1992. While the 10-year trend for this population is stable and the current index remains above goal, indices have declined in recent years, as have estimates of survival rates. The Pacific Population of white-fronted geese breeds primarily on the Yukon Delta of Alaska and winters in the Central Valley of California. The Tule Population is known to breed only in a restricted region of southeast Alaska around the Upper Cook Inlet and also winters in the Central Valley. Recent estimates of the Pacific Population of white-fronted geese are above goal, while the Tule Population remains below its Plan objective.

Status of Brant

At least two subspecies of brant occur in North America (Appendix E): the light-bellied and black-bellied brant. Two populations of light-bellied brant (i.e., Atlantic and Eastern High Arctic) breed in eastern Arctic Canada. The Atlantic Brant Population has recovered since crashing in the 1970s as a result of severe winter conditions. This population currently exceeds the Plan objective. The Eastern High Arctic Population breeds in the Canadian Arctic between the eastern Queen Elizabeth Islands and northern Ellesmere Island. This population of brant winters almost exclusively in Ireland and stages in Iceland during both spring and fall migration. The Eastern High Arctic Population appears stable at this time.

The Pacific, or black-bellied, brant subspecies breeds in the western Arctic of North America. In the early 1980s a dramatic decline and redistribution of Pacific brant occurred in western Alaska, a particularly important breeding region for this population. The 3-year mean population estimate for Pacific brant is 88% of the Plan goal. The Pacific brant population is presently considered stable. Recent banding and morphological research document a breeding convergence of the Pacific brant with the light-bellied brant (i.e., Atlantic brant). While not yet taxonomically differentiated, this brant, sometimes referred to as grey-bellied, has been recognized as a distinct Western High Arctic Population. The Western High Arctic Population breeds on the Parry Islands of the Northwest Territories and winters in Puget Sound. A population objective of 12,000 wintering birds has been established, but regular winter survey counts are not yet available.

Status of Emperor Geese

This maritime goose breeds in coastal tundra habitats in Alaska and Eastern Siberia and winters along the shores of the Aleutian Islands and the Gulf of Alaska, with smaller numbers in Kamchatka. Breeding surveys conducted in Alaska show the emperor goose population to be stable at a level less than half of the population objective.

Status of Hawaiian Geese

The Hawaiian goose is the only native goose species of the Hawaiian archipelago. It is nonmigratory and utilizes a range of habitats from volcanic uplands to lowland wetlands. This species was once decimated by over-hunting and predation by nonnative species. An extensive captive-rearing and reintroduction program began in 1949 and has aided in increasing the population to its present size of 1,175.

Swan Population Objectives

No subspecies are recognized for any of the three swan species considered in the Plan. For management purposes, objectives are specified for two populations of tundra swans and three populations of trumpeter swans (Table 4). Tundra swan breeding ranges encompass most of the Arctic and sub-Arctic, from the west coast of Alaska to the northwest coast of Quebec. The Eastern Population winters primarily in the Mid-Atlantic States surrounding Chesapeake Bay and Albemarle-Pamlico Sounds. The Western Population winters at various locations along the Pacific Coast, from southern British Columbia and the Central Valley of California, south to the lower Colorado River in southwest Arizona and California.

The current breeding range of trumpeter swans is part of a much larger range that historically encompasses the prairies, boreal forests, the intermountain region from southern Alaska through southern Wyoming, and east to the western Great Lakes and northern Ontario. Vigorous reintroduction efforts are underway in portions of this species' historic range. The Pacific Coast Population is the largest of the three recognized populations. It breeds throughout most of Alaska south of the tree line, southwestern Yukon, and extreme northwestern British Columbia and winters primarily on the Pacific Coast from southeast Alaska to Washington State, with smaller numbers in parts of interior British Columbia. The Rocky Mountain Population breeds in the Yukon, British Columbia, Northwest Territory, and Alberta, and in Montana, Wyoming, Idaho, Oregon, and Nevada. It winters primarily in the tristate area of Wyoming, Montana, and Idaho, with small numbers at other scattered locations in Nevada and Oregon. The Interior Population is composed of many restoration flocks that now breed in Canada in Saskatchewan and Ontario, and in the United States from eastern Montana to the eastern end of Lake Ontario. An abundance-based objective for the Rocky Mountain Population is currently being debated, and an interim objective to sustain a minimum growth rate is in effect.

The mute swan is native to Europe and was introduced to private estates in the United States in the late 1800s for aesthetic purposes. Initial introductions were in the vicinity of Long Island, New York. By about 1910, some of these captive birds had escaped, resulting in a feral population of breeding swans in southeastern New York. While mute swans are for the most part nonmigratory, some seasonal migrations, and at times more lengthy migrations, do take place. By the 1970s wild populations of mute swans were established in all four flyways and in Canada. The increasing population of mute swans is of management interest because its aggressive nature has created concern about competition between mute swans and native species of waterfowl. Also, the feeding habits of this species can degrade the quality of habitats for native species. Where concentrations occur, eat-outs of submerged aquatic vegetation have been reported. Flyways and federal governments of the United States and Canada are considering management policies in order to address the growing population of feral mute swans.

Status of Tundra Swans

The mean number of tundra swans in the Eastern Population over the past 3 years exceeds the Plan objective by approximately 30% while the 3 year mean for the Western Population exceeds the Plan objective by approximately the same percentage. Recent trends indicate the Eastern Population to be increasing, while the Western Population appears to be stable.

Status of Trumpeter Swans

All three populations of trumpeter swans increased in abundance between 1990 and 2000. The Pacific Coast Population currently exceeds its population objective by 35 percent. Lead poisoning continues to present a management challenge for this population. The Rocky Mountain Population is estimated to have increased by 9.1% per year during the 1990s, exceeding its interim population objective of 5% annual growth rate. Increases in the Rocky Mountain Population have largely occurred in Canada, whereas the small numbers of swans from this population breeding in the western United States have remained unchanged over the past decade. There is continued concern about the small segment of Rocky Mountain Trumpeters in the United States, given their restricted distribution and the potential for catastrophic natural or anthropogenic population impacts. The Interior Population currently exceeds its population objective by over 21%. Objectives for trumpeter swans are currently undergoing international review.

Status of Mute Swans

Mute swans have exhibited increasing population trends, particularly in eastern North America. The Atlantic Flyway Mute Swan Mid-Summer Survey reported a 13% increase in total swans between 1999 and 2002 with an estimated flyway-wide population over 14,000 birds. Since 1986, data from this survey indicate that the feral mute swan population has increased in size over 148%. The Mississippi Flyway also hosts approximately 5,000 mute swans, most of which occur in Michigan. The Central and Pacific Flyways support significantly smaller feral populations.

Table 3. Status and objectives for North American goose populations.

Species/population	Population Mean (2001-2003)[a]	Population Trend (1994-2003)[b]	Population Objective
CANADA GOOSE			
Atlantic	156,200	Increasing	150,000[c,d]
Atlantic Flyway Resident	1,022,100	Increasing	650,000[e,f]
North Atlantic	No estimate	No estimate	Not yet established
Southern James Bay	95,200	No trend	100,000[e]
Mississippi Valley	325,200	No trend	375,000[e]
Mississippi Flyway Giants	1,539,600	Increasing	1,000,000[e]
Eastern Prairie	220,300	No trend	200,000[e]
Western Prairie and Great Plains	651,300	Increasing	285,000[g]
Tall Grass Prairie	421,900	No trend	250,000[g]
Short Grass Prairie	160,600	Decreasing	150,000[g]
Hi-Line	225,300	Increasing	80,000[g]
Rocky Mountain	163,600	Increasing	117,000[e]
Pacific	No estimate[h]	No estimate[h]	Not yet established
Lesser	No estimate	No estimate	Not yet established
Dusky	17,100[i]	Increasing[j]	Avoid ESA[k] listing
Cackling	166,300	No trend	250,000[l]
Aleutian	43,000[i]	Increasing	40,000[g]
Vancouver	No estimate	No estimate	Not yet established
Taverner's	No estimate	No estimate	Not yet established
SNOW GOOSE			
Greater	702,700	No trend[m]	500,000[e]
Mid-continent lesser	2,490,800	No trend[m]	1,000,000-1,500,000[g]
Western Central Flyway lesser	165,400	No trend[m]	110,000[g]
Wrangel Island lesser	106,300	Increasing	120,000[e]
Western Arctic lesser	580,000	Increasing	200,000[e]
ROSS'S GOOSE	619,000	Increasing	100,000[e]
WHITE-FRONTED GOOSE			
Mid-continent	802,200	No trend[m]	600,000[l]
Tule	5,500[i]	No trend	10,000[g]
Pacific	404,800	Increasing	300,000[l]

Table 3 continued

Species/population	Population Mean (2001-2003)[a]	Population Trend (1994-2003)[b]	Population Objective
BRANT			
Atlantic	163,800	No trend	124,000[g]
Pacific	122,700	No trend	150,000[g]
Western High Arctic	No estimate	No estimate	12,000[g]
Eastern High Arctic[n]	20,000	No trend	Not yet established
EMPEROR GOOSE[n]	71,400	No trend	150,000[e]
HAWAIIAN GOOSE[n]	1,175	No trend	2,800[e]

a Incomplete survey years were excluded from the computation. Where no estimates are available for 2001-2003, the most recent estimate is presented.
b Many goose population surveys, particularly breeding ground surveys, have shorter periods of record than surveys established for ducks. For this reason trend estimates are based on a shorter (10-year) interval, or for the period of record when 10 years of data are not available.
c Breeding pair index.
d Objective partitioned: 125,000 pairs Ungava Peninsula; 25,000 pairs boreal Quebec. The 3-year mean population of 156,200 presented for this population refers to that portion of the population breeding on the Ungava Peninsula.
e Total spring population.
f Reduce to this level by 2005.
g Winter population.
h State and provincial surveys exist but it is not yet possible to develop a population-wide index.
i Population estimates based on neck collar observations during the winter.
j Official estimates of population size from neck collar data show an increasing trend; however, direct counts of breeding population size in Alaska remain depressed with no indication of positive trend.
k ESA – Endangered Species Act (United States).
l Autumn population.
m Ten-year trends may mask shorter-term trends in this population.
n Not shared among two or more signatory nations. Management is the responsibility of the nation which encompasses the range of the species or population.

Table 4. Status and goals for North American swan populations.

Species and Population	3-Year Winter Population Mean (2001-2003)	Recent Trend (1994-2003)[a]	Population Objective
TUNDRA SWAN			
Eastern Population	103,400	Increasing	80,000[b]
Western Population	82,900	No trend	60,000[b]
TRUMPETER SWAN			
Pacific Coast Population	17,551[c]	Increasing[d]	13,000[e]
Rocky Mountain Population	3,666 (9.1%)[c,f]	Increasing[d]	5% annual growth rate[g]
Interior Population	2,430[c]	Increasing[d]	2,000[e]
MUTE SWAN	20,000[h]	Increasing[h]	Not yet established

a Swan population surveys have shorter periods of record than surveys established for ducks. For this reason trend estimates are based on a shorter (10-year) interval, or for the period of record when 10 years of data are not available.
b Winter population.
c 2000 index from the North American Trumpeter Swan Survey conducted every 5 years.
d 1990-2000.
e Autumn population.
f Average annual growth rate 1995-2000.
g Interim objective specified until an abundance objective is adopted.
h Based on the Atlantic Flyway Mute Swan Mid-Summer Survey and individual state survey data from the Mississippi, Central, and Pacific Flyways.

Relationship of Population Objectives to Habitat Objectives

The Plan specifies its ultimate objectives in terms of the abundance and distribution of North American waterfowl populations. Its goal is to meet population objectives through the wise application of local or regional-scale habitat conservation actions guided by regional habitat conservation objectives. To accomplish this, Plan partners strive to quantitatively link regional waterfowl habitat objectives with continental waterfowl population objectives. Empirical and conceptual biological models provide means to link population and habitat objectives (see Appendix A).

Plan partners strive to develop models linking regional waterfowl habitat objectives with continental waterfowl population objectives.

Seventeen years after the inauguration of the Plan, the empirical basis for regional habitat objectives varies widely among joint ventures. The amount of baseline life-history information available for individual waterfowl species varies considerably by geographic region. So does information on resource utilization by waterfowl and environmental influences on bird demography. The logistical challenges and costs of working in different environments, the geographic location of public and private research institutions with waterfowl expertise, and regional differences in the perceived relative importance of waterfowl in relation to other wildlife resources account for and contribute to this disproportionate availability of baseline data. The joint venture habitat conservation objectives presented in Table 5 reflect this geographic variability in the quantity and quality of scientific information on bird-habitat relationships. While some objectives have been derived and evaluated with the aid of empirical models, others are based more heavily on expert opinion. The ongoing challenge to Plan partners is to develop more consistent models for habitat conservation and to evaluate and refine these models to improve habitat conservation strategies. A review of joint venture habitat objectives and the methods used to derive them will be part of the Plan's comprehensive progress assessment scheduled for 2004-2005.

Table 5. Joint Venture Habitat Objectives (acres)

Joint Venture	Protect/Secure	Restore/Enhance
Atlantic Coast	945,000	209,790
Central Valley Habitat	200,000	734,555
Eastern Habitat	1,435,230	1,221,550
Gulf Coast	1,129,972	921,016
Intermountain West	1,500,000	1,000,000
Lower Mississippi Valley	407,000	2,046,000
Pacific Coast (United States)	249,000	108,000
Pacific Coast (Canada)	390,696	105,155
Playa Lakes	400,000	1,200,000
Prairie Habitat	6,672,240[a]	—
Prairie Pothole	1,891,315	4,409,398
Rainwater Basin	50,000	38,333
San Francisco Bay	107,000	129,000
Upper Mississippi/Great Lakes	758,572[a]	—

a Habitat Objective is to conserve additional acres through a combination of securement, protection, restoration, enhancement, and management.

V. Strengthening the Scientific Base for Plan Implementation

Biological Foundations

Waterfowl and their habitat needs are the common bond that connects four flyways in three nations in pursuit of Plan goals.

The Plan's vision of maintaining landscapes capable of sustaining waterfowl populations can only be realized through an understanding of the habitat conditions necessary to sustain target populations of birds throughout their annual cycles. The Plan's biological foundation, therefore, includes waterfowl population objectives, habitat objectives, and an understanding of the links between them. It encompasses the ecological understanding of factors that affect the distribution and abundance of waterfowl, and especially the links between landscape changes (e.g., water abundance, land use, habitat quality, and Plan conservation actions) and waterfowl vital rates (e.g., recruitment rates, mortality rates, and population growth rates). Such knowledge is essential for science-based waterfowl management.

Plan population objectives are based on historical abundances of species and consensus among waterfowl stakeholders about population levels that ensure viability and provide for harvest and other forms of public enjoyment. Once established, population objectives direct managers to target certain habitats and to design specific conservation actions in order to sustain populations.

The cost-effectiveness of conservation actions crucially depends on providing appropriate resources in the right places for target species. Our ecological understanding of factors affecting waterfowl populations directs those decisions. Thus, the biological knowledge base is truly the foundation for the Plan's success.

Because of a rich scientific history and extensive practical management experience, the Plan is fortunate to have a broad scientific base on which to build conservation plans. This base varies greatly, however, among species and regions. For instance, we know a great deal more about mid-continent mallards than we do about king eiders in the central Arctic or masked ducks in Mexico. Regardless of the Plan's strong positioning, waterfowl live in an ever-changing world, and their habitats are under unrelenting pressure from human development. Consequently, managers are challenged to make conservation decisions and investments in the face of much uncertainty about the impact of their actions on waterfowl populations. Plan partners are continually challenged to improve the biological foundation on which key conservation decisions depend and to continuously improve their work through adaptive management.

Sound Science is Essential for Effective Conservation

The three visions of the 1998 update were (1) conserving landscapes to sustain waterfowl populations, (2) broadening partnerships, and (3) strengthening the biological basis of waterfowl conservation. The Plan Committee reaffirms the importance of each of these and believes that progress on the first two elements has been successfully evolving in all three nations. The Committee now feels that it must focus particularly on strengthening the Plan's biological foundations as we move into the second 15-year phase of Plan implementation.

Within the context of continental bird conservation, it is imperative that each bird initiative develops a sound scientific basis for its decisions and efforts. Sound science helps ensure that management actions have the predicted biological consequences and that management choices are optimal, or at least appropriate, at national, regional, and local levels. Development of a strong scientific base is the key to the Plan's continuing leadership in conservation. It is equivalent to private sector investments that improve product quality and maximize benefit/cost ratios. As the joint ventures broaden their conservation mandates and pursue multispecies management, continental leadership for waterfowl science is even more important.

Waterfowl conservation continues to rely heavily on traditional research and development by Plan partners. The importance of continued monitoring cannot be overstated. National data sets describing population trends and distribution, including those describing the harvest, are fundamental to the science base. Typically pursued independently from routine program delivery, research and development remain the main avenue for shaping and testing most new ideas. In waterfowl conservation there are two main approaches to research and development. The first is basic research to better understand how ecological systems work (such as carbon sequestration in wetlands) or what has gone wrong (such as scaup declines in the Western Boreal Forest). The second is field testing new program ideas such as duck use and nesting success in fall-seeded cereal crops. The results from such research are used to develop new programs or direct other conservation actions.

Adaptive Management

As a complement to traditional research, the Plan Committee is increasingly promoting the use of adaptive management. Adaptive management is a broad concept allowing for a diversity of approaches. We recognize that while uncertainty attends many management decisions, management actions themselves can offer important means for reducing future uncertainty. Here, we use adaptive management in a broad and inclusive sense to mean the use of cyclic planning, implementation, and evaluation to improve management performance. Specific applications range from simple assessments of straightforward management choices to formal application of statistical decision theory (as in adaptive harvest management). Plan managers design conservation activities not only to have significant biological impact but also to provide opportunities for learning to ensure future management decisions are well informed ones.

To manage adaptively, each conservation program must have clear, quantifiable objectives; specific predicted biological outcomes of alternative management actions; monitoring procedures to measure the outcome variables defined in the objectives; an evaluation process to compare outcomes with original objectives; and a commitment to use the lessons learned to adjust future decisions. The evaluation components may vary from simple monitoring of the results of routine management to rigorous experimental application of alternative management options. Although adaptive management does not need to be complex, it does require discipline. Critical preconditions for successful adaptive management include stakeholder consensus about objectives and a commitment to manage adaptively. Adaptive management is useful only if partners will respond to new knowledge.

At regional, national, and continental levels, the Plan can enhance its cost-effectiveness by improving capacity in all three iterative steps: planning, implementation, and evaluation. Planning, at all levels, is based on a set of assumptions, often embodied in implicit or explicit models. These models predict how waterfowl will respond to habitat changes and management actions. Strategic planning incorporates this biological foundation (our existing "assumption set") in selecting priority areas for specific management actions.

Strategic planning will also determine the distribution of Plan resources. Whether empirical or conceptual, such models should be tested wherever the impact of the associated management decision is great and the uncertainty is significant. A strong biological foundation is as important for the design of effective conservation policies as it is for delivery of grassland easements or wetland restorations. Moreover, adaptive management can provide a framework for learning how to modify public policies more effectively.

Adaptive management and traditional research have complementary roles, and different mixes are appropriate in different regions depending upon the state of knowledge and stage of implementation.

Adaptive Management in the Prairie Habitat Joint Venture

The Prairie Habitat Joint Venture (PHJV), with its commitment to biological monitoring and assessment, has institutionalized adaptive feedback for conservation and demonstrated how investment evaluation can improve conservation success.

Improving Conservation Planning

In the 1980s, PHJV partners merged the U.S. Fish and Wildlife Service Mallard Productivity Model with an economic module developed by Ducks Unlimited Canada. By using this tool to predict duck production before and after hypothetical implementation, planners could select among suites of programs to achieve PHJV population goals. Their work resulted in the first ever biologically based conservation plan for western Canada.

In the spirit of adaptive management, a PHJV Assessment Study was then used to evaluate the effectiveness of individual treatments and test the assumptions and parameters in the Mallard Productivity Model. The model, developed mostly from studies in northern U.S. grasslands, did not predict waterfowl production rates well when planners applied it in the parklands where most Canadian habitat programs were delivered. New data collected during the assessment have since been applied to develop a simpler, multispecies, decision support system that uses wetland and land-cover characteristics to predict waterfowl densities and breeding success. This new spatially explicit production model now guides program delivery in both prairie and parkland regions. It is also helping the PHJV integrate waterfowl planning with other bird conservation initiatives and can be used to estimate potential gains from changes in public policy. A new monitoring project is now underway to further test and refine this new model. Enhanced surveys and banding, and a new system of habitat monitoring, further support PHJV planning.

Modifying Conservation Programs

Programs with disappointing results, like predator-fenced plots of nesting cover and leased nesting cover, were discontinued. Some programs were better focused. For example, payments to farmers to delay haying were restricted to the highest-density waterfowl areas or used in association with conversion of land from annual cropping to forage production. Conservation fallow programs were restricted to landscapes important for northern pintails. Nesting success was lower near wetlands and better away from edges of cover patches, leading to better targeting for restoration of perennial cover. Purposes of some programs were refined. For instance, rotational grazing systems are now used mainly to support conversion of land from annual cropping. Other actions have moved to the forefront based on evaluation results, such as promotion of fall-seeded cereal crops as alternatives to spring seeded cereals. Cost savings were identified. Once established, planted nesting cover maintained its productive capacity for at least 6 years before haying or burning was needed to rejuvenate the stand.

Managers have modified guidelines for nearly all PHJV conservation programs as a result of evaluations and delivery experience. Evaluation results have also fundamentally affected the PHJV's strategic outlook. It is clear that to sustain waterfowl populations, intensive programs must be coupled with public policy and extension efforts that result in large-scale landscape improvements.

Using Adaptive Management to Shift Interventions: Beaver Pond Management Assessment

Beaver ponds make up an important mosaic of wildlife habitat in Eastern Canada. On the assumption that management actions could improve the capacity of beaver ponds to support waterfowl, the Eastern Habitat Joint Venture (EHJV) developed a beaver pond management program to rehabilitate unproductive or abandoned beaver ponds. It included dam removal, water level manipulations, nesting structures, and poplar management. Managers expected that water manipulations and provision of nesting structures might increase waterfowl breeding pair densities and brood production. Indirect benefits were expected from poplar management when beavers re-colonized abandoned ponds, utilized the poplar as food, and restored flooded conditions.

This hypothesis was tested through the Beaver Pond Management Assessment Program (1993-97). The research compared waterfowl pair and brood densities and distributions on a series of managed and unmanaged ponds. The EHJV partners learned that intensive management of beaver ponds had little impact on waterfowl densities or brood production. The lack of natural nest cavities and low overall wetland productivity in the region resulted in low densities of pairs settling on these areas. Brood habitat seemed adequate for the numbers of ducks using the landscape.

These assessment results have greatly modified conservation of beaver pond landscapes. Given that intensive management of existing habitats appears to have limited impact, the best option for enhancing waterfowl production is to address the total amount of flooded habitat on the landscape. The EHJV now believes that sound forestry practices (including improving poplar availability) combined with beaver management (work with trappers and provincial agencies to sustain beaver populations) is a more effective, and less costly, approach. Healthy and productive beaver populations are critical to the long-term availability and distribution of wetlands in the region. Conserving adequate food resources for beaver, practicing sound forestry, and deploying nest boxes should ensure adequate nest sites for cavity-nesting birds.

Northern Pintail Action Group Advocates Accelerated Research and Management Actions

Despite record increases in May pond abundance across the U.S. northern plains and parts of prairie Canada during the 1990s, northern pintail populations did not increase nearly as strongly as other prairie-nesting dabbling ducks. Moreover, the estimated numbers of pintails in spring have decreased through each wet-dry cycle on the prairies since surveys began in 1955. Concerns among Plan partners prompted formation of an ad-hoc working group following an international pintail workshop in March 2001.

Workshop participants reached strong consensus: the single most important factor responsible for the lack of recovery with improved wetland conditions was poor nest success on the prairie breeding grounds. Poor nest success is a result of the conversion of native prairie to cropland followed by continuous annual cropping. Conversion exposes pintails to higher predation rates by an altered predator community, and the species' stubble nesting habits lead to nest losses which are due to both predation and farm machinery. Concerns also remain about reduced breeding propensity, impacts of disease, and adult hen survival during the breeding season.

In May 2003, the Plan Committee adopted the group's prospectus for a Pintail Action Group. The group will function as part of the NAWMP Science Support Team and will network with Plan habitat joint ventures, agencies, and nongovernmental organizations throughout the continent to advocate actions in support of northern pintail conservation.

The Pintail Action Group will:

- Identify needed conservation actions and the evaluations required to help improve subsequent performance.
- Serve as a forum for exchanging technical information on pintail biology and management.
- Work through joint ventures, flyway councils, and other partners to develop science and communication recommendations for pintail recovery actions.
- Help increase funding for needed work through existing partnerships.
- Report progress annually to the Plan Committee.

The Pintail Action Group recommends that Plan partners:

- Accelerate habitat conservation measures (e.g., seeding of fall cereals, cropland conversion to perennial cover, grassland protection) in prairie breeding areas at a sufficient scale to significantly reduce acreages of cultivation and spring tillage.
- Evaluate and improve the effectiveness of such programs.
- Maintain existing pintail habitats outside the prairie breeding areas.
- Support development of an adaptive harvest management framework for pintails.
- Reexamine population size and distribution and improve population-monitoring programs.
- Enhance operational banding.
- Implement additional nesting ecology studies, studies of landscape factors that attract breeding pairs, adaptive habitat management programs, studies of cross-seasonal effects, and more rigorous tests of the multiple hypotheses that could explain the pintail decline.

The Plan's Scientific Agenda

The Plan Committee has delegated leadership to the science support team (NSST) for both setting the technical agenda and overseeing its implementation. The NSST is a working group composed of biologists from federal agencies, each of the four administrative Flyways, and the individual joint ventures. Consistent with Plan Committee guidance and NSST technical advice, Plan leaders at all levels need to ensure that scientific efforts are adequately staffed, funded, and managed to support both continental learning and regional decision-making. Key areas of scientific focus should include the following:

Population research and monitoring

Significant gaps remain in basic information on the ecology, abundance, and trends of many waterfowl populations. Moreover, we need better understanding of how variation in conditions throughout life cycles affects population change of all species.

Scientific needs of habitat joint ventures

Joint ventures need to maintain or develop monitoring and assessment systems capable of discerning habitat changes over time (including Plan interventions) at appropriate spatial scales. Presently, information is lacking for an evaluation of the cumulative impact of habitat joint ventures while controlling for overall net changes in land-use. Some obvious needs include more frequent and comprehensive monitoring of land use changes in the prairie pothole region and population monitoring on the major waterfowl migration and wintering areas.

Plan partners need monitoring to estimate progress toward achieving Plan goals and to help test planning models and underlying assumptions. Where progression from population objectives to vital rate objectives is desirable, monitoring of those vital rates will also be necessary.

Joint ventures also need to develop a better understanding of how specific management actions and habitat changes affect waterfowl recruitment and survival. Similarly, Plan partners need coordinated strategies to gain insights about the effects of large-scale spatial and temporal variation in habitat conditions on waterfowl vital rates. Migration areas pose special challenges for biological assessment because of the mobility of migrating birds.

Scientific needs in support of certain species

Species joint ventures have been created for Arctic geese, sea ducks, and black ducks to address major information gaps. For other species with major knowledge gaps, such as northern pintail and scaup, the NSST will help the Plan Committee devise mechanisms to learn more about these important species. The new Northern Pintail Action Group is one recent example. It is vital that the scientific products and expertise of the species joint ventures be fully integrated with any overlapping habitat joint ventures so that new insights are incorporated quickly in the design of habitat initiatives.

Emerging scientific priorities and partnerships

Factors that could greatly affect the success of the Plan are discussed in Section III. Plan partners must enhance their collective capacity to monitor and anticipate these factors and their effects and to respond in ways that will ensure the adequacy of conservation plans. In order to meet these challenges, Plan partners must fully engage the broader scientific community within universities, cooperative wildlife research units, government agencies, and nongovernmental organizations. Many such alliances already are contributing to the Plan's scientific foundation, but the links are uneven and should be strengthened at all administrative levels. The Plan must structurally link scientific partners within the Plan—the NSST is one good example—but future partnerships will necessarily be broader and include nontraditional collaborators such as climatologists, hydrologists, resource economists, and social scientists. Increasingly, managers also require timely economic and social data in addition to ecological science support to help inform management decisions.

The Plan as a Learning Community

The Plan's adaptive approach to management will succeed only if joint ventures continue to expand their capacities for regional planning, implementation, and evaluation. More formal and more frequent cycles of planning, implementation, and evaluation at both regional and continental scales are desirable. Reporting what is learned throughout the Plan community will ensure that partners learn from one another and move forward in a coordinated and efficient way. The Plan Committee has tasked the NSST with promoting effective strategies for adaptive management among partners and for communicating successful approaches to planning and evaluation to other bird initiatives. The NSST will encourage more regular reporting and discussion of biological progress within joint ventures, among joint ventures, and between the Plan Committee and the joint ventures. But the NSST will be successful in its charge *only* if strong parallel technical committees are leading this work at the joint venture level.

Reporting what is learned throughout the Plan community will ensure that partners learn from one another and move forward in a coordinated and efficient way.

Because the Plan works continentally, nationally, regionally, and locally, adaptive management and strategic planning must also occur at multiple spatial scales. The spatial scale determines the relevant questions, challenges, learning opportunities, and the scope of possible inferences at each level. It is important to appreciate these differences while attempting to provide information relevant for decision-makers at all levels. For example, the Plan Committee requires analyses to help prioritize activities at a continental scale, while a habitat joint venture manager would be more concerned with

understanding the relationship between regional habitat variables and waterfowl vital rates. At the same time, understanding population dynamics throughout the annual cycle can help JV managers develop effective regional conservation plans and data gathered at the JV level for local decision-making will also help inform continental prioritization. Thus, managers at all levels benefit from efficient information sharing.

The Plan community is committed to improving scientific information where it is lacking and to integrating the most current and accurate science into the Plan's decision support systems.

The Plan community is committed to improving scientific information where it is lacking and to integrating the most current and accurate science into the Plan's decision support systems. The capacity of joint ventures and other implementing partners needs to be improved to provide the best possible understanding of population and landscape trends and the biological effectiveness of Plan actions. In addition, local data gathering will help guide continental priorities. Improving the cost-effectiveness of Plan actions and strengthening the scientific underpinnings of waterfowl plans are key to maintaining the Plan's leadership role in conservation.

Applying New Technologies to Improve Management: the Eastern Harlequin Duck

Improvements in satellite-radio telemetry have enabled Plan partners to gather new data on population delineation. Even if this delineation were possible using traditional banding and recapture techniques, the data would take years to obtain. As one of the first studies in anticipation of a new Sea Duck Joint Venture, Plan researchers applied the satellite radios to eastern harlequin ducks to determine affinities among breeding, molting, and wintering areas.

When this population was listed as "endangered" in Canada in 1990, managers thought that the entire eastern population breeding in Quebec, Labrador, and Newfoundland wintered in Atlantic Canada and Maine. That wintering population totaled fewer than 1,000 individuals. Using satellite radios during two field seasons (1997-98), researchers learned that harlequins breeding in northern Quebec and Labrador molt and winter in Greenland. Those breeding in the southern part of the range winter in Atlantic Canada and Maine. The understanding that there is genetic interchange between the Greenland and the North American populations and that the overall population is greater than had been thought has led to important management changes. The eastern harlequin was down-listed to a "Species of Special Concern" in Canada. Recognizing that management scope for this species extends beyond North America, cooperative research between Canada and Greenland is underway to determine the size of Greenland's breeding and wintering populations, and genetic sampling is ongoing to determine the degree of interchange between Greenland and North America.

VI. Challenges

The cost of conserving all North American waterfowl and their habitats will be many billions of dollars, far beyond the means of traditional waterfowl conservation resources. Funding increases for agencies and nongovernment organizations are needed but are not the complete remedy. It is essential to use the Plan's broad partnerships to reach out to other interests, integrating the needs of waterfowl with other sociologically desired outcomes like clean water, clean air, and sustainable food, fiber, and energy. In this way, waterfowl conservation funds can be leveraged with the billions of dollars expended annually for these human needs. Plan partners can help shape future policies and programs through the Plan's strong scientific foundation—specifically the ability to determine the type, amount, and location of conservation actions required to achieve desired population objectives.

The challenge for the Plan community is three-fold: (1) to direct available funds where they can be used most effectively, (2) to capture the potential waterfowl benefits of a host of related federal, state, and provincial programs, and (3) to better inform those making management decisions by improving the scientific knowledge necessary to achieve Plan goals. To address these challenges, Plan community leaders on the Plan Committee, on joint venture management boards, in federal, state and provincial governments, and in private institutions should:

- Strive to acquire resources to realize the Plan's visions and accomplish the recommendations in the 2004 Plan.
- Foster appropriate links with other governmental and nongovernmental groups that affect waterfowl habitats in priority areas of North America and develop effective liaisons across related sectors of the economy.
- Foster appropriate links with areas outside of North America that are important to some species of North American waterfowl (e.g., Russia, Greenland, Latin America, and the Caribbean).
- Recognize, monitor, and address emerging sociological, economic, and environmental trends that affect waterfowl and seek new cooperative opportunities for waterfowl conservation.
- Address the persistent deficiencies in breeding habitat in the mid-continent prairie region.
- Address conservation needs in the boreal forest, portions of which have emerged as a high priority area of concern.
- Complete and implement Mexico's *National Strategy for the Management of Waterfowl and their Habitats*.

At the technical level, joint ventures, the science support team, and other Plan partners should:

- Identify significant limiting factors for species or populations of waterfowl exhibiting long-term population declines.
- Develop and use adaptive processes of biologically based planning and evaluation to ensure that habitat work targets priority conservation needs of waterfowl, wherever they occur.
- Improve our knowledge of the links between habitat dynamics and waterfowl population responses to design and deliver more effective waterfowl conservation programs and promote supportive public policies.

The Plan community needs to consider whether the Plan's present organizational "form" matches its desired future "function" as detailed in this document and should:

- ➢ Examine Plan Committee roles and responsibilities, followed by Plan Committee structure and membership.
- ➢ Strengthen scientific and operational links and coordination among habitat joint ventures; between habitat and species joint ventures; and among the Plan Committee, flyways, the science support team, and all the joint ventures.

NAWMP Progress Assessment 2005-2006

To ensure that the Plan is fulfilling its purpose, the Plan Committee, with the support of the science support team, and in cooperation with the species and habitat joint ventures, will undertake a comprehensive assessment of progress toward Plan goals. This assessment will include an update of regional habitat objectives based on evaluation results, identification of additional science support needs, and a refined estimate of the resources needed to accomplish Plan objectives. The assessment will also solidify strategic biological planning, implementation, and evaluation throughout the Plan community and renew the working relationships between the Plan Committee and the joint ventures.

It is vital that all the major Plan stakeholders participate in some manner in this review. The Plan Committee will provide international leadership in this endeavor with technical support from its science support team. The joint ventures, in particular their technical committees, and associated flyway councils should also be full participants in the work. The scope and process for this assessment was elaborated in meetings of Plan stakeholders. The assessment began in 2005, with a final report for the Plan community by the end of 2006.

The results of this comprehensive assessment will help the Plan Committee and its partners set the stage for the 2009 Update, helping to clarify future priority needs. The results should also provide powerful incentive for financial supporters of the Plan to continue their aid.

VII. Looking Forward

Partners in the North American Waterfowl Management Plan are on a proven path for conservation success. Conservation at landscape scales that is supported by broad partnerships and guided by sound science has achieved more in the past 18 years than the Plan's founders could have imagined.

There is much to celebrate about these unprecedented accomplishments. Yet, old challenges, like improving duck recruitment in the prairie pothole region, persist, and new challenges, like sustaining waterfowl in the boreal forest, and initiating a national waterfowl management program in Mexico, are ahead. Circumstances have changed, but waterfowl today face an array of pressures that are just as imposing as those faced in 1986, at the inception of the Plan.

With this 2004 Plan, the Plan community reinforces its unwavering commitment to waterfowl conservation and particularly to the central role of science in guiding Plan actions. The adaptive processes advocated here offer a clear path to success, even in the face of ecological and sociological uncertainties.

Our continent's spectacular waterfowl have a bright future if we continue to strive on their behalf. We have a solid Plan. We have a history of achievement. A future of waterfowl in abundance is now ours to secure.

Appendix A: Model-based Strategic Planning and Evaluation for Waterfowl Conservation

The fundamental premise of the North American Waterfowl Management Plan is that the cumulative effect of many local and regional conservation actions will result in dynamic but sustainable landscapes capable of providing for the physiological needs of waterfowl at prescribed population levels. As with all wildlife conservation, perennial challenges for Plan partners are to synthesize available scientific data and expert opinion into models that predict the demographic effects of natural environmental variation and management interventions; to apply these models to geospatial habitat and environmental databases and develop habitat conservation objectives and criteria for the prescription of management actions; and to evaluate model assumptions to improve predictions and conservation strategies. These challenges are most effectively addressed through diligent application of the planning, implementation, and evaluation phases of an iterative conservation process.

The Values of Strategic Planning for Habitat Conservation

Strategic planning guides the delivery of conservation at multiple scales. It is founded on the understanding that every part of a landscape has a unique potential to affect populations and a unique cost of conservation to management agencies and society. Collectively, biological benefits and costs determine management efficiency. The essence of strategic management is to attain the greatest possible benefit at the lowest cost. This approach demands that conservation partners collaborate and pursue a preestablished design of predicted sustainability. Consequently, strategic conservation planning has the greatest value when managers are willing and able to prioritize management alternatives. Planning increases the likelihood of making cost effective decisions by avoiding misapplications of management treatments and investments in areas with limited potential to affect populations. In this fashion, spatial planning represents biological quality assurance and may increase the credibility of habitat managers.

The most effective strategic conservation plans are continually refined and updated. They provide useful guidance to multiple audiences that range from the highest-level program administrators to field managers who make day-to-day decisions about where and how to deliver management.

In simple terms, strategic conservation planning for habitat management involves geographic prioritization at continental, regional, and local scales. At its coarsest scale, strategic planning identifies regions of the continent that are most important to the maintenance or recovery of populations of priority species (see Appendix B). Because regions are heterogeneous, regional strategic planning seeks to identify landscapes that are most important to priority species. Within these priority landscapes, habitat managers face choices at the project scale about what sites to secure, restore, or enhance, and managers must select from a suite of management options with differing impacts on different species. At each scale, planning benefits from the use of a systematic process that relates priority birds to their habitats.

In general, the reliability of planning predictions will improve as spatial scales, and the biological information planning that it is based on, become more refined. This refinement and increased reliability usually comes with added costs which must be weighed against the increased benefits.

Inasmuch as they affect habitat management decisions by partners, joint venture implementation plans are examples of regional strategic conservation plans. A joint venture implementation plan should provide biological input into collective and individual management decision processes used by partners, including:

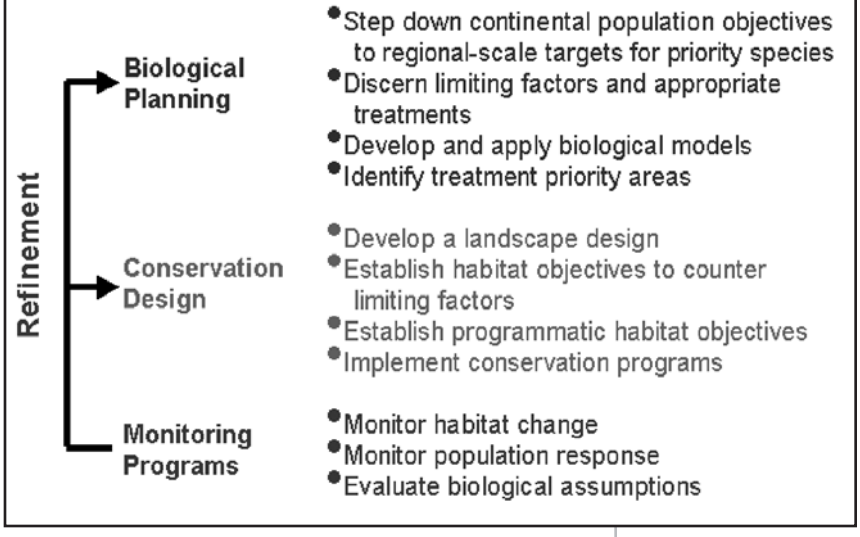
(1) where to deliver habitat conservation to maximize population impacts;

(2) what form management should take at a site given habitat condition and landscape structure; and

(3) how much habitat is required to attain joint venture population objectives.

The scope of information gained should include (1) landscape designs that embrace similarities and differences in the ways a joint venture's priority species relate to their habitat, local site characteristics, and management activities, and (2) explicit goals for habitat associations that are adequate to meet population objectives for these species. These core elements of our biologically driven conservation strategy are the foundation for efficiently delivering the diverse programs that are the implementation tools of joint ventures and their partners (Fig. A-1).

Figure A-1. Developing and refining a biologically driven conservation strategy.



Because strategic plans with these attributes include a geographic component, they are referred to as spatially explicit plans. Spatially explicit conservation plans are powerful tools for building and maintaining partnerships and for conveying the goals and strategies of those partnerships. They are useful because they unite partners in a common set of approaches to direct conservation in priority areas. This unity may be most effectively achieved when many members of the partnership participate in developing a community strategy for conservation.

Model-based Planning

Biological models that relate populations of priority species to their habitats and habitat management actions form the basis of regional biologically driven conservation strategies. Assembling models at the start of the strategic planning process accomplishes two things:

- explicitly identifies the assumptions underlying the management decision process, and thus enables testing the most critical assumptions as hypotheses through research and evaluation; and
- defines the spatial data (the data themes and resolution) required to develop planning tools. Since data acquisition often represents a large proportion of the total cost of planning, only spatial data required for model application should be acquired.

Most models will be specific to waterfowl species and to management treatments (e.g., wetland protection, grassland restoration, reforestation). This specificity is necessary because different species may relate to habitats and landscapes uniquely, and because varying costs and desired outcomes underlie the application of individual management practices. A useful early step in the strategic planning process is to develop a matrix of priority species ("umbrella" or indicator species, if possible) and management treatments, shading those matrix cells that correspond to an appropriate treatment for a species. Models may then be assembled for each shaded cell in the matrix.

The Nature of Biological Models

Models are simply measurable statements about our understanding of how species relate to their habitats at site and landscape scales. There are two basic types of models: empirical and conceptual. Empirical models are mathematical or statistical statements derived from research or monitoring data (Fig. A-2). Empirical models that are used to make explicit predictions about the magnitude of management population impacts are particularly desirable when working with costly management practices. In this situation, it may be warranted to develop new empirical models, especially where a high degree of uncertainty exists about waterfowl-habitat relationships. Because the time and cost of developing new empirical models may be significant, existing empirical models believed to be reliable should be used, with a commitment to evaluate their predictions. Unfortunately, useful preexisting empirical models for planning at regional scales are rare. This rarity is because researchers have often incorporated model parameters that can not be measured from data available for regional-scale planning (such as satellite imagery), or have developed models from data collected at local scales that fail to incorporate the full range of regional environmental conditions. The strategic planning process is one way to allow managers to request researchers to develop models specific to their needs.

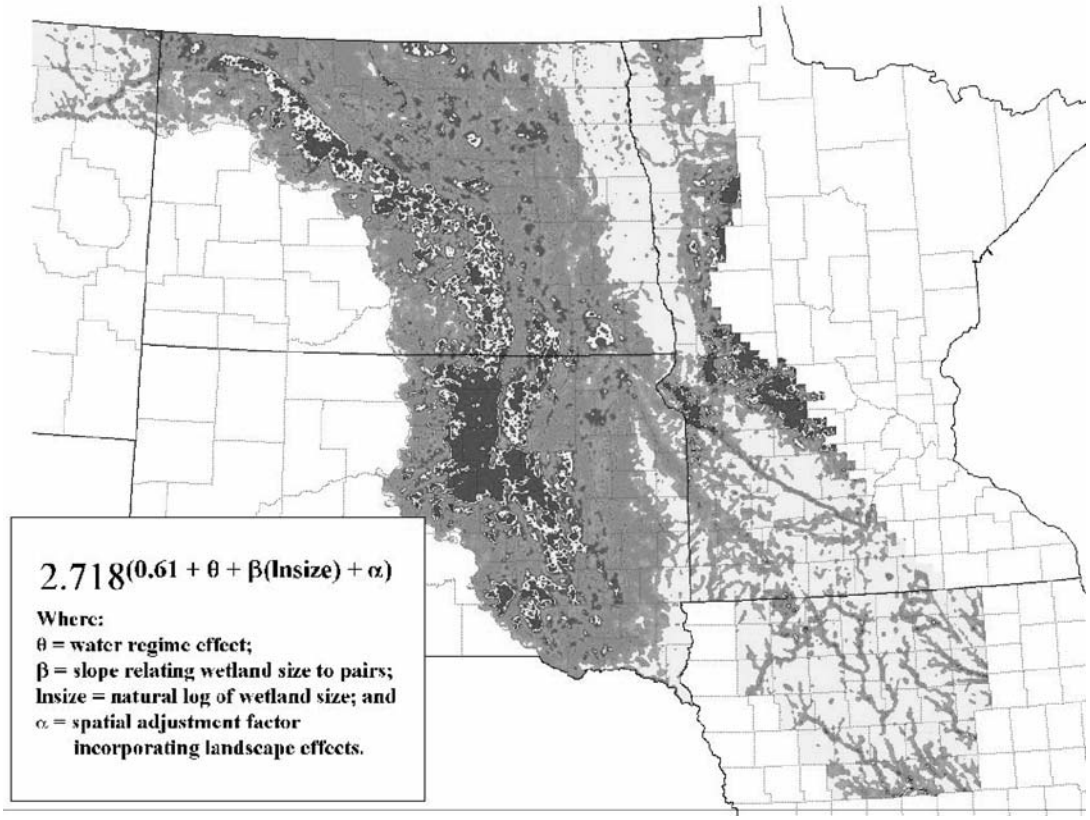
In contrast to empirical models, conceptual models are general descriptive statements about species-habitat relationships that often, but not necessarily, include empirically based parameter estimates (Fig. A-3). Such models draw on an awareness of past research results but are constructed from a general understanding of how habitats affect a species. Conceptual models are fundamentally expert driven, and the planning process moves forward without waiting for the results from new research. This approach has been widely applied in conservation planning because it enables managers to proceed with conservation implementation in the face of imperfect information but with the best biological guidance available. Systematically applying an informed set of assumptions about bird-habitat relationships often results in better management decisions than the haphazard application of management treatments.

Conceptual models are often fast and inexpensive to produce and apply. On the other hand, their assumptions and parameter estimates must be evaluated—particularly those that are most tenuous and may cause managers to expend funds ineffectively or overlook management opportunities. Data are required to evaluate model assumptions and to assess progress toward population goals, even though they were not necessary for planning.

A lack of empirical models has sometimes led joint ventures to defer planning. The fallacy in this approach is that while empirical models are being developed—usually over a period of several to many years—management is proceeding without formal biological guidance. A satisfactory alternative is to start the planning process by using conceptual models.

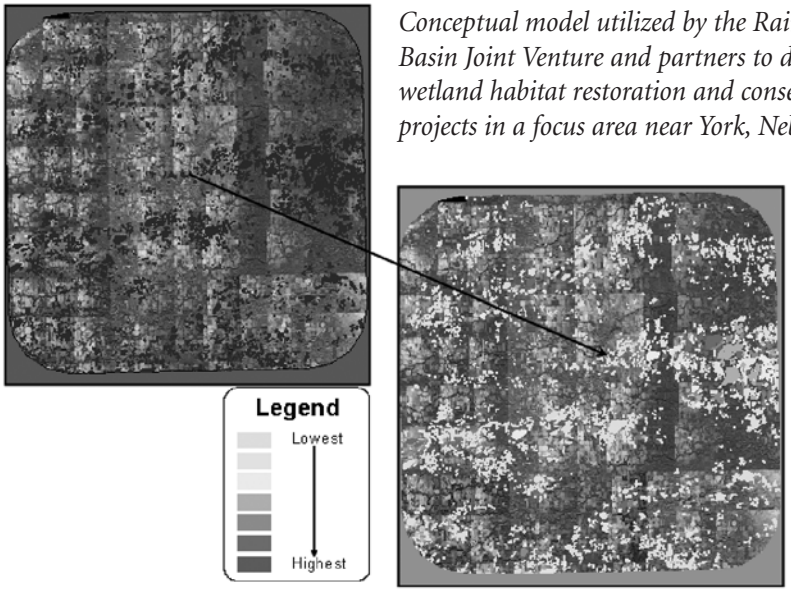
Whether planning is based on empirical or conceptual models, it requires a commitment to monitoring and assessment in order to ascertain if the models are providing accurate predictions. Planning is part of the adaptive management iterative cycle; consequently, planning without evaluation and/or continuous plan updating breaks this cycle and diminishes management effectiveness.

Figure A-2. Empirical model-based predictions of nesting hen access to upland habitats



Important treatments among Prairie Pothole Joint Venture partners are the protection and restoration of grasslands for upland nesting waterfowl. Cost effective management of grasslands for waterfowl improves with an understanding of the distribution of nesting hens among landscapes that make up the joint venture. This map, commonly referred to as a "thunderstorm" map, shows the predicted combined number of mallard, northern pintail, gadwall, northern shoveler, and blue-winged teal hens that could nest within each 40 acre unit of the joint venture. It is based on a suite of empirical models that predicts the number of pairs of these species that will occur on average in each wetland in the joint venture, as well as empirical estimates of how far hens will travel from a wetland to an upland nest site. An example of a model predicting mallard pairs per wetland is shown. These models were developed from monitoring data of the distribution and abundance of waterfowl pairs collected across the joint venture each year. The warmer colors on the map indicate areas where a higher relative number of nesting hens may benefit from the same management expenditure. Other considerations aside, conserving grasslands for waterfowl in these areas will be more cost-effective than elsewhere.

Figure A-3. Conceptual model-based assessment of relative wetland restoration benefits for waterfowl.



Conceptual model utilized by the Rainwater Basin Joint Venture and partners to direct wetland habitat restoration and conservation projects in a focus area near York, Nebraska.

The Rainwater Basin Joint Venture recognized that a new planning paradigm was required to direct conservation actions. The goal was to target cost effective conservation actions at wetlands that provided the greatest benefit to migratory waterfowl. Because of the lack of research and technical information concerning waterfowl use of migration habitats, an empirical model was not a viable option. Natural resource professionals developed a conceptual model based on their best working knowledge of the Rainwater Basin. Several factors were identified to assess the potential of wetlands for migrating waterfowl, including wetland density, disturbance factors, proximity to existing managed wetlands, proximity to other significant staging and foraging areas, and risk. Researchers applied these metrics to develop a spatially explicit decision tool that identifies wetlands with the greatest waterfowl potential. Geographic information system technology was also used to match eligible landowners with existing conservation programs that provide options for wetland protection, enhancement, and restoration. Research is ongoing in the Rainwater Basin to improve this model and to evaluate model assumptions.

Developing a Landscape Design

Priority waterfowl species generally exhibit differences in the ways they relate to sites, landscapes, and management actions across a joint venture. Furthermore, many joint ventures have adopted a goal of the integrated conservation of all birds. Similarities and differences in the ways priority species distribute themselves makes spatially explicit biological planning and strategic landscape design essential for efficient attainment of a joint venture's population goals.

Ideally, joint ventures should pursue landscape designs that maximize aggregate species benefits without compromising the value of management to targeted species. For example, a joint venture may seek to design landscapes that provide high quality habitat for grassland nongame birds at the same time it pursues the greatest potential benefits for upland nesting waterfowl. In reality, it is rarely if ever possible to provide habitat in one location that maximizes benefits for the full suite of joint venture priority species.

Developing a landscape design requires integrating treatment priority areas for key species (that are identified in the biological planning process) to account for similarities in habitat use and to reconcile management conflicts among species to the satisfaction of the range of joint venture partners. Although an infinite number of landscape designs are possible, strategic landscape designs seek to accommodate the population goals of joint ventures within the smallest amount of habitat at the lowest possible cost.

Maps as Spatially Explicit Decision Support Tools — Guidance to Field Managers

Accomplishing the goals of the Plan requires that joint ventures develop partnerships with field-level habitat managers. Joint ventures can benefit/contribute to this partnership with maps that are useful for targeting management actions to achieve conservation objectives. Maps made by applying biological models to spatial data are spatially explicit decision support tools and are critical products of regional-scale strategic planning. Nevertheless, it is important to emphasize that the quality of biological models used to design landscapes and create maps determine the ultimate value of planning to management.

Maps are particularly useful communication tools for complex biological information because they enable managers to view the effects of three or more variables in species-habitat relationships in two-dimensional space.

Setting Habitat Objectives and Assessing Accomplishments

Conserving, restoring, or managing habitats for one species will inevitably have either a positive or adverse effect on other species. Thus, calculating habitat objectives for an individual species is impractical under an overarching goal of conserving populations of multiple species. Despite this complexity, being able to determine and defend the amount of habitat necessary to attain joint venture population goals and national/continental population objectives and being able to defend those figures will be increasingly important as human demands for space and resources increase. Instead of calculating habitat objectives for individual priority species, joint venture habitat objectives should be calculated for habitat associations (e.g., emergent wetlands, bottomland hardwood forest, or grasslands). These habitat objectives will be based on the strategic landscape design that incorporates our understanding of similarities and differences in how priority species relate to sites, landscapes, and management actions.

In addition to enabling development of landscape designs and explicit habitat objectives for the suite of priority species, biological models also enable assessment of management accomplishments in terms of the predicted consequences of individual management actions (e.g., a wetland restoration) for regional population carrying capacity. An accounting system based on population impacts helps partners move toward the ultimate goal of the Plan, the greatest population impacts at the lowest possible cost.

Lastly, it is important to recognize that population and habitat objectives are developed at different scales. Plan population objectives are established at a continental scale and are stepped-down to joint ventures in the biological planning process. Habitat objectives, because they are based on landscape designs founded on individual species-habitat relations that vary among ecoregions and seasons, are developed at a ecoregional or joint venture scale which then can be aggregated into national or continental objectives. Consequently, the strategic growth of national and continental habitat conservation initiatives is inseparably linked to a strong joint venture strategic planning capability.

Extending the Reach of Waterfowl Conservation

By applying these same principles of biological planning and landscape design to other environmental and socioeconomic functions of habitats, such as water quality enhancement, carbon sequestration, or flood-damage reduction, joint ventures may be able to effectively extend their reach to nontraditional partners that often greatly affect our priority landscapes. By doing so it may be possible to incorporate the waterfowl habitat delivery potential of an array of government programs that seek these other benefits of habitats. Achieving this possibility will require that joint ventures provide potential partners with tools to help them help waterfowl. These tools include spatially explicit landscape designs and habitat objectives that are paired with credible, biologically driven conservation strategies.

Coping with Uncertainty in Biological Models

One advantage of model-based strategic planning is that it explicitly describes management decision processes and assumptions. After years of monitoring and research on North American waterfowl—the most studied group of wildlife in the world—there are still some fundamental gaps in the biological foundation. Model-based planning acts as a framework for identifying and filling these gaps because it is a systematic application of the biological foundation.

On the other hand, every biological model, like every habitat management decision, simplifies and distorts waterfowl-habitat relationships. Uncertainty is and will remain a prevalent facet of the management and conservation of biological systems. In the face of making decisions when the outcomes are uncertain, wildlife conservation planners and managers have only two options. The first is to defer decisions until understanding of the managed system improves. Continued and possibly escalating human-caused and naturally occurring change in biological systems—and the likelihood that research will offer no short-term solution to management dilemmas—are factors which render this option largely unacceptable and risk irreparable damage to the wildlife resource. The second, more prudent response is to base conservation resource allocations on current scientific understanding supplemented with educated guesses. Managers should proceed with conservation programs while maintaining the explicit goal of reducing uncertainties and improving future conservation strategies. The use of such conceptual models may be very useful in the planning process; however, it is not a long-term solution for the problem of lack of empirical data. Monitoring and empirical data are ultimately needed in order to assess the success or failure of management actions.

There are several types of uncertainty that impact the ability of waterfowl managers to make optimal resource allocation decisions while implementing the Plan. First, planners are faced with an incomplete understanding of ecological processes that determine the influence of habitat, climate, and human disturbance (e.g., hunting pressure) on waterfowl survival and recruitment. Waterfowl harvest managers have termed this "structural uncertainty." There is structural uncertainty at every level of the strategic planning process. An example is the current lack of knowledge about the nature and form of density-dependence in waterfowl populations. A basic tenet of equilibrium theory is that at any given time, a given habitat has a population threshold, often termed its "carrying capacity." When the population climbs above that carrying capacity, survival and/or recruitment are negatively affected. Presently, waterfowl managers have only a rudimentary understanding of the carrying capacity of individual habitat blocks. They know even less about how habitat carrying capacity, waterfowl abundance, and climatic forces interact to influence vital rates at regional and population-wide scales. This lack of information obviously compromises the manager's ability to provide an adequate area and distribution of habitats to minimize density dependent effects.

A second source of uncertainty in habitat conservation delivery has been characterized as "incomplete management control." Given the complexity of habitats utilized by waterfowl, and the myriad of site-specific geomorphologic and climatologic factors that influence the type and quality of habitats, it is impossible for managers to predict with certainty the outcome of particular habitat management activities. As a result, even if managers had perfect knowledge of the optimal habitat type and structure for a specific locale, achieving this desired result would remain as much an art as an exact science. Evaluations of specific management treatments broadly replicated in space and time will continue to enhance the capability to predict the habitat impacts of site-specific management actions. Unfortunately, evaluations are unlikely to eliminate the element of surprise in managing waterfowl habitats.

Finally, resource limitations frequently mean that managers must sample waterfowl populations and habitat resources and estimate important parameters rather than directly measure these quantities. Uncertainty surrounding parameter estimates can not only hamper the effectiveness of model-based conservation decisions, but it can also impede efforts to reduce structural uncertainties and to improve predictions about the effects of management actions.

Reducing Uncertainty Through Implementation and Evaluation

Only by explicitly stating assumptions made in the planning process can managers and planners devise robust conservation strategies and mechanisms. To promote robust conservation strategies, planners and managers need to assess the potential influence of the uncertainties underlying their assumptions and place a high priority on those uncertainties that have potentially great implications.

Ultimately, managers assess the validity of the assumptions made during the planning process so they can confirm or improve their conservation strategies. There are three broad approaches to evaluating assumptions, and each has advantages in specific contexts.

The first approach to reducing uncertainty is largely passive. It may be most useful in learning about broad-scale ecological processes that affect the distribution and availability of habitats and, ultimately, waterfowl survival and recruitment. This approach is passive in that it relies on informative, natural variation in habitat availability and climatic conditions at large scales. Natural processes typically have the potential to affect waterfowl at broader spatial scales and with greater frequency than habitat changes brought about by intensive conservation effort. An exception might be rapid, large-scale landscape changes induced by governmental policies such as agricultural land conservation policies.

Managers need to take advantage of large-scale, natural or human-induced variations to better understand how waterfowl respond to their environment. Using this passive approach, managers can propose a suite of alternative models which codify and encompass the range of some important management uncertainty. They then use monitoring programs to track changes in waterfowl demographics as well as pertinent habitat and environmental parameters. As model predictions are compared with observations, managers can evaluate the suitability of their competing models. Alternatively, a single model might be developed to best summarize current understanding, and the results of monitoring programs would be used to adjust this single best model over time.

The second approach views the process of management itself to reduce planning uncertainties with active experimentation. This approach may be most useful to evaluate either uncertainties associated with a particular management treatment or to a suite of treatments applied to a landscape. Managers proceed with habitat conservation with the dual objectives of meeting conservation targets and reducing uncertainty to improve future decisions. Again, a model suite that incorporates the range of some important uncertainty is necessary, as are population and environmental monitoring programs to measure response to habitat manipulations.

Lastly, directed research, as a third approach, will continue to be an important means of testing planning assumptions and reducing uncertainties. Both of the first two approaches are interrelated with, and dependent upon, directed research. It is likely that both retrospective analyses and observational studies will contribute to the development of useful planning models and to the specification of monitoring protocols. Where lack of baseline data inhibits the development of models for conservation planning, directed studies may be the most efficient means to develop basic life history, range and movement, resource availability, and resource utilization databases. In addition, focused research may be the most practical means to parameterize conceptual models in order to develop more useful empirical models of habitat-population interactions.

Summary

The fundamental challenge facing waterfowl conservation planners is to develop cohesive regional conservation strategies that will lead to achievement of the Plan's waterfowl population objectives. This challenge is most effectively addressed with iterative cycles of planning, implementation, and evaluation throughout the conservation delivery process. As joint ventures have matured, they have increasingly invested both in strategic planning predicated on reliable biological information and in improving the quality of biological information through monitoring, evaluation, and research.

Biologically driven strategic conservation involves the development and application of empirical or conceptual models that describe waterfowl response to landscape conditions. Model-based biological planning is the foundation for developing efficient landscape designs that incorporate similarities and differences in the ways multiple priority species relate to habitats and management. Objectives for habitat conservation that can adequately support regional waterfowl population levels needed to attain continental population objectives may be developed from these landscape designs.

Models are imperfect representations of the processes that influence parameters of interest (e.g., bird abundance). Biological assumptions must be identified and incorporated into models in a manner that facilitates tests of their validity. As the results of evaluations become available, planning models may be adjusted to reflect new understanding and conservation strategies revised based on improved model predictions. Where multiple alternative models have been described, conservation strategies can be adjusted to reflect growing confidence in a particular model or subset of models, and the cycle of planning, implementing, and evaluating repeats. The complexity of ecological systems and the dynamic nature of migratory waterfowl and their habitats necessitates long-term perspective and institutional patience as managers pursue an improved biological basis for waterfowl habitat conservation actions.

Appendix B: Species Prioritization Analysis

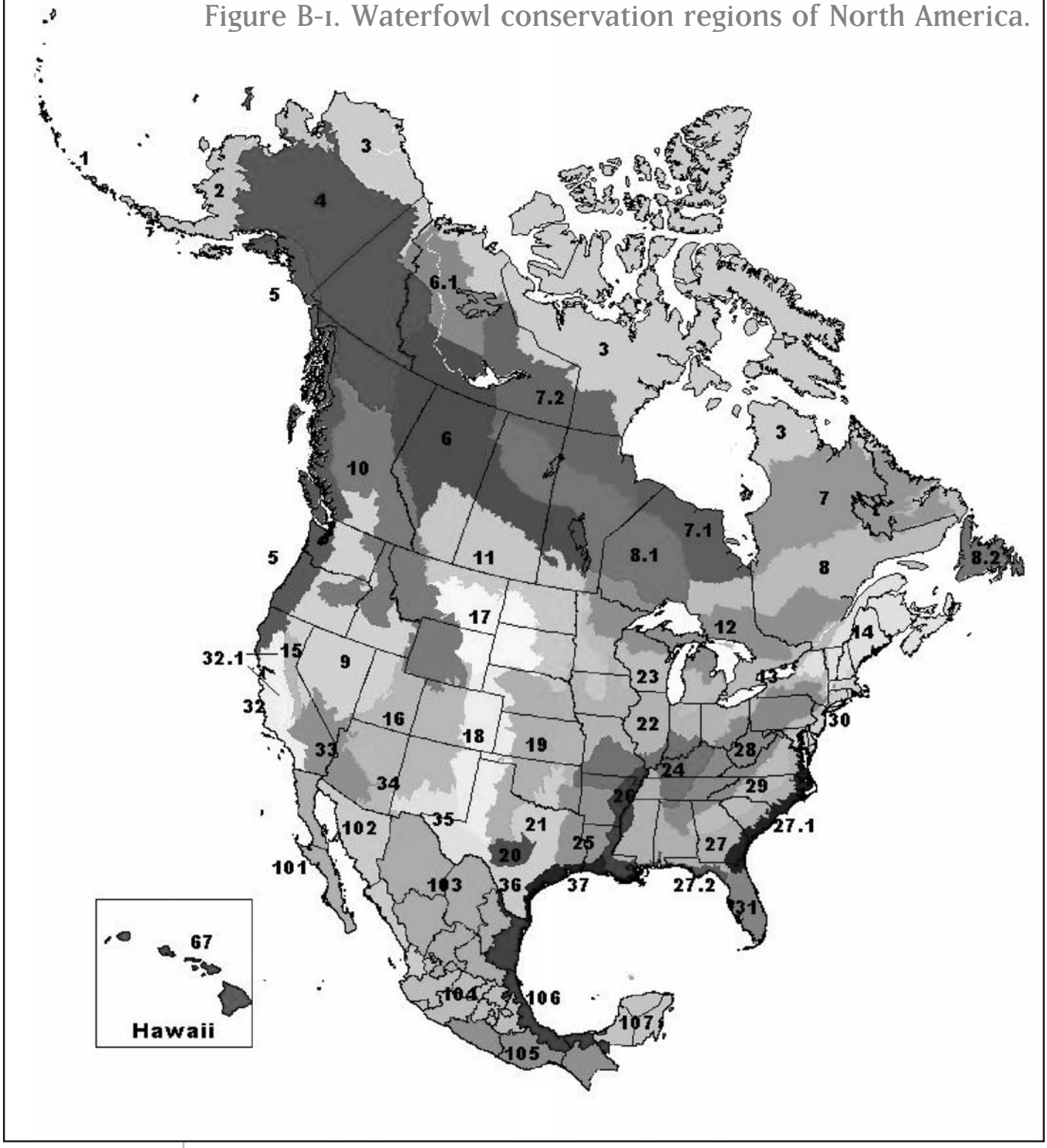
Species prioritization has recently been the subject of considerable attention and vigorous debate. At its core, the selection of priority species is a subjective process based on the relative values stakeholders place on species. Still, prioritization may provide useful programmatic guidance at regional and continental scales when most stakeholders agree on species' relative values.

Plan partners, including the North American Waterfowl Management Plan Science Support Team (NSST), joint ventures, and biologists from Canada, Mexico, and the United States, have prioritized species based on the reasons that North Americans value waterfowl: socioeconomic importance and population trend or vulnerability to population decline. These criteria stem from a tradition of waterfowl hunting, which requires that those species common enough to support a significant sport or subsistence harvest remain abundant and a societal ethic that does not casually accept the extirpation or extinction of species.

Species priorities for the Plan are a necessary precursor to the strategic planning that underwrites joint venture implementation plans (see Appendix A). To be most useful, priorities must be identified at continental and regional scales. At regional scales, they should conform to the geographic units that are used for planning. The NSST believes that planning and conservation implementation are most efficient when tailored to ecological regions with relatively homogeneous waterfowl communities, habitats, species-habitat relationships, and threats to habitats. Consequently, we modified ecological units known as "Bird Conservation Regions" to better reflect the abundance and diversity of waterfowl across North America. These "waterfowl conservation regions" (WCRs) are the Plan's geographic units for prioritization at the regional scale. Waterfowl conservation regions cover the continent, yet they are smaller than flyways and most joint ventures, and they are more homogeneous than flyway states and most joint ventures, making them more tractable planning units (Figure B-1).

Despite these advantages of using WCRs, they are not perfect for prioritization or for depicting areas of critical importance to continental waterfowl populations. In more arid parts of the continent, there can be considerable heterogeneity among landscapes and particularly within WRCs in more arid parts of the continent. The Plan Committee and the NSST anticipate that joint venture strategic planning will account for this heterogeneity, and when more spatially refined information is available, it should always take precedence over the coarse, continental-scale assessment reported in Appendix A. The Plan community, represented by the NSST, will report these improvements in regular updates of prioritization products as one aspect of fulfilling the promise of strengthening the biological foundation for waterfowl conservation.

Figure B-1. Waterfowl conservation regions of North America.



Prioritization Methods

Continental Species Prioritization

For some species, long-term population trends and historical harvest data do not tell the whole story in assessing species priority. Gadwalls are an example. An increasing trend since the 1970s and a moderate harvest importance identify gadwalls as a Moderate continental priority for the Plan. Yet beginning in 1995, the harvest of gadwalls nearly doubled that of the previous several years, and breeding populations have declined from nearly 4 million in 1997 to 2.2 million in 2002. Gadwall breeding populations are tied to the prairie pothole region—they do not "over fly" to the north during drought years in the region. It is unknown if this declining trend will persist or is just a "bump in the road" for what has been a waterfowl conservation "bright spot." Nevertheless, the combination of deteriorating habitat conditions across the prairie pothole region and sustained high harvest warrants close scrutiny for this species in the future. This fluctuation underscores the need for the Plan community to regularly update species and geographic priorities.

Ducks

Continental prioritization of ducks is based on two factors: continental population trend and combined continental harvest data. Population trends (1970-2002) were assessed by using data from the Waterfowl Breeding Population and Habitat Survey (WBPHS) for the full period of record. Expert opinion determined population trend for species that are poorly surveyed by the WBPHS survey (e.g., sea ducks). Ultimately, categories of population trend were defined as *Increasing*, *Stable*, *Unknown,* or *Decreasing*—with Unknown and Decreasing trends weighted equally for prioritization.

Data from the U.S. Fish and Wildlife Service (USFWS) Waterfowl Parts Survey, 1980-99 were used to estimate average annual sport harvest for the United States. The Canadian Wildlife Service (CWS) provided harvest data for Canada. Mexican sport harvest was assumed to be inconsequential to continental waterfowl populations.[3] Finally, a variety of short-term surveys helped estimate aboriginal harvest of various species and the Greenland harvest of king and common eiders. Using these data, we estimated the proportion each species represented of the overall mean annual continental sport and subsistence harvest. A high harvest species represented greater than 15% of the overall mean annual harvest (i.e., mallards). A moderate harvest species represented 1-14% of the mean annual harvest, and low harvest species made up less than 1%.

Continental priority for ducks was assigned by using the following matrix and is listed for each species in Table B-1 (p. 57).

Continental Duck Species Priority

	Population Trend			
Importance in Harvest	Decreasing	Unknown	Stable	Increasing
High	**Highest**	**Highest**	**High**	**Mod. High**
Moderate	**High**	**High**	**Mod. High**	**Moderate**
Low	**Mod. High**	**Mod. High**	**Moderate**	**Mod. Low**

3 Kramer et al., 1995, Waterfowl Harvest and Hunter Activity in Mexico, Transactions of the 60th North American Wildlife and Natural Resource Conference.

Geese and Swans

Unlike ducks, for most managed populations of geese and swans, explicit population objectives have been established. Moreover, intensive management of goose populations tends to ensure that increasing populations of geese that are above objective levels are more liberally harvested than declining or stable populations that are at or below objective size. Consequently, for geese and swans continental prioritization was based on a matrix of population trend (1993-2002) and deviation from Plan population objective (2000-2002) as follows. The results are reported in Table B-1 (p. 57).

Continental Goose and Swan Species Priority

	Population Trend			
Population Size Relative to Objective	Decreasing	Unknown	Stable	Increasing
Below	**Highest**	**Highest**	**High**	**Mod. High**
Unknown	**Highest**	**Expert Opinion**	**Mod. High**	**Moderate**
At Objective	**High**	**Mod. High**	**Moderate**	**Mod. Low**
Above	**Moderate**	**Mod. Low**	**Mod. Low**	**Expert Opinion**

Table B-1. Derivation of continental priorities for North American ducks, geese, and swans. AOU = American Ornithologists Union.

	Trend 1970-2003	DS[a]	Regular Harvest 1980-1999	Subsistence Harvest[b]	% Total Harvest	Harvest Importance	Continental Priority
Duck Species							
Mallard	Stable	a	4,623,156	100,000	35.3	High	**High**
American black duck	Decreasing	a	439,955	30,000	3.5	Moderate	**High**
Lesser scaup	Decreasing	a	383,513	14,000	3	Moderate	**High**
Northern pintail	Decreasing	a	594,799	42,000	4.8	Moderate	**High**
Common eider	Decreasing	c	51,947	156,920c	1.6	Moderate	**High**
Blue-winged and cinnamon teal	Stable	a	741,007	12,000	5.6	Moderate	**Mod High**
American wigeon	Stable	a	645,443	7,000	4.9	Moderate	**Mod High**
Canvasback	Stable	a	72,101	2,000[d]	0.6	Low	**Mod High**
Redhead	Stable	a	144,470	4,000	1.1	Moderate	**Mod High**
Common goldeneye	Stable	c	131,075	13,634	1	Moderate	**Mod High**
Long-tailed duck	Decreasing	c	30,560	16,341	0.4	Low	**Mod High**
King eider	Decreasing	c	2,036	27,469[e]	0	Low	**Mod High**
Steller's eider	Decreasing	c	91	270	0	Low	**Mod High/ *High*[f1, g]**
Spectacled eider	Decreasing	c	0	247	0	Low	**Mod High/ *High*[f1, g]**
Black scoter	Decreasing	c	19,099	8,228	0.2	Low	**Mod High**
White-winged scoter	Decreasing	c	28,205	2,954	0.2	Low	**Mod High**
Surf scoter	Decreasing	c	32,923	831	0.3	Low	**Mod High**
Muscovy duck	Decreasing	d	0	Not estimated	0	Low	**Mod High/ *High*[f2, g]**
Masked duck	Unknown	d	0	Not estimated	0	Low	**Mod *High*[g]**
Green-winged teal	Increasing	a	1,386,215	30,000	10.6	Moderate	**Moderate**
Wood duck	Increasing	b	1,203,660	15,000	9.1	Moderate	**Moderate**
Gadwall	Increasing	a	853,041	7,000	6.4	Moderate	**Moderate**
Northern shoveler	Increasing	a	373,964	4,000	2.8	Moderate	**Moderate**
Ring-necked duck	Increasing	a	506,049	18,000	3.9	Moderate	**Moderate**
Greater scaup	Stable	a	82,317	3,000	0.6	Low	**Moderate**
Bufflehead	Increasing	a	168,682	7,546	1.3	Moderate	**Moderate**
Western Barrow's goldeneye	Stable	c	8,318	884	0.1	Low	**Moderate**
Eastern Barrow's goldeneye	Stable	c	3,338	355	0	Low	**Moderate/ *High*[h]**
Western harlequin duck	Stable	c	1,898	1,032	0	Low	**Moderate**
Eastern harlequin duck	Stable	c	2,183	1,186	0	Low	**Moderate/ *High*[h]**
Mottled duck	Stable	e	78,027	0	0.6	Low	**Moderate**
Hawaiian duck	Stable	f	0	0	0	Low	**Moderate/ *High*[f1, g]**
Laysan duck	Stable	f	0	0	0	Low	**Moderate/ *High*[f1, g]**
Fulvous whistling duck	Increasing	d	1,357	Not estimated	0	Low	**Mod Low**
Black-bellied whistling duck	Increasing	d	1,216	Not estimated	0	Low	**Mod Low**

	Trend 1970-2003	DS[a]	Regular Harvest 1980-1999	Subsistence Harvest[b]	% Total Harvest	Harvest Importance	Continental Priority
Mexican duck	Increasing	d	0	Not estimated	0	Low	**Mod Low**[g]
Ruddy duck	Increasing	a	44,966	1,000	0.3	Low	**Mod Low**
Common merganser	Increasing	c	37,070	7,000	0.3	Low	**Mod Low**
Red-breasted merganser	Increasing	c	31,346	2,000	0.2	Low	**Mod Low**
Hooded merganser	Increasing	c	86,083	6,000	0.7	Low	**Mod Low**
Canada Goose Populations							
Atlantic	Increasing		134,900	175,000[i]			**High**
Lesser	Unknown		Unknown	Not Set			**High**
Dusky	Stable		17,300	Avoid Listing			**High**
Southern James Bay	Stable		89,400	100,000[k]			**High**
Cackling	Stable		181,700	250,000[j]			**High**
Aleutian	Increasing		33,400	40,000[j]			**Mod High**
North Atlantic	Unknown		Unknown	Not Set			**Mod High**
Vancouver	Unknown		Unknown	Not Set			**Moderate**
Taverner's	Unknown		Unknown	Not Set			**Moderate**
Mississippi Valley	Stable		589,600	375,000[k]			**Moderate**
Shortgrass Prairie	Decreasing		175,000	150,000[j]			**Moderate**
Pacific	Stable		Unknown	Not Set			**Moderate**
Rocky Mountain	Increasing		162,229	117,100[j]			**Mod Low**
Eastern Prairie	Stable		235,600	200,000[k]			**Mod Low**
Tallgrass Prairie	Stable		316,500	250,000[j]			**Mod Low**
Atlantic Flyway Resident	Increasing		997,700	650,000[k]			**Above Objective**
Mississippi Flyway Giant	Increasing		1,442,900	1,000,000[k]			**Above Objective**
Western Prairie/Great Plains	Increasing		662,600	285,000[j]			**Above Objective**
Hi-Line	Increasing		246,900	80,000[j]			**Above Objective**
Lesser Snow Goose Populations							
Wrangel Island	Increasing		102,500	120,000[k]			**Mod High**
Western Central Flyway	Stable		114,400	110,000[j]			**Moderate**
Mid-continent	Stable		2,478,200	1,000,000[j]			**Above Objective**[l]
Western Arctic	Increasing		486,000	200,000[k]			**Above Objective**
Greater Snow Goose	Increasing		763,500	500,000[k]			**Above Objective**[l]
Ross's Goose	Increasing		619,000	100,000[k]			**Above Objective**

	Trend 1970-2003	DS[a]	Regular Harvest 1980-1999	Subsistence Harvest[b]	% Total Harvest	Harvest Importance	Continental Priority
Greater White-fronted Goose							
Mid-continent	Stable		914,300	600,000[m]			**Mod Low**
Pacific Flyway	Increasing		381,200	300,000[j]			**Mod Low**
Tule White-fronted Goose	Stable		5,500	10,000[j]			**High**
Pacific Brant	Stable		132,000	150,000[j]			**High**
Western High Arctic Brant	Unknown		Unknown	12,000			**High**
Eastern High Arctic Brant	Stable		20,000	Not Set			**Mod High**
Atlantic Brant	Stable		161,400	124,000[j]			**Mod Low**
Emperor Goose	Stable		68,600	150,000[k]			**High[g]**
Hawaiian Goose	Stable		1,175	2,800			**High[f1, g]**
Tundra Swan Populations							
Eastern	Increasing		101,800	80,000[j]			**Mod Low**
Western	Stable		79,500	60,000[j]			**Mod Low**
Trumpeter Swan Populations							
Rocky Mountain	Increasing		3,666 (9.1%)	5% Ann. Growth			**High**
Interior	Increasing		2,430	2,000			**Moderate[2]**
Pacific Coast	Increasing		17,551	13,000[m]			**Mod Low**
Mute Swan	Increasing		20,000	Not Set			**Above Objective[g]**

a Data Source (Trend): a - WBPHS Survey; b - Breeding Bird Survey; c - Sea Duck Joint Venture; d - SEMARNAT; e - Gulf Coast Joint Venture; f - Pacific Coast Joint Venture
b Generally believed to be biased low because of under reporting and unsurveyed areas.
c Includes an estimated 80,000 bird harvest in Greenland.
d Sport harvest does not reflect hunter valuation and is depressed because of restrictive regulations during the period evaluated.
e Includes an estimated 5,000 bird harvest in Greenland.
f Listed as Threatened or Endangered in (1) the United States; (2) Mexico- Conservation plans developed under authority of national threatened and endangered species legislation.
g Species that do not routinely cross jurisdictional boundaries of Canada, the United States, or Mexico. There is no Plan expectation of conservation by non-jurisdictional entities.
h Species of Special Concern in Canada – Conservation plans developed under authority of national threatened and endangered species legislation.
i Breeding pair objective.
j Winter index objective.
k Total breeding population objective.
l Designated as an overpopulation concern by Canada and the United States.
m Autumn index objective.
n Based on expert opinion.

Region Species Prioritization

The 1986 Plan included a map of areas of major concern to North American waterfowl. This map reflected the considerable expertise of the waterfowl conservation community, drawn from lifetimes of experience with breeding and nonbreeding waterfowl. The conservation of habitats in those priority areas is as important today as it was in 1986. Nevertheless, as the number of joint ventures has expanded and as individual joint ventures have grown beyond the ecologically based regions envisioned in 1986, the Plan Committee and the NSST believe it is prudent to provide guidance from a continental perspective that can be used by managers throughout North America. For this purpose, the NSST developed priority species lists from each WCR to help Plan partners target their conservation efforts on the species with the greatest conservation need in that WCR in the appropriate phase of their annual cycle.

Addressing persistent challenges related to decisions about where and how to most efficiently attain the goals of the Plan requires *a priori* information about the distribution and abundance of waterfowl. Despite the fact that North American waterfowl are more effectively surveyed each year than any other group of birds, no single survey, during either breeding or nonbreeding seasons, adequately assesses distribution of ducks or geese across the continent-wide extent of the Plan. This lack of information poses challenges for the strategic conservation of habitats across North America and requires that data from diverse surveys be merged to depict these patterns of seasonal distribution and abundance. Unfortunately, there are practical limits to the number of survey databases that can be combined in a systematic assessment, and there are limits in the spatial resolution of data from the widespread surveys that are most useful for continental assessment. Inevitably, these limitations affect the results of species prioritization at regional scales. Therefore, lists of priority species presented in Tables B-2 and B-3 are not prescriptions for conservation but a starting point for joint venture planning at regional scales. It is hoped that these lists will help joint ventures make conservation decisions based on a better understanding of the regional significance of a particular waterfowl species within the continental context of all species of North American waterfowl.

Geographic Importance for Breeding Ducks

Data on breeding duck distribution from the May breeding survey and Breeding Bird Survey (BBS), 1980-99, and perceived threats to a species' habitat were used for WCR-scale species prioritization. Mean annual May survey stratum estimates were assigned to WCRs in the traditional and eastern survey areas by the WCR that encompassed the majority of a stratum. In a few cases, two WCRs comprised nearly equal areas of survey strata. In these cases, one half the mean stratum population estimate was assigned to each WCR, as if species were uniformly distributed within the stratum. For areas of the United States and southwestern Canada that are not covered by the May survey, BBS data were used. Breeding Bird Survey estimates were generated by using an inverse distance interpolation (estimates from the 15 nearest BBS routes) to assess the relative abundance of species across the United States and southern Canada in a digital data layer (GIS coverage). Each pixel in the interpolated coverage was assigned to a WCR.

Percent of the surveyed population and the relative density of a species breeding in a WCR were derived from relative abundance estimates from the May survey and BBS. Percent and relative density were ranked as *High*, *Moderately High*, *Moderately Low*, or *Low*. In areas of North America not covered by the May survey or BBS, WCRs received categorical ranks based on expert opinion and published literature.

The NSST developed scores for threats to habitats within WCRs by using the following criteria:

Very Low	Expected future conditions better than historical conditions.
Low	Expected future conditions similar to historical conditions – no known threats.
Moderate	Slight to moderate decline in future habitat abundance or quality, but current conditions similar to historical conditions; or, future conditions expected to be stable but significant habitat losses have already occurred.
Moderately High	Severe past or expected future deterioration or decline in habitat quality or availability.
High	Extreme past or expected future deterioration or decline in habitat quality or availability.

In order to determine the geographic importance of a WCR to a species, the categorical assessments of percent, relative density, and threats to habitat were weighted equally. WCRs that were of Low importance to a species were not included in Tables B-2 and B-3 because they represented ecological regions in which the species occurred infrequently or in very low relative abundance.

Geographic Importance for Nonbreeding Ducks

Procedures used to assess the importance of WCRs for nonbreeding species were similar to those used for breeding species, except that U.S. and Mexican Midwinter Inventory (MWI) data were used, and assessments for Canada were based on expert input. Counties in the United States and Mexican MWI survey sites were assigned to WCRs to assess the percent of a species wintering in a WCR and to estimate its density.

In consideration of the importance of midlatitude migration habitat during the nonbreeding period, county-level mean harvest estimates (1980-99) from the Parts Survey database were treated as an index to distribution during fall migration. The aggregate total mean harvest of counties assigned to a WCR was used to calculate the percent of harvest occurring in a WCR. Categorical percent, density (from MWI data), harvest, and threats to nonbreeding habitat were used to assess geographic importance of WCRs for a species during the nonbreeding period. Geographic importance and continental priority rank were used to assess conservation need of a species in a particular WCR by using the matrix described above.

No spatially extensive data sets were available to assess geographic importance for molting or during spring migration. Major concentration areas during these periods, based on published sources and expert opinion, are incorporated into the map of *Areas of Continental Significance to North American Ducks, Geese, and Swans* (p. 6). Conservation of these habitats is particularly important and may be highly efficient because of the number of birds that can be affected in one area.

Breeding and Nonbreeding Geese and Swans

The importance of specific WCRs to breeding and nonbreeding geese and swans was based on information provided by Canadian, U.S. and Mexican waterfowl biologists, including members of the Arctic Goose Joint Venture Technical Committee. Their extensive understanding of how managed populations of geese and swans distribute themselves seasonally enabled the incorporation of major spring and fall migration habitats into the assessment of nonbreeding geographic importance, whereas harvest data for managed populations of geese and swans is unavailable.

Pelagic Conservation Regions
Spectacled and common eiders make limited use of terrestrial WCRs during their annual cycle. Many other species of sea ducks occupy offshore areas almost exclusively during the nonbreeding season. For these species, pelagic conservation regions (PCRs; adopted from the North American Waterbird Conservation Plan[4] and are listed in Tables B-2 and B-3, although the adjacent terrestrial WCR also is listed.

Assessing Conservation Needs

The Plan Committee and the NSST believe that the conservation need of a species in a particular WCR is a function of the geographic importance of the WCR for that species and the species overall continental priority status for the Plan. Conservation need may be interpreted as the need for habitat conservation *and/or* the need for monitoring. A designation of high conservation need for a species within a particular WCR does not necessarily imply a great need for habitat conservation. To determine conservation need, geographic importance ranks were combined with continental priority ranks by using the following matrix. Conservation need is reported in Tables B-2 and B-3 next to geographic importance.

Regional Conservation Need

	Continental Priority			
Geographic Importance	High	Moderately High	Moderate	Moderately Low or Above Objective
High	**Highest**	**High**	**High**	**High**
Mod. High	**High**	**Mod. High**	**Mod. High**	**Moderate**
Mod. Low	**Moderate**	**Mod. Low**	**Mod. Low**	**Low**

Cautionary Notes About Prioritization

Species prioritization within WCRs **does not** imply that harvest regulation should be used to directly manage survival at this scale. The aggregate effects of the entire annual cycle throughout the annual range of a species determine waterfowl demographics.

Finally, there may be local **"hotspots"** that are not characteristic of overall WCRs. Management of these areas may be an imperative, even if the WCR is otherwise of moderately low importance for a species. Prioritization based on continental data sets should never supercede sound biological planning at regional scales. Joint ventures and others with better information about the importance of proposed project areas should always receive due consideration. The Plan Committee expects joint ventures to identify the benefits of habitat management in these local priority areas and to communicate the importance of these areas to others outside the joint venture. One result of regional biological planning is the identification of these "hotspots" as joint venture focus areas, where appropriate.

4 Kushlan, J.A. et al. 2002. Waterbird Conservation for the Americans: *The North American Waterbird Conservation Plan*, www.waterbirdconsevation.org.

Table B-2. Combined Prioritization for Breeding and Nonbreeding Ducks

(Empty cells indicate low conservation need or absence.)

WCR	Pelagic WCRs[a] Breeding	Pelagic WCRs[a] Nonbreeding	Species/ Population	Continental Priority	Breeding Importance	Breeding Need	Nonbreeding Importance	Nonbreeding Need
1		1012	Common eider	HIGH			MOD HIGH	**HIGH**
1			Northern pintail	HIGH	MOD LOW	**MODERATE**		
1		1012	Black scoter	MOD HIGH			MOD LOW	**MOD LOW**
1		1012	King eider	MOD HIGH			MOD LOW	**MOD LOW**
1		1012	Long-tailed duck	MOD HIGH			MOD HIGH	**MOD HIGH**
1		1012	Spectacled eider	MOD HIGH			MOD HIGH	**MOD HIGH**
1		1012	Steller's eider	MOD HIGH			HIGH	**HIGH**
1		1012	Surf scoter	MOD HIGH			MOD LOW	**MOD LOW**
1		1012	White-winged scoter	MOD HIGH			MOD LOW	**MOD LOW**
1		1012	Harlequin duck	MODERATE	MOD LOW	**MOD LOW**	HIGH	**HIGH**
2	1012	1012	Common eider	HIGH	MOD LOW	**MODERATE**	MOD HIGH	**HIGH**
2			Mallard	HIGH	MOD LOW	**MODERATE**		
2			Northern pintail	HIGH	HIGH	**HIGHEST**		
2			American wigeon	MOD HIGH	MOD HIGH	**MOD HIGH**		
2		1012	Black scoter	MOD HIGH	HIGH	**HIGH**	MOD HIGH	**MOD HIGH**
2			Canvasback	MOD HIGH	MOD LOW	**MOD LOW**		
2			Common goldeneye	MOD HIGH			MOD LOW	**MOD LOW**
2		1012	King eider	MOD HIGH			HIGH	**HIGH**
2		1012	Long-tailed duck	MOD HIGH	HIGH	**HIGH**	MOD HIGH	**MOD HIGH**
2	1012	1012	Spectacled eider	MOD HIGH	HIGH	**HIGH**	HIGH	**HIGH**
2		1012	Steller's eider	MOD HIGH	HIGH	**HIGH**	HIGH	**HIGH**
2		1012	Surf scoter	MOD HIGH	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
2		1012	White-winged scoter	MOD HIGH			MOD LOW	**MOD LOW**
2			Barrow's goldeneye	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
2			Bufflehead	MODERATE	MOD LOW	**MOD LOW**		
2			Gadwall	MODERATE	MOD LOW	**MOD LOW**		
2			Greater scaup	MODERATE	MOD HIGH	**MOD HIGH**		
2			Green-winged teal	MODERATE	MOD HIGH	**MOD HIGH**		
2		1012	Harlequin duck	MODERATE	MOD HIGH	**MOD HIGH**	MOD HIGH	**MOD HIGH**
2			Northern shoveler	MODERATE	MOD HIGH	**MOD HIGH**		
2			Ring-necked duck	MODERATE	MOD LOW	**MOD LOW**		
3	1001/1015	1001	Common eider	HIGH	HIGH	**HIGHEST**	HIGH	**HIGHEST**
3			Northern pintail	HIGH	MOD HIGH	**HIGH**	MOD LOW	**MODERATE**
3			Black scoter	MOD HIGH	MOD LOW	**MOD LOW**		
3			Common goldeneye	MOD HIGH	MOD HIGH	**MOD HIGH**		
3			King eider	MOD HIGH	HIGH	**HIGH**		
3			Long-tailed duck	MOD HIGH	HIGH	**HIGH**		
3	1001/1015	1001	Spectacled eider	MOD HIGH	MOD HIGH	**MOD HIGH**	MOD HIGH	**MOD HIGH**
3			Steller's eider	MOD HIGH	MOD HIGH	**MOD HIGH**		
3			Surf scoter	MOD HIGH	MOD HIGH	**MOD HIGH**		
3			White-winged scoter	MOD HIGH	MOD LOW	**MOD LOW**		
3			Harlequin duck	MODERATE	MOD HIGH	**MOD HIGH**		
4			Lesser scaup	HIGH	MOD HIGH	**HIGH**		
4			Mallard	HIGH	MOD HIGH	**HIGH**	MOD LOW	**MODERATE**
4			Northern pintail	HIGH	MOD HIGH	**HIGH**		
4			American wigeon	MOD HIGH	HIGH	**HIGH**		
4			Black scoter	MOD HIGH	MOD LOW	**MOD LOW**		
4			Canvasback	MOD HIGH	MOD HIGH	**MOD HIGH**		

WCR	Pelagic WCRs[a] Breeding	Pelagic WCRs[a] Nonbreeding	Species/ Population	Continental Priority	Breeding Importance	Breeding Need	Nonbreeding Importance	Nonbreeding Need
4			Common goldeneye	MOD HIGH	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
4			Long-tailed duck	MOD HIGH	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
4			Redhead	MOD HIGH	MOD LOW	**MOD LOW**		
4			Surf scoter	MOD HIGH	HIGH	**HIGH**		
4			White-winged scoter	MOD HIGH	MOD HIGH	**MOD HIGH**		
4			Barrow's goldeneye	MODERATE	MOD HIGH	**MOD HIGH**		
4			Bufflehead	MODERATE	MOD HIGH	**MOD HIGH**	MOD LOW	**MOD LOW**
4			Greater scaup	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
4			Green-winged teal	MODERATE	MOD HIGH	**MOD HIGH**		
4			Harlequin duck	MODERATE	MOD HIGH	**MOD HIGH**	MOD LOW	**MOD LOW**
4			Northern shoveler	MODERATE	MOD HIGH	**MOD HIGH**		
4			Ring-necked duck	MODERATE	MOD LOW	**MOD LOW**		
5		1011	Common eider	HIGH			MOD LOW	**MODERATE**
5			Lesser scaup	HIGH	MOD LOW	***MODERATE***	MOD HIGH	**HIGH**
5			Mallard	HIGH	MOD LOW	**MODERATE**	MOD HIGH	**HIGH**
5			Northern pintail	HIGH	MOD LOW	**MODERATE**	MOD HIGH	**HIGH**
5			American wigeon	MOD HIGH	MOD LOW	**MOD LOW**	HIGH	**HIGH**
5		1010/1011	Black scoter	MOD HIGH			MOD HIGH	**MOD HIGH**
5			Blue-winged/ cinnamon teal	MOD HIGH MOD HIGH	MOD HIGH MOD HIGH	**MOD HIGH** **MOD HIGH**		
5			Canvasback	MOD HIGH			MOD HIGH	**MOD HIGH**
5			Common goldeneye	MOD HIGH	MOD LOW	**MOD LOW**	MOD HIGH	**MOD HIGH**
5		1010/1011	Surf scoter	MOD HIGH			HIGH	**HIGH**
5		1010/1011	White-winged scoter	MOD HIGH			HIGH	**HIGH**
5			Barrow's goldeneye	MODERATE			HIGH	**HIGH**
5			Bufflehead	MODERATE	MOD LOW	**MOD LOW**	HIGH	**HIGH**
5			Gadwall	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
5			Greater scaup	MODERATE	MOD LOW	**MOD LOW**	HIGH	**HIGH**
5			Green-winged teal	MODERATE	MOD LOW	**MOD LOW**	MOD HIGH	**MOD HIGH**
5		1010/1011	Harlequin duck	MODERATE	MOD HIGH	**MOD HIGH**	HIGH	**HIGH**
5			Northern shoveler	MODERATE	MOD LOW	**MOD LOW**	MOD HIGH	**MOD HIGH**
5			Ring-necked duck	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
5			Wood duck	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
5			Red-breasted merganser	MOD LOW			MOD HIGH	**MODERATE**
5			Ruddy duck	MOD LOW			MOD HIGH	**MODERATE**
6			Lesser scaup	HIGH	HIGH	**HIGHEST**		
6			Mallard	HIGH	MOD HIGH	**HIGH**		
6			Northern pintail	HIGH	MOD HIGH	**HIGH**		
6			American wigeon	MOD HIGH	HIGH	**HIGH**		
6			Blue-winged teal	MOD HIGH	MOD HIGH	**MOD HIGH**		
6			Canvasback	MOD HIGH	MOD HIGH	**MOD HIGH**		
6			Common goldeneye	MOD HIGH	HIGH	**HIGH**	MOD LOW	**MOD LOW**
6			Long-tailed duck	MOD HIGH	MOD LOW	**MOD LOW**		
6			Redhead	MOD HIGH	MOD HIGH	**MOD HIGH**		
6			Surf scoter	MOD HIGH	MOD HIGH	**MOD HIGH**		
6			White-winged scoter	MOD HIGH	HIGH	**HIGH**		
6			Bufflehead	MODERATE	HIGH	**HIGH**		
6			Gadwall	MODERATE	MOD HIGH	**MOD HIGH**		
6			Green-winged teal	MODERATE	HIGH	**HIGH**		
6			Northern shoveler	MODERATE	MOD HIGH	**MOD HIGH**		
6			Ring-necked duck	MODERATE	HIGH	**HIGH**		

WCR	Pelagic WCRs[a] Breeding	Pelagic WCRs[a] Nonbreeding	Species/ Population	Continental Priority	Breeding Importance	Breeding Need	Nonbreeding Importance	Nonbreeding Need
6			Common merganser	MOD LOW	MOD HIGH	**MODERATE**		
6			Ruddy duck	MOD LOW	MOD HIGH	**MODERATE**		
6.1			Lesser scaup	HIGH	HIGH	**HIGHEST**		
6.1			Mallard	HIGH	MOD HIGH	**HIGH**		
6.1			Northern pintail	HIGH	MOD HIGH	**HIGH**		
6.1			American wigeon	MOD HIGH	MOD HIGH	**MOD HIGH**		
6.1			Canvasback	MOD HIGH	MOD LOW	**MOD LOW**		
6.1			Common goldeneye	MOD HIGH	MOD LOW	**MOD LOW**		
6.1			Long-tailed duck	MOD HIGH	MOD HIGH	**MOD HIGH**		
6.1			Redhead	MOD HIGH	MOD LOW	**MOD LOW**		
6.1			Surf scoter	MOD HIGH	MOD HIGH	**MOD HIGH**		
6.1			White-winged scoter	MOD HIGH	HIGH	**HIGH**		
6.1			Bufflehead	MODERATE	MOD LOW	**MOD LOW**		
6.1			Gadwall	MODERATE	MOD LOW	**MOD LOW**		
6.1			Green-winged teal	MODERATE	MOD HIGH	**MOD HIGH**		
6.1			Northern shoveler	MODERATE	MOD LOW	**MOD LOW**		
6.1			Ring-necked duck	MODERATE	MOD LOW	**MOD LOW**		
6.1			Red-breasted merganser	MOD LOW	MOD HIGH	**MODERATE**		
7			American black duck	HIGH	MOD HIGH	**HIGH**		
7	1002	1002/1003	Common eider	HIGH	HIGH	**HIGHEST**	MOD HIGH	**HIGH**
7			Lesser scaup	HIGH	MOD LOW	**MODERATE**		
7			Northern pintail	HIGH	MOD LOW	**MODERATE**		
7			American wigeon	MOD HIGH	MOD LOW	**MOD LOW**		
7			Black scoter	MOD HIGH	MOD HIGH	**MOD HIGH**		
7			Common goldeneye	MOD HIGH	HIGH	**HIGH**	MOD LOW	**MOD LOW**
7			King eider	MOD HIGH	MOD LOW	**MOD LOW**		
7			Long-tailed duck	MOD HIGH	HIGH	**HIGH**		
7			Surf scoter	MOD HIGH	HIGH	**HIGH**		
7		1003	White-winged scoter	MOD HIGH			MOD HIGH	**MOD HIGH**
7			Barrow's goldeneye	MODERATE	MOD HIGH	**MOD HIGH**		
7			Bufflehead	MODERATE	MOD LOW	**MOD LOW**		
7			Green-winged teal	MODERATE	MOD LOW	**MOD LOW**		
7			Harlequin duck	MODERATE	HIGH	**HIGH**		
7			Ring-necked duck	MODERATE	MOD LOW	**MOD LOW**		
7			Common merganser	MOD LOW	MOD HIGH	**MODERATE**	MOD LOW	**MOD LOW**
7			Red-breasted merganser	MOD LOW	MOD HIGH	**MODERATE**		
7.1			American black duck	HIGH	MOD HIGH	**HIGH**	MOD HIGH	**HIGH**
7.1	1002	1002	Common eider	HIGH	MOD LOW	**MODERATE**	HIGH	**HIGHEST**
7.1			Lesser scaup	HIGH	MOD LOW	**MODERATE**		
7.1			Mallard	HIGH	MOD LOW	**MODERATE**		
7.1			Northern pintail	HIGH	MOD LOW	**MODERATE**		
7.1			American wigeon	MOD HIGH	MOD LOW	**MOD LOW**		
7.1		1002	Black scoter	MOD HIGH			MOD HIGH	**MOD HIGH**
7.1			Common goldeneye	MOD HIGH	MOD LOW	**MOD LOW**		
7.1			King eider	MOD HIGH	MOD HIGH	**MOD HIGH**		
7.1			Long-tailed duck	MOD HIGH	MOD HIGH	**MOD HIGH**		
7.1			Surf scoter	MOD HIGH	HIGH	**HIGH**		
7.1			White-winged scoter	MOD HIGH	MOD LOW	**MOD LOW**		
7.1			Bufflehead	MODERATE	MOD LOW	**MOD LOW**		
7.1			Green-winged teal	MODERATE	MOD LOW	**MOD LOW**		

WCR	Pelagic WCRs[a] Breeding	Pelagic WCRs[a] Nonbreeding	Species/ Population	Continental Priority	Breeding Importance	Breeding Need	Nonbreeding Importance	Nonbreeding Need
7.1			Ring-necked duck	MODERATE	MOD LOW	**MOD LOW**		
7.2			Lesser scaup	HIGH	MOD HIGH	**HIGH**		
7.2			Mallard	HIGH	MOD LOW	**MODERATE**		
7.2			Northern pintail	HIGH	MOD LOW	**MODERATE**		
7.2			American wigeon	MOD HIGH	MOD LOW	**MOD LOW**		
7.2			Black scoter	MOD HIGH	HIGH	**HIGH**		
7.2			Blue-winged teal	MOD HIGH	MOD LOW	**MOD LOW**		
7.2			Canvasback	MOD HIGH	MOD LOW	**MOD LOW**		
7.2			Common goldeneye	MOD HIGH	MOD LOW	**MOD LOW**		
7.2			Long-tailed duck	MOD HIGH	MOD LOW	**MOD LOW**		
7.2			Redhead	MOD HIGH	MOD LOW	**MOD LOW**		
7.2			White-winged scoter	MOD HIGH	MOD HIGH	**MOD HIGH**		
7.2			Bufflehead	MODERATE	MOD HIGH	**MOD HIGH**		
7.2			Gadwall	MODERATE	MOD LOW	**MOD LOW**		
7.2			Green-winged teal	MODERATE	MOD LOW	**MOD LOW**		
7.2			Northern shoveler	MODERATE	MOD LOW	**MOD LOW**		
7.2			Ring-necked duck	MODERATE	MOD LOW	**MOD LOW**		
8			American black duck	HIGH	MOD HIGH	**HIGH**	MOD HIGH	**HIGH**
8	1003	1003	Common eider	HIGH	HIGH	**HIGHEST**	HIGH	**HIGHEST**
8			Lesser scaup	HIGH	MOD LOW	**MODERATE**		
8			Mallard	HIGH	MOD LOW	**MODERATE**	MOD LOW	**MODERATE**
8			American wigeon	MOD HIGH	MOD LOW	**MOD LOW**		
8		1003	Black scoter	MOD HIGH			MOD HIGH	**MOD HIGH**
8			Blue-winged teal	MOD HIGH	MOD LOW	**MOD LOW**		
8			Common goldeneye	MOD HIGH	HIGH	**HIGH**	HIGH	**HIGH**
8		1003	King eider	MOD HIGH			MOD HIGH	**MOD HIGH**
8		1003	Long-tailed duck	MOD HIGH			MOD HIGH	**MOD HIGH**
8		1003	Surf scoter	MOD HIGH	MOD HIGH	**MOD HIGH**	HIGH	**HIGH**
8			Barrow's goldeneye	MODERATE	HIGH	**HIGH**	MOD HIGH	**MOD HIGH**
8			Bufflehead	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
8			Green-winged teal	MODERATE	MOD LOW	**MOD LOW**		
8		1003	Harlequin duck	MODERATE	MOD HIGH	**MOD HIGH**	MOD HIGH	**MOD HIGH**
8			Ring-necked duck	MODERATE	MOD HIGH	**MOD HIGH**		
8			Common merganser	MOD LOW			HIGH	**HIGH**
8			Hooded merganser	MOD LOW	MOD HIGH	**MODERATE**		
8			Red-breasted merganser	MOD LOW	MOD HIGH	**MODERATE**	MOD LOW	**MOD LOW**
8.1			Lesser scaup	HIGH	MOD HIGH	**HIGH**		
8.1			Mallard	HIGH	MOD HIGH	**HIGH**		
8.1			Northern pintail	HIGH	MOD LOW	**MODERATE**		
8.1			American wigeon	MOD HIGH	MOD HIGH	**MOD HIGH**		
8.1			Black scoter	MOD HIGH	MOD HIGH	**MOD HIGH**		
8.1			Blue-winged teal	MOD HIGH	MOD LOW	**MOD LOW**		
8.1			Common goldeneye	MOD HIGH	HIGH	**HIGH**		
8.1			Redhead	MOD HIGH	MOD LOW	**MOD LOW**		
8.1			Surf scoter	MOD HIGH	MOD HIGH	**MOD HIGH**		
8.1			White-winged scoter	MOD HIGH	MOD HIGH	**MOD HIGH**		
8.1			Bufflehead	MODERATE	MOD HIGH	**MOD HIGH**		
8.1			Gadwall	MODERATE	MOD LOW	**MOD LOW**		
8.1			Green-winged teal	MODERATE	MOD HIGH	**MOD HIGH**		
8.1			Northern shoveler	MODERATE	MOD LOW	**MOD LOW**		
8.1			Ring-necked duck	MODERATE	HIGH	**HIGH**		

WCR	Pelagic WCRs[a] Breeding	Pelagic WCRs[a] Nonbreeding	Species/ Population	Continental Priority	Breeding Importance	Breeding Need	Nonbreeding Importance	Nonbreeding Need
8.1			Red-breasted merganser	MOD LOW	MOD HIGH	**MODERATE**		
8.2			American black duck	HIGH	MOD HIGH	**HIGH**		
8.2	1003	1003	Common eider	HIGH	HIGH	**HIGHEST**	HIGH	**HIGHEST**
8.2			Common goldeneye	MOD HIGH	MOD LOW	**MOD LOW**		
8.2		1003	King eider	MOD HIGH			MOD HIGH	**MOD HIGH**
8.2		1003	Long-tailed duck	MOD HIGH			MOD HIGH	**MOD HIGH**
8.2		1003	White-winged scoter	MOD HIGH	MOD HIGH	**MOD HIGH**	MOD LOW	**MOD LOW**
8.2			Green-winged teal	MODERATE	MOD LOW	**MOD LOW**		
8.2		1003	Harlequin duck	MODERATE	MOD HIGH	**MOD HIGH**	MOD HIGH	**MOD HIGH**
8.2			Ring-necked duck	MODERATE	MOD HIGH	**MOD HIGH**		
8.2			Red-breasted merganser	MOD LOW	MOD HIGH	**MODERATE**		
9			Lesser scaup	HIGH	MOD LOW	**MODERATE**	MOD LOW	**MODERATE**
9			Mallard	HIGH	MOD LOW	**MODERATE**	MOD HIGH	**HIGH**
9			Northern pintail	HIGH	MOD LOW	**MODERATE**	MOD HIGH	**HIGH**
9			American wigeon	MOD HIGH	MOD LOW	**MOD LOW**	MOD HIGH	**MOD HIGH**
9			Canvasback	MOD HIGH	MOD LOW	**MOD LOW**	MOD HIGH	**MOD HIGH**
9			Cinnamon teal	MOD HIGH	MOD HIGH	**MOD HIGH**		
9			Common goldeneye	MOD HIGH	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
9			Redhead	MOD HIGH	MOD HIGH	**MOD HIGH**	MOD HIGH	**MOD HIGH**
9			Barrow's goldeneye	MODERATE	HIGH	**HIGH**	MOD HIGH	**MOD HIGH**
9			Bufflehead	MODERATE	MOD LOW	**MOD LOW**	MOD HIGH	**MOD HIGH**
9			Gadwall	MODERATE	MOD HIGH	**MOD HIGH**		
9			Greater scaup	MODERATE	MOD LOW	**MOD LOW**	MOD HIGH	**MOD HIGH**
9			Green-winged teal	MODERATE	MOD LOW	**MOD LOW**	MOD HIGH	**MOD HIGH**
9			Harlequin duck	MODERATE			HIGH	**HIGH**
9			Northern shoveler	MODERATE	MOD LOW	**MOD LOW**	MOD HIGH	**MOD HIGH**
9			Ring-necked duck	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
9			Wood duck	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
9			Ruddy duck	MOD LOW	MOD HIGH	**MODERATE**	MOD HIGH	**MODERATE**
10			Lesser scaup	HIGH	MOD HIGH	**MOD HIGH**	MOD LOW	**MODERATE**
10			Mallard	HIGH	MOD LOW	**MODERATE**	MOD HIGH	**HIGH**
10			Northern pintail	HIGH	MOD LOW	**MODERATE**		
10			American wigeon	MOD HIGH	MOD HIGH	**MOD HIGH**	MOD LOW	**MOD LOW**
10			Canvasback	MOD HIGH	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
10			Cinnamon teal	MOD HIGH	MOD HIGH	**MOD HIGH**		
10			Common goldeneye	MOD HIGH	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
10			Redhead	MOD HIGH	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
10			White-winged scoter	MOD HIGH	MOD HIGH	**MOD HIGH**		
10			Barrow's goldeneye	MODERATE	HIGH	**HIGH**	MOD HIGH	**MOD HIGH**
10			Bufflehead	MODERATE	HIGH	**HIGH**	MOD LOW	**MOD LOW**
10			Gadwall	MODERATE	MOD LOW	**MOD LOW**		
10			Greater scaup	MODERATE			MOD LOW	**MOD LOW**
10			Green-winged teal	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
10			Harlequin duck	MODERATE	MOD HIGH	**MOD HIGH**		
10			Northern shoveler	MODERATE	MOD LOW	**MOD LOW**		
10			Ring-necked duck	MODERATE	MOD HIGH	**MOD HIGH**		
10			Wood duck	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
10			Hooded merganser	MOD LOW	MOD HIGH	**MODERATE**		
11			Lesser scaup	HIGH	MOD HIGH	**HIGH**	HIGH	**HIGHEST**
11			Mallard	HIGH	HIGH	**HIGHEST**	HIGH	**HIGHEST**
11			Northern pintail	HIGH	HIGH	**HIGHEST**	HIGH	**HIGHEST**
11			American wigeon	MOD HIGH	MOD HIGH	**MOD HIGH**	MOD HIGH	**MOD HIGH**

WCR	Pelagic WCRs[a] Breeding	Pelagic WCRs[a] Nonbreeding	Species/ Population	Continental Priority	Breeding Importance	Breeding Need	Nonbreeding Importance	Nonbreeding Need
11			Blue-winged teal	MOD HIGH	HIGH	**HIGH**	MOD HIGH	**MOD HIGH**
11			Canvasback	MOD HIGH	HIGH	**HIGH**	HIGH	**HIGH**
11			Common goldeneye	MOD HIGH	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
11			Redhead	MOD HIGH	HIGH	**HIGH**	HIGH	**HIGH**
11			White-winged scoter	MOD HIGH	MOD LOW	**MOD LOW**		
11			Bufflehead	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
11			Gadwall	MODERATE	HIGH	**HIGH**	MOD LOW	**MOD LOW**
11			Green-winged teal	MODERATE	HIGH	**HIGH**	MOD LOW	**MOD LOW**
11			Northern shoveler	MODERATE	HIGH	**HIGH**	HIGH	**HIGH**
11			Ring-necked duck	MODERATE	MOD HIGH	**MOD HIGH**	MOD HIGH	**MOD HIGH**
11			Wood duck	MODERATE	MOD LOW	**MOD LOW**		
11			Ruddy duck	MOD LOW	HIGH	**HIGH**		
12			American black duck	HIGH	MOD HIGH	**HIGH**	MOD LOW	**MODERATE**
12			Lesser scaup	HIGH	MOD LOW	**MODERATE**	MOD HIGH	**HIGH**
12			Mallard	HIGH	MOD LOW	**MODERATE**	MOD LOW	**MODERATE**
12			American wigeon	MOD HIGH	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
12			Black scoter	MOD HIGH			HIGH	**HIGH**
12			Blue-winged teal	MOD HIGH	MOD LOW	**MOD LOW**		
12			Canvasback	MOD HIGH			MOD LOW	**MOD LOW**
12			Common goldeneye	MOD HIGH	MOD HIGH	**MOD HIGH**	MOD HIGH	**MOD HIGH**
12			Long-tailed duck	MOD HIGH			MOD LOW	**MOD LOW**
12			Redhead	MOD HIGH			MOD LOW	**MOD LOW**
12			Surf scoter	MOD HIGH			HIGH	**HIGH**
12			White-winged scoter	MOD HIGH			MOD HIGH	**MOD HIGH**
12			Bufflehead	MODERATE	MOD LOW	**MOD LOW**	MOD HIGH	**MOD HIGH**
12			Greater scaup	MODERATE			MOD HIGH	**MOD HIGH**
12			Green-winged teal	MODERATE	MOD LOW	**MOD LOW**		
12			Ring-necked duck	MODERATE	MOD HIGH	**MOD HIGH**	MOD LOW	**MOD LOW**
12			Wood duck	MODERATE	MOD LOW	**MOD LOW**		
12			Hooded merganser	MOD LOW	HIGH	**HIGH**		
13			American black duck	HIGH	MOD HIGH	**HIGH**	MOD HIGH	**HIGH**
13			Common eider	HIGH			MOD LOW	**MODERATE**
13			Lesser scaup	HIGH			HIGH	**HIGHEST**
13			Mallard	HIGH	MOD HIGH	**HIGH**	MOD LOW	**MODERATE**
13			Northern pintail	HIGH			MOD LOW	**MODERATE**
13			American wigeon	MOD HIGH	MOD LOW	**MOD LOW**		
13			Black scoter	MOD HIGH			MOD HIGH	**MOD HIGH**
13			Blue-winged teal	MOD HIGH	MOD LOW	**MOD LOW**		
13			Canvasback	MOD HIGH	MOD LOW	**MOD LOW**	MOD HIGH	**MOD HIGH**
13			Common goldeneye	MOD HIGH	MOD LOW	**MOD LOW**	HIGH	**HIGH**
13			Long-tailed duck	MOD HIGH			HIGH	**HIGH**
13			Redhead	MOD HIGH	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
13			Surf scoter	MOD HIGH			HIGH	**HIGH**
13			White-winged scoter	MOD HIGH			MOD HIGH	**MOD HIGH**
13			Bufflehead	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
13			Gadwall	MODERATE			MOD LOW	**MOD LOW**
13			Greater scaup	MODERATE			MOD HIGH	MOD HIGH
13			Green-winged teal	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
13			Ring-necked duck	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
13			Wood duck	MODERATE	MOD LOW	**MOD LOW**		
13			Common merganser	MOD LOW			MOD HIGH	**MODERATE**
13			Hooded merganser	MOD LOW	MOD HIGH	**MODERATE**		

WCR	Pelagic WCRs[a] Breeding	Pelagic WCRs[a] Nonbreeding	Species/ Population	Continental Priority	Breeding Importance	Breeding Need	Nonbreeding Importance	Nonbreeding Need
13			Red-breasted merganser	MOD LOW			HIGH	**MODERATE**
14			American black duck	HIGH	HIGH	**HIGHEST**	MOD HIGH	**HIGH**
14	1004	1004	Common eider	HIGH	HIGH	**HIGHEST**	HIGH	**HIGHEST**
14			Lesser scaup	HIGH			MOD LOW	**MODERATE**
14			Mallard	HIGH	MOD LOW	**MODERATE**	MOD LOW	**MODERATE**
14			Northern pintail	HIGH	MOD LOW	**MODERATE**	MOD LOW	**MODERATE**
14			American wigeon	MOD HIGH	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
14		1004	Black scoter	MOD HIGH			MOD LOW	**MOD LOW**
14			Blue-winged teal	MOD HIGH	MOD LOW	**MOD LOW**		
14			Common goldeneye	MOD HIGH	MOD HIGH	**MOD HIGH**	MOD HIGH	**MOD HIGH**
14		1004	Long-tailed duck	MOD HIGH			HIGH	**HIGH**
14		1004	Surf scoter	MOD HIGH			HIGH	**HIGH**
14		1004	White-winged scoter	MOD HIGH			MOD HIGH	**MOD HIGH**
14			Barrow's goldeneye	MODERATE			MOD HIGH	**MOD HIGH**
14			Bufflehead	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
14			Gadwall	MODERATE	MOD LOW	**MOD LOW**		
14			Green-winged teal	MODERATE	MOD HIGH	**MOD HIGH**	MOD LOW	**MOD LOW**
14		1004	Harlequin duck	MODERATE			MOD HIGH	**MOD HIGH**
14			Ring-necked duck	MODERATE	MOD HIGH	**MOD HIGH**		
14			Wood duck	MODERATE	MOD HIGH	**MOD HIGH**	MOD LOW	**MOD LOW**
14			Common merganser	MOD LOW			MOD HIGH	**MODERATE**
14			Hooded merganser	MOD LOW	MOD HIGH	**MODERATE**		
14			Red-breasted merganser	MOD LOW			MOD HIGH	**MODERATE**
15			Mallard	HIGH	MOD LOW	**MODERATE**	MOD LOW	**MODERATE**
15			Northern pintail	HIGH			MOD LOW	**MODERATE**
15			American wigeon	MOD HIGH			MOD LOW	**MOD LOW**
15			Canvasback	MOD HIGH			MOD LOW	**MOD LOW**
15			Cinnamon teal	MOD HIGH	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
15			Bufflehead	MODERATE			MOD LOW	**MOD LOW**
15			Northern shoveler	MODERATE			MOD LOW	**MOD LOW**
15			Wood duck	MODERATE	MOD LOW	**MOD LOW**		
16			Lesser scaup	HIGH	MOD LOW	**MODERATE**		
16			Mallard	HIGH	MOD LOW	**MODERATE**	MOD LOW	**MODERATE**
16			Northern pintail	HIGH	MOD LOW	**MODERATE**		
16			American wigeon	MOD HIGH	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
16			Blue-winged/ cinnamon teal	MOD HIGH	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
16			Canvasback	MOD HIGH	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
16			Common goldeneye	MOD HIGH			MOD LOW	**MOD LOW**
16			Redhead	MOD HIGH	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
16			Bufflehead	MODERATE			MOD LOW	**MOD LOW**
16			Gadwall	MODERATE	MOD LOW	**MOD LOW**		
16			Green-winged teal	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
16			Northern shoveler	MODERATE			MOD LOW	**MOD LOW**
16			Ring-necked duck	MODERATE	MOD LOW	**MOD LOW**		
16			Common merganser	MOD LOW	MOD HIGH	**MODERATE**	MOD HIGH	**MODERATE**
17			Lesser scaup	HIGH	MOD LOW	**MODERATE**		
17			Mallard	HIGH	MOD HIGH	**HIGH**	MOD LOW	**MODERATE**
17			Northern pintail	HIGH	MOD HIGH	**HIGH**	MOD LOW	**MODERATE**
17			American wigeon	MOD HIGH	MOD HIGH	**MOD HIGH**	MOD LOW	**MOD LOW**
17			Blue-winged teal	MOD HIGH	MOD HIGH	**MOD HIGH**	MOD LOW	**MOD LOW**

WCR	Pelagic WCRs[a] Breeding	Pelagic WCRs[a] Nonbreeding	Species/ Population	Continental Priority	Breeding Importance	Breeding Need	Nonbreeding Importance	Nonbreeding Need
17			Canvasback	MOD HIGH	MOD LOW	**MOD LOW**		
17			Common goldeneye	MOD HIGH			MOD LOW	**MOD LOW**
17			Redhead	MOD HIGH	MOD LOW	**MOD LOW**		
17			Bufflehead	MODERATE	MOD LOW	**MOD LOW**		
17			Gadwall	MODERATE	MOD HIGH	**MOD HIGH**	MOD LOW	**MOD LOW**
17			Green-winged teal	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
17			Northern shoveler	MODERATE	MOD HIGH	**MOD HIGH**	MOD LOW	**MOD LOW**
17			Ring-necked duck	MODERATE	MOD LOW	**MOD LOW**		
18			Mallard	HIGH	MOD LOW	**MODERATE**	MOD HIGH	**HIGH**
18			Northern pintail	HIGH	MOD LOW	**MODERATE**	MOD HIGH	**HIGH**
18			American wigeon	MOD HIGH			MOD LOW	**MOD LOW**
18			Blue-winged teal	MOD HIGH	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
18			Common goldeneye	MOD HIGH			MOD HIGH	**MOD HIGH**
18			Redhead	MOD HIGH			MOD LOW	**MOD LOW**
18			Gadwall	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
18			Green-winged teal	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
18			Northern shoveler	MODERATE			MOD LOW	**MOD LOW**
18			Common merganser	MOD LOW			MOD HIGH	**MODERATE**
18			Hooded merganser	MOD LOW			MOD HIGH	**MODERATE**
19			Mallard	HIGH	MOD LOW	**MODERATE**	MOD HIGH	**HIGH**
19			Northern pintail	HIGH	MOD LOW	**MODERATE**	MOD HIGH	**HIGH**
19			American wigeon	MOD HIGH			MOD LOW	**MOD LOW**
19			Blue-winged/ cinnamon teal	MOD HIGH	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
19			Canvasback	MOD HIGH			MOD LOW	**MOD LOW**
19			Common goldeneye	MOD HIGH			MOD HIGH	**MOD HIGH**
19			Redhead	MOD HIGH			MOD LOW	**MOD LOW**
19			Gadwall	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
19			Green-winged teal	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
19			Northern shoveler	MODERATE			MOD LOW	**MOD LOW**
19			Ring-necked duck	MODERATE			MOD LOW	**MOD LOW**
19			Wood duck	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
19			Common merganser	MOD LOW			MOD HIGH	**MODERATE**
20			Northern pintail	HIGH			MOD LOW	**MODERATE**
20			American wigeon	MOD HIGH			MOD LOW	**MOD LOW**
20			Canvasback	MOD HIGH			MOD LOW	**MOD LOW**
20			Redhead	MOD HIGH			MOD LOW	**MOD LOW**
20			Bufflehead	MODERATE			MOD LOW	**MOD LOW**
20			Gadwall	MODERATE			MOD LOW	**MOD LOW**
20			Green-winged teal	MODERATE			MOD LOW	**MOD LOW**
20			Wood duck	MODERATE			MOD LOW	**MOD LOW**
21			Lesser scaup	HIGH			MOD LOW	**MODERATE**
21			Mallard	HIGH			MOD LOW	**MODERATE**
21			Northern pintail	HIGH			MOD LOW	**MODERATE**
21			American wigeon	MOD HIGH			MOD HIGH	**MOD HIGH**
21			Blue-winged teal	MOD HIGH			MOD HIGH	**MOD HIGH**
21			Canvasback	MOD HIGH			MOD HIGH	**MOD HIGH**
21			Common goldeneye	MOD HIGH			MOD HIGH	**MOD HIGH**
21			Redhead	MOD HIGH			MOD HIGH	**MOD HIGH**
21			Bufflehead	MODERATE			MOD LOW	**MOD LOW**
21			Gadwall	MODERATE			MOD HIGH	**MOD HIGH**

WCR	Pelagic WCRs[a] Breeding	Pelagic WCRs[a] Nonbreeding	Species/ Population	Continental Priority	Breeding Importance	Breeding Need	Nonbreeding Importance	Nonbreeding Need
21			Green-winged teal	MODERATE			MOD HIGH	**MOD HIGH**
21			Mottled duck	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
21			Northern shoveler	MODERATE			MOD HIGH	**MOD HIGH**
21			Ring-necked duck	MODERATE			MOD HIGH	**MOD HIGH**
21			Wood duck	MODERATE	MOD LOW	**MOD LOW**	MOD HIGH	**MOD HIGH**
22			American black duck	HIGH			MOD HIGH	**HIGH**
22			Lesser scaup	HIGH			MOD LOW	**MODERATE**
22			Mallard	HIGH	MOD LOW	**MODERATE**	MOD HIGH	**HIGH**
22			American wigeon	MOD HIGH			MOD LOW	**MOD LOW**
22			Blue-winged teal	MOD HIGH	MOD LOW	**MOD LOW**	MOD HIGH	**MOD HIGH**
22			Canvasback	MOD HIGH			MOD HIGH	**MOD HIGH**
22			Common goldeneye	MOD HIGH			MOD HIGH	**MOD HIGH**
22			Redhead	MOD HIGH			MOD LOW	**MOD LOW**
22			Bufflehead	MODERATE			MOD LOW	**MOD LOW**
22			Gadwall	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
22			Greater scaup	MODERATE			MOD LOW	**MOD LOW**
22			Green-winged teal	MODERATE			MOD LOW	**MOD LOW**
22			Northern shoveler	MODERATE			MOD LOW	**MOD LOW**
22			Ring-necked duck	MODERATE			MOD HIGH	**MOD HIGH**
22			Wood duck	MODERATE	MOD HIGH	**MOD HIGH**	MOD HIGH	**MOD HIGH**
22			Common merganser	MOD LOW			MOD HIGH	**MODERATE**
22			Hooded merganser	MOD LOW			MOD HIGH	**MODERATE**
23			American black duck	HIGH	MOD HIGH	**HIGH**	MOD HIGH	**HIGH**
23			Lesser scaup	HIGH			MOD HIGH	**HIGH**
23			Mallard	HIGH	MOD LOW	**MODERATE**	MOD HIGH	**HIGH**
23			American wigeon	MOD HIGH			MOD LOW	**MOD LOW**
23			Blue-winged teal	MOD HIGH	MOD HIGH	**MOD HIGH**	MOD HIGH	**MOD HIGH**
23			Canvasback	MOD HIGH			MOD HIGH	**MOD HIGH**
23			Common goldeneye	MOD HIGH			MOD HIGH	**MOD HIGH**
23		1016	Long-tailed duck	MOD HIGH			MOD LOW	**MOD LOW**
23			Redhead	MOD HIGH			MOD HIGH	**MOD HIGH**
23			Bufflehead	MODERATE			MOD LOW	**MOD LOW**
23			Gadwall	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
23			Greater scaup	MODERATE			MOD HIGH	**MOD HIGH**
23			Green-winged teal	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
23			Northern shoveler	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
23			Ring-necked duck	MODERATE	MOD HIGH	**MOD HIGH**		
23			Wood duck	MODERATE	MOD HIGH	**MOD HIGH**	MOD LOW	**MOD LOW**
23			Hooded merganser	MOD LOW			MOD HIGH	**MODERATE**
24			American black duck	HIGH			MOD HIGH	**HIGH**
24			Lesser scaup	HIGH			MOD LOW	**MODERATE**
24			Mallard	HIGH			MOD HIGH	**HIGH**
24			Northern pintail	HIGH			MOD LOW	**MODERATE**
24			American wigeon	MOD HIGH			MOD LOW	**MOD LOW**
24			Blue-winged teal	MOD HIGH			MOD LOW	**MOD LOW**
24			Canvasback	MOD HIGH			MOD LOW	**MOD LOW**
24			Common goldeneye	MOD HIGH			MOD HIGH	**MOD HIGH**
24			Bufflehead	MODERATE			MOD LOW	**MOD LOW**
24			Gadwall	MODERATE			MOD LOW	**MOD LOW**
24			Greater scaup	MODERATE			MOD LOW	**MOD LOW**
24			Northern shoveler	MODERATE			MOD LOW	**MOD LOW**

WCR	Pelagic WCRs[a] Breeding	Pelagic WCRs[a] Nonbreeding	Species/ Population	Continental Priority	Breeding Importance	Breeding Need	Nonbreeding Importance	Nonbreeding Need
24			Ring-necked duck	MODERATE			MOD LOW	**MOD LOW**
24			Wood duck	MODERATE	MOD HIGH	**MOD HIGH**	MOD LOW	**MOD LOW**
24			Hooded merganser	MOD LOW			MOD HIGH	**MODERATE**
25			Lesser scaup	HIGH			MOD HIGH	**HIGH**
25			Mallard	HIGH			MOD HIGH	**HIGH**
25			Northern pintail	HIGH			MOD LOW	**MODERATE**
25			American wigeon	MOD HIGH			MOD HIGH	**MOD HIGH**
25			Blue-winged teal	MOD HIGH			MOD HIGH	**MOD HIGH**
25			Canvasback	MOD HIGH			MOD HIGH	**MOD HIGH**
25			Common goldeneye	MOD HIGH			MOD LOW	**MOD LOW**
25			Redhead	MOD HIGH			MOD LOW	**MOD LOW**
25			Bufflehead	MODERATE			MOD LOW	**MOD LOW**
25			Gadwall	MODERATE			MOD HIGH	**MOD HIGH**
25			Green-winged teal	MODERATE			MOD HIGH	**MOD HIGH**
25			Mottled duck	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
25			Northern shoveler	MODERATE			MOD LOW	**MOD LOW**
25			Ring-necked duck	MODERATE			MOD HIGH	**MOD HIGH**
25			Wood duck	MODERATE	MOD HIGH	**MOD HIGH**	HIGH	**HIGH**
26			Lesser scaup	HIGH			MOD HIGH	**HIGH**
26			Mallard	HIGH			HIGH	**HIGHEST**
26			Northern pintail	HIGH			MOD HIGH	**HIGH**
26			American wigeon	MOD HIGH			MOD HIGH	**MOD HIGH**
26			Blue-winged teal	MOD HIGH			MOD HIGH	**MOD HIGH**
26			Canvasback	MOD HIGH			MOD HIGH	**MOD HIGH**
26			Common goldeneye	MOD HIGH			MOD LOW	**MOD LOW**
26			Redhead	MOD HIGH			MOD LOW	**MOD LOW**
26			Bufflehead	MODERATE			MOD LOW	**MOD LOW**
26			Gadwall	MODERATE			MOD HIGH	**MOD HIGH**
26			Greater scaup	MODERATE			MOD HIGH	**MOD HIGH**
26			Green-winged teal	MODERATE			MOD HIGH	**MOD HIGH**
26			Mottled duck	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
26			Northern shoveler	MODERATE			MOD HIGH	**MOD HIGH**
26			Ring-necked duck	MODERATE			MOD HIGH	**MOD HIGH**
26			Wood duck	MODERATE	HIGH	**HIGH**	MOD HIGH	**MOD HIGH**
26			Ruddy duck	MOD LOW			MOD HIGH	**MODERATE**
27			American black duck	HIGH			MOD HIGH	**HIGH**
27			Lesser scaup	HIGH			MOD HIGH	**HIGH**
27			Mallard	HIGH			MOD HIGH	**HIGH**
27			American wigeon	MOD HIGH			MOD LOW	**MOD LOW**
27			Canvasback	MOD HIGH			MOD LOW	**MOD LOW**
27			Common goldeneye	MOD HIGH			MOD HIGH	**MOD HIGH**
27			Redhead	MOD HIGH			MOD LOW	**MOD LOW**
27			Bufflehead	MODERATE			MOD HIGH	**MOD HIGH**
27			Gadwall	MODERATE			MOD LOW	**MOD LOW**
27			Greater scaup	MODERATE			MOD HIGH	**MOD HIGH**
27			Ring-necked duck	MODERATE			MOD HIGH	**MOD HIGH**
27			Wood duck	MODERATE	MOD HIGH	**MOD HIGH**	MOD HIGH	**MOD HIGH**
27			Ruddy duck	MOD LOW			MOD HIGH	**MODERATE**
27.1			American black duck	HIGH	MOD LOW	**MODERATE**	HIGH	**HIGHEST**
27.1			Lesser scaup	HIGH			HIGH	**HIGHEST**
27.1			Mallard	HIGH			MOD HIGH	**HIGH**

WCR	Pelagic WCRs[a] Breeding	Pelagic WCRs[a] Nonbreeding	Species/ Population	Continental Priority	Breeding Importance	Breeding Need	Nonbreeding Importance	Nonbreeding Need
27.1			Northern pintail	HIGH			MOD HIGH	**HIGH**
27.1			American wigeon	MOD HIGH			MOD HIGH	**MOD HIGH**
27.1		1006	Black scoter	MOD HIGH			MOD HIGH	**MOD HIGH**
27.1			Blue-winged teal	MOD HIGH			MOD HIGH	**MOD HIGH**
27.1			Canvasback	MOD HIGH			HIGH	**HIGH**
27.1			Common goldeneye	MOD HIGH			MOD HIGH	**MOD HIGH**
27.1		1006	Long-tailed duck	MOD HIGH			MOD LOW	**MOD LOW**
27.1			Redhead	MOD HIGH			MOD HIGH	**MOD HIGH**
27.1		1006	Surf scoter	MOD HIGH			HIGH	**HIGH**
27.1		1006	White-winged scoter	MOD HIGH			MOD HIGH	**MOD HIGH**
27.1			Bufflehead	MODERATE			HIGH	**HIGH**
27.1			Gadwall	MODERATE			MOD HIGH	**MOD HIGH**
27.1			Greater scaup	MODERATE			HIGH	**HIGH**
27.1			Green-winged teal	MODERATE			MOD HIGH	**MOD HIGH**
27.1			Mottled duck	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
27.1			Northern shoveler	MODERATE			MOD HIGH	**MOD HIGH**
27.1			Ring-necked duck	MODERATE			MOD HIGH	**MOD HIGH**
27.1			Wood duck	MODERATE	MOD HIGH	**MOD HIGH**	MOD HIGH	**MOD HIGH**
27.1			Hooded merganser	MOD LOW			MOD HIGH	**MODERATE**
27.1			Red-breasted merganser	MOD LOW			MOD HIGH	**MODERATE**
27.1			Ruddy duck	MOD LOW			HIGH	**HIGH**
27.2			Lesser scaup	HIGH			HIGH	**HIGHEST**
27.2			Mallard	HIGH			MOD LOW	**MODERATE**
27.2			Northern pintail	HIGH			MOD LOW	**MODERATE**
27.2			American wigeon	MOD HIGH			MOD HIGH	**MOD HIGH**
27.2			Blue-winged teal	MOD HIGH			MOD HIGH	**MOD HIGH**
27.2			Canvasback	MOD HIGH			MOD HIGH	**MOD HIGH**
27.2			Common goldeneye	MOD HIGH			MOD LOW	**MOD LOW**
27.2			Redhead	MOD HIGH			HIGH	**HIGH**
27.2			Bufflehead	MODERATE			MOD HIGH	**MOD HIGH**
27.2			Gadwall	MODERATE			MOD HIGH	**MOD HIGH**
27.2			Greater scaup	MODERATE			MOD HIGH	**MOD HIGH**
27.2			Green-winged teal	MODERATE			MOD HIGH	**MOD HIGH**
27.2			Mottled duck	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
27.2			Northern shoveler	MODERATE			MOD HIGH	**MOD HIGH**
27.2			Ring-necked duck	MODERATE			MOD HIGH	**MOD HIGH**
27.2			Wood duck	MODERATE	MOD HIGH	**MOD HIGH**	MOD HIGH	**MOD HIGH**
27.2			Hooded merganser	MOD LOW			MOD HIGH	**MODERATE**
27.2			Red-breasted merganser	MOD LOW			MOD HIGH	**MODERATE**
27.2			Ruddy duck	MOD LOW			MOD HIGH	**MODERATE**
28			American black duck	HIGH			MOD HIGH	**HIGH**
28			Mallard	HIGH			MOD LOW	**MODERATE**
28			Canvasback	MOD HIGH			MOD LOW	**MOD LOW**
28			Common goldeneye	MOD HIGH			MOD LOW	**MOD LOW**
28			Bufflehead	MODERATE			MOD LOW	**MOD LOW**
28			Gadwall	MODERATE			MOD LOW	**MOD LOW**
28			Wood duck	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
29			American black duck	HIGH			MOD HIGH	**HIGH**
29			Lesser scaup	HIGH			MOD LOW	**MODERATE**
29			Mallard	HIGH			MOD LOW	**MODERATE**
29			Canvasback	MOD HIGH			MOD LOW	**MOD LOW**

WCR	Pelagic WCRs[a] Breeding	Pelagic WCRs[a] Nonbreeding	Species/ Population	Continental Priority	Breeding Importance	Breeding Need	Nonbreeding Importance	Nonbreeding Need
29			Common goldeneye	MOD HIGH			MOD LOW	**MOD LOW**
29			Redhead	MOD HIGH			MOD LOW	**MOD LOW**
29			Bufflehead	MODERATE			MOD LOW	**MOD LOW**
29			Greater scaup	MODERATE			MOD LOW	**MOD LOW**
29			Ring-necked duck	MODERATE			MOD LOW	**MOD LOW**
29			Wood duck	MODERATE	MOD LOW	**MOD LOW**	MOD HIGH	**MOD HIGH**
29			Hooded merganser	MOD LOW			MOD HIGH	**MODERATE**
30			American black duck	HIGH	MOD HIGH	**HIGH**	HIGH	**HIGHEST**
30		1005	Common eider	HIGH			HIGH	**HIGHEST**
30			Lesser scaup	HIGH			MOD HIGH	**HIGH**
30			Mallard	HIGH	MOD LOW	**MODERATE**	MOD HIGH	**HIGH**
30			Northern pintail	HIGH			MOD LOW	**MODERATE**
30			American wigeon	MOD HIGH			MOD LOW	**MOD LOW**
30		1005	Black scoter	MOD HIGH			HIGH	**HIGH**
30			Blue-winged teal	MOD HIGH			MOD LOW	**MOD LOW**
30			Canvasback	MOD HIGH			HIGH	**HIGH**
30			Common goldeneye	MOD HIGH			MOD HIGH	**MOD HIGH**
30		1005	King eider	MOD HIGH			MOD HIGH	**MOD HIGH**
30		1005	Long-tailed duck	MOD HIGH			HIGH	**HIGH**
30		1005	Surf scoter	MOD HIGH			HIGH	**HIGH**
30		1005	White-winged scoter	MOD HIGH			HIGH	**HIGH**
30			Bufflehead	MODERATE			HIGH	**HIGH**
30			Gadwall	MODERATE			MOD LOW	**MOD LOW**
30			Greater scaup	MODERATE			HIGH	**HIGH**
30			Green-winged teal	MODERATE			MOD LOW	**MOD LOW**
30		1005	Harlequin duck	MODERATE			HIGH	**HIGH**
30			Wood duck	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
30			Hooded merganser	MOD LOW			MOD HIGH	**MODERATE**
30			Red-breasted merganser	MOD LOW			MOD HIGH	**MODERATE**
30			Ruddy duck	MOD LOW			MOD HIGH	**MODERATE**
31			Lesser scaup	HIGH			MOD HIGH	**HIGH**
31			Northern pintail	HIGH			MOD LOW	**MODERATE**
31			American wigeon	MOD HIGH			MOD HIGH	**MOD HIGH**
31			Blue-winged teal	MOD HIGH			MOD HIGH	**MOD HIGH**
31			Canvasback	MOD HIGH			MOD LOW	**MOD LOW**
31			Redhead	MOD HIGH			MOD LOW	**MOD LOW**
31			Bufflehead	MODERATE			MOD LOW	**MOD LOW**
31			Green-winged teal	MODERATE			MOD LOW	**MOD LOW**
31			Mottled duck	MODERATE	HIGH	**HIGH**	HIGH	**HIGH**
31			Northern shoveler	MODERATE			MOD LOW	**MOD LOW**
31			Ring-necked duck	MODERATE			HIGH	**HIGH**
31			Wood duck	MODERATE	MOD LOW	**MOD LOW**		
31			Hooded merganser	MOD LOW			MOD HIGH	**MODERATE**
32			Lesser scaup	HIGH			MOD HIGH	**HIGH**
32			Mallard	HIGH	MOD LOW	**MODERATE**	MOD LOW	**MODERATE**
32			Northern pintail	HIGH			MOD HIGH	**HIGH**
32			American wigeon	MOD HIGH			MOD HIGH	**MOD HIGH**
32		1010	Black scoter	MOD HIGH			MOD HIGH	**MOD HIGH**
32			Canvasback	MOD HIGH			MOD LOW	**MOD LOW**
32			Common goldeneye	MOD HIGH			MOD LOW	**MOD LOW**
32		1010	Surf scoter	MOD HIGH			MOD HIGH	**MOD HIGH**

WCR	Pelagic WCRs[a] Breeding	Pelagic WCRs[a] Nonbreeding	Species/ Population	Continental Priority	Breeding Importance	Breeding Need	Nonbreeding Importance	Nonbreeding Need
32		1010	White-winged scoter	MOD HIGH			MOD HIGH	**MOD HIGH**
32			Bufflehead	MODERATE			MOD HIGH	**MOD HIGH**
32			Greater scaup	MODERATE			MOD HIGH	**MOD HIGH**
32			Green-winged teal	MODERATE			MOD LOW	**MOD LOW**
32			Northern shoveler	MODERATE			MOD HIGH	**MOD HIGH**
32			Wood duck	MODERATE	MOD LOW	**MOD LOW**		
32			Ruddy duck	MOD LOW			MOD HIGH	**MODERATE**
32.1			Lesser scaup	HIGH			MOD HIGH	**HIGH**
32.1			Mallard	HIGH	MOD HIGH	**HIGH**	HIGH	**HIGHEST**
32.1			Northern pintail	HIGH	MOD LOW	**MODERATE**	HIGH	**HIGHEST**
32.1			American wigeon	MOD HIGH			HIGH	**HIGH**
32.1			Blue-winged/ cinnamon teal	MOD HIGH			MOD HIGH	**MOD HIGH**
32.1			Canvasback	MOD HIGH			MOD HIGH	**MOD HIGH**
32.1			Surf scoter	MOD HIGH			MOD LOW	**MOD LOW**
32.1			White-winged scoter	MOD HIGH			MOD LOW	**MOD LOW**
32.1			Barrow's goldeneye	MODERATE			MOD LOW	**MOD LOW**
32.1			Bufflehead	MODERATE			MOD HIGH	**MOD HIGH**
32.1			Gadwall	MODERATE	MOD LOW	**MOD LOW**	MOD HIGH	**MOD HIGH**
32.1			Greater scaup	MODERATE			MOD LOW	**MOD LOW**
32.1			Green-winged teal	MODERATE			HIGH	**HIGH**
32.1			Northern shoveler	MODERATE			HIGH	**HIGH**
32.1			Ring-necked duck	MODERATE			MOD HIGH	**MOD HIGH**
32.1			Wood duck	MODERATE	MOD LOW	**MOD LOW**	MOD HIGH	**MOD HIGH**
32.1			Common merganser	MOD LOW			MOD HIGH	**MODERATE**
32.1			Hooded merganser	MOD LOW			MOD HIGH	**MODERATE**
32.1			Ruddy duck	MOD LOW			HIGH	**HIGH**
33			Mallard	HIGH			MOD LOW	**MODERATE**
33			Northern pintail	HIGH			MOD LOW	**MODERATE**
33			American wigeon	MOD HIGH			MOD LOW	**MOD LOW**
33			Blue-winged/ cinnamon teal	MOD HIGH			MOD LOW	**MOD LOW**
33			Canvasback	MOD HIGH			MOD LOW	**MOD LOW**
33			Common goldeneye	MOD HIGH			MOD LOW	**MOD LOW**
33			Redhead	MOD HIGH			MOD LOW	**MOD LOW**
33			Bufflehead	MODERATE			MOD LOW	**MOD LOW**
33			Gadwall	MODERATE			MOD LOW	**MOD LOW**
33			Green-winged teal	MODERATE			MOD LOW	**MOD LOW**
33			Northern shoveler	MODERATE			MOD LOW	**MOD LOW**
34			Mallard	HIGH			MOD LOW	**MODERATE**
34			Northern pintail	HIGH			MOD LOW	**MODERATE**
34			Canvasback	MOD HIGH			MOD LOW	**MOD LOW**
34			Bufflehead	MODERATE			MOD LOW	**MOD LOW**
34			Gadwall	MODERATE			MOD LOW	**MOD LOW**
34			Green-winged teal	MODERATE			MOD LOW	**MOD LOW**
34			Northern shoveler	MODERATE			MOD LOW	**MOD LOW**
35			Mallard	HIGH			MOD LOW	**MODERATE**
35			Bufflehead	MODERATE			MOD LOW	**MOD LOW**
36			Lesser scaup	HIGH			MOD LOW	**MODERATE**
36			Mallard	HIGH			MOD LOW	**MODERATE**
36			Northern pintail	HIGH			MOD LOW	**MODERATE**

WCR	Pelagic WCRs[a] Breeding	Pelagic WCRs[a] Nonbreeding	Species/ Population	Continental Priority	Breeding Importance	Breeding Need	Nonbreeding Importance	Nonbreeding Need
36			American wigeon	MOD HIGH			MOD LOW	**MOD LOW**
36			Blue-winged/ cinnamon teal	MOD HIGH			MOD LOW	**MOD LOW**
36			Canvasback	MOD HIGH			MOD LOW	**MOD LOW**
36			Redhead	MOD HIGH			MOD HIGH	**MOD HIGH**
36			Bufflehead	MODERATE			MOD LOW	**MOD LOW**
36			Gadwall	MODERATE			MOD HIGH	**MOD HIGH**
36			Greater scaup	MODERATE			MOD LOW	**MOD LOW**
36			Green-winged teal	MODERATE			MOD LOW	**MOD LOW**
36			Mottled duck	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
36			Northern shoveler	MODERATE			MOD LOW	**MOD LOW**
36			Ring-necked duck	MODERATE			MOD LOW	**MOD LOW**
36			Black-bellied whistling duck	MOD LOW	MOD HIGH	**MODERATE**	MOD HIGH	**MODERATE**
36			Fulvous whistling duck	MOD LOW	MOD HIGH	**MODERATE**		
37			Lesser scaup	HIGH			HIGH	**HIGHEST**
37			Mallard	HIGH			MOD HIGH	**HIGH**
37			Northern pintail	HIGH			HIGH	**HIGHEST**
37			American wigeon	MOD HIGH			HIGH	**HIGH**
37			Blue-winged teal	MOD HIGH	MOD LOW	**MOD LOW**	HIGH	**HIGH**
37			Canvasback	MOD HIGH			MOD HIGH	**MOD HIGH**
37			Common goldeneye	MOD HIGH			MOD HIGH	**MOD HIGH**
37			Redhead	MOD HIGH			HIGH	**HIGH**
37		1007	White-winged scoter	MOD HIGH			MOD HIGH	**MOD HIGH**
37			Bufflehead	MODERATE			MOD HIGH	**MOD HIGH**
37			Gadwall	MODERATE			HIGH	**HIGH**
37			Greater scaup	MODERATE			MOD HIGH	**MOD HIGH**
37			Green-winged teal	MODERATE			HIGH	**HIGH**
37			Mottled duck	MODERATE	HIGH	**HIGH**	HIGH	**HIGH**
37			Northern shoveler	MODERATE			HIGH	**HIGH**
37			Ring-necked duck	MODERATE			HIGH	**HIGH**
37			Wood duck	MODERATE	MOD HIGH	**MOD HIGH**	MOD HIGH	**MOD HIGH**
37			Black-bellied whistling duck	MOD LOW	MOD HIGH	**MODERATE**	HIGH	**HIGH**
37			Fulvous whistling duck	MOD LOW	HIGH	**HIGH**	HIGH	**HIGH**
37			Hooded merganser	MOD LOW			MOD HIGH	**MODERATE**
37			Red-breasted merganser	MOD LOW			MOD HIGH	**MODERATE**
37			Ruddy duck	MOD LOW			MOD HIGH	**MODERATE**
67			Hawaiian duck	MODERATE	HIGH	**HIGH**	HIGH	**HIGH**
67			Laysan duck	MODERATE	HIGH	**HIGH**	HIGH	**HIGH**
101			Northern pintail	HIGH			MOD HIGH	**HIGH**
101			Lesser scaup	HIGH			MOD LOW	**MODERATE**
101			American wigeon	MOD HIGH			MOD LOW	**MOD LOW**
101			Blue-winged teal	MOD HIGH			MOD LOW	**MOD LOW**
101			Canvasback	MOD HIGH			MOD LOW	**MOD LOW**
101			Cinnamon teal	MOD HIGH			MOD LOW	**MOD LOW**
101			Redhead	MOD HIGH			MOD HIGH	**MOD HIGH**
101			Gadwall	MODERATE			MOD HIGH	**MOD HIGH**
101			Green-winged teal	MODERATE			MOD LOW	**MOD LOW**
101			Northern shoveler	MODERATE			MOD LOW	**MOD LOW**
101			Ring-necked duck	MODERATE			MOD LOW	**MOD LOW**

WCR	Pelagic WCRs[a] Breeding	Pelagic WCRs[a] Nonbreeding	Species/ Population	Continental Priority	Breeding Importance	Breeding Need	Nonbreeding Importance	Nonbreeding Need
102			Mallard	HIGH			MOD HIGH	**HIGH**
102			Lesser scaup	HIGH			MOD LOW	**MODERATE**
102			Northern pintail	HIGH			HIGH	**HIGHEST**
102			American wigeon	MOD HIGH			MOD LOW	**MOD LOW**
102			Blue-winged teal	MOD HIGH			MOD HIGH	**MOD HIGH**
102			Canvasback	MOD HIGH			MOD HIGH	**MOD HIGH**
102			Cinnamon teal	MOD HIGH			MOD HIGH	**MOD HIGH**
102			Masked duck	MOD HIGH	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
102			Redhead	MOD HIGH			MOD HIGH	**MOD HIGH**
102			Gadwall	MODERATE			MOD HIGH	**MOD HIGH**
102			Green-winged teal	MODERATE			MOD HIGH	**MOD HIGH**
102			Northern shoveler	MODERATE			MOD HIGH	**MOD HIGH**
102			Ring-necked duck	MODERATE			MOD HIGH	**MOD HIGH**
102			Black-bellied whistling duck	MOD LOW	MOD HIGH	**MODERATE**	MOD HIGH	**MODERATE**
102			Fulvous whistling duck	MOD LOW	HIGH	**HIGH**	MOD HIGH	**MODERATE**
103			Mallard	HIGH			MOD HIGH	**HIGH**
103			Lesser scaup	HIGH			MOD LOW	**MODERATE**
103			Northern pintail	HIGH			HIGH	**HIGHEST**
103			American wigeon	MOD HIGH			MOD LOW	**MOD LOW**
103			Blue-winged teal	MOD HIGH			MOD HIGH	**MOD HIGH**
103			Cinnamon teal	MOD HIGH			MOD LOW	**MOD LOW**
103			Bufflehead	MODERATE			MOD LOW	**MOD LOW**
103			Gadwall	MODERATE			MOD LOW	**MOD LOW**
103			Green-winged teal	MODERATE			MOD HIGH	**MOD HIGH**
103			Northern shoveler	MODERATE			MOD HIGH	**MOD HIGH**
103			Ring-necked duck	MODERATE			MOD LOW	**MOD LOW**
103			Wood duck	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
103			Mexican duck	MOD LOW	HIGH	**HIGH**	HIGH	**HIGH**
104			Northern pintail	HIGH			MOD HIGH	**HIGH**
104			American wigeon	MOD HIGH			MOD HIGH	**MOD HIGH**
104			Blue-winged teal	MOD HIGH			MOD HIGH	**MOD HIGH**
104			Canvasback	MOD HIGH			MOD HIGH	**MOD HIGH**
104			Cinnamon teal	MOD HIGH			HIGH	**HIGH**
104			Muscovy duck	MOD HIGH			MOD LOW	**MOD LOW**
104			Bufflehead	MODERATE			MOD LOW	**MOD LOW**
104			Gadwall	MODERATE			MOD LOW	**MOD LOW**
104			Green-winged teal	MODERATE			MOD HIGH	**MOD HIGH**
104			Northern shoveler	MODERATE			MOD HIGH	**MOD HIGH**
104			Mexican duck	MOD LOW	HIGH	**HIGH**	HIGH	**HIGH**
105			Lesser scaup	HIGH			MOD HIGH	**HIGH**
105			Northern pintail	HIGH			MOD LOW	**MODERATE**
105			American wigeon	MOD HIGH			MOD LOW	**MOD LOW**
105			Cinnamon teal	MOD HIGH			HIGH	**HIGH**
105			Green-winged teal	MOD HIGH			MOD LOW	**MOD LOW**
105			Masked duck	MOD HIGH	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
105			Muscovy duck	MOD HIGH	MOD HIGH	**MOD HIGH**	MOD HIGH	**MOD HIGH**
105			Bufflehead	MODERATE			MOD LOW	**MOD LOW**
105			Northern shoveler	MODERATE			MOD HIGH	**MOD HIGH**
105			Black-bellied whistling duck	MOD LOW	MOD HIGH	**MODERATE**	MOD HIGH	**MODERATE**

WCR	Pelagic WCRs[a] Breeding	Pelagic WCRs[a] Nonbreeding	Species/ Population	Continental Priority	Breeding Importance	Breeding Need	Nonbreeding Importance	Nonbreeding Need
105			Fulvous whistling duck	MOD LOW	MOD HIGH	**MODERATE**	MOD HIGH	**MODERATE**
106			Lesser scaup	HIGH			MOD HIGH	**HIGH**
106			Northern pintail	HIGH			MOD HIGH	**HIGH**
106			American wigeon	MOD HIGH			MOD HIGH	**MOD HIGH**
106			Blue-winged teal	MOD HIGH			MOD HIGH	**MOD HIGH**
106			Canvasback	MOD HIGH			HIGH	**HIGH**
106			Cinnamon teal	MOD HIGH			MOD HIGH	**MOD HIGH**
106			Masked duck	MOD HIGH			MOD LOW	**MOD LOW**
106			Muscovy duck	MOD HIGH	HIGH	**HIGH**	HIGH	**HIGH**
106			Redhead	MOD HIGH			HIGH	**HIGHEST**
106			Gadwall	MODERATE			MOD HIGH	**MOD HIGH**
106			Green-winged teal	MODERATE			MOD HIGH	**MOD HIGH**
106			Mottled duck	MODERATE	MOD HIGH	**MOD HIGH**	MOD HIGH	**MOD HIGH**
106			Ring-necked duck	MODERATE			MOD HIGH	**MOD HIGH**
106			Wood duck	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
106			Black-bellied whistling duck	MOD LOW	HIGH	**HIGH**	MOD HIGH	**MODERATE**
106			Fulvous whistling duck	MOD LOW	HIGH	**HIGH**	MOD HIGH	**MODERATE**
107			Lesser scaup	HIGH			MOD LOW	**MODERATE**
107			Northern pintail	HIGH			MOD LOW	**MODERATE**
107			American wigeon	MOD HIGH			MOD HIGH	**MOD HIGH**
107			Blue-winged teal	MOD HIGH			HIGH	**HIGH**
107			Redhead	MOD HIGH			MOD HIGH	**MOD HIGH**
107			Gadwall	MODERATE			MOD HIGH	**MOD HIGH**
107			Green-winged teal	MODERATE			MOD HIGH	**MOD HIGH**
107			Ring-necked duck	MODERATE			MOD HIGH	**MOD HIGH**
107			Black-bellied whistling duck	MOD LOW	MOD HIGH	**MODERATE**	MOD HIGH	**MODERATE**
107			Fulvous whistling duck	MOD LOW	MOD HIGH	**MODERATE**	MOD HIGH	**MODERATE**

a Pelagic WCRs -

1001 - Arctic Shelf
1003 - Newfoundland-Labrador Shelf
1004 - Scotian Shelf
1005 - NE US Continental Shelf
1006 - SE US Continental Shelf
1007 - Gulf of Mexico
1008 - Pacific Central American Coastal
1009 - Gulf of California
1010 - Pacific Coastal
1011 - Gulf of Alaska
1012 - E. Bering Sea
1013 - W. Bering Sea
1014 - Chukchi Sea
1015 - Beaufort Sea
1016 - Great Lakes

Table B-3. Combined Prioritization for Breeding and Nonbreeding Geese and Swans.

(Empty cells indicate low conservation need or absence.)

WCR	Species/Population	Continental Priority	Breeding Importance	Breeding Need	Nonbreeding Importance	Nonbreeding Need
1	Emperor goose	HIGH			HIGH	**HIGHEST**
1	Western high Arctic brant	HIGH			MOD HIGH	**HIGH**
1	Canada goose – Aleutian	MOD HIGH	HIGH	**HIGH**		
2	Canada goose – Cackling	HIGH	HIGH	**HIGHEST**		
2	Canada goose – Lesser	HIGH	HIGH	**HIGHEST**	HIGH	**HIGHEST**
2	Emperor goose	HIGH	HIGH	**HIGHEST**	HIGH	**HIGHEST**
2	Pacific brant	HIGH	HIGH	**HIGHEST**	HIGH	**HIGHEST**
2	Canada goose – Aleutian	MOD HIGH			HIGH	**HIGH**
2	Lesser snow goose - Wrangel Island	MOD HIGH			HIGH	**HIGH**
2	Canada goose - Taverner's	MODERATE	HIGH	**HIGH**	HIGH	**HIGH**
2	Tundra swan – Eastern	MOD LOW	HIGH	**HIGH**		
2	Tundra swan – Western	MOD LOW	HIGH	**HIGH**		
2	White-fronted goose - Pacific Flyway	MOD LOW	HIGH	**HIGH**	HIGH	**HIGH**
3	Canada goose – Atlantic	HIGH	HIGH	**HIGHEST**		
3	Canada goose – Lesser	HIGH	MOD HIGH	**HIGH**		
3	Pacific brant	HIGH	HIGH	**HIGHEST**		
3	Western high Arctic brant	HIGH	HIGH	**HIGHEST**		
3	Eastern high Arctic brant	MOD HIGH	HIGH	**HIGH**		
3	Canada goose - Shortgrass Prairie	MODERATE	HIGH	**HIGH**		
3	Canada goose - Taverner's	MODERATE	HIGH	**HIGH**		
3	Lesser snow goose - Western Central Flyway	MODERATE	HIGH	**HIGH**		
3	Atlantic brant	MOD LOW	HIGH	**HIGH**		
3	Canada goose - Tallgrass Prairie	MOD LOW	HIGH	**HIGH**		
3	Tundra swan – Eastern	MOD LOW	HIGH	**HIGH**		
3	Tundra swan – Western	MOD LOW	HIGH	**HIGH**		
3	White-fronted goose – Mid-continent	MOD LOW	HIGH	**HIGH**		
3	Greater snow goose	Above objective	HIGH	**HIGH**	MOD HIGH	MODERATE
3	Lesser snow goose – Mid-continent	Above objective	HIGH	**HIGH**		
3	Lesser snow goose - Western Arctic	Above objective	HIGH	**HIGH**	HIGH	**HIGH**
3	Ross's goose	Above objective	HIGH	**HIGH**		
4	Canada goose – Lesser	HIGH	HIGH	**HIGHEST**		
4	White-fronted goose – Tule	HIGH	HIGH	**HIGHEST**		
4	Lesser snow goose - Wrangel Island	MOD HIGH			HIGH	**HIGH**
4	Canada goose - Taverner's	MODERATE	MOD HIGH	**MOD HIGH**		
4	Trumpeter swan - Pacific Coast	MOD LOW	HIGH	**HIGH**	HIGH	**HIGH**
4	Tundra swan – Western	MOD LOW			HIGH	**HIGH**
4	White-fronted goose – Mid-continent	MOD LOW	HIGH	**HIGH**		
5	Canada goose – Cackling	HIGH			HIGH	**HIGHEST**
5	Canada goose – Dusky	HIGH	HIGH	**HIGHEST**	HIGH	**HIGHEST**
5	Canada goose – Lesser	HIGH			HIGH	**HIGHEST**
5	Emperor goose	HIGH			MOD LOW	**MODERATE**
5	Pacific brant	HIGH			HIGH	**HIGHEST**
5	Western high Arctic brant	HIGH			HIGH	**HIGHEST**
5	Canada goose – Aleutian	MOD HIGH			HIGH	**HIGH**
5	Lesser snow goose - Wrangel Island	MOD HIGH			HIGH	**HIGH**
5	Canada goose – Pacific	MODERATE	HIGH	**HIGH**	MOD HIGH	**MOD HIGH**
5	Canada goose - Taverner's	MODERATE			HIGH	**HIGH**

WCR	Species/Population	Continental Priority	Breeding Importance	Breeding Need	Nonbreeding Importance	Nonbreeding Need
5	Canada goose – Vancouver	MODERATE	HIGH	**HIGH**	HIGH	**HIGH**
5	Trumpeter swan - Pacific Coast	MOD LOW	HIGH	**HIGH**	HIGH	**HIGH**
5	Tundra swan – Western	MOD LOW			HIGH	**HIGH**
5	White-fronted goose - Pacific Flyway	MOD LOW	MOD HIGH	**MODERATE**	HIGH	**HIGH**
5	Lesser snow goose - Western Arctic	Above objective			MOD HIGH	**MODERATE**
6	Trumpeter swan - Rocky Mountain	HIGH	HIGH	**HIGHEST**	HIGH	**HIGHEST**
6	Lesser snow goose - Wrangel Island	MOD HIGH			MOD HIGH	**MOD HIGH**
6	Canada goose - Shortgrass Prairie	MODERATE	MOD HIGH	**MOD HIGH**		
6	Lesser snow goose - Western Central Flyway	MODERATE			HIGH	**HIGH**
6	Canada goose - Eastern Prairie	MOD LOW			MOD HIGH	**MODERATE**
6	Canada goose - Rocky Mountain	MOD LOW			MOD HIGH	**MODERATE**
6	Tundra swan – Eastern	MOD LOW			HIGH	**HIGH**
6	Tundra swan – Western	MOD LOW			HIGH	**HIGH**
6	White-fronted goose – Mid-continent	MOD LOW			MOD HIGH	**MODERATE**
6	Lesser snow goose - Western Arctic	Above objective			HIGH	**HIGH**
6	Ross's goose	Above objective			HIGH	**HIGH**
6.1	Canada goose - Shortgrass Prairie	MODERATE	HIGH	**HIGH**		
7	Canada goose – Atlantic	HIGH	HIGH	**HIGHEST**		
7	Canada goose - North Atlantic	MOD HIGH	HIGH	**HIGH**		
7	Atlantic brant	MOD LOW			HIGH	**HIGH**
7	Canada goose - Mississippi Flyway Giant	Above objective			MOD HIGH	**MODERATE**
7.1	Canada goose - Southern James Bay	HIGH	HIGH	**HIGHEST**		
7.1	Canada goose - Mississippi Valley	MODERATE	HIGH	**HIGH**		
7.1	Atlantic brant	MOD LOW			HIGH	**HIGH**
7.1	Canada goose - Mississippi Flyway Giant	Above objective			MOD HIGH	**MODERATE**
7.1	Lesser snow goose – Mid-continent	Above objective	MOD HIGH	**MODERATE**	HIGH	**HIGH**
7.2	Canada goose - Eastern Prairie	MOD LOW	HIGH	**HIGH**		
7.2	Canada goose - Mississippi Flyway Giant	Above objective			HIGH	**HIGH**
7.2	Canada goose - Western Prairie/Great Plains	Above objective	HIGH	**HIGH**		
7.2	Lesser snow goose – Mid-continent	Above objective	MOD HIGH	**MODERATE**	HIGH	**HIGH**
8	Canada goose – Atlantic	HIGH	MOD LOW	**MODERATE**		
8	Canada goose - North Atlantic	MOD HIGH	MOD HIGH	**MOD HIGH**		
8	Canada goose - Mississippi Flyway Giant	Above objective			MOD HIGH	**MODERATE**
8.1	Canada goose – Southern James Bay	HIGH			MOD LOW	**MODERATE**
8.1	Canada goose - Mississippi Flyway Giant	Above objective			MOD HIGH	**MODERATE**
8.1	Canada goose - Western Prairie/Great Plains	Above objective	HIGH	**HIGH**		
8.2	Canada goose - North Atlantic	MOD HIGH	HIGH	**HIGH**		
9	Canada goose – Cackling	HIGH			MOD HIGH	**HIGH**
9	Canada goose – Lesser	HIGH			HIGH	**HIGHEST**
9	Trumpeter swan – Rocky Mountain	HIGH	MOD HIGH	**HIGH**	MOD HIGH	**HIGH**
9	White-fronted goose – Tule	HIGH			HIGH	**HIGHEST**
9	Canada goose - Aleutian	MOD HIGH			HIGH	**HIGH**
9	Lesser snow goose - Wrangel Island	MOD HIGH			HIGH	**HIGH**
9	Canada goose – Pacific	MODERATE			HIGH	**HIGH**
9	Canada goose – Taverner's	MODERATE			HIGH	**HIGH**
9	Canada goose - Rocky Mountain	MOD LOW			HIGH	**HIGH**
9	Tundra swan – Western	MOD LOW			HIGH	**HIGH**
9	White-fronted goose - Pacific Flyway	MOD LOW			HIGH	**HIGH**
9	Lesser snow goose - Western Arctic	Above objective			MOD HIGH	**MODERATE**
9	Ross's goose	Above objective			MOD HIGH	**MODERATE**
10	Canada goose – Lesser	HIGH			MOD HIGH	**HIGH**

WCR	Species/Population	Continental Priority	Breeding Importance	Breeding Need	Nonbreeding Importance	Nonbreeding Need
10	Trumpeter swan – Rocky Mountain	HIGH	MOD LOW	**MODERATE**	MOD LOW	**MODERATE**
10	Canada goose – Pacific	MODERATE			HIGH	**HIGH**
10	Canada goose – Taverner's	MODERATE			MOD HIGH	**MOD HIGH**
10	Canada goose - Rocky Mountain	MOD LOW	HIGH	**HIGH**	MOD HIGH	**MODERATE**
10	Trumpeter swan – Pacific Coast	MOD LOW			MOD HIGH	**MODERATE**
10	Tundra swan – Western	MOD LOW			HIGH	**HIGH**
11	Lesser snow goose - Wrangel Island	MOD HIGH			MOD HIGH	**MOD HIGH**
11	Canada goose - Shortgrass Prairie	MODERATE			HIGH	**HIGH**
11	Lesser snow goose - Western Central Flyway	MODERATE			HIGH	**HIGH**
11	Trumpeter swan – Interior	MODERATE	HIGH	**HIGH**	HIGH	**HIGH**
11	Canada goose - Eastern Prairie	MOD LOW			HIGH	**HIGH**
11	Canada goose - Rocky Mountain	MOD LOW	MOD HIGH	**MODERATE**		
11	Canada goose – Tallgrass Prairie	MOD LOW			HIGH	**HIGH**
11	Tundra swan – Eastern	MOD LOW			HIGH	**HIGH**
11	Tundra swan – Western	MOD LOW			MOD HIGH	**MODERATE**
11	White-fronted goose – Mid-continent	MOD LOW			HIGH	**HIGH**
11	Canada goose - Hi-Line	Above objective	HIGH	**HIGH**		
11	Canada goose - Mississippi Flyway Giant	Above objective	HIGH	**HIGH**	HIGH	**HIGH**
11	Canada goose - Western Prairie/Great Plains	Above objective	HIGH	**HIGH**	HIGH	**HIGH**
11	Lesser snow goose – Mid-continent	Above objective			HIGH	**HIGH**
11	Lesser snow goose - Western Arctic	Above objective			HIGH	**HIGH**
11	Ross's goose	Above objective			HIGH	**HIGH**
12	Canada goose – Atlantic	HIGH			MOD HIGH	**HIGH**
12	Canada goose – Southern James Bay	HIGH			MOD HIGH	**HIGH**
12	Canada goose - Mississippi Valley	MODERATE			MOD LOW	**MOD LOW**
12	Canada goose - Mississippi Flyway Giant	Above objective	MOD HIGH	**MODERATE**	MOD HIGH	**MODERATE**
13	Canada goose – Atlantic	HIGH			HIGH	**HIGHEST**
13	Canada goose - Southern James Bay	HIGH			HIGH	**HIGHEST**
13	Atlantic brant	MOD LOW			MOD LOW	**MOD LOW**
13	Tundra swan – Eastern	MOD LOW			MOD HIGH	**MODERATE**
13	Canada goose - Mississippi Flyway Giant	Above objective	HIGH	**HIGH**	MOD HIGH	**MODERATE**
13	Greater snow goose	Above objective			HIGH	**HIGH**
14	Canada goose - North Atlantic	MOD HIGH			HIGH	**HIGH**
14	Atlantic brant	MOD LOW			MOD HIGH	**MODERATE**
16	Trumpeter swan - Rocky Mountain	HIGH	MOD HIGH	**HIGH**	MOD HIGH	**HIGH**
16	Canada goose - Rocky Mountain	MOD LOW			MOD HIGH	**MODERATE**
16	Tundra swan – Western	MOD LOW			MOD HIGH	**MODERATE**
17	Lesser snow goose - Wrangel Island	MOD HIGH			MOD HIGH	**MOD HIGH**
17	Canada goose - Shortgrass Prairie	MODERATE			MOD HIGH	**MOD HIGH**
17	Trumpeter swan – Interior	MODERATE	HIGH	**HIGH**	HIGH	**HIGH**
17	Canada goose - Hi-Line	Above objective			MOD HIGH	**MODERATE**
17	Canada goose - Western Prairie/Great Plains	Above objective	MOD HIGH	**MODERATE**	MOD HIGH	**MODERATE**
17	Lesser snow goose - Western Arctic	Above objective			MOD HIGH	**MODERATE**
17	Ross's goose	Above objective			MOD HIGH	**MODERATE**
18	Canada goose - Shortgrass Prairie	MODERATE			HIGH	**HIGH**
18	Lesser snow goose - Western Central Flyway	MODERATE			HIGH	**HIGH**
18	Canada goose - Hi-Line	Above objective	MOD HIGH	**MODERATE**	HIGH	**HIGH**
18	Ross's goose	Above objective			MOD HIGH	**MODERATE**
19	Canada goose - Shortgrass Prairie	MODERATE			MOD LOW	**MOD LOW**
19	Lesser snow goose - Western Central Flyway	MODERATE			HIGH	**HIGH**
19	Canada goose - Tallgrass Prairie	MOD LOW			MOD HIGH	**MODERATE**

WCR	Species/Population	Continental Priority	Breeding Importance	Breeding Need	Nonbreeding Importance	Nonbreeding Need
19	White-fronted goose – Mid-continent	MOD LOW			HIGH	**HIGH**
19	Canada goose - Western Prairie/Great Plains	Above objective	HIGH	**HIGH**	HIGH	**HIGH**
19	Lesser snow goose – Mid-continent	Above objective			HIGH	**HIGH**
19	Ross's goose	Above objective			MOD HIGH	**MODERATE**
21	Canada goose - Tallgrass Prairie	MOD LOW			HIGH	**HIGH**
21	White-fronted goose – Mid-continent	MOD LOW			MOD HIGH	**MODERATE**
21	Canada goose - Western Prairie/Great Plains	Above objective			MOD HIGH	**MODERATE**
21	Lesser snow goose – Mid-continent	Above objective			MOD HIGH	**MODERATE**
22	Canada goose - Southern James Bay	HIGH			MOD LOW	**MODERATE**
22	Canada goose - Mississippi Valley	MODERATE			HIGH	**HIGH**
22	Canada goose - Eastern Prairie	MOD LOW			HIGH	**HIGH**
22	Canada goose - Tallgrass Prairie	MOD LOW			MOD LOW	**MOD LOW**
22	Canada goose - Mississippi Flyway Giant	Above objective	HIGH	**HIGH**	MOD HIGH	**MODERATE**
22	Canada goose - Western Prairie/Great Plains	Above objective	MOD HIGH	**MODERATE**	HIGH	**HIGH**
22	Lesser snow goose – Mid-continent	Above objective			HIGH	**HIGH**
23	Canada goose - Southern James Bay	HIGH			HIGH	**HIGHEST**
23	Canada goose - Mississippi Valley	MODERATE			HIGH	**HIGH**
23	Trumpeter swan – Interior	MODERATE	MOD HIGH	**MOD HIGH**	MOD HIGH	**MOD HIGH**
23	Tundra swan – Eastern	MOD LOW			HIGH	**HIGH**
23	Canada goose – Mississippi Flyway Giant	Above objective	HIGH	**HIGH**	MOD HIGH	**MODERATE**
24	Canada goose - Southern James Bay	HIGH			MOD HIGH	**HIGH**
24	Canada goose – Mississippi Valley	MODERATE			HIGH	**HIGH**
24	Canada goose - Eastern Prairie	MOD LOW			MOD LOW	**MOD LOW**
24	Canada goose - Mississippi Flyway Giant	Above objective	MOD HIGH	**MODERATE**	MOD HIGH	**MODERATE**
25	Lesser snow goose – Mid-continent	Above objective			MOD HIGH	**MODERATE**
26	Canada goose - Mississippi Valley	MODERATE			MOD LOW	**MOD LOW**
26	Lesser snow goose – Mid-continent	Above objective			MOD HIGH	**MODERATE**
27	Canada goose - Southern James Bay	HIGH			MOD LOW	**MODERATE**
27.1	Canada goose – Atlantic	HIGH			MOD HIGH	**HIGH**
27.1	Atlantic brant	MOD LOW			MOD HIGH	**MODERATE**
27.1	Tundra swan – Eastern	MOD LOW			HIGH	**HIGH**
27.1	Greater snow goose	Above objective			HIGH	**HIGH**
28	Canada goose – Atlantic	HIGH			MOD HIGH	**HIGH**
29	Canada goose – Atlantic	HIGH			MOD HIGH	**HIGH**
30	Canada goose – Atlantic	HIGH			HIGH	**HIGHEST**
30	Canada goose - North Atlantic	MOD HIGH			HIGH	**HIGH**
30	Atlantic brant	MOD LOW			HIGH	**HIGH**
30	Tundra swan – Eastern	MOD LOW			HIGH	**HIGH**
30	Canada goose - Mississippi Flyway Giant	Above objective	MOD HIGH	**MODERATE**	MOD HIGH	**MODERATE**
30	Greater snow goose	Above objective			HIGH	**HIGH**
32	Pacific brant	HIGH			HIGH	**HIGHEST**
32.1	Canada goose – Cackling	HIGH			MOD HIGH	**HIGH**
32.1	White-fronted goose - Tule	HIGH			HIGH	**HIGHEST**
32.1	Canada goose – Aleutian	MOD HIGH			HIGH	**HIGH**
32.1	Lesser snow goose - Wrangel Island	MOD HIGH			HIGH	**HIGH**
32.1	Canada goose – Pacific	MODERATE			MOD HIGH	**MOD HIGH**
32.1	Canada goose - Rocky Mountain	MOD LOW			MOD LOW	**MOD LOW**
32.1	Tundra swan – Western	MOD LOW			HIGH	**HIGH**
32.1	White-fronted goose - Pacific Flyway	MOD LOW			HIGH	**HIGH**
32.1	Lesser snow goose - Western Arctic	Above objective			HIGH	**HIGH**
32.1	Ross's goose	Above objective			HIGH	**HIGH**

WCR	Species/Population	Continental Priority	Breeding Importance	Breeding Need	Nonbreeding Importance	Nonbreeding Need
33	Trumpeter swan - Rocky Mountain	HIGH			MOD LOW	**MODERATE**
36	White-fronted goose – Mid-continent	MOD LOW			MOD HIGH	**MODERATE**
37	Canada goose - Tallgrass Prairie	MOD LOW			HIGH	**HIGH**
37	White-fronted goose – Mid-continent	MOD LOW			HIGH	**HIGH**
37	Lesser snow goose – Mid-continent	Above objective			HIGH	**HIGH**
67	Hawaiian goose	HIGH	HIGH	**HIGHEST**	HIGH	**HIGHEST**
101	Pacific brant	HIGH			HIGH	**HIGHEST**
101	Lesser snow goose - Western Central Flyway	MODERATE			MOD LOW	**MOD LOW**
101	White-fronted goose – Mid-continent	MOD LOW			MOD HIGH	**MODERATE**
101	White-fronted goose - Pacific Flyway	MOD LOW			MOD HIGH	**MODERATE**
102	Pacific brant	HIGH			MOD HIGH	**HIGH**
102	Lesser snow goose - Western Central Flyway	MODERATE			HIGH	**HIGH**
102	White-fronted goose – Mid-continent	MOD LOW			MOD HIGH	**MODERATE**
102	White-fronted goose - Pacific Flyway	MOD LOW			MOD HIGH	**MODERATE**
103	Lesser snow goose - Western Central Flyway	MODERATE			HIGH	**HIGH**
103	White-fronted goose – Mid-continent	MOD LOW			MOD HIGH	**MODERATE**
103	White-fronted goose - Pacific Flyway	MOD LOW			MOD HIGH	**MODERATE**
103	Lesser snow goose – Mid-continent	Above objective			MOD HIGH	**MODERATE**
106	White-fronted goose – Mid-continent	MOD LOW			MOD HIGH	**MODERATE**
106	Lesser snow goose – Mid-continent	Above objective			MOD HIGH	**MODERATE**

Appendix C: Institutional, Legal, and Administrative Authorities, Functions, and Arrangements

Plan Committee

The North American Waterfowl Management Plan Committee is an international body that provides leadership and oversight for the activities undertaken in support of the North American Waterfowl Management Plan.

Leadership

Taking advice from all Plan partners and the North American Waterfowl Management Plan Science Support Team (NSST), the Plan Committee provides leadership and promotes synergies within the North American waterfowl community, across relevant sectors, and internationally by:

- Championing waterfowl conservation in the context of coordinated bird management.
- Enhancing communications on waterfowl conservation and coordination within North America and with other nations that share North American waterfowl.
- Continually scanning the institutional network influencing waterfowl conservation and seeking ways to foster synergy among them.
- Promoting the development and assessment of continental waterfowl population objectives and species and geographic priorities through development and distribution of the Plan document.
- Connecting with the broader scientific community and ensuring that the Plan — and the NSST — link effectively and operationally with relevant scientific authorities such as the joint venture technical committees; flyway councils; and federal, state, and provincial agencies.
- Serving as a forum for discussion of major, long-term, international waterfowl issues and problems, and developing those discussions into recommendations for consideration by the cooperating partners and countries.
- Directing waterfowl-related recommendations to the Canadian Wildlife Service, the U.S. Fish and Wildlife Service, and the Mexican General Directorate of Wildlife, and returning information from those agencies to the Plan community.

Plan Management

The Plan Committee has oversight responsibility for assuring the quality of Plan actions and the overall effectiveness of the Plan. The committee also needs to be able to report on the impact of Plan funding and activities. To meet these obligations, the committee orchestrates Plan community resources to:

- Review and monitor progress toward achieving the Plan's population goals and related habitat objectives.
- Update the Plan approximately every 5 years in response to new or changing circumstances, policy developments, and opportunities.

- ➢ Foster an adaptive management approach among joint ventures in conservation implementation.
- ➢ Review and endorse waterfowl conservation components of joint venture plans.
- ➢ Review implementation and evaluation strategies developed by joint venture or other regional partnerships.
- ➢ Review periodic joint venture reports to ensure joint venture activities effectively further the Plan's purposes.
- ➢ Encourage coordination and consensus among joint ventures and other relevant bodies concerning waterfowl conservation needs, biological planning, monitoring, and assessment.
- ➢ Maintain and promote strong relationships with flyway councils, wetland councils, the North American Bird Conservation Initiative's Trilateral Committee, and other bird initiatives.
- ➢ Host periodic conferences for the NSST, joint ventures, and Plan partners to discuss improvements to the Plan's biological foundation.
- ➢ Annually solicit joint ventures and other Plan partners for input on the status of Plan implementation and issues to be addressed by the Plan Committee.
- ➢ Prepare periodic reports on the status of Plan implementation for the three federal wildlife agencies using input from the joint ventures and the NSST.
- ➢ Review periodically — in the spirit of adaptive management promoted in this Update — the Plan Committee's own effectiveness and consider structural, relational, and management approaches to enhance committee impact.

Membership

The Plan Committee consists of 18 members, 6 each from Canada, the United States, and Mexico, selected from agencies responsible for waterfowl management in their respective countries and appointed by the director of their federal wildlife agencies.

NAWMP Science Support Team (NSST)

The NAWMP Science Support Team (NSST) was created in 2000 to provide technical advice to the Plan Committee. Its mission is "To help strengthen the biological foundations of the Plan, and facilitate continuous improvement of Plan conservation programs." The team provides the following major services to the Plan:

1. *Provides technical input and recommendations to the Plan Committee on Plan implementation.* The team periodically reviews Plan population objectives, species priorities, geographic priorities, and habitat objectives; provides input on Plan updates; performs technical assistance in crafting broad-scale implementation strategies for the Plan; and helps interpret long-term implications of climate changes, agroeconomic trends, policy impacts, and other global dynamics for the future of waterfowl conservation.

2. *Facilitates identification of methods for biological planning and for evaluating Plan performance at continental and regional scales.* The NSST promotes adaptive management; assists regional Plan partnerships with stepping down continental population objectives and the development of habitat objectives; assists regional partnerships in developing a better understanding of the effects of habitat variation on population demography in order to link regional habitat objectives to continental population objectives; and assesses Plan progress while accounting for uncontrolled environmental variation. Methodological contributions could include identifying common currencies and definitions for interjoint venture planning, and seeking standardization and integration in survey and data management protocols for habitat and population monitoring.

3. *Acts as a forum for discussions on, and integration of biological planning and evaluation at multiple spatial scales.* The team helps improve the coordination of national, continental, and regional biological planning, monitoring, and assessment, as well as identifies broad-scale information gaps and technical issues beyond the scope of individual joint ventures.

4. *Facilitates technical information exchange and reporting.* The NSST helps to improve technical information exchange among joint ventures, between the Plan Committee and the joint ventures, among the flyways and the Plan community, and between the North American Wetlands Conservation Council(s) and the Plan community.

5. *Helps identify and communicate data, monitoring, assessment, and research needs to U.S. Geological Survey-Biological Resources Discipline, academia, U.S. Fish and Wildlife Service, and other Plan partners* and enables objective comparison of proposed evaluation activities. It facilitates technical integration with the flyway system and other bird initiatives on issues of common interest.

6. *Reports to the Plan Committee and Plan partners on the status of Plan biological foundation, evaluation results, and implications for future conservation activities.* The Plan Committee intends to begin regular reviews of joint venture progress in attaining the regional goals and objectives of the Plan. In support of these periodic reviews, the NSST will receive, consolidate, and assess regional progress reports and make related recommendations to the Plan Committee.

Membership

The NSST consists of three national representatives appointed by the Plan Committee Co-Chairs and one technical representative from each of the joint ventures and flyway councils. Ad-hoc members may also be appointed by the co-chairs of the Plan Committee.

Joint Ventures

"Think Continentally; Act Locally" is one concept that led to the creation of joint ventures by Plan founders. They recognized that success could only be achieved through the collaborative efforts of a range of public and private organizations, coordinated through a continental perspective, energized by local passion, and informed by resident expertise. In Canada and the United States, where there has been a strong history of closely coordinated conservation actions by governments and several nongovernment organizations, formal partnerships, called "joint ventures" have been formed to help implement the Plan. Joint ventures are planning and adaptive management focal points which join diverse interests to restore and protect habitat by advocating partnerships at the local level. The biological foundation components of joint venture perspectives that deal with waterfowl population goals and related habitat objectives are sanctioned by and accountable to the Plan Committee for meeting their responsibilities. In recent years, with the planning for all bird conservation in North America, many joint ventures have adopted a structure, objectives, and operations to accommodate conservation initiatives that will foster all bird conservation.

Two types of joint ventures currently operating:

➢ *Habitat* joint ventures are the fundamental regional conservation units of the Plan. They comprise diverse stakeholders committed to waterfowl conservation in a specific area, identified as one of the Plan's priority habitats. They were formed in response to research that indicated habitat loss and degradation were the causes of decline for many waterfowl species during the mid-1980s. Additional habitat joint ventures can be formed when formal partnerships for waterfowl habitat conservation develop in other areas of concern.

➢ *Species* joint ventures focus on knowledge acquisition that supports management actions. Black Duck and Arctic Goose Joint Ventures were specified in the original Plan to address concerns about the status of populations, to rectify the lack of data to specify the nature of the problem, or to design management solutions. Interest in forming a Sea Duck Joint Venture began in 1998 for much the same reasons. Species joint ventures comprise agencies capable of contributing effort, talent, and financial resources toward coordinated scientific activity. Research results are fed into the planning of habitat joint ventures. Additional species joint ventures can be considered wherever a significant science need is identified, together with a proposed coalition of partners.

Joint ventures are autonomous units which subscribe to the Plan's vision and principles and implement Plan objectives, and priorities through regional and local conservation efforts. Each joint venture is overseen by its own management body, develops a strategic implementation and evaluation plan, and organizes completion of its tasks through various support committees. Habitat joint ventures "step-down" the Plan's continental population objectives to develop regional habitat objectives by using sound science enhanced with local knowledge, and an evaluation of local opportunities and conservation dynamics. A joint venture's management interventions are expected to be strategic, science-based, and molded through adaptive management. Plan Committee endorsement of a joint venture's implementation plan can greatly facilitate recruitment of various institutional, financial, and human resources to achieve habitat objectives. Joint ventures report annually to the Plan Committee and Plan partners on the status of joint venture activities, challenges, and accomplishments.

Existing joint ventures that have a waterfowl conservation component endorsed by the Plan Committee are listed below with the country and year in which they were founded:

Habitat Joint Ventures

Atlantic Coast (U.S.: 1986)
Central Valley Habitat (U.S.: 1986)
Eastern Habitat (Canada: 1986)
Gulf Coast (U.S.: 1986)
Lower Mississippi Valley (U.S.: 1986)
Prairie Habitat (Canada: 1986)
Prairie Pothole (U.S.: 1986)
Playa Lakes (U.S.: 1990)
Intermountain West (U.S.: 1992)
Pacific Coast (U.S. & Canada: 1992)
Rainwater Basin (U.S.: 1992)
Upper Mississippi River — Great Lakes Region (U.S.: 1992)
San Francisco Bay (U.S.: 2000)

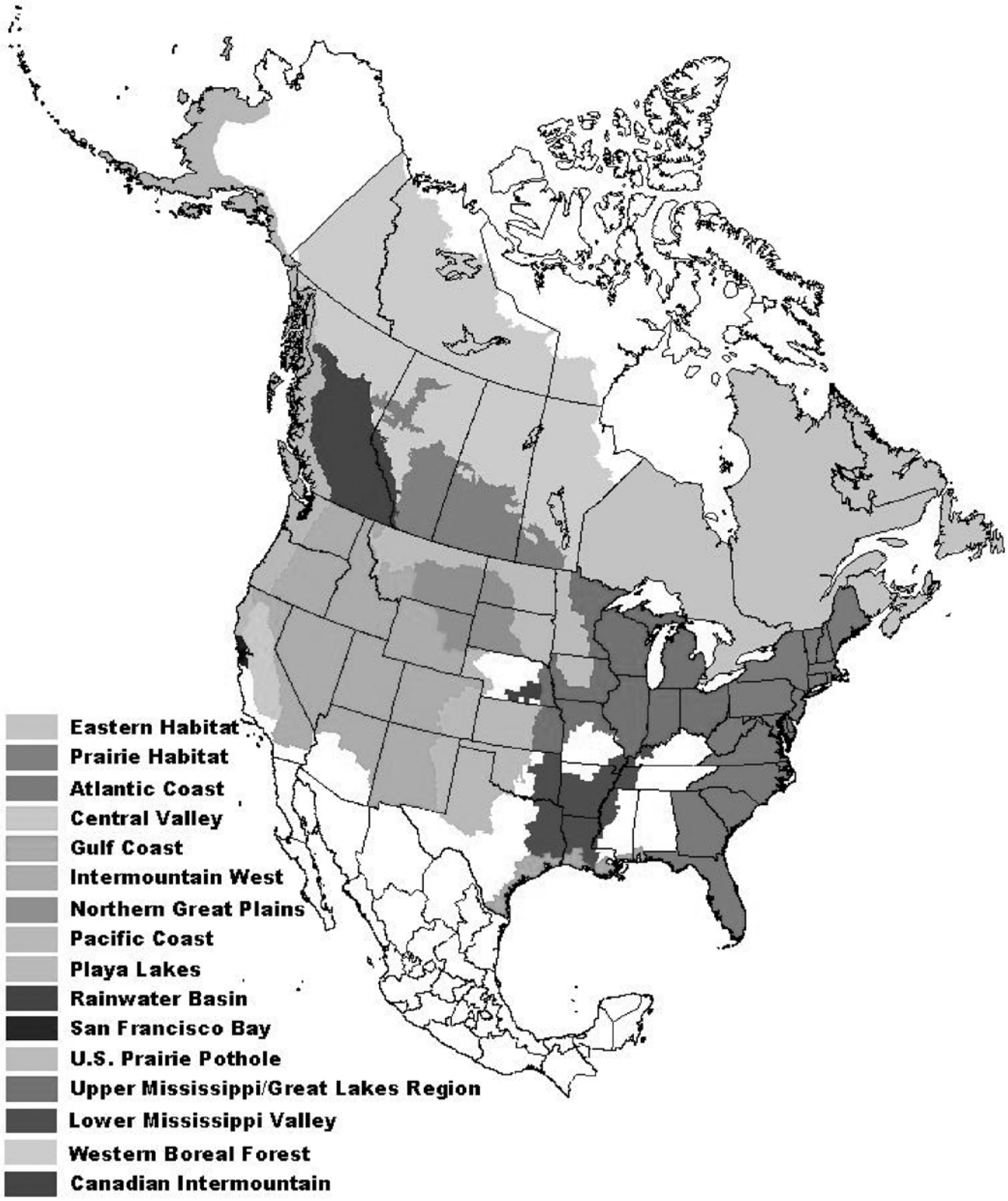
Species Joint Ventures

Arctic Goose (U.S. & Canada: 1986)
Black Duck (U.S. & Canada: 1986)
Sea Duck (U.S. & Canada: 1999)

Pending Review by the Plan Committee

Canadian Intermountain (Canada)
Northern Great Plains (U.S.)
Sonoran (U.S.)
Central Hardwoods (U.S.)

Figure C-1. NAWMP Joint Ventures.



National Administration

Canada

In Canada, the Plan is administered by the North American Wetlands Conservation Council (NAWCC) Canada, (see page 120) which is now a component of the North American Bird Conservation Initiative (NABCI) Canada Council. Working with the U.S. North American Wetlands Conservation Council and the General Directorate of Wildlife of the Secretariat of Environment and Natural Resources (SEMARNAT) in Mexico, the NAWCC (Canada) advises the Minister of the Environment through the NABCI Canada Council on the development, coordination, and implementation of wetland conservation initiatives of national or international importance. It also coordinates development of all habitat joint venture submissions for funding and acts as a window to the U.S. funding process.

National coordination is provided by the North American Waterfowl Management Plan Implementation Office, Canadian Wildlife Service, Environment Canada, and the Secretariat of NABCI/NAWCC (Canada). These offices provide funding support; maintain an accomplishment tracking system; provide input into *Birdscapes*, an international habitat magazine in cooperation with Mexico and the United States; coordinate the production of an annual report entitled "Canadian Habitat Matters;" publish the Plan Partners Contact List; assist in implementation of the Plan Awards Program; and coordinate with joint ventures and the provinces to achieve Plan goals in Canada.

The Canadian Wildlife Service also coordinates a number of other national level programs which complement aspects of the Plan. The coordination includes involvement in regulations that control the hunting of migratory game birds under the *Migratory Birds Convention Act*; the Convention on Wetlands of International Importance (Ramsar, Iran); the Habitat Stewardship Program; the Canadian Species at Risk Program; and research on a wide variety of wildlife topics, particularly migratory birds.

Joint venture management boards and provincial steering committees have formed many partnerships. Canadian partners include the federal government, all provincial governments and numerous government agencies (including the flyway councils), conservation organizations, municipalities, corporations, and landowners. These partners are directly responsible for designing, implementing, and monitoring programs and projects across the country.

United States

In the United States, the Plan has become a network of partnerships that connects various elements of the waterfowl conservation community. State and federal governments, the flyway councils, corporations, organizations, and individuals all have important roles in realizing the goals of the Plan. The nexus of these efforts is the regional joint ventures. Joint ventures are self-directed partnerships of agencies, organizations, corporations, tribes, or individuals that connect diverse programs aimed at migratory bird and habitat conservation on public and private lands.

Public land management is directed at acquiring high-priority public lands and restoring, enhancing, and managing habitats on existing lands. Partners include all of the states that participate in a joint venture and most of the major federal land-management agencies, such as the U.S. Fish and Wildlife Service's National Wildlife Refuge System; the Bureaus of Land Management, Reclamation, and Indian Affairs; the Department of Agriculture Forest Service; and the Department of Defense.

Private land management is directed at improving wetland, grassland, and forest habitats for waterfowl. Private lands are conserved through a diverse network of programs and partnerships, including the U.S. Fish and Wildlife Service's Partners for Fish and Wildlife, corporate partnerships, private land programs conducted by conservation organizations, state wildlife conservation programs, and federal programs such as the Department of Agriculture's Wetlands Reserve Program, Wildlife Habitat Incentive Program, Conservation Reserve Program, and the Environmental Quality Improvement Program.

National coordination of the Plan is provided by the U.S. Fish and Wildlife Service's Division of Bird Habitat Conservation (formerly the North American Waterfowl and Wetlands Office). It provides funding support; maintains an accomplishment tracking system; conducts national evaluation activities; publishes *Birdscapes* in cooperation with Canada and Mexico as well as annual progress reports and other reports; and coordinates with other federal agencies and the U.S. Congress.

Mexico

In Mexico, conservation under the Plan is coordinated through the General Directorate of Wildlife of the Secretariat of Environment and Natural Resources (SEMARNAT). Conservation efforts are directed at improving the overall conditions of wetland ecosystems within a framework of the great wealth of Mexico's biological diversity and are guided by the *National Strategy for the Management of Waterfowl and Their Habitats in Mexico*. This plan is being developed by the Subcommittee on Waterfowl and their Habitats in Mexico, an advisory group to the General Directorate of Wildlife, to guide conservation initiatives in the conservation of waterfowl and their habitats.

The economic importance of waterfowl is relatively small in Mexico and is dwarfed by the economic and sociological importance of all aspects of biological resources. Conservation projects are developed, implemented, and managed in cooperation with national and local nongovernmental organizations and with the involvement of the local communities. Conservation education is an integral part of conservation implementation. Developing sustainable uses of wetlands and associated wildlife on a regional basis and working with local communities to develop and implement management plans are high priorities.

Prioritization of wetlands with respect to importance for waterfowl is based on the national strategy. This document will provide the regional framework to guide future conservation initiatives and specific actions to secure the conservation of wetland ecosystems and associated wildlife. This work will be implemented regionally through local partnerships.

Authorities, Jurisdictions, and Linkages

Several landmark agreements established the legal foundation for conservation of waterfowl in North America. The *Convention for the Protection of Migratory Birds* (Migratory Bird Treaty) between the United States and Great Britain (for Canada) in 1916 mandated the first federal responsibility for managing waterfowl resources in North America across international boundaries. This treaty and subsequent treaties between the United States and Mexico in 1936, Japan in 1972, and the Soviet Union in 1978, ensured and expanded international cooperation and protection for migratory waterfowl and their habitats. Implementation of these treaties through enabling legislation in each country established policy frameworks to regulate hunting and other uses while ensuring long-term monitoring and conservation of these resources.

Another watershed event in waterfowl management was the establishment of the flyway system and the formation of councils in each of the Atlantic, Mississippi, Central, and Pacific Flyways in 1952. These flyway councils, consisting of state/provincial wildlife agencies, were intended to serve as administrative vehicles that would forge an effective partnership with federal agencies to improve waterfowl research and management programs, including the development of annual hunting regulations in the United States. Canada's participation in the flyways provides input — in the form of information exchange, coordination of research, and development of shared objectives — into developing its own hunting regulations for migratory game birds. Flyway councils pioneered the development of science-based waterfowl management plans to set population, habitat, and harvest goals. Each of these plans was tailored to specific populations or geared towards particular waterfowl situations, flyway by flyway. Although many challenges remain, the flyway council system has been an effective force on behalf of waterfowl conservation for more than 50 years.

In 1986, Canada and the United States came together to establish the North American Waterfowl Management Plan (Mexico joined in 1994). The Plan identifies desirable population and habitat goals and recommends resolutions to problems facing waterfowl management on an international scale. Although the Plan remains vibrant, having extended the reach and impact of continental waterfowl conservation as documented in Plan updates in 1994 and 1998, this current document strives to reexamine the Plan's original goals and strengthen its scientific base to meet both present and future challenges. In its brief history, the Plan has achieved unparalleled success in advancing the principles of waterfowl management and research by forming a union of partnerships with private and governmental organizations across the continent.

Formal recognition of the cultural and dietary importance of migratory birds to Aboriginal, Native American, indigenous, and local communities can be found in the 1999 amendment to the Migratory Bird Convention. These peoples will play an increasingly active role in management decisions affecting the waterfowl resource as their communities become more fully integrated into the Plan over time.

Other alliances relevant to continental conservation include the Convention on Wetlands of International Importance (Ramsar, Iran, 1971), the 1992 Convention on Biological Diversity, the 1992 North American Free Trade Agreement, the parallel North American Agreement on Environmental Cooperation, and the Trilateral Committee for Wildlife and Ecosystem Conservation and Management.

The North American Wetlands Conservation Act of 1989 established the North American Wetlands Conservation Council (NAWCC) to review the merits of wetland conservation proposals submitted for funding under the act's grants program. The council ranks and prioritizes projects based on certain biological criteria and recommendations made by joint venture management boards in the United States and by the Canadian and Mexican federal governments. The Council recommends proposals for funding to the Migratory Bird Conservation Commission, the funding authority under the act.

Appendix D: Plan Monitoring Needs

Functions of Monitoring

Monitoring that supports North American waterfowl conservation serves two primary functions. First, monitoring provides data needed for management decisions that are based upon current resource status. Second, analysis of monitoring data can help identify the causes of population change and provide an improved basis for future management decision-making.

The nature and characteristics of monitoring programs determine the type of management decisions that they can support and evaluate. Surveys designed primarily to estimate abundance and assess population trajectory can also be helpful in identifying population changes and spatial pattern in change. Unfortunately, they provide little support for management decision-making except to direct resources to identify the causes of population decline or overabundance. In contrast, surveys that also provide measures of environmental or other factors believed to affect population status offer some opportunity to test hypotheses about fundamental issues of population limitation and regulation. More useful yet are surveys that are tightly integrated within an explicit management decision-making process that involves biological prediction and testing so as to inform decisions while learning about mechanisms affecting population status. Abundance surveys, as well as surveys such as banding, marking, production surveys (designed to estimate vital rates), and harvest surveys, when coordinated with monitoring of natural and management-induced environmental changes, can inform management decisions and provide important insights into the mechanisms underlying population change.

Adaptive resource management (ARM) provides an explicit framework that ensures that monitoring data are relevant and useful in making immediate management decisions. This framework provides a means to improve future decision-making through an iterative cycle of biological prediction and testing. Both institutional and technical challenges have limited practical ARM implementation. Adaptive management of the recreational harvest of North American waterfowl, however, stands as a good example of this process, where the role and use of monitoring data is clearly defined prior to a decision-making cycle. While the challenges are many, application of the concepts of ARM should be a high priority in the development and implementation of regional bird conservation plans.

Monitoring Needs

Six general monitoring needs have been identified in support of the Plan:

(1) *Abundance* — Enable assessment of population status and the development of population objectives by expanding and enhancing surveys that provide the primary means of tracking changes in waterfowl abundance.

(2) *Vital Rates and Harvest Rates* — Enhance efforts and improve methods to monitor population recruitment, survival rates, and harvest rates to better understand the mechanisms causing population change.

(3) *Coordinated Environmental Monitoring* — Expand and integrate environmental monitoring at multiple scales with population surveys (abundance and vital rates) to test hypotheses about factors limiting population growth, test assumptions underlying Plan habitat conservation objectives, and evaluate Plan conservation actions.

(4) *Cross-scale Integration* — Integrate and coordinate population and habitat monitoring at continental, regional, and local scales so that patterns in population or habitat change at one scale are informative of ecological processes responsible for patterns at other scales.

(5) *Data Management and Accessibility* — Improve data management and retrieval protocols to provide conservation planners and researchers with rapid access to spatially referenced waterfowl population and habitat data.

(6) *New Technologies* — Implement new and emerging tracking technologies to supplement traditional monitoring databases and improve opportunities to learn about waterfowl response to environmental variation at multiple scales.

Abundance

The long history of monitoring waterfowl abundance in North America has contributed greatly to the maturation of the Plan as a vehicle for conservation. While many monitoring programs were designed largely to aid in understanding the impacts of harvest regulations on waterfowl populations, retrospective analyses of these data have provided insights into habitat-population relationships that formed the cornerstone for the Plan's habitat objectives and conservation strategies. Population abundance surveys enable routine assessment of population status and the establishment of population objectives. When closely coordinated with environmental monitoring, data from abundance surveys can be useful in identifying agents of population change and evaluating the effects of conservation programs. A minimum objective is to ensure the existence of at least one reliable means of tracking changes in abundance for all North American waterfowl.

One critical element in the design of bird abundance surveys is the estimation of detection probability, since rigorous attention to issues of sampling design alone will not ensure that population estimates are reliable. This unreliability is due largely to the common situation in which counts of birds on sampling units represent some unknown fraction of those actually present. Variable detection probabilities impose bias in sample-based density estimators and may bias trend estimates. In the analysis of data from waterfowl population surveys that do not address detection probability (e.g., Mid-winter Waterfowl Survey), it is common to assume either a constant detection probability over time or the absence of a long-term trend in detection probability and to use the resulting counts or estimates as indices of population size.

In practice it is likely that detection probability varies both temporally and spatially in response to environmental and operational (e.g., changes in observers, vehicles, or observation equipment) factors. It is possible to account for some factors inducing variability in detection probability within a modeling framework. When logistically possible, it is preferable to design surveys that include methods to directly estimate detection probability (e.g., Waterfowl Breeding Population and Habitat Survey). Recently, great theoretical advances have been made in methods for the estimation of detection probability which may be valuable in improving existing population abundance surveys and in designing new surveys for species that are inadequately covered by existing survey programs (e.g., many sea ducks).

Vital Rates and Harvest Rates

In addition to abundance surveys, the extensive annual effort to retrieve data from leg-banded, neck-collared, and otherwise marked birds has contributed substantially to the general understanding of seasonal habitat affinities of waterfowl populations, the degree of mixing among populations, philopatry and movement, and changes in vital rates that influence distribution and abundance.

Harvest and part collection surveys, in conjunction with band recovery data, provide information on hunting mortality and age ratios in the fall population that are reflective of the past year's recruitment. Special ground or aerial productivity surveys also provide information on waterfowl recruitment. Analysis of demographic survey data has helped managers understand which population processes and periods during the annual cycle limit waterfowl population growth.

As a part of multifaceted studies to understand the effects of environmental changes on waterfowl populations, targeted year-round waterfowl banding and marking programs could enable estimation of seasonal survival rates that would be more closely associated with seasonal resource availability. Emerging tracking technologies (see New Technologies, p. 125) show promise in both delineation of waterfowl populations and in direct measurement of vital rates. The spatially referenced nature of tracking data also offers the opportunity to study the response of individual birds to environmental variation at multiple scales. A better understanding of ecological processes affecting waterfowl survival, recruitment, and abundance, is essential to the development of model-based habitat conservation objectives that can be evaluated and improved through an adaptive process.

Coordinated Environmental Monitoring

Environmental monitoring programs coordinated or integrated with waterfowl surveys are needed to evaluate hypotheses about the influence of habitat, weather, and management actions on population status. As a precursor to the development or enhancement of environmental monitoring strategies, alternative hypotheses about the nature of regional environmental influences on populations must be specified. These hypotheses should be codified into models that predict population responses to environmental changes. Model-based monitoring strategies might then be defined to allow discrimination among models that predict different population responses to environmental conditions or management actions.

Considerable forethought will be necessary to develop population, habitat (i.e., resource), and weather monitoring protocols at appropriate spatial and temporal scales. Model-based monitoring programs might be developed, for instance, to better understand the effects of a local-scale habitat treatment, the effects of a suite of management treatments at a landscape level, or the effects of precipitation patterns and habitat availability on waterfowl at a regional scale. Coordinated environmental monitoring may be closely tied to the population monitoring protocol (e.g., counting wet ponds while counting birds) or utilize different methodologies such as classification of remotely sensed data or summarization of weather reporting station data.

Cross-scale Integration

No single appropriate spatial or temporal scale exists for waterfowl monitoring. The spatial and temporal scale of a monitoring program is dictated by the objectives of that program, specifically the management decisions it has been designed to inform. For instance, the U.S. Fish and Wildlife Service (USFWS) and the Canadian Wildlife Service (CWS) collaborate annually on the Waterfowl Breeding Population and Habitat Survey. This large-scale survey supports the annual development of national waterfowl hunting regulation frameworks and provides a primary means of assessing the status of a number of high priority waterfowl species.

At smaller regional scales, waterfowl surveys are conducted to better understand the influence of specific environmental factors on population distribution, abundance, survival, and recruitment. A good example is the annual Four-Square-Mile Survey conducted by the U.S. Fish and Wildlife Service in the U.S. portion of the prairie pothole region. Counts of breeding waterfowl and annual assessments of habitat condition have enabled the development of models to predict breeding waterfowl distribution and abundance. The predictions of these models are foundational to the development of regional habitat conservation strategies in the U.S. prairie pothole region.

Waterfowl population surveys also occur at local spatial scales and over short time intervals. Examples are special purpose surveys designed to evaluate the impact of either a particular management treatment or periodic waterfowl counts conducted on state, provincial, or federal waterfowl management or refuge areas. Data from small-scale surveys are frequently inaccessible to all but a few researchers or managers associated with a particular facility or research project.

A limitation of scale-specific monitoring programs is that it can be difficult to understand the mechanisms causing patterns observed in the monitoring data. For instance, data from the Waterfowl Breeding Population and Habitat Survey can be used to detect a change in abundance, but it may be impossible to understand the mechanisms causing that change without additional information about regional demographic processes. At a local scale, changes in surveyed waterfowl abundance in a particular management area before and after a habitat modification is uninformative without some understanding of regional and even continental patterns of population abundance.

The utility of monitoring data at multiple scales suggests that some level of integration across scales is warranted. Integration might involve the formal merger of ongoing survey protocols using multilevel survey designs; or it can be simpler, such as centralized management of, or centralized access to, spatially referenced survey data from local-scale, regional-scale, and continental-scale programs.

Data Management and Accessibility

Effective conservation planning requires an understanding of how bird populations respond to habitats at local, regional, and continental scales. Thus, an immediate challenge for biologists in developing science-based waterfowl conservation plans is to access and understand the content of historical and contemporary bird population and habitat data. A tremendous volume of baseline data exists, diffusely distributed among federal and state governmental agencies and nongovernmental organizations. It is frequently difficult to access important data, and databases vary significantly in their level of documentation. Too often long-term databases are incomplete or unavailable electronically.

The USFWS, in cooperation with the U.S. Geological Survey's National Biological Information Infrastructure and Patuxent Wildlife Research Center, is collaborating in the development of a data center for the distribution of standardized, well-documented, spatially referenced bird population and habitat databases. The primary intent of this data center is to provide Internet access to a distributed network of databases maintained by the USFWS, USGS, and other agency and nongovernmental partners in bird conservation. It is incumbent upon all agencies and organizations involved in the monitoring of bird populations or habitats to ensure that their data are professionally managed, well-documented, Internet accessible, and linked to a centralized data portal such as the USFWS-USGS site described. The costs in personnel and finances for these data management and retrieval requirements should be considered in initial phases of survey development.

New Technologies

Innovative application of traditional methods of population survey will continue to play an important role in habitat conservation. Unfortunately, because of fiscal and logistical constraints, these methods alone will not provide all the data that habitat joint ventures need in order to understand bird responses to environmental changes at multiple scales. Emerging wildlife tracking technologies hold great promise for supplementing information derived from traditional survey techniques. Plan partners must maintain an awareness of advances in wildlife tracking technology such as recent developments in satellite telemetry and Global Positioning System (GPS)-based tracking devices.

Satellite telemetry continues to evolve, and enhancements such as light-weight solar recharging batteries have extended the life of individual platform terminal transmitter (PTTs) and have decreased their size, making them applicable to duck-sized birds. Satellite telemetry, unfortunately, remains a costly tracking alternative and its spatial precision (hundreds of meters), while sufficient to identify broad-scale patterns in movement, limits its use in evaluating how birds are responding to environmental changes and disturbances at a local scale. On the other hand, a combination of local observational studies and satellite tracking studies might help elucidate factors affecting bird distribution, movement, and abundance.

Tracking of duck sized birds by GPS is not yet feasible. A GPS receiver today is little more than a microchip, battery technology, antenna configuration, and transmitter, yet limitations still constrain efforts to miniaturize GPS-based PTTs. With continued expansion of GPS commercial markets, the trend toward miniaturization should continue to the point where this technology is applicable and cost-effective for waterfowl. The spatial precision of GPS derived waterfowl positions, in conjunction with geospatial environmental databases, would enable modeling of factors affecting waterfowl distribution, movement, and abundance throughout the annual cycle at various scales and testing key planning assumptions.

These new tracking technologies, as well as other tools such as genetic markers and stable isotope methods, are also providing managers with more effective means to delineate discrete population segments that might be candidates for individualized management strategies. Identification of population segments also facilitates the interpretation of patterns observed in population monitoring data and helps managers identify population segments that may be increasing or declining and target conservation resources appropriately.

Monitoring Responsibilities

Primary responsibilities in meeting monitoring needs for North American waterfowl conservation are described for the North American Waterfowl Science Support Team (NSST), Federal agencies responsible for migratory bird conservation, and joint ventures.

North American Waterfowl Science Support Team (NSST)

As the principal technical advisory body to the International Plan Committee and the primary vehicle for cross-joint venture collaboration, it is incumbent on the NSST to propose a coordinated multiscale monitoring strategy that (a) includes a monitoring protocol for each species that provides reliable estimates of absolute abundance during some portion of the annual cycle, (b) identifies a cohesive set of regional population and habitat monitoring programs to better understand regional factors affecting continental waterfowl populations and to promote ongoing refinement of habitat conservation objectives and strategies, and (c) identifies opportunities for collaboration in population and/or habitat monitoring with other bird conservation initiatives.

Federal Management Agencies

As the agencies with primary statutory responsibility for the management and conservation of migratory birds, it is incumbent on the USFWS, CWS, and SEMARNAT to document resource requirements for meeting the objectives of the monitoring strategy described by the NSST as well as requirements associated with other responsibilities such as the regulation of waterfowl harvest. The Federal management agencies, in conjunction with other governmental partners in each country, should seek to develop and implement effective programs to monitor absolute abundance of all North American waterfowl species. The Federal agencies should continue to support the monitoring necessary for the effective regulation of recreational and subsistence harvest of waterfowl. These agencies should also lead in the development of a monitoring data management infrastructure that provides internet access to standardized, well-documented, spatially referenced databases. This should be a distributed infrastructure providing Internet links to the data resources of these agencies, to joint ventures, and to other individual joint venture partner organizations. Lastly, as reources permit, the federal migratory bird management agencies should provide technical expertise and operational support for the development of regional monitoring strategies.

Joint Ventures

It is the responsibility of joint venture technical committees to work with the NSST in order to develop a cohesive continental monitoring strategy to support waterfowl habitat conservation. Joint ventures must also specify hypotheses about the primary environmental factors affecting waterfowl distribution and abundance and, in cooperation with the NSST, they must describe regional and local-scale monitoring protocols needed to evaluate alternative hypotheses and refine habitat conservation objectives and strategies. Furthermore joint ventures should develop partnerships to fund necessary monitoring priorities and to promote the monitoring resource needs of the federal migratory bird management agencies to governmental appropriators in Canada, Mexico, and the United States.

Detailed Assessment of Population Abundance Monitoring Needs

The scale-specific monitoring programs required to identify the causes of population change or to evaluate specific management actions are many and varied. While the importance of monitoring for effective management cannot be overstated, it is beyond the scope of this continental strategic plan to outline every need in detail. Instead, this section focuses on identifying the monitoring necessary to provide at least one reliable means of estimating absolute abundance of all North American ducks, geese, and swans.

Two general principles pertain to the survey needs identified in this section. First, survey programs should be guided by statistical objectives derived from explicit consideration of the needs of decision makers. Second, to be most useful, monitoring programs, including those that monitor abundance, should be guided by and integrated within a management decision process that includes biological prediction (i.e., about factors influencing population status) and testing. Environmental covariates believed to have large effects on population status should be monitored concurrently with population abundance and vital rates.

North American waterfowl monitoring programs represent, arguably, the most extensive coordinated wildlife monitoring programs in the world. Unfortunately, despite the substantial effort expended to track population abundance and to assess trend, many North American waterfowl populations are currently not monitored sufficiently to estimate population size, detect a population trend, or establish a population objective. Some species are distributed partly or entirely outside the bounds of existing population surveys. This distribution challenge is particularly true for sea ducks, which primarily breed in remote boreal and Arctic regions and winter in open water habitats that are difficult and dangerous to survey. Additionally, broad-scale breeding surveys were optimally timed for specific dabbling ducks and led to poor population estimates for species, such as some diving ducks and sea ducks, that migrate and breed later. Also, methods to estimate and adjust for detection probability, while well developed for waterfowl sample surveys, are ineffectively implemented in some regions, particularly inaccessible boreal areas; consequently, biases in trend estimation caused by observer and aircraft changes and other unaccounted for effects can result.

At present, there is not a consensus among waterfowl biologists about the most practical and efficient means to monitor status of all waterfowl populations. The material presented in this section is intended to encourage, rather than discourage, continued debate over survey methodologies for specific populations.

Dabbling Ducks

The dabbling ducks are probably the best-monitored group of waterfowl in North America. Cooperative breeding ground surveys established by Canada and the United States in 1955 focus on primary breeding areas for dabbling species and are optimally timed to estimate their abundance, particularly for early nesting species such as the mallard. Over the past several decades, many states and provinces have initiated complementary breeding waterfowl surveys, and the United States and Canadian federal governments have expanded breeding surveys into eastern regions of Canada. Nevertheless, concern remains about the low intensity of sampling in the vast boreal regions of Canada and Alaska.

Existing breeding ground surveys provide a reasonable means to track population trends for most dabbling species; however, there are exceptions. Green-winged teal, for instance, occupy a very broad breeding range. While state-provincial surveys and expanded federal breeding population surveys in eastern Canada have improved coverage for this species, significant portions of its breeding range in northern Canada and Alaska are not surveyed. Expansion of breeding ground surveys into additional Arctic regions of Canada and Alaska will be necessary to more completely cover the breeding range of this species.

Blue-winged teal and cinnamon teal pose different challenges in estimating population size. When observed from the air, these species are difficult to distinguish, and estimates of each species have traditionally been combined. Since 1986 the Plan has included a combined population objective for blue-winged and cinnamon teal to be consistent with their combined estimation. Within the region traditionally surveyed by the United States and Canadian federal governments, significant breeding range overlaps occur in Montana and southern Alberta. Likewise, range overlaps occur within other western states and provinces where breeding waterfowl surveys are conducted. One possibility for deriving separate population estimates for blue-winged and cinnamon teal would be to estimate species' proportions in areas of range overlap using data collected by ground crews for the purpose of visibility-bias correction. Another challenge in estimating abundance of cinnamon teal is that a large proportion of this species breeding range is presently unsurveyed in Mexico and the states of Idaho, Arizona, New Mexico, Kansas, Oklahoma, and Texas. New surveys would be necessary to improve coverage for cinnamon teal in these areas.

The northern pintail migrates very early in the spring, occupying breeding habitats shortly after they become ice-free. The pintail initiates breeding activities earlier than other ducks, and this timing creates some concern about the potential to undercount this species during the traditional Waterfowl Breeding Population and Habitat Survey since incubation may have begun prior to survey flights. One way to overcome this limitation in present survey protocols would be to conduct a separate breeding population survey optimally timed earlier in the spring for pintails. Such a survey would partly coincide with the Waterfowl Breeding Population and Habitat Survey conducted in May.

Neither of the two populations of mottled ducks in North America, the Florida Population or the Western Gulf Coast Population, is adequately covered by breeding surveys. The mid-winter index is considered unreliable for this species in Florida, so a significant portion of the mottled duck breeding range in that state is surveyed annually. Nevertheless, the exact proportion of the Florida population that is surveyed, and the consistency of this proportion, is unknown. The only breeding season surveys of Western Gulf Coast mottled ducks occur on transects of some national wildlife refuge lands in Texas and are not designed to produce an estimate of abundance for any portion of the species' range. An experimental survey of the lower and middle Texas coast holds promise for obtaining breeding population estimates for this region; however, there remains a need to develop protocols and expand survey efforts to include Louisiana and the Chenier Plain of Texas to produce a reliable, annual population estimate for Western Gulf Coast mottled ducks.

Perhaps no other species of North American waterfowl presents as much a challenge to the design of protocols for monitoring population abundance as the wood duck. The breeding range of wood ducks lies largely outside areas in which state, provincial, and Federal cooperative breeding population surveys are conducted. Where aerial survey coverage does overlap wood duck breeding range, the densely wooded habitats this species occupies makes population estimation impossible. Ground-based breeding population surveys conducted by 11 northeastern states do provide wood duck population estimates but cover only a small fraction of the wood duck's breeding range. The North American Breeding Bird Survey, a volunteer-run point count survey coordinated through the USGS Patuxent Wildlife Research Center, has shown promise as a means of monitoring wood duck relative abundance and trend; however, this survey does not routinely incorporate methods to allow for the estimation of detection probability, so estimation of absolute population abundance is not possible. Repeated measures by different observers might provide a means of estimating detection probability and enable estimation of absolute abundance. New applications of solicited band recovery data obtained from the harvest parts collection survey are currently being explored and hold promise for estimating absolute abundance of this species by using a simple, two-sample Lincoln-Peterson type estimator.

The Mexican duck, muscovy duck, and the fulvous and black-bellied whistling ducks are poorly surveyed throughout their range. Of the group, more baseline data exist for the Mexican duck. Mid-winter estimates are available for some of these species for certain regions in Mexico surveyed cooperatively by the United States and Mexican federal governments every 1 to 3 years. Mid-winter counts for these species are generally not considered reliable indices to population status, and there is a need for coordinated aerial and ground-based breeding population surveys. There may be potential to monitor breeding populations of the whistling ducks along the Texas Gulf Coast in association with mottled duck surveys as they are developed. New and as yet undefined surveys will be necessary in Mexico.

The two resident endemic Hawaiian duck species, the Hawaiian Duck and the Laysan duck, are presently monitored during the annual Hawaiian Waterbird Survey. This survey is not considered adequate for these species, and review of survey protocols is ongoing.

Diving Ducks

Cooperative breeding ground surveys presently cover most of the breeding range of diving ducks in North America. An exception is the redhead for which a substantial segment of the breeding population remains unsurveyed in the Great Basin region of the northern U.S. Rocky Mountains. The cooperative breeding ground surveys, in general, are not optimally timed for most diving ducks. The redhead, ruddy duck, and scaup species exhibit protracted migration chronologies, and nesting activity occurs later in spring than for many dabblers. These facts have raised some concern about the potential for double-counting migrating birds as they pass through adjacent survey strata. It is possible that aerial transects could be repeated later in the spring to derive better breeding population estimates for diving ducks as well as for sea ducks.

Greater and lesser scaup have traditionally not been identified to species during aerial waterfowl surveys. It is possible to distinguish the species in flight under good lighting conditions; however, on the water, the species cannot be distinguished during aerial surveys. The greater scaup breeds almost entirely in the Arctic and is the most abundant scaup in tundra regions. Lesser scaup have a much broader breeding range that extends south through the prairie pothole region. Lesser scaup occupy boreal forests of northwestern Canada and interior Alaska at much higher densities than greater scaup. Because of differences in primary breeding habitats, populations have been roughly estimated for the individual species by segregating tundra and boreal forest strata (Table 2, p. 27). This is an imperfect solution since mixing of breeding populations occurs in both habitat types. Derivation of improved species-specific population estimates may require ground surveys conducted in conjunction with existing aerial surveys. Additionally, a significant proportion of the greater scaup breeding range is presently unsurveyed in the Yukon and Nunavut and would require expansion of the geographic scope of the Waterfowl Breeding Population and Habitat Survey.

The masked duck is widespread but occurs at relatively low densities throughout its range extending from South America to central Mexico and the Caribbean. It is reclusive and inhabits densely vegetated lakes and wetlands, also frequenting mangroves during the nonbreeding season. It is not known to congregate in large numbers. Little work has been conducted on protocols for monitoring masked ducks. Its habits may render aerial-based surveys less effective than coordinated ground-based programs.

Sea Ducks

Sea ducks are poorly monitored by traditional waterfowl surveys, and information on population size and trend for most species is unreliable. The federal, state, and provincial cooperative breeding waterfowl surveys, conducted in spring and used as a basis for setting population goals for many North American waterfowl, do not cover the core breeding ranges of about half the sea duck species. These surveys are not optimally timed for sea ducks, which generally nest later than dabbling ducks. Despite the limitations of existing data sets, populations of several sea duck species are strongly suspected to be in decline. There is an urgent need for more intensive, precise surveys that will provide an index to population size for long-term monitoring and robust detection of trends for all sea duck species.

In some instances, multiple species could be monitored with generalized survey protocols, whereas certain species will require individualized surveys because of their restricted range or isolated habitats. Generally, surveys will be required annually to achieve sufficient data to detect trends in a reasonable time frame. There may be instances where a population can be monitored less frequently; for example, intensive counts of common eiders in nesting colonies are generally more accurate than traditional surveys and might be repeated at longer (e.g., 5-yr) intervals.

One option for monitoring breeding populations of some sea duck species is another large-scale survey similar to the existing cooperative breeding waterfowl survey conducted by the United States and Canada, but flown later and over a larger geographic area. A comprehensive survey of this type would require significant commitments in aircraft and personnel. Despite logistical and fiscal impediments, breeding ground surveys may be the most feasible approach for many sea ducks since severe logistical constraints (e.g., weather) and cost concerns (e.g., charter aircraft, weather related down-time) can make winter surveys difficult, particularly in northern areas.

For some sea ducks, on the other hand, it may be more efficient to monitor population status through coordinated winter surveys. Because of concentrations of sea ducks at coastal wintering areas, in some instances winter surveys may be more cost effective than breeding ground surveys. Studies are also beginning to show that some species of sea ducks are highly philopatric to winter ranges. To date, a winter survey adequate for sea ducks does not exist on either coast. Mid-winter inventories are geographically restricted and include inland and near-shore habitats, but not deepwater areas commonly used by sea ducks. On the Atlantic coast, a near-shore aerial survey designed to provide an index of sea ducks wintering in coastal habitats was initiated in 1990, but high variability in annual indices suggests that significant improvements in design are necessary to increase its utility in detecting trends. Efforts are underway to improve this survey by identifying important offshore concentration areas along the Atlantic seaboard. Initial results indicate substantial use of offshore shoal areas; however, there appears to be significant movement among shoal habitats from year to year and within a single winter season.

On the Pacific Coast, only piecemeal surveys have been conducted at sporadic time intervals. An improved Atlantic sea duck survey (including the Great Lakes) and a coordinated survey effort from Alaska to California should be considered. Species that could potentially be monitored through winter surveys include all three species of scoters, the American subspecies of common eider, goldeneyes, buffleheads, harlequin ducks, and red-breasted and common mergansers. Conversely, winter surveys would probably be inappropriate for those sea duck species that breed in North America but winter elsewhere where no regular surveys occur. For example, some king eiders, common eiders, and harlequin ducks breeding in eastern North America winter in Greenland, and some common eiders, king eiders, and long-tailed ducks breeding in western North America winter in Russia. Effective monitoring of the hooded merganser, a species that breeds in cavities and inhabits densely wooded regions, may require strategies similar to those recommended for the wood duck.

Geese

The general objective for goose monitoring is to develop and/or maintain, at a minimum, periodic population assessments of all recognized goose populations. For some of these populations, a cost-effective, logistically feasible survey methodology has yet to be devised. Highest priority for survey development has been for those populations subject to significant harvest pressure or those whose status is a matter of concern. In some instances, a number of goose populations gather in mixed flocks on their wintering and migratory ranges, making population inventory difficult. In these cases, a high priority is the development of breeding surveys conducted when populations are segregated.

Of the 20 populations of Canada geese described in this Plan, 7 have operational breeding ground surveys. Improvement of these breeding population surveys is a continuing priority. Tall-Grass Prairie, Short-Grass Prairie, Western Prairie and Great Plains, Hi-Line, Rocky Mountain, Dusky, and Aleutian populations are presently monitored entirely or partially through mid-winter or special purpose surveys. Unfortunately, surveys conducted on the wintering grounds can be difficult to interpret because of mixing among populations. There are presently no operational means of monitoring population abundance for Taverner's, Pacific, Lesser, and Vancouver populations, although work is underway on surveys for the Taverner's, Pacific, and Lesser Canadas. Currently, the Lesser and Taverner's populations are partially and inadequately surveyed during the Waterfowl Breeding Population and Habitat Survey and the Arctic Coastal Plain Survey. Several states and provinces conduct surveys of the Pacific Population; however, these surveys are not yet sufficiently coordinated to provide a composite index of abundance for this population. Lastly, the geographic breeding range of the North Atlantic Population of Canada geese is presently being reexamined. Currently, survey protocols are believed to be insufficient for this population.

The greater snow goose occupies a large breeding range extending from northern Foxe Basin and central Baffin Island to Ellesmere Island and northwest Greenland. Comprehensive breeding grounds surveys would present great logistical and financial challenges. Presently greater snow geese are monitored through a photographic inventory conducted annually along 400 km of the St. Lawrence River and estuary. This type of survey has proved to be a cost-effective means of monitoring status of this population. In 2001, an expanded version of this survey was initiated because of an increasingly widespread distribution and more frequent inland dispersal of geese to feed in agricultural fields. This expanded survey should be continued.

Currently, the Mid-continent and the Western Central Flyway populations of lesser snow geese are monitored through mid-winter waterfowl surveys. Unfortunately, mixing of populations with Ross's geese on the wintering grounds can make estimation of population size difficult. A photographic inventory of Canadian lesser snow goose breeding colonies takes place at periodic intervals. Ross's geese are also periodically monitored by using photographic inventories of breeding colonies. Several major Ross's goose breeding colonies have been inventoried annually since 1993. Coordinated ground surveys are required to separate Ross's geese from sympatric lesser snow geese. Additional resources are necessary to implement photographic breeding colony inventories for other populations and to increase the frequency of monitoring of lesser snow and Ross's goose breeding colonies.

The Mid-continent Population of white-fronted geese is presently indexed in the fall by using an aerial census of staging birds in prairie Canada, supplemented with simultaneous reports of minor concentrations elsewhere. In spite of this, there is need for additional survey effort directed at the portion of this population breeding in Alaska. Abundance of the Pacific Population of white-fronts is monitored through an annual breeding population survey. The status of Tule white-fronted geese has been assessed using special purpose surveys in the past, and a reliable, operational methodology for an annual or periodic inventory is still in development.

Winter surveys are used to monitor the status of the four recognized populations of brant in North America. The mid-winter survey appears to perform well in indexing long-term population change of Atlantic brant, and this survey should be continued at present levels of effort and geographic coverage. Pacific brant breed over a vast region encompassing portions of Alaska, Arctic Canada, and Russia. Little is known about the subpopulation structure of Pacific brant, and both marking studies and genetic investigations are needed to better define subpopulations. Western High Arctic brant breed on the Parry Islands of the Northwest Territories, stage at Izembek Lagoon with Pacific brant, and winter in northern regions of Puget Sound. As with Pacific brant, additional work is needed to more precisely delineate and define this stock of birds. Operational surveys to monitor breeding populations at major Pacific brant colonies should be evaluated and could become important if population delineation studies define distinct subpopulations. Efforts are also underway in Alaska to refine estimates of dispersed-nesting (noncolonial) brant. For Western High Arctic brant, winter surveys should be expanded to include all potential wintering areas. Alternatively, breeding population surveys of the Parry Islands or a survey of birds staging in Izembek Lagoon (where they occupy a portion of the Lagoon separate from Pacific brant), could provide an adequate means of inventory. Eastern High Arctic brant are monitored annually on their wintering grounds in Ireland.

The abundance of emperor geese breeding in North America is adequately monitored in the United States through the annual Emperor Goose Spring Population Survey. This survey is conducted in Alaska during May when the population is most concentrated. Additional effort is needed to monitor the component of this population breeding in Russia.

The Hawaiian goose is monitored through the annual Hawaiian Waterbird Survey. This survey is not considered adequate for this species, and efforts to improve protocols are continuing.

Swans

Population abundance of both the Eastern and Western Populations of tundra swans is adequately indexed through the mid-winter waterfowl survey. Any proposed changes in the intensity or geographic coverage of the Pacific or Atlantic Flyway mid-winter surveys should be reviewed to ensure that they do not affect the usefulness of these surveys for monitoring tundra swans. In the case of trumpeter swans, a number of regional surveys monitor components of the three populations currently recognized in North America; however, flyway management plans for all three populations have used the long-running and comprehensive North American Trumpeter Swan Survey as the basis for setting population objectives and monitoring population change. Despite the small size of trumpeter swan populations, comprehensive monitoring of population abundance at 5-year intervals is sufficient given the number of smaller-scale regional surveys that track shorter-term changes in certain population segments. Alternatively, consolidation of the resources expended on all trumpeter swan surveys may enable more frequent monitoring through the comprehensive North American Trumpeter Swan Survey.

Appendix E: Taxonomy of North American Waterfowl

FAMILY: Anatidae	**Ducks, geese, and swans**
SUBFAMILY: Anatinae	**ducks**
TRIBE: Anatini	**Dabbling ducks and perching ducks**
Anas platyrhynchos platyrhynchos	Mallard
Anas platyrhynchos diazi	Mexican subspecies
Anas acuta acuta	Northern pintail
Anas bahamensis bahamensis	White-cheeked pintail
Anas rubripes	American black duck
Anas fulvigula fulvigula	Mottled duck, nominate subspecies
Anas fulvigula maculosa	Mottled duck, western gulf subspecies
Anas strepera	Gadwall
Anas americana	American wigeon
Anas crecca carolinensis	Green-winged teal
Anas discors	Blue-winged teal
Anas cyanoptera septentrionalium	Cinnamon teal
Anas clypeata	Northern shoveler
Anas wyvilliana	Hawaiian duck
Anas laysanensis	Laysan duck
Aix sponsa	Wood duck
Cairina moschata	Muscovy duck
TRIBE: Aythyini	**Diving ducks or pochards**
Aythya americana	Redhead
Aythya valisineria	Canvasback
Aythya affinis	Lesser scaup
Aythya marila mariloides	Greater scaup
Aythya collaris	Ring-necked duck
TRIBE: Oxyurini	**Stiff-tailed ducks**
Oxyura jamaicensis jamaicensis	Ruddy duck
Oxyura jamaicensis rubida	Ruddy duck, continental subspecies
Nomonyx dominicus	Masked duck
TRIBE: Mergini	**Sea ducks**
Histrionicus histrionicus	Harlequin duck
Clangula hyemalis	Long-tailed duck
Somateria spectabilis	King eider
Somateria mollissima v-nigra	Common eider, Pacific subspecies
Somateria mollissima borealis	Common eider, Northern subspecies
Somateria mollissima dresseri	Common eider, Southern subspecies
Somateria mollissima sedentaria	Common eider, Hudson Bay subspecies
Somateria fischeri	Spectacled eider
Polysticta stelleri	Steller's eider

Melanitta nigra americana	Black scoter
Melanitta fusca deglandi	White-winged scoter
Melanitta perspicillata	Surf scoter
Bucephala clangula americana	Common goldeneye
Bucephala islandica	Barrow's goldeneye
Bucephala albeola	Bufflehead
Lophodytes cucullatus	Hooded merganser
Mergus merganser americanus	Common merganser
Mergus serrator	Red-breasted merganser
SUBFAMILY: Dendrocyninae	**Whistling ducks**
Dendrocygna autumnalis autumnalis	Black-bellied whistling duck
Dendrocygna bicolor	Fulvous whistling duck
Dendrocygna arborea	West Indian whistling duck
SUBFAMILY: Anserinae	**Geese and swans**
TRIBE: Anserini	
Branta canadensis canadensis	Canada goose, nominate subspecies
Branta canadensis interior	Canada goose, interior subspecies
Branta canadensis occidentalis	Canada goose, dusky subspecies
Branta canadensis fulva	Canada goose, Vancouver subspecies
Branta canadensis maxima	Canada goose, giant subspecies
Branta canadensis moffitti	Canada goose, western subspecies
Branta canadensis taverneri	Canada goose, Taverner's subspecies
Branta canadensis hutchinsii	Canada goose, Richardson's subspecies
Branta canadensis parvipes	Canada goose, lesser subspecies
Branta canadensis leucopareia	Canada goose, Aleutian subspecies
Branta canadensis minima	Canada goose, cackling subspecies
Branta bernicla hrota	Brant, Atlantic subspecies (light-bellied)
Branta bernicla nigricans	Brant, Pacific subspecies (dark-bellied)
Branta sandvicensis	Hawaiian goose
Anser albifrons frontalis	Greater white-fronted goose, Pacific subspecies
Anser albifrons gambelli	Greater white-fronted goose, tule subspecies
Chen caerulescens caerulescens	Snow goose, lesser subspecies
Chen caerulescens atlanticus	Snow goose, greater subspecies
Chen rossii	Ross's goose
Chen canagica	Emperor goose
TRIBE: Cygnini	
Cygnus olor	Mute swan (feral)
Cygnus buccinator	Trumpeter swan
Cygnus columbianus	Tundra swan

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The sequence and naming of subfamilies and tribes follows Livezey (1986). The naming of genera and species within genera follows Johnsgard (1978) and American Ornithologists' Union (1998). The naming of subspecies within species follows Bellrose (1980), Madge and Burn (1988) including reference works used in these compilations, and McCraken et al. (2001).

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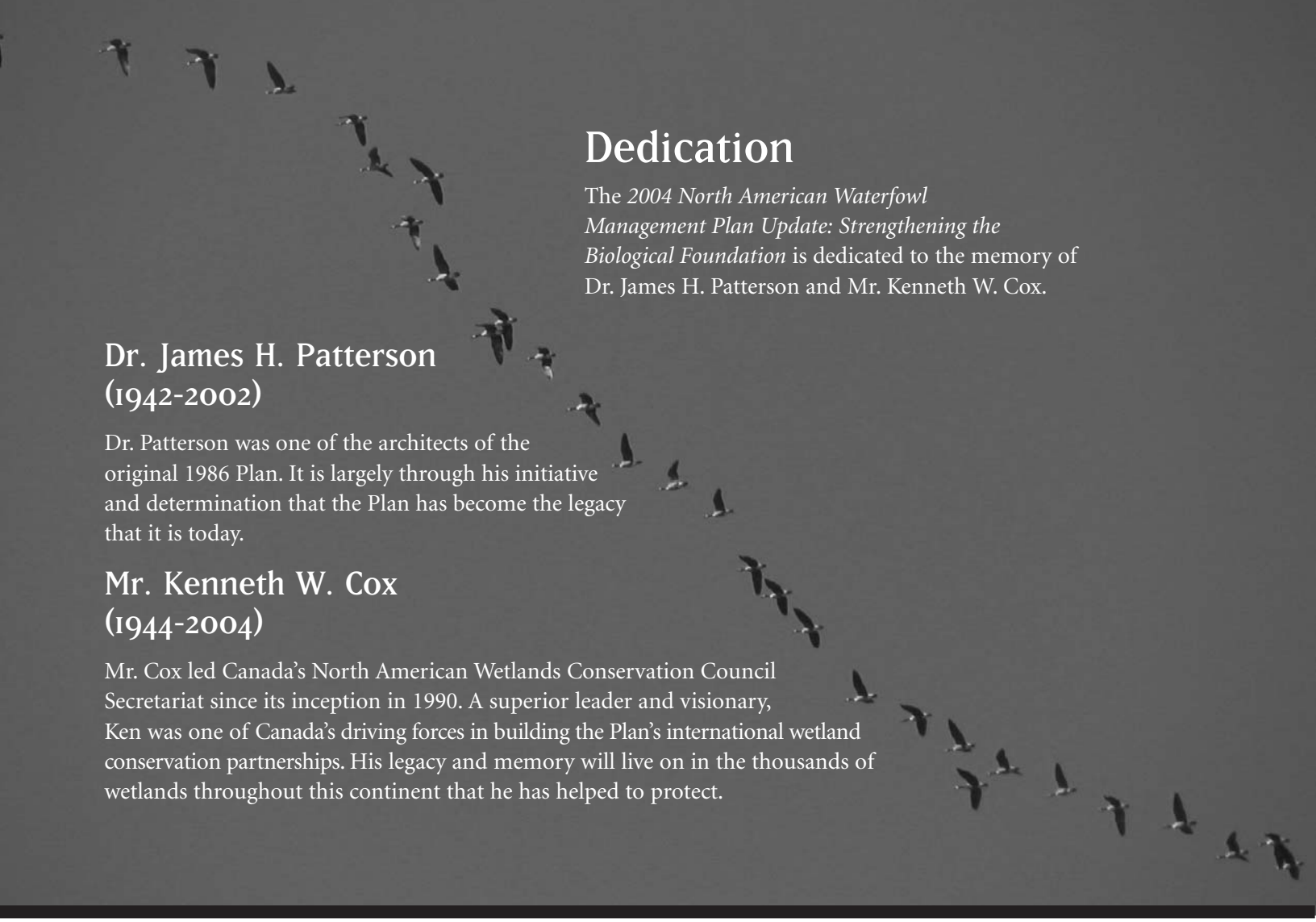

Dedication

The *2004 North American Waterfowl Management Plan Update: Strengthening the Biological Foundation* is dedicated to the memory of Dr. James H. Patterson and Mr. Kenneth W. Cox.

Dr. James H. Patterson (1942-2002)

Dr. Patterson was one of the architects of the original 1986 Plan. It is largely through his initiative and determination that the Plan has become the legacy that it is today.

Mr. Kenneth W. Cox (1944-2004)

Mr. Cox led Canada's North American Wetlands Conservation Council Secretariat since its inception in 1990. A superior leader and visionary, Ken was one of Canada's driving forces in building the Plan's international wetland conservation partnerships. His legacy and memory will live on in the thousands of wetlands throughout this continent that he has helped to protect.

Photo above: Canada Geese, Barbara Robinson, Canadian Wildlife Service
Cover photos: Mallard, Ducks Unlimited Canada
Grasslands, Jurgen Hoth, North American Commission for Environmental Cooperation

Ce document est aussi disponible en français sous le titre
Renforcer les fondements biologiques – 2004 Orientation stratégique

Este documento esta disponible en español con el título
Consolidación de los fundamentos biológicos – 2004 Guía estratégica

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Biological Foundation

Landscape Approach

Partnerships