

Northern Prairie and Parkland **Waterbird Conservation Plan**

2004

Plan Coordinators:

Gerard W. Beyersbergen, Canadian Wildlife Service
Neal D. Niemuth, United States Fish and Wildlife Service
Michael R. Norton, Canadian Wildlife Service

Published by the Prairie Pothole Joint Venture, Carol Lively, Coordinator.
United States Fish and Wildlife Service, Denver, Colorado.

Beyersbergen, G.W., N. D. Niemuth, and M.R. Norton, coordinators. 2004.
Northern Prairie & Parkland Waterbird Conservation Plan. A plan associated
with the Waterbird Conservation for the Americas initiative.
Published by the Prairie Pothole Joint Venture, Denver, Colorado. 183pp.

Table of Contents

EXECUTIVE SUMMARY	4
ACKNOWLEDGMENTS	7
1.0 INTRODUCTION	9
1.1 Goals and Objectives.....	9
1.2 Species Covered by the Plan	11
1.3 A Continental Perspective on the Northern Prairie & Parkland Region	13
1.3.i Physical Geography of the Northern Prairie & Parkland Region	13
1.3.ii Ecological Importance of the Northern Prairie & Parkland Region	13
1.3.iii Threats to the Ecological Integrity of the Northern Prairie & Parkland Region	14
1.4 Waterbird Conservation in the Northern Prairie & Parkland Region.....	16
1.4.i History and Legal Framework	17
1.4.ii Existing Monitoring and Research	17
1.4.iii Conservation Initiatives	19
1.4.iv Role of the Northern Prairie & Parkland Region in North American Waterbird Conservation.....	22
2.0 WATERBIRDS IN THE NORTHERN PRAIRIE & PARKLAND REGION.....	23
2.1 Introduction □	23
2.1.i Colonial vs. Non-Colonial Breeders.	23
2.1.ii Staging and Migrant Waterbirds	23
2.2 Breeding Waterbirds: Biology, Distribution, and Status	24
2.2.i Distribution and Habitat Needs of Nesting Species.....	25
2.2.ii Population Estimates & Trends of Breeding Waterbirds	25
2.2.iii Key Sites Used by Breeding Waterbirds	26
2.2.iv Spatial and Temporal Variability in Breeding	27
2.3 Staging and Migrant Waterbirds: Distribution, Habitat, and Status.....	29
2.3.i Habitat Needs of Staging and Migrant Waterbirds	29
2.3.ii Whooping Crane: The Northern Prairie & Parkland Region’s Migrant.....	29
2.3.iii Key Sites Used by Staging Waterbirds	30
2.4 Conservation Issues and Threats to Waterbirds.....	30
2.5 Conservation Priority of Waterbirds in the Northern Prairie & Parkland Region	31
2.5.i Conservation Status Assessment Process.....	31
2.5.ii Conservation Status Rankings	33
3.0 WATERBIRD INFORMATION NEEDS & CONSERVATION STRATEGIES.....	34
3.1 Introduction	34
3.2 Population ..□	35
3.2.i Population Inventory and Monitoring	35
3.2.i.a Breeding Waterbirds	36
3.2.i.b Staging and Migrant Waterbirds	36
3.2.ii Population Goals.....	36
3.2.iii Priority Population Monitoring Action Needs	37

3.3 Habitat	37
3.3.i Habitat Conservation and Management Prioritization	37
3.3.ii Inventory and Monitoring	39
3.3.iii Management.....	40
3.3.iii.a Landscape-level Conservation	40
3.3.iii.b Managing Wetlands & Water	41
3.3.iii.c Managing Uplands	41
3.3.iii.d Specialized Management	42
3.3.iv Priority Habitat Needs	42
3.4 Priority Research Needs.....	43
3.5 Integration	43
4.0 COMMUNICATION	45
4.1 Communication Goals.....	45
4.2 Target Audiences	45
4.3 Key Messages	45
4.4 Communication Activities.....	46
5.0 PARTNERSHIPS AND NEXT STEPS OF THE NORTHERN PRAIRIE & PARKLAND WATERBIRD CONSERVATION PLAN.....	46
5.1 Working Group Organization, Leadership, and Partnerships.....	46
5.2 Implementation Process and Adaptive Planning	46
5.3 Measuring the Success of Implementation of the Northern Prairie & Parkland Waterbird Conservation Plan	47
6.0 GLOSSARY.....	48
7.0 REFERENCES	50
8.0 APPENDICES	A1
A. Comprehensive list of waterbird species found in the Northern Prairie & Parkland Region	A1
B. Existing Monitoring Programs and Databases	A3
C. Species Jurisdiction Rankings	A5
D. Species Accounts	A7
E. Key Staging/Stopover Sites used by Whooping Cranes	A101
F. Waterbird Key Sites (Canada only).....	A102
G. Waterbird Conservation Issues	A106
H. Waterbird Sampling Issues and Information Needs	A113
I. Management Toolbox	A120
J. Bibliography	www.npwrc.usgs.gov/resource/literatr/wbirdbib/wbirdbib.htm

Executive Summary

The Northern Prairie and Parkland Region (NP&PR) contains millions of wetland basins that harbor large proportions of the populations of many North American waterbird species. However, knowledge of waterbirds in the NP&PR is limited, and there has been little direction for waterbird conservation planning or management. Canadian and U.S. partners developed the Northern Prairie and Parkland Waterbird Conservation Plan under the auspices of the North American Waterbird Conservation Plan to provide an overview of the status and current knowledge of waterbirds and waterbird habitat in the Region and to outline strategies and priorities for monitoring, research, and management.

Much wetland and upland habitat in the NP&PR has been lost or degraded, primarily due to agriculture. Consequently, populations of many species of waterbirds are considered at risk. Least Tern and Whooping Crane are listed as endangered species and the Least Bittern is listed as threatened in portions of the NP&PR, and the plan identifies Western Grebe, Franklin's Gull, Black Tern, Horned Grebe, American Bittern, Yellow Rail, and King Rail as species of high concern.

Highest priority conservation issues affecting waterbirds in the NP&PR are:

- Loss and degradation of wetland habitats, which directly affects all waterbird species throughout the NP&PR.
- Loss and degradation of upland habitats surrounding wetlands, which directly affects most waterbird species throughout the NP&PR.

Retention and development of wildlife-friendly agriculture programs (e.g., "Swampbuster" provision in U.S. Farm Bill) will have a major impact on waterbird conservation in the NP&PR by helping preserve the existing wetland and upland habitat base. Specifically addressing waterbird conservation issues in the NP&PR necessitates that limited resources directed toward waterbird conservation are strategically applied, which will require considerable knowledge of waterbird ecology that is presently lacking. Reliable, comprehensive population information that incorporates wetland availability and landscape context is the foremost information need.

Specific priority research and information needs include:

- Accurate distribution, abundance, and population trend data for all species, particularly non-colonial waterbirds.
- An understanding of habitat requirements at local and landscape levels for all waterbirds with emphasis on priority species.
- An understanding of factors affecting survival and productivity.
- Establishing and evaluating standard protocols for surveys, especially in relation to regional issues and local challenges.
- An understanding of the impacts of diseases on waterbirds.
- An understanding of the influence of environmental conditions, particularly water conditions, on dispersal and population shifts.
- An understanding of the relative role of breeding, staging, and wintering grounds on waterbird populations (e.g., knowing where conservation bottlenecks are and who will address them). These issues will need to be addressed at a broader scale than the NP&PR

Waterbird Conservation Plan.

- A knowledge of the response of different waterbirds to various management treatments.
- An expanded spatial context for waterbirds, e.g., how they respond to natural and human-induced environmental changes, and how changing waterbird populations—especially new, large colonies of gulls—affect other species, particularly shorebirds.

The plan recommends a landscape approach to help integrate conservation planning for waterbirds with conservation planning for other species, particularly extensive waterfowl conservation efforts in the NP&PR. The purpose of the plan was to provide an overview and outline priorities and strategies; implementation of the plan is an additional step that will need to be undertaken by partners within the NP&PR. Key recommendations for implementation of the plan include:

- Initiation of standardized, region-wide surveys for colonial and non-colonial species.
- Development of statistically sound, defensible estimates of distribution, abundance, and population trends for all waterbird species in the NP&PR.
- Understanding habitat requirements at local and landscape levels for all waterbirds.
- Development of NP&PR-wide spatially explicit habitat models for waterbirds.
- Completion of NP&PR-wide wetland inventory.
- Completion of NP&PR-wide upland habitat inventory, to be updated at regular intervals.
- Development of a standardized, readily accessible database in which to store population survey data.
- Above all, conservation of habitat for priority species identified through the tools and tasks listed above.

The plan is supported by the Prairie Habitat Joint Venture in Canada and the Prairie Pothole Joint Venture in the U.S. The plan will be coordinated and implemented by the U.S. Fish and Wildlife Service, Canadian Wildlife Service, and the respective joint ventures. Effective waterbird conservation in the NP&PR will require a shift in focus of federal agriculture programs as well as significant programs and funding specifically directed at waterbirds.

Acknowledgments

A large number of people from a variety of agencies and organizations in the U.S. and Canada contributed to this plan. We thank everyone for their support, and ask that they help continue waterbird conservation in the Northern Prairie & Parkland Region by updating information, monitoring birds, and working to conserve habitat. The Prairie Pothole Joint Venture and the Prairie Habitat Joint Venture supported the development, publication, and distribution of the plan. In Canada, the Waterbird Working Group moved the development of the plan forward through their active participation. The Prairie Canada Shorebird Conservation Plan provided the initial framework, design, and some of the background material from which the Northern Prairie & Parkland Waterbird Conservation Plan was developed. The plan has been reviewed and endorsed by the Regional Planning and Implementation Committee of the North American Waterbird Council.

Many people gave generously of their time to write species accounts and other sections of the plan, provide information on key sites, or review early drafts of the plan, including Kristine Askerooth, Dave Azure, Mairi Babey, Doug Backlund, Michael Barr, Richard Bishop, Natoma Buskness, John Carlson, Bill Chappell, Cal Cuthbert, Charles Deschamps, Ken DeSmet, Dave Duncan, Kathy Duttonhefner, Loney Dickson, John Dunlop, Bonita Eliason, Mike Estey, Eileen Dowd-Stukel, Steve Fairbairn, Suzanne Fellows, Frank Fraser, Todd Grant, Lisa Gelvin-Innvaer, Bev Gingras, Mike Gollop, Kelly Graham, Diane Granfors, Todd Grant, Jason Greenall, Sandra Hagen, Barb Hanbidge, Jim Hansen, Stephen Hanus, Katie Haws, Mark Heckbert, Laura Hubers, Gary Huschle, Stephanie Jones, Rob Kaye, Jeff Keith, Tim Kessler, Gregg Knutsen, Stan Kohn, Colleen Kolbeck, William Koonz, Rachel Laubhan, Steve Lewis, Carol Lively, Tom Maccagno, Beth Madden, Ron Martin, Kurt Mazur, David McKenna, Glen McMaster, Will Meeks, Doug Mosser, George Newton, Gary Nuechterlein, Katharine Parsons, Fritz Prellwitz, Dave Prescott, Margo Pybus, Chuck Pyle, Wayne Renaud, Ron Reynolds, Kory Richardson, Keith Roney, Ronnie Sanchez, John Sauer, Paulette Scherr, Bill Schultze, Michael Semenchuk, Jill Shaffer, Karen Smith, Mary Soler, Dan Svingen, Peter Taylor, Phil Taylor, Drajs Vujnovic, Jennifer Wheeler, Ted Wiens, Steve Wilds, Alex Wilke, and Jim Zohrer. The significant efforts of Kevin Hannah, Karla Guyn, Carol Lively, Ron Reynolds, Tom Sadler, Jill Shaffer, Alan Smith, and Jennifer Wheeler are particularly appreciated. Thank you to Martin Schmoll, who produced all the maps for the species accounts. Special thanks are also due to the Alberta Natural Heritage Information Centre, Saskatchewan Conservation Data Centre, and Manitoba Conservation Data Centre, as well as the Northern Prairie Wildlife Research Center, which is hosting the waterbird bibliography on its web site. We thank everyone who contributed and extend our apologies to anyone we inadvertently omitted from this list.

Cover photograph of Black Tern © G.W. Beyersbergen

1.0 Introduction

1.1 Goals and Objectives

The North American Waterbird Conservation Plan (www.waterbirdconservation.org) was developed to provide a continental perspective on the status of and conservation efforts for waterbirds in North America. Regional plans, based on assemblages of Bird Conservation Regions (BCRs) called Waterbird Conservation Regions, focus on regional issues for waterbird conservation. The Northern Prairie & Parkland Waterbird Conservation Plan (NPPWCP) is a joint Canada/United States venture that describes the current knowledge, biology and conservation efforts for 40 waterbird species in the Northern Prairie & Parkland Region (NP&PR).

The overall goal of this conservation plan is

“To provide guidelines for conservation that, when implemented, result in maintaining and managing healthy populations, distributions, and habitats of waterbirds throughout the Northern Prairie & Parkland Region of North America.”

To successfully achieve the goals of the NPPWCP, a number of actions will be required, including:

- Acquiring sufficient information about the population dynamics, population trends, breeding, migration and staging strategies, and habitat preferences of waterbirds in the NP&PR to make knowledgeable management recommendations;
- Conserving and enhancing sufficient high-quality habitat to support healthy populations of waterbirds in the region;
- Informing the public, decision-makers, and all those involved in land management in the NP&PR about the importance of the Region to waterbirds, and about the biology, trends, and management of waterbird species; and
- Ensuring that coordinated conservation efforts (regional, national, and international) are in place to address the key conservation priorities of waterbirds in the NP&PR.

This document will:

- Assess the importance of the NP&PR to waterbirds;
- Describe current knowledge on population sizes and trends, habitat requirements, distributions, and key sites for each species of waterbird present in the region;
- Identify conservation issues for each of the species;
- Prepare a conservation status assessment for each species based on regional biological information, conservation issues, and continental ranking schemes;
- Provide guidance on conservation and management strategies that provide on-the-ground benefits to waterbirds;
- Provide direction for integrated, landscape-level waterbird conservation that considers and incorporates conservation planning for other species;
- Suggest high priority information gaps that must be filled to increase our ability to successfully manage waterbird species, and indicate related research questions that need to be addressed;

- Recognize the importance of staging and wintering areas in other regions to waterbirds that breed in the NP&PR;
- Provide information on key programs and funding sources that can provide resources for waterbird conservation; and
- Provide a reference listing of existing management plans relevant to species in the region; a separate bibliography with a listing of publications relevant to waterbirds in the region is available at www.npwrc.usgs.gov/resource/literatr/wbirdbib/wbirdbib.htm. Current publications can be found through literature databases such as Wildlife Worldwide, which is available online and to which all USFWS employees are subscribed.

The NP&PR consists of those areas covered by the Prairie Pothole Joint Venture (PPJV) in the United States and the Prairie Habitat Joint Venture (PHJV) in Canada (Figure 1). The PPJV and PHJV are regional, cooperative entities established under the North American Waterfowl Management Plan. Originally developed for planning and implementation of waterfowl conservation, the joint ventures have expanded to include integrated bird conservation. Integration and implementation of the NP&PR Waterbird Conservation Plan will take place under the auspices of the PPJV and PHJV. Those portions of Nebraska in BCR 11 will be included in Nebraska’s all-bird conservation plan.

Figure 1. Location of the Northern Prairie & Parkland Waterbird Conservation Region (dark shaded areas) and Bird Conservation Region 11 (black outline) in north-central North America.



The purpose of this plan is to provide a foundation for regional, integrated waterbird conservation planning; it will not supplant or replace existing plans that have been developed for rare or harvested species.

Citations are not provided in the text of this document, but a list of references used in development of the plan is provided in Section 7.

1.2 Species Covered by the Plan

Waterbirds are a taxonomically and morphologically diverse group of birds that are closely tied to water bodies for a substantial portion of their life history. The group includes members of 8 orders and 22 families of birds in North America. Thirty-nine species of waterbirds breed in the NP&PR and are included in this plan. Many other species (Appendix A) occur in the NP&PR as migrants or vagrants; of these, only one species, the Whooping Crane, is included in the plan because it is an endangered species and consistently occurs in the NP&PR during migration. The 40 species covered in the NPPWCP include:

- loons (Gaviidae; 1 species)
- grebes (Podicipedidae; 6 species)
- pelicans (Pelecanidae; 1 species)
- cormorants (Phalacrocoracidae; 1 species)
- herons, night-herons, bitterns, and egrets (Ardeidae; 11 species)
- ibises (Threskiornithidae; 1 species)
- rails, coots and moorhens (Rallidae; 7 species)
- cranes (Gruidae; 2 species)
- gulls and terns (Laridae; 10 species)

Some of our most recognizable birds, such as the American White Pelican, are included in this group, as are some of our least known and inconspicuous species, such as the Yellow Rail. Some species breed in large colonies, with tens of thousands of birds packed onto a small island during the spring and summer, whereas others breed solitarily. The varied members of the group use nearly every type of wetland habitat available, from large, deep lakes to ephemeral, shallow marshes.

Throughout this plan, the full suite of 40 species (Table 1) is considered under each topic heading in the interest of promoting integrated conservation approaches and solutions. As mentioned, only one migrant, the Whooping Crane, is specifically addressed in the plan. Breeding species are further grouped as colonial breeders or non-colonial breeders. The degree of coloniality varies, but in the plan 24 species are considered colonial breeders and 15 are considered non-colonial breeders. Many of the non-colonial breeders are sometimes referred to as marshbirds, although some colonial species nest in marshes. Terms are defined in the Glossary; waterbird species that occur infrequently in the NP&PR and are considered accidental or vagrants are listed in Appendix A. Shorebirds and waterfowl are not addressed in this plan. Regional plans for shorebirds have been developed under the U.S. and Canadian shorebird plans, and plans for waterfowl have been developed under the North American Waterfowl Management Plan.

Table 1. Waterbird species included in the Northern Prairie & Parkland Waterbird Conservation Plan. All species breed in the NP&PR except Whooping Crane.

Common Name	Scientific Name	Colonial [C] Non-colonial [N]	Breeding Distribution
Common Loon	<i>Gavia immer</i>	N	Widespread
Pied-billed Grebe	<i>Podilymbus podiceps</i>	N	Widespread
Horned Grebe	<i>Podiceps auritus</i>	N/C*	Widespread
Red-necked Grebe	<i>Podiceps grisegena</i>	N/C	Widespread
Eared Grebe	<i>Podiceps nigricollis</i>	C/N	Widespread
Western Grebe	<i>Aechmophorus occidentalis</i>	C	Widespread
Clark's Grebe	<i>Aechmophorus clarkii</i>	C	Local
American White Pelican	<i>Pelecanus erythrorhynchos</i>	C	Widespread
Double-crested Cormorant	<i>Phalacrocorax auritus</i>	C	Widespread
American Bittern	<i>Botaurus lentiginosus</i>	N	Widespread
Least Bittern	<i>Ixobrychus exilis</i>	N/C	Widespread
Great Blue Heron	<i>Ardea herodias</i>	C	Widespread
Great Egret	<i>Ardea alba</i>	C	Peripheral
Snowy Egret	<i>Egretta thula</i>	C	Peripheral
Cattle Egret	<i>Bubulcus ibis</i>	C	Local
Little Blue Heron	<i>Egretta caerulea</i>	C	Peripheral
Tricolored Heron	<i>Egretta tricolor</i>	C	Peripheral
Green Heron	<i>Butorides virescens</i>	N/C	Widespread
Black-crowned Night-Heron	<i>Nycticorax nycticorax</i>	C	Widespread
Yellow-crowned Night-Heron	<i>Nyctanassa violacea</i>	C	Peripheral
White-faced Ibis	<i>Plegadis chihi</i>	C	Local
Yellow Rail	<i>Coturnicops noveboracensis</i>	N	Widespread
Black Rail	<i>Laterallus jamaicensis</i>	N	Peripheral
King Rail	<i>Rallus elegans</i>	N	Widespread
Virginia Rail	<i>Rallus limicola</i>	N	Widespread
Sora	<i>Porzana carolina</i>	N	Widespread
Common Moorhen	<i>Gallinula chloropus</i>	N	Peripheral
American Coot	<i>Fulica americana</i>	N	Widespread
Sandhill Crane	<i>Grus canadensis</i>	N	Widespread
Whooping Crane	<i>Grus americana</i>	N	Non-breeding
Franklin's Gull	<i>Larus pipixcan</i>	C	Widespread
Bonaparte's Gull	<i>Larus philadelphia</i>	C/N	Peripheral
Ring-billed Gull	<i>Larus delawarensis</i>	C	Widespread
California Gull	<i>Larus californicus</i>	C	Widespread
Herring Gull	<i>Larus argentatus</i>	C	Peripheral
Caspian Tern	<i>Sterna caspia</i>	C	Local
Common Tern	<i>Sterna hirundo</i>	C	Widespread
Forster's Tern	<i>Sterna forsteri</i>	C	Widespread
Least Tern	<i>Sterna antillarum</i>	C/N	Local
Black Tern	<i>Chlidonias niger</i>	C	Widespread

*N/C: degree of coloniality varies; most typical behavior is listed first.

1.3 A Continental Perspective on the Northern Prairie & Parkland Region

1.3.i Physical Geography of the Northern Prairie & Parkland Region

The NP&PR covers 1,197,000 km² in two disjunct units. The primary unit arcs southeast from the boreal transition zone in central Alberta to central Iowa, bounded on the south and west by the Missouri River (Figure 1). The second unit in the NP&PR is the Peace Parkland, located on the east-central edge of British Columbia and northwestern Alberta. Landscapes in the planning region include prairie potholes, aspen parklands, northern grasslands, and the boreal transition zone. Other plans or documents may refer to the region covered in this document as BCR 11 or the Prairie Pothole Region (PPR). The boundaries of the planning region covered in this document differ somewhat from those of BCR 11 or the PPR (Figure 1), so the area covered under this plan is referred to as the Northern Prairie & Parkland Region and the document is referred to as the Northern Prairie & Parkland Waterbird Conservation Plan. The boundary of the NP&PR is synonymous with the boundaries of the Prairie Pothole and Prairie Habitat joint ventures, and includes most of BCR 11, as well as portions of BCRs 6 and 10 (see www.nabci-us.org/map.html for more information on BCRs).

As the glaciers receded from this part of the continent approximately 10,000 years ago, they left behind small depressions in the landscape created by the melting of ice blocks and deposition of glacial debris. These “potholes” contain a variety of small wetlands ranging from wet meadows and shallow water ponds to saline lakes, marshes, and fens. The density of wetlands in the region may be as high as 60/km² (155/mile²); most of these wetlands are small, < 0.5 ha (1 acre) in size. In some areas, reservoirs have been created by damming streams and rivers. The region is also dotted with oxbow wetlands created from the changing flow of rivers and streams.

The dominant native vegetative community of the NP&PR is prairie, followed by woodlands and wetlands. Mixed-grass prairies are dominant in most of the region, although the northern and western fringes include fescue grasslands and the southeastern portion includes tallgrass prairie. Boreal transition forest and aspen parklands extend from the northern boundary in a belt 100-200 km to the south.

European settlement has greatly transformed the region. Extensive cultivation has reduced the tallgrass prairie by about 99 percent, the mixed-grass prairie by approximately 80 percent, and the number of wetlands by up to 50 percent. Suppression of prairie fires and the extirpation of bison have resulted in a marked increase in woody cover in some areas.

1.3.ii Ecological Importance of the Northern Prairie & Parkland Region

The NP&PR has been identified as the most important waterfowl production area in North America. The myriad wetlands that make the NP&PR valuable to waterfowl also make it valuable to a host of other species, especially waterbirds. In North Dakota alone, at least 63 species of birds are wetland associates. Many species of waterbirds reach their highest densities or are found primarily in the NP&PR. Although population data for waterbirds are often lacking, distributional data show the NP&PR to be especially important for Eared Grebe, American White

Pelican, Franklin's Gull, California Gull, Forster's Tern, and Black Tern. In addition, wetland margins and dense upland vegetation surrounding wetlands provide habitat for a variety of upland species and provide nesting cover for many wetland-dependent birds. During droughts, dry wetlands provide cover for upland and wetland-edge birds, while typical waterbird species may be absent. In addition to birds, prairie potholes also provide habitat for many game and non-game mammals, fish, reptiles, and amphibians. Less visible are aquatic invertebrates, which provide a protein-rich diet for juveniles and adults of many species of waterbirds.

Prairie wetlands provide habitat for a host of wildlife species and perform a variety of ecological functions, including water retention and flood control, sediment and nutrient retention, water filtration, and ground water recharge. Undisturbed wetlands typically function as carbon sinks, although the amount of carbon is small relative to the net primary productivity of wetlands. The ecological functioning of wetlands, particularly production, nutrient retention, and nutrient release, is influenced by changes in water level, which are primarily driven by precipitation.

The ecological importance of the NP&PR goes beyond wetlands. Grasslands are considered North America's most endangered ecosystem, and even though the NP&PR has lost a lot of grassland due to agricultural development, much grassland remains relative to most regions of North America. The NP&PR harbors many species of grassland birds, some of which are rare or declining, such as Sprague's Pipit and Baird's Sparrow. Grasslands in the NP&PR complement wetlands, as many species of wetland birds nest in surrounding uplands. In addition, grasslands increase water retention, filter water entering wetlands, and retain large amounts of nutrients and carbon. Because inputs from uplands readily enter wetlands, managing surrounding landscapes is key to managing wetlands. This may be especially true in areas of the NP&PR where wetlands are widely distributed throughout a predominantly agricultural landscape. Even the simple presence of grass buffers around wetlands can have a significant impact on a wetland's water quality and suitability for wetland-dependent wildlife.

1.3.iii Threats to the Ecological Integrity of the Northern Prairie & Parkland Region

Many species and ecological functions are being lost in the NP&PR as native habitat is altered or converted to other uses. Because agriculture is the primary land use, many of the threats to the ecological integrity of the NP&PR are related to agricultural practices and programs. Threats can be direct, as in habitat loss from wetland drainage and conversion of grassland to cropland, or indirect, such as pesticide-induced loss of invertebrate populations necessary for growth and survival of birds.

Vast numbers of wetlands already have been converted to other uses in the NP&PR. Statewide estimates of number of wetlands lost are 89% for Iowa, 49% for North Dakota, 42% for Minnesota, 35% for South Dakota, and 27% for Montana. The percentage of surface area lost is smaller than the percentage of number of wetlands, as smaller wetlands, which are easier to drain, are drained first. However, small wetlands are disproportionately used by breeding waterfowl, and loss of small wetlands can disrupt habitat connectivity and reduce diversity and function of wetland complexes. Estimates of wetland loss for the Canadian prairie/parkland regions from 1985 to 1999 are 4.9% for Manitoba, 4.4% for Alberta, and 3.0% for Saskatchewan (M. Watmough, pers. comm.).

The strength of the agricultural economy influences incentives to convert native habitat to crop fields, as grassland and wetland conversion increase when crop prices are high. However, agriculture can have a tremendous impact on land use even in the absence of direct market forces. For example, the U.S. Department of Agriculture's Conservation Reserve Program (CRP), which takes land out of production by paying farmers to plant grass on croplands for a contracted time period, paid farmers in North Dakota approximately \$100 million per year during the late 1990s. Wetlands in the U.S. presently receive some protection under the Swampbuster provision of the *Food Security Act of 1990* (a.k.a. Farm Bill), which denies federal agricultural benefits to farmers who drain wetlands, although wetlands can be farmed in dry years. Important as Swampbuster is to wetland-dependent wildlife, protection under the Swampbuster provision is temporary, and may be lost as new farm bill legislation is enacted. Wetland protection also may be jeopardized by other government regulations and decisions. For example, the U.S. Supreme Court ruled that isolated, non-navigable, intrastate wetlands (such as those typical of the NP&PR) are no longer protected under Section 404 of the *Clean Water Act of 1972*, which prohibits the dredging or filling of any portion of the waters of the United States without a permit.

Canadian wetlands are afforded protection on federal and provincial "crown" lands under a variety of federal and provincial wetland policies, along with relevant acts and regulations. Outside these areas, wetland protection for larger water bodies falls under federal legislation such as the *Fisheries Act* and the *Navigable Waters Protection Act*. Wetland drainage on private lands is regulated, but not stopped, by permitting procedures covered under water acts in Alberta (*The Water Act*), Saskatchewan (*The Water Corporation Act*), and Manitoba (*The Water Rights Act*).

Wetlands can be degraded even if they are not drained, as cultivation of wetland basins during dry years may reduce quality of wetland habitat during subsequent wet years when basins hold water. Marsh plants can survive several years of cultivation, but tillage of basins over extended periods can alter wetland plant community composition and reduce structure of wetland vegetation. In addition, wetlands in agricultural fields may have reduced numbers of invertebrates relative to wetlands in grasslands. Agriculture also has many less obvious, indirect effects that threaten the ecological integrity of the NP&PR, including siltation and fertilizer and herbicide inputs. Pesticides can decrease reproductive success as well as cause direct and indirect mortality of birds. Declines in populations of piscivorous raptors during the DDT era are well documented, along with declines of some waterbirds, but it is likely that smaller, less visible waterbirds also were impacted, although the extent of any decline is unknown. Other pesticides such as carbofuran, chlorpyrifos, and parathion can cause direct mortality of birds, kill invertebrates upon which many waterbirds feed, and contaminate food resources.

Many non-agricultural threats to wetlands also exist. Increased burning of fossil fuels, particularly at coal-fired generating plants, causes acidification of precipitation, which has led to reduced productivity of some wetlands. Human-induced climate change (i.e., "global warming"), if it does occur, has the potential to alter temperature, precipitation amounts and patterns, growing season, plant evapo-transpiration, and a host of related factors such as snow cover, timing of migration, timing and duration of dormancy, species composition of native and agricultural systems, and urbanization, all of which could have dramatic impacts on many

aspects of ecology in the NP&PR. Exotic species are spreading within the region, including terrestrial species such as leafy spurge and spotted knapweed and wetland/riparian species such as purple loosestrife and salt cedar. Many ecosystem functions are lost or altered as native species are displaced, alien species invade, and natural disturbances such as grazing and fire are altered.

1.4 Waterbird Conservation in the Northern Prairie & Parkland Region

1.4.i History and Legal Framework

Uncontrolled commercial hunting for the food and feather trade in the late 1800s and early 1900s decimated many North American waterbird species. Although Canada had established bird refuges as early as 1887, the first protection undertaken specifically for waterbirds in North America was the 1903 designation of Pelican Island National Wildlife Refuge in Florida, which was established to protect nesting egrets and Brown Pelicans. Canada took a big step forward in May 1915 when 12 Saskatchewan lakes (Basin, Bigstick, Bitter, Cabri, Chaplin, Crane, Goose, Johnstone [Old Wives], Lenore, Quill, Redberry and White Bear) and 14 Alberta lakes (Big Hay, Birch, Buffalo, Cooking, Gaskell, Grease Wood, Lac la Biche, Lac Ste. Anne, Many Island, Ministik, Miquelon, Moose Head, Pakowki and Wabamum) were protected. Many of these lakes were established as Federal Migratory Bird Sanctuaries by 1925 (although some were later delisted) and by these acts many of the most important breeding lakes for colonial waterbirds in Prairie Canada were protected. As in Canada, most National Wildlife Refuges in the United States portion of the NP&PR were acquired to provide breeding or migration habitat for waterfowl, but some refuges were acquired specifically to protect waterbirds such as American White Pelicans, and virtually all refuges harbor multiple species of waterbirds.

In 1913 the *Weeks-McLean Act* (also referred to as the *Migratory Bird Act of 1913*) was passed in the United States, which declared that migratory and insectivorous birds were under the jurisdiction of the federal government. The *Weeks-McLean Act* was later struck down, but became the basis for the *Migratory Bird Treaty Act* (MBTA, known as the *Migratory Birds Convention Act* in Canada) between Canada and the United States, which was signed in Washington on August 16, 1916. This was ratified in the U.S. later that same year and in Canada in 1917; regulations under the MBTA took effect continent-wide in 1918. This act closed the hunting season on Sandhill Cranes (until 1961 when a hunting season resumed in 8 Central Flyway states and in 1964 in Manitoba and Saskatchewan) and regulated hunting seasons for waterfowl, American Coots, Common Moorhens, and rails. Double-crested Cormorants and American White Pelicans were not initially covered under the MBTA, as they were deemed a potential threat to fisheries. It was not until 1978 and 1982 that most breeding colonies of American White Pelicans and Double-crested Cormorants were protected across Prairie Canada. In Canada, all waterbirds are covered by the MBCA except for American White Pelicans and Double-crested Cormorants, which come under provincial jurisdictions. In the United States, pelicans and cormorants were given federal protection in a 1972 addendum to the 1936 *Migratory Bird Treaty Act* with Mexico. The *Endangered Species Act* (1973) in the United States and the *Species At Risk Act* (2003) in Canada provide protection and recovery planning for endangered species or species at risk, including several waterbird species in the NP&PR.

Conservation of waterbird habitat in the United States was enacted through legislative protection of wetlands under Section 404 of the *Clean Water Act* of 1972. Section 404 slowed, but did not eliminate, wetland losses in the United States. Unfortunately, in 2001 the Supreme Court of the United States ruled that isolated, non-navigable, intrastate wetlands (such as those typical of the NP&PR) were no longer protected. The final outcome of this ruling is not clear, though, as it is subject to interpretation and application of regulations and guidelines. Wetlands may still be protected under state laws or federal programs such as *The Food Security Act* of 1985. The objective of Canada's *Federal Policy on Wetland Conservation: 1991*, applicable to federal lands, is "to promote the conservation of Canada's wetlands to sustain their ecological and socio-economic functions, now and in the future." Canada's *Prairie Farm Rehabilitation Act* (PFRA) of 1935 (www.agr.gc.ca/pfra/main_e.htm) was established to rehabilitate areas of Prairie Canada decimated during the drought of the 1930s. Although not targeted at wetlands and waterbirds, the general rehabilitation and management of the landscape for agriculture, primarily cattle grazing, has conserved wetlands and native grassland, which benefits waterbirds and other wildlife.

1.4.ii Existing Monitoring and Research

Waterbird monitoring in the NP&PR has taken place under a multitude of programs, time frames, and formats. This section is not comprehensive and does not include local or short-term programs (see Appendix B) but provides information on several broad-scale efforts.

The National Colonial Bird Register at Cornell University was an attempt to create a comprehensive, long-term database documenting numbers of waterbirds at colonies throughout the United States and portions of Canada. The Register provided a repository for detailed data, but records were included opportunistically with no mechanism or funding for sampling, and the National Audubon Society terminated support of the National Colonial Bird Register in the late 1980s. Since then, there has been no comprehensive program to specifically monitor waterbirds in the NP&PR, although some states and provinces maintain records of waterbird colonies in natural heritage programs, provincial conservation data centers, or state databases similar to the Cornell Registry. Less information is available regarding populations and locations of non-colonial waterbirds, with the exception of American Coot, which is monitored because it is a game species.

The North American Breeding Bird Survey (BBS) presently has 326 routes in the NP&PR: 208 in Canada (87 in Alberta, 62 in Saskatchewan, 59 in Manitoba) and 118 in the United States (28 in Montana, 31 in North Dakota, 21 in South Dakota, 29 in Minnesota, and 9 in Iowa). BBS data, collected in June, provide useful information on distribution, relative abundance, and population trends of many bird species. However, not all routes are surveyed every year. In addition, routes must be surveyed at least twice by a single observer to be included in population trend analyses. Thus, the number of routes available for calculation of species' trends may be lower than the total number of registered routes. However, it is not known how accurate this method is for monitoring waterbirds that are seldom seen or heard during nesting or any part of their summer residency, especially as BBS routes do not target wetlands. In the Canadian prairies, an intensification of survey effort to complement the

BBS is being undertaken through the Grassland Bird Monitoring (GBM) program, which also samples waterbirds.

Breeding Ground Surveys for waterfowl are conducted cooperatively between the United States and Canada during the month of May to estimate populations of waterfowl and American Coot. These surveys consist of an aerial component and a ground component that surveys a sub-sample of ground segments within the aerial transects. Large wetlands are avoided in the ground segments. These surveys have been run annually since 1955. However, a new set of transects was established and old ones were dropped in the Canadian prairies in 1975, and the number of transects was further expanded in 1989. Approximately 120 transects occur within the NP&PR in Canada and 48 in the U.S. Transects vary in length, and are broken into 30-km segments, with the 48 U.S. transects totaling approximately 10,400 km. Since 2000, five species of grebes have also been monitored on the ground verification segments (air-ground surveys) in Prairie Canada. Other than American Coot, waterbirds are not the primary target of these surveys and the accuracy of current methodology for surveying waterbirds has not been tested. Information on wetland number, type, and habitat condition also is recorded on these surveys.

The U.S. Fish and Wildlife Service conducts surveys to estimate population size and level of harvest for management of certain waterbirds harvested in the United States and Canada. The nesting range of the mid-continent population of Sandhill Cranes includes the northern limits of the NP&PR, but the majority of the population migrates and stages throughout the Region excluding Minnesota and Iowa. Spring surveys of staging cranes in the central Platte Valley of Nebraska have been conducted annually since 1982. However, data on Common Moorhen, Sora, and Virginia Rail population sizes, distribution, and trends are lacking. Annual harvest information for American Coot, Purple Gallinule, Common Moorhen, rails, and Sandhill Crane are provided in the United States through the Migratory Bird Harvest Information Program (HIP) conducted by USFWS Division of Migratory Bird Management. Similar information is collected in Canada by the Canadian Wildlife Service through the National Harvest Survey of migratory bird hunters who purchase the Canadian Migratory Bird Hunting Permit. In Canada, American Coots are harvested annually across the NP&PR and Sandhill Cranes are harvested in Saskatchewan and Manitoba. Hunting of rails, which formerly occurred in all three prairie provinces, is no longer permitted.

In Prairie Canada many colonial waterbird species were surveyed in the 1960s and reported on in a number of articles by K. Vermeer of the Canadian Wildlife Service. Comprehensive surveys of American White Pelican, Double-Crested Cormorant, gulls, terns, and Great Blue Heron were conducted in 1998 in south and central Alberta. In Saskatchewan, all known American White Pelican and some Double-crested Cormorant colonies were surveyed in 1991. In 1999, a survey of Saskatchewan provincial wildlife field staff was used to define the status of a number of Great Blue Heron colonies. The most recent survey of colonial birds in Manitoba was conducted in 1999 on Lake Winnipegosis. Incidental data exist for most other waterbird species in the NP&PR as identified in several general or specific surveys.

The Whooping Crane is federally listed as an endangered species in both countries and the Least Tern is federally listed as an endangered species in the United States. The Whooping Crane is

considered a migrant in the NP&PR and is monitored irregularly during migration with primary monitoring efforts occurring on the breeding and wintering areas. The Least Tern is regularly surveyed in those states that have breeding populations. Least Bittern and Yellow Rail are federally listed as Threatened or Species of Special Concern, respectively, in Canada, but they are not monitored with any regularity at this time. A number of species are listed as threatened or endangered or as species of special concern at state or provincial levels (Appendix C); many of these jurisdictions have developed monitoring or survey strategies suited to specific information needs in the conservation of these species. For example, the Yellow Rail, listed nationally, and Virginia Rail were the focus of an Alberta province-wide survey of all known and potential sites in 2000 to provide information on current status and distribution of these species.

Waterbirds have generally received little research effort relative to waterfowl due to the minor economic impact of waterbirds and associated funding relative to waterfowl. Comprehensive research studies on waterfowl and wetlands in the NP&PR have been undertaken by the USFWS, CWS, USGS Northern Prairie Wildlife Research Center, the Delta Waterfowl Research Station, Ducks Unlimited, and the Institute for Wetland and Waterfowl Research, to name a few. Many of the techniques and underlying ecological relationships from waterfowl research can serve as a foundation to better understand waterbirds with similar habitat needs and will be useful in planning future waterbird research. Research on waterbirds is occasionally conducted by faculty and graduate students at universities from within and without the region. Most research is conducted in cooperation with state, provincial, and federal resource management agencies. In the United States, the Webless Migratory Gamebird Research Program is available to support research of webless migratory gamebirds, including waterbirds. Between 1995 and 2000 this program provided \$1,141,468 to support 33 projects with a total cost exceeding \$4,000,000 nationally.

1.4.iii Conservation Initiatives

As with monitoring, existing waterbird conservation efforts are uncoordinated and opportunistic. The information included in this section is not inclusive and does not identify all existing conservation initiatives.

In the United States and Canada, conservation of waterbirds has received little attention, although regional or continental plans have been developed for threatened and endangered species, as well as some other high priority species (Table 2). A continental plan has been developed for colonial waterbird species, as well as management guidelines for harvested species (Table 2). Local plans vary with jurisdiction; specific status or rankings by federal and provincial or state governments are outlined in Appendix C.

Table 2. Regional and continental conservation plans, management plans, and assessments developed for waterbirds in North America. Full citations are provided in Section 7 of this document.

Species	Plan/Title
Least Tern	Recovery Plan for the Interior Population of the Least Tern
Whooping Crane	1996-1997 Contingency Plan: Federal-state Cooperative Protection of Whooping Cranes (U.S.); National Recovery Plan for the Whooping Crane (Canada); Whooping Crane Recovery Plan (U.S)
Sandhill Crane	Management Guidelines for Mid-continent Sandhill Cranes
Black Tern	Status Assessment and Conservation Plan for the Black Tern in North America
Caspian Tern	Status Assessment and Conservation Recommendations for the Caspian Tern in North America
Double-crested Cormorant	Final Environmental Impact Statement: Double-crested Cormorant Management in the United States
Colonial waterbirds	Waterbird Conservation for the Americas
Harvested species	Migratory Shore and Upland Game Bird Management in North America

Waterfowl conservation actions, particularly wetland conservation, have resulted in considerable benefits for many species of waterbirds in the region. The North American Waterfowl Management Plan (NAWMP) was established as a joint effort by Canada, the United States, and Mexico to enhance continental waterfowl populations. The U.S. government provided incentives for migratory bird conservation through passage of the North American Wetlands Conservation Act (NAWCA; northamerican.fws.gov/NAWCA/act.htm) in 1989. NAWCA supports NAWMP objectives by encouraging public-private partnerships to conserve North American wetland ecosystems for waterfowl, other migratory birds, fish, and wildlife. From 1986-2002, NAWMP partners channeled \$2.3 billion (U.S.) to protect and enhance 9.8 million acres of waterfowl habitat continent-wide, which also benefits many non-waterfowl species. In the NP&PR, partners channeled more than \$500 million through the Prairie Pothole and Prairie Habitat joint ventures to protect and enhance 3.9 million acres of waterfowl habitat. NAWMP was updated in 1998, specifically directing benefits for other species in addition to waterfowl. The second objective of the PPJV implementation plan is to “Stabilize or increase populations of declining wetland/grassland-associated wildlife species in the PPR, with special emphasis on non-waterfowl migratory birds.” Program delivery by the PPJV increasingly reflects this broadened mandate. Similarly, the PHJV’s Strategic Framework for 1999-2004 states that the PHJV will work together with other bird initiatives, through the North American Bird Conservation Initiative, to facilitate a coordinated approach to bird and habitat conservation.

Ramsar Wetlands of International Importance, as designated under the Ramsar Convention of 1971, often are important staging and breeding areas for colonial waterbirds. Designated Ramsar sites in the NP&PR include Beaverhill Lake, Alberta; Last Mountain and Quill Lakes, Saskatchewan; Oak-Hammock and Delta Marshes in Manitoba; and Sand Lake National Wildlife

Refuge, South Dakota. The Western Hemisphere Shorebird Reserve Network (WHSRN) program, although directed at shorebirds, highlights important wetlands that also are beneficial to other water-dependent species. Although designation as a Ramsar wetland or WHSRN site does not confer any direct protection, the designation does provide international recognition of a site's natural values.

The Important Bird Areas (IBA) program of BirdLife International has four site categories and in the NP&PR recognizes sites of importance to congregatory species. Sites can be designated as IBAs of global, continental, or national significance according to their use by birds in numbers that meet specific thresholds. However, IBA designation does not confer direct protection. The IBA program in Canada, cooperatively delivered by Bird Studies Canada and the Canadian Nature Federation, has identified and designated a number of sites in the NP&PR. The majority of these sites are associated with lakes or large wetland complexes, and several meet IBA thresholds for significant use by various waterbird species (Table 3). At select sites, management plans are being developed by the local committees or groups that nominated these sites. Site plans can include strategies for ongoing surveys and monitoring of birds using the site. The American Bird Conservancy is identifying globally important IBA sites in the U.S., whereas the Audubon Society is identifying IBAs of state significance. The IBA process in the U.S. portion of the NP&PR is primarily in a planning phase; the Audubon Society will be assembling a technical team to work on IBA development in the region.

Table 3. Distribution and status of Important Bird Areas in the Canadian Prairie portion of the Northern Prairie & Parkland Waterbird Conservation Region.

	Alberta	Saskatchewan	Manitoba
Total number of IBAs in the NP&PR (BCR11)	30	44	10
Total lake- or wetland-associated IBAs	29	36	9
Total IBAs meeting threshold for use by waterbirds (various species)	9	18	8

In the United States, the U.S. Fish and Wildlife Service has extensive programs, funded largely through sale of federal Duck Stamps, to protect wetland and grassland habitat for waterfowl through fee title purchase and conservation easements. As of 2002, the sale of federal Duck Stamps has generated more than \$600 million. This money has been used to conserve over 5 million acres of waterfowl habitat in the United States, which has been incorporated into the U.S. Fish and Wildlife Service's National Wildlife Refuge System (Table 4). Historically, many lands were protected through fee title purchase, but presently the primary tool for protecting wetlands and surrounding uplands is purchase of conservation easements. Ducks Unlimited is a major funding partner in easement acquisition in portions of the NP&PR. The Wetland Reserve Program (WRP) is an important U.S. Department of Agriculture program that protects and enhances wetlands and surrounding uplands. However, availability of money for WRP varies among states, and in some areas, demand for WRP leases exceeds available funding. In Canada, protection is provided to wetlands and uplands located within the Migratory Bird Sanctuaries and National Wildlife Areas administered by the Canadian Wildlife Service. Additional habitat is protected through the National Parks network and by state and provincial agencies and non-governmental organizations.

Table 4. State totals for lands protected under U.S. Fish and Wildlife Service fee title and permanent easement conservation programs. Numbers are approximate.

	North Dakota	South Dakota	Montana	Minnesota	Iowa
Refuges (number)	62	7	22	12	6
Refuges (acres)	296,000	52,000	1,149,000	214,000	86,000
Waterfowl Protection Areas (acres)	254,000	155,000	107,000	177,000	18,000
Wetland easements (acres)	820,000	472,000	25,000	91,000	3,000*
Grassland easements (acres)	136,000	429,000	34,000	814	< 1,000*

*Iowa presently has 103,000 acres enrolled in various forms of the Wetland Reserve Program; wetlands are the primary focus of this program, but many acres of grassland also are protected, reducing inputs of fertilizer, pesticides, and silt.

The U.S. Fish and Wildlife Service also administers the Partners for Fish and Wildlife program that assists private landowners with habitat restoration, development, and management on their property. In addition to providing technical and financial assistance, the program protects thousands of acres of wetlands and grasslands under term leases in the U.S. portion of the NP&PR. Since 1987, the Partners for Wildlife Program and cooperators have helped 2,500 landowners enhance wildlife habitat on 162,000 acres in North Dakota alone. More than 25,000 landowners nationwide have participated in this voluntary program. A variety of additional conservation programs are available through the U.S. Department of Agriculture, including the Wildlife Habitat Incentive Program, the Environmental Quality Incentive Program, and the Conservation Reserve Enhancement Program.

1.4.iv Role of the Northern Prairie & Parkland Region in North American Waterbird Conservation

The millions of wetlands in the NP&PR are the foundation of the famed “duck factory” of North America, and the PPJV and PHJV of the NAWMP were set up to guide waterfowl management in the region. Within these joint ventures, high priority landscapes have been targeted for wetland and upland conservation efforts over the last 15 years. Although efforts have been specifically directed at waterfowl, benefits to other water-dependent species likely are considerable as the wetlands that benefit waterfowl can also benefit waterbirds with similar habitat needs. Given the long history of wetland and upland conservation in the NP&PR and resultant development of management expertise, integration of conservation efforts may especially benefit waterbirds.

The NP&PR harbors a large proportion of the total population and breeding range for many North American waterbird species. Information on waterbird populations is notoriously poor, but it is estimated that the proportion of the continental breeding population found in the NP&PR is > 60% for Franklin’s Gull; > 50% for Pied-billed Grebe, American Bittern, Sora, American Coot, and Black Tern; and approximately 30% for American White Pelican and California Gull. High numbers of waterbird species and individuals in the NP&PR indicate that the area is

critically important to continental waterbird conservation. However, waterbirds breeding in the NP&PR spend only a portion of their annual cycle there, and migration corridors, staging areas, and wintering grounds are also vital to waterbird conservation. Continental planning efforts must recognize and support conservation of linkages between different geographic regions, and regional plans should identify and address conservation issues within their respective boundaries.

2.0 WATERBIRDS IN THE NORTHERN PRAIRIE & PARKLAND REGION

2.1 Introduction

2.1.i Colonial vs. Non-Colonial Breeders

The majority of waterbird species (24, or 62%) that breed in the NP&PR are colonial nesters whereas the remainder (15 species, 38%) are generally solitary nesters (Table 1). The NP&PR has a relatively high proportion of non-colonial nesters, as only 20% of waterbird species across the continent are non-colonial nesters. Some species, particularly herons and egrets, nest in mixed-species colonies. A few colonial species occasionally nest singly, and a few solitary species occasionally nest in small groups or loose colonies. The former situation may be the result of low population levels or lack of sufficient food supplies; the latter may result from a superabundance of food resulting in a close nesting association that may be described as semi-colonial behavior.

2.1.ii Staging and Migrant Waterbirds

Waterbirds often stage, or congregate, prior to and during migration. During this time the birds forage and rest, taking advantage of secure roost sites and high-energy food resources to gain fat prior to continued migration and the breeding season. A well-known staging area outside the NP&PR is the annual congregation of 500,000 Sandhill Cranes in the Platte River Valley, but staging areas, and their importance to a species' conservation, are not limited to Sandhill Cranes during spring. Many species of waterbirds stage in late summer, fall, winter, and spring at lesser-known but equally important locations to replenish and build energy reserves, rest, molt, or initiate pre-breeding courtship behavior. For example, Eared Grebes move to saline staging/molting lakes in the Great Basin of the United States prior to fall migration, although some adults will molt closer to breeding areas. During migration, Franklin's Gulls congregate in large (formerly up to 2.5 million birds) flocks. Common Loons, which are highly territorial during the breeding season, also stage on large lakes where food is abundant.

Staging areas are extremely important energetically. For example, Sandhill Cranes may increase their body mass up to 20% at staging areas. Efficient foraging is probably even more important when species undergo molt, which is energetically demanding. Unfortunately, human disturbance to staging birds can have significant energetic consequences, and human presence at staging areas should be minimized. Because of their importance to waterbirds for feeding, molting, migration, energetics, and social interactions, protecting staging areas may be as important as protecting breeding and wintering habitat.

2.2 Breeding Waterbirds: Biology, Distribution, and Status

2.2.i Distribution and Habitat Needs of Nesting Species

Distribution of the 39 species breeding within the NP&PR can be clumped into three general categories: widespread, peripheral, and local (Table 1, Appendix D). Twenty-five species that breed in the NP&PR do so over > 10% of the NP&PR and are considered “widespread” breeders. Five species that breed in few highly localized or confined sites across the region are considered “local” breeders. Nine species are considered peripheral breeders, with primary breeding ranges outside the NP&PR and occasional breeding occurrences at the fringes of the NP&PR. Many additional species are occasionally found in the NP&PR either as very rare breeders or vagrants during spring or fall migration; all waterbird species that have been observed in the NP&PR are listed in Appendix A.

Colonial waterbirds may be subdivided according to the substrate that they choose for nesting. In general, these species may nest on a floating platform, on an island, or in trees or tall shrubbery. With few exceptions most species fall neatly into one of these categories. Species using the same nesting substrate often are found nesting in association with other colonial waterbirds. Species nesting on platforms in marshes include the Eared, Western, and Clark’s grebes, Black-crowned Night-Heron, White-faced Ibis, Franklin’s Gull, and Forster’s and Black terns. The solitary nesting American Coot may be found nesting with these species. Among the island-nesting species, American White Pelicans, Double-crested Cormorants, California, Herring and Ring-billed gulls, and Caspian and Common terns often are found nesting together. Tree-nesting species include most of the herons and Double-crested Cormorants in some areas. These colonies may be composed of single species or, especially in the southeastern portion of the NP&PR, many species. Non-colonial species may nest on a floating platform of vegetation, in emergent vegetation over water, or on the ground in drier sites such as sedge meadows, or even in dry upland vegetation. Cranes build a mound of vegetation that may be constructed in shallow water on or near the edge of a wetland.

Waterbirds also can be categorized by their preference for a general type of wetland utilized for nesting during the breeding season in the NP&PR (Table 5); more detailed habitat requirements are recorded in the waterbird species accounts (Appendix D).

Table 5. General waterbird habitat preferences based on amount of emergent vegetation, open water, and preferred nesting habitat.

Group A	Group B	Group C	Group D	Group E
Wetland with - substantial emergent vegetation - variable open water	Wetland with - emergent vegetation - partial open water	Wetland with - emergent vegetation - extensive open water	Wetland with - emergent vegetation - open water - nesting trees	Lake or River - open water - barren ground - islands
American Bittern Least Bittern Black-crowned Night-Heron Yellow Rail Black Rail King Rail Virginia Rail Sora	Sandhill Crane Franklin's Gull Bonaparte's Gull Forster's Tern Black Tern	Common Loon Pied-billed Grebe Horned Grebe Red-necked Grebe Eared Grebe Western Grebe Clark's Grebe White-faced Ibis American Coot Common Moorhen	Great Blue Heron Great Egret Snowy Egret Tricolored Heron Little Blue Heron Cattle Egret Green Heron Yellow-crowned Night Heron	American White Pelican Double-crested Cormorant Ring-billed Gull California Gull Herring Gull Caspian Tern Common Tern Least Tern

Wetlands in Group A generally have extensive stands of emergent vegetation. These sites range from flooded sedge meadows to cattail or bulrush stands in deep water marshes and may be seasonal to permanent wetlands. The second group of wetlands (B) includes mostly larger, permanent freshwater marshes with patches of emergent vegetation interspersed with open water. Wetlands in the third group (C) have emergent vegetation (sedges, rushes, *Phragmites*) with extensive areas of open water. Some shallow-water marshes are included in this set but the majority are deep-water marshes or lakes. The fourth group (D) of wetlands is typified by the presence of wooded areas that serve as nesting sites on islands, flooded stands of trees, or uplands near the wetland; some waterbirds using this group also will nest on barren sites. The final group (E) includes wetlands or waterways with an island (vegetated or barren), sandbar, or exposed shoreline. Although these species are separated into general categories, habitat preferences will overlap across the region. Many wetlands have multiple vegetation zones that reflect basin substrate and water depth; distribution and structure of vegetation in a basin may change depending on variation in water levels. Maintaining appropriate interspersions of vegetation and wetland complexes is important because waterbirds may use multiple zones throughout the year or in different years.

2.2.ii Population Estimates & Trends of Breeding Waterbirds

Population estimates and trends are reliable for only a few of the species covered by this plan. Numbers of strongly colonial species that are historically of management interest, such as American White Pelican, are relatively well known for local populations, as are regional population estimates for Sandhill Crane and American Coot, which are popular game birds. For these species, specific inventories and surveys have been conducted and can be used to estimate population size and trends.

For many of the remaining species only the BBS contains useful data, despite weaknesses of this survey for detecting some waterbird species. Nonetheless, the BBS does provide some indication of which species are increasing or decreasing, and serves to further highlight those species most in need of additional monitoring. For example, some waterbird species such as Whooping Crane only breed in areas lacking BBS coverage. Other species such as Yellow Rail are present in areas with BBS coverage, but detection is so low as to preclude analysis. Population trends can be estimated from the BBS at continental, regional, BCR, and state/province scales. Knowledge of trends across North America is generally better than at finer scales due to a greater number of survey routes at the continental scale. Correspondingly, continental population trends are more likely to show statistical significance because of larger sample sizes than at the BCR scale.

We reviewed trend analysis of data for 36 species regularly found on BBS routes (excluding Yellow Rail, Black Rail, Whooping Crane, and Bonaparte's Gull) from 1966-2000. Across North America, these data indicate that 12 of the 36 species showed statistically significant ($P < 0.05$) increases, and 5 showed statistically significant decreases (see Species Accounts, Appendix D, for details). However, reliability of trend estimates is low for many species even at this broadest scale because of small sample sizes and high variation. Within the NP&PR, four species showed statistically significant increases, and two showed statistically significant decreases. Reliability of trend estimates is even lower within the BCR because of reduced sample sizes relative to continental estimates.

Virtually no information exists on total population size in either North America or the NP&PR for marshbirds and some colonial species. Of those species for which a NP&PR population estimate is available, Eared Grebe and American Coot are considered the most abundant, with breeding populations likely exceeding 800,000 individuals. California Gull, Franklin's Gull, Double-crested Cormorant, and perhaps Ring-billed Gull probably number in the 100,000s. Several species have large continental breeding populations but are only peripheral breeders in the NP&PR including Cattle, Great, and Snowy egrets, and Tricolored Heron, among others. Other species such as Yellow Rail and King Rail are widespread in the NP&PR, but with low abundance. For most species, information is insufficient to set population targets.

2.2.iii Key Sites Used by Breeding Waterbirds

A majority of the colonial waterbirds breed in fairly large concentrations and use specific lakes or sites on an annual or fairly regular basis. These sites may consist of islands or wooded patches typically used by herons and Double-crested Cormorant or emergent vegetation typically used by grebes, terns, and some gulls (Table 5). Many of these sites have been identified through systematic surveys and observations. Most non-colonial species nest in low densities, making it difficult to define key breeding areas. The ephemeral nature of prairie wetlands further complicates the process as many non-colonial and some colonial species (e.g., Franklin's Gull, Eared Grebe, Black Tern) shift nesting sites among years depending on availability of water and nesting habitat conditions. Wetland complexes of varying size and degree of permanency surrounded by upland habitat are likely the most appropriate targets as key areas for this suite of species.

Key sites in the NP&PR identified as critical to the conservation of populations of waterbirds will be recognized on several levels of importance as outlined by BirdLife International under the Important Bird Area (IBA) program (www.ibacanada.com and www.audubon.org/bird/iba). Global and continental IBAs are identified through application of quantitative criteria based on numbers of birds using the site as noted below:

- Globally Important Waterbird Area – The site is known to hold or thought to hold on a regular basis 1% or more of the global population or 20,000 or more waterbirds.
- Continentally Important Waterbird Area – The site is known to hold or thought to hold on a regular basis 1% or more of the continental population or 15,000 or more waterbirds.

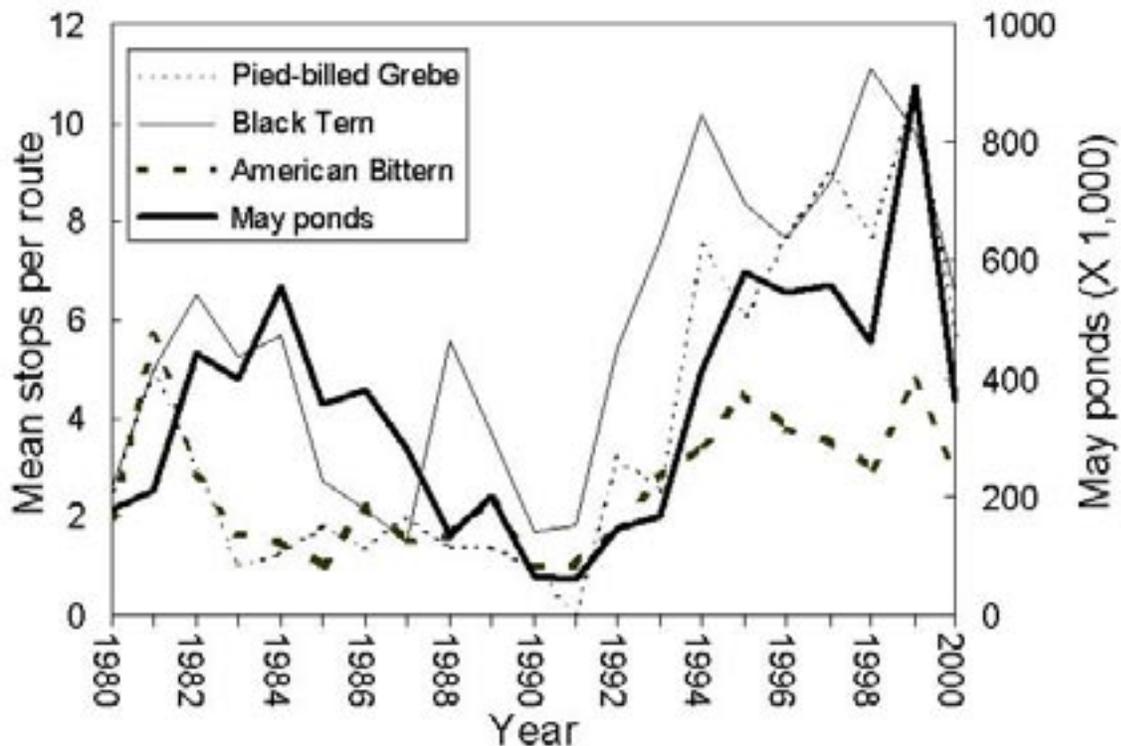
A regional site may not meet IBA criteria even though it is highly important to a species listed under a regional jurisdiction’s endangered species act (e.g., Least Tern sites on the Missouri River) or a species’ status assessment listing (e.g., Yellow Rail sites in Alberta). A list of these sites needs to be developed under the heading of “Regionally Important Waterbird Sites.”

The BirdLife database will be used to maintain the inventory of Important Bird Areas for waterbirds in North America. Databases and inventory of Important Bird Areas at regional levels will be maintained by the National Audubon Society in the United States and by Bird Studies Canada and the Canadian Nature Federation in Canada. However, given the broad spatial distribution of wetland habitat in the NP&PR and dispersed breeding of many marshbirds, focusing attention only on IBAs or individual sites will result in a huge shortfall of conservation for most marshbirds. Therefore, entire landscapes will need to be identified and preserved, as well as specific locations identified under projects such as the IBA program.

2.2.iv Spatial and Temporal Variability in Breeding

The breeding distribution and density of many species of waterfowl in North America are influenced by the number and condition of wetlands. Understanding this relationship is critical to the monitoring and management of waterfowl populations in the NP&PR. Although the effect of wetland availability on breeding distribution and density of waterbirds is poorly known, limited information indicates that waterbirds are affected in a manner similar to waterfowl. Numbers of several waterbird species are positively correlated with number of May ponds (Figure 2), and changes in Black Tern populations in the prairie provinces of Canada are correlated with changes in Mallard populations, both of which change with availability of wetlands.

Figure 2. Relationship between mean number of BBS stops on which Pied-billed Grebe, Black Tern, and American Bittern were detected and estimated number of May ponds in north-central North Dakota, 1980-2000.



Fluctuations in waterbird numbers in response to wetland availability may be particularly important in the NP&PR, which is highly susceptible to drought and harbors a large proportion of the breeding populations for several species of waterbirds. Understanding the relationship between wetland numbers and waterbirds is likely as critical to the monitoring and management of waterbird populations in the NP&PR as it is for waterfowl. For example, if birds settle in different areas depending on water availability, apparent changes in local and regional populations may reflect wetland conditions instead of true population changes.

In addition to affecting regional numbers and distribution of waterbirds, changes in water availability can alter habitat and influence local distribution and behavior of waterbirds. Temporal variation in water levels creates the “reservoir effect,” which influences productivity of wetlands and potentially their suitability for waterbirds. Changes in water levels also encourage horizontal zonation of emergent vegetation, which is important to many species of waterbirds. Population movements, foraging tactics, breeding seasonality, prey availability, susceptibility to predation, foraging sociality, competition, nest site selection, and nest site tenacity of waterbirds all can be influenced by water availability, although effect varies with species and location. Ultimately, altered behavior, prey availability, and susceptibility to predation can affect local reproductive success and population size. Effects of water availability on waterbirds also may be influenced by water availability in other regions, as well as other local conditions such as land use.

2.3 Staging and Migrant Waterbirds: Distribution, Habitat, and Status

2.3.i Habitat Needs of Staging and Migrant Waterbirds

Several species of waterbirds have breeding ranges that lie primarily north of the NP&PR. These species, including Sandhill Crane, Herring Gull, and Bonaparte's Gull, may rely on habitat within the NP&PR for migration staging or stopover. Several other species, such as Eared Grebe, American Coot, and American White Pelican, may stage in large numbers on lakes other than their breeding lakes in preparation for southward migration in fall. Food resources may be inadequate or simply not available on breeding lakes to build the energy reserves required to successfully complete migration.

In particular, young birds may stage for a period of time after fledging to acquire energy reserves necessary for their first migration. Black Terns leave nest marshes and gather in flocks at preferred feeding sites for several weeks before migrating south. Soras and Virginia Rails congregate in larger wetlands with abundant food prior to migration. Before migrating to wintering areas, Red-necked Grebes move to molting sites, typically large lakes. Red-necked Grebes also congregate in spring on larger lakes, where calling and courtship behavior are common.

General habitat requirements of staging waterbirds therefore must include access to abundant food resources (e.g., aquatic or terrestrial sources) and areas that provide seclusion and/or security against disturbance and predation while molting, feeding, resting, or courting (e.g., emergent vegetation, upland cover or bare shorelines). Topographical variation and climate fluctuation create a diversity of wetland depths, permanency, and successional stages across the prairie pothole landscape, virtually assuring that wetlands in some portion of the NP&PR will meet the requirements of staging and migrant waterbirds in any one season. Larger lakes, marshes, and reservoirs tend to be more heavily used by staging birds due to abundance of food and lower likelihood of disturbance. Islands can be particularly valuable in providing secure roosting areas. Sandhill Cranes make frequent and heavy use of sandbars in major rivers. The South Saskatchewan River near Outlook and Eston in southwestern Saskatchewan provides excellent resting sites with access to rich food sources (e.g., extensive grain fields) during fall migration. However, changes in water levels of lakes, reservoirs, and rivers can have a major impact on the suitability of islands and sandbars by affecting the number and distribution of sites and the presence of connections to mainland.

2.3.ii Whooping Crane: The Northern Prairie & Parkland Region's Migrant

The Whooping Crane is the only non-breeding species included in this plan, and its population hit a low point in 1941 with only 15 individuals in a migratory flock and six in a non-migratory flock. As of 2003, there were 300 Whooping Cranes in the wild. Of these, 194 belonged to the Wood Buffalo-Aransas flock, which migrates through the NP&PR each spring and fall. It is predicted that the Whooping Crane population in North America will reach 500 birds in approximately 27 years. Although the species clearly remains in an extremely vulnerable situation, it is expected to continue a slow recovery.

The Whooping Crane migrates through the NP&PR each spring and fall, stopping to rest and feed. Roosting or migration stopover sites for Whooping Cranes are typically freshwater, shallow wetlands, usually less than four hectares in size and less than one kilometer from foraging sites. In spring, temporary and seasonal wetlands are used most frequently for roosting, whereas semi-permanent and permanent wetlands are used during fall. For feeding, birds utilize croplands at upland sites, generally close to roost sites. Sites that are further from potential disturbance (e.g., buildings) or threats (e.g., powerlines) are preferred.

Migration of the Whooping Crane is well monitored in the NP&PR, and several sites throughout the NP&PR are used by migrating birds on a regular basis (Appendix E), although only a few birds may use each site in any given year. For a comprehensive overview of Whooping Crane sightings on migration in the U.S., visit www.npwrc.usgs.gov/resource/2003/wcdata/wcdata.htm. Canada's Whooping Crane Recovery Plan (1994) identifies a need to protect habitat at these areas, which may be possible for some wetlands, but migrant Whooping Cranes also forage in fields and other uplands, which are frequently privately owned and less easily protected.

2.3.iii Key Sites Used by Staging Waterbirds

Generally speaking, knowledge of key sites for staging waterbirds is weaker than for breeding birds; however some of the higher profile sites in Canada are identified in Appendix F. Sandhill Cranes, which are hunted in some areas, are surveyed regularly and major staging areas are well documented across the region. American Coots and grebes are often found in close association with large concentrations of waterfowl during spring and fall migration. Sites important to staging waterfowl also may be of importance for these species, but this must be verified. For most species, sites used during migration and staging are poorly documented, and the importance of the NP&PR to staging birds is not known. However, conservation of wetland complexes and associated uplands within the region will help ensure that necessary habitats are available for migrant and staging waterbirds, even if knowledge of specific sites and requirements is limited.

2.4 Conservation Issues and Threats to Waterbirds

Following the arrival of Europeans on the prairie landscape, waterbirds have been subjected to a broad range of pressures including habitat loss, habitat degradation, hunting, and harassment because of perceived competition for fish. Enactment of the *Migratory Bird Convention (Treaty) Act* and subsequent regional wildlife acts have provided some protection. However, habitat in the NP&PR continues to be lost and degraded as a result of human activities including agriculture, oil and gas exploration and development, urban and recreational development, fisheries, forestry, and hydroelectric development. A prioritized list of conservation issues in the NP&PR was developed through a series of discussions and meetings among conservation partners and is provided in Table 6; a detailed list of conservation issues and threats is provided in Appendix G.

Table 6. Prioritized conservation issues and threats to waterbirds in the Northern Prairie and Parkland Region.

Issue	Priority	Geographic Scale (Broad: 1 - Local: 5)	Uncertainty Level (Low: 1 - High 5)	Number of species
Wetland Loss/Deterioration	High	1	1	All
Upland Habitat Loss/Deterioration	High	1	2-3	Most
Climate Change	Medium	1	5	All
Contaminants	Medium	2	5	Most
Disturbance / Recreation	Medium	3	3	Few
Water Management	Medium	3	3	Most
Over-abundant Species	Medium	4-5	1	Few
Disease / Toxicity / Parasites	Medium	4-5	3-4	Most
Fisheries / Aquaculture	Medium	4-5	4-5	Few
Exotics / Invasives	Medium	4-5	4-5	Unknown
Collisions	Low	4	5	Most
Depredation	Low	5	1	Few
Predators	Low	5	1	Few
Artificial Islands	Low	5	1	Few
Fire	Low	5	1	Unknown
Ingestion / Garbage	Low	5	3	Unknown
Harvest	Low	5	3-4	Limited

2.5 Conservation Priority of Waterbirds in the Northern Prairie & Parkland Region

2.5.i Conservation Status Assessment Process

The conservation status of each of the 40 species covered by this plan was evaluated based on available—though often limited—information. Primary sources included BBS data from BCR 11 over the period 1966-2000 and the Partners In Flight species assessment database, which were supplemented with information from Manomet Science Center. Species were classified into one of four categories according to the conservation threats they face. Prioritization labels below are modified somewhat from the continental plan that identifies five categories; labels from the continental plan are listed in parentheses:

Listed (***Highly Imperiled***): Federally listed (Canadian or U.S.) endangered or threatened species.

High Concern: Populations known or thought to be declining; other known or potential threats exist.

Moderate Concern: Populations are either a) declining with moderate threats or distributions; b) stable with known or potential threats and moderate to restricted distributions; c)

relatively small; d) relatively restricted; and e) declining but with no other known threats. Low Risk (Combined **Low** and **Not Currently at Risk**): Populations are either a) stable with moderate threats and distributions; b) increasing but with known or potential threats and moderate to restricted distributions; or c) of moderate size.

Species were prioritized by evaluating six factors that influence the level of threat faced by each species. These factors were evaluated using survey data, information from the ornithological literature, and by species experts. Scores for each factor ranged from 1 (most secure) to 5 (most vulnerable) and are listed in the species accounts (Appendix D). Thresholds for scoring of each factor differed for colonial and non-colonial species in recognition of different threats conferred by the biology of the two groups. The factors evaluated were:

- population trend and population trend uncertainty during the period 1966-2000
- relative abundance
- threats faced during the breeding season
- threats faced during the non-breeding season
- breeding distribution
- non-breeding distribution

Species were initially evaluated for all of North America by a committee appointed by the North American Waterbird Conservation Plan. The proportion of the continental breeding population found within the NP&PR was included as a seventh factor to assess the importance of the NP&PR to each species. These proportions then were converted to an Area Importance Score of 1 - 5 according to the following:

Proportion of North American population breeding in BCR11	Area Importance Score
> 50 %	5
25 - 49 %	4
10 - 24 %	3
1 - 9 %	2
< 1 %	1

Species receiving an Area Importance Score of 5 were raised by one concern category (e.g., from moderate to high concern) because of the extreme importance of the NP&PR to continental conservation of that species. For some species, the continental population also represented the global population, thereby increasing the importance of regional conservation efforts. Species receiving an Area Importance Score of 1 may have been lowered by one or more concern categories following review by regional experts to reflect the minimal effect that conservation activities within the NP&PR would have on them.

2.5.ii Conservation Status Rankings

Preliminary scores (Table 7) have been reviewed and occasionally adjusted according to input from species experts and updated information. We differentiated between prioritization based solely on conservation vulnerability and prioritization based on management interest because of a species' harvest status or nuisance or over-abundance potential. For example, Sandhill Crane and Sora are relatively abundant and increasing in the NP&PR and are therefore considered to have low conservation vulnerability; however, they are of high management interest because they are harvested in some areas. Similarly, Double-crested Cormorant, California Gull, and Ring-billed Gull are considered of low conservation vulnerability because they also are abundant and appear to be increasing in some areas, but are of higher management concern because of the potential impact of Double-crested Cormorant on fisheries and concern about gull depredation of bird nests and fledglings, including those of the threatened and endangered Piping Plover.

Table 7. Conservation vulnerability rankings for waterbirds in the Northern Prairie & Parkland Region. Factor scores and further information on rankings are included in species accounts (Appendix D).

Vulnerability	Colonial Species	Non-colonial Species
Listed ‡	Least Tern	Whooping Crane, Least Bittern
High Concern	Western Grebe Franklin's Gull Black Tern	Horned Grebe American Bittern Yellow Rail King Rail
Moderate Concern	Eared Grebe American White Pelican Black-crowned Night-heron Great Blue Heron Caspian Tern Common Tern	Virginia Rail Black Rail
Low Risk	Clark's Grebe Double-crested Cormorant* White-faced Ibis Little Blue Heron Snowy Egret Tricolored Heron Yellow-crowned Night-heron Cattle Egret Great Egret Green Heron Ring-billed Gull* California Gull* Herring Gull Bonaparte's Gull Forster's Tern	Common Loon Pied-billed Grebe Red-necked Grebe Sandhill Crane** Sora** Common Moorhen** American Coot**

‡ Species are federally listed as endangered or threatened in Canada and/or the U.S. and already have or will have conservation plans in place.

* may be of higher management concern due to issues associated with increasing populations.

** may be of higher management concern because of harvest in some locations.

Most of the species of high conservation concern have experienced sharp population declines or have a large proportion of their population in the NP&PR. For example, >66% of Franklin's Gulls in North America breed within the NP&PR, and conservation activities in the NP&PR should provide significant benefits for species such as these. Many species of moderate concern are declining, are likely to decline given known threats, or would be highly susceptible to potential threats not yet occurring. These frequently are species for which additional information is required, and that should be monitored closely. However, it is important to note that regional population trends can be highly variable for some waterbird species, depending on water conditions. Included in the low risk group are some species of high concern range-wide but that breed at the margins of the NP&PR.

3.0 WATERBIRD INFORMATION NEEDS AND CONSERVATION STRATEGIES

3.1 Introduction

A recurring difficulty throughout the development of this plan has been the general paucity of information about waterbirds in the NP&PR. High-profile species such as Whooping Crane or Least Tern are relatively well understood, as are some harvested species such as Sandhill Crane and American Coot. However, so little is known about some marshbird species in the NP&PR that we are presently unable to accurately define their range, distribution within their range, population size, or breeding status. Obviously, lack of information complicates and impairs conservation planning. We have identified general information needs that are required for effective conservation, as well as more specific research questions that address the general information needs. A detailed—but not comprehensive—list of sampling issues, information needs, plan assumptions, and research questions is found in Appendix H.

A primary emphasis of all-bird conservation in North America is a landscape-level approach to decision-making and habitat management. This approach, if it is to be implemented, requires that habitat selection and population processes be understood at a landscape level, which requires a commitment for (1) better information on regional waterbird distribution, density, and demographics; and (2) accurate and current spatial data including landcover, wetlands delineation, and cultural/political features.

Knowing landscape-level relationships is not sufficient to ensure useful conservation guidance. Management treatments need to be identified and made available to managers to enhance habitat and populations where needed. This process could be similar to the Multi-Agency Approach to Planning and Evaluation (MAAPE) process that guides implementation of the North American Waterfowl Management Plan in the United States portion of the NP&PR. MAAPE identified specific local objectives and a comprehensive list of habitat-based strategies for meeting the objectives. However, information used to develop the process is based on decades of monitoring and scientific research and is focused on one species, the Mallard. Developing a similar process for waterbirds will require a significant commitment to understanding the response of waterbirds to local factors such as predation, vegetation characteristics, land use and management, and wetland restoration and management, all under a variety of conditions over broad geographic areas. In all cases, we need concrete products that managers can use as tools in protection and

management of waterbird habitat and populations (Appendix I). Because waterfowl are associated with higher levels of financial support and greater public awareness and support for related wetland preservation and management, areas of overlap with waterfowl management should be identified to maximize conservation benefits for other wetland-dependent birds. It also must be recognized that any management or conservation treatment will not benefit all species and that actions that change habitat characteristics may benefit some species and negatively impact others. These considerations are further complicated by the dynamic nature of vegetation and water levels in prairie wetlands.

Finally, accuracy, standards, and characteristics of population and habitat data should be evaluated and documented. Metadata descriptions should be applied to spatial data following content standards put forth by the U.S. Federal Geospatial Data Committee; sampling protocol and other pertinent information should be recorded for population data. When possible, data should be collected and archived at a single location that can be easily accessed by all cooperators.

3.2 Populations

3.2.i Population Inventory and Monitoring

The foremost information need for waterbird conservation in the NP&PR is the development and implementation of a regional/continental waterbird monitoring program. This survey should be designed to provide information on regional population change and focus on habitat associations rather than be an opportunistic aggregation of existing efforts. Survey issues are developed at length in Appendix H, but in general the survey(s) should:

- (1) be stratified to sample the numerous wetlands of all sizes and types found in the NP&PR;
- (2) be geographically extensive to capture regional changes in waterbird distribution;
- (3) be geo-referenced to facilitate development of spatially explicit habitat models;
- (4) consider colonial and non-colonial species;
- (5) evaluate water conditions or be linked to indices of local or regional water conditions;
- (6) provide linkage with national and international monitoring schemes to evaluate continental trends and distribution;
- (7) be designed to provide information useful for conservation and not just monitor for the sake of monitoring; and
- (8) build on existing resources when appropriate.

Population survey data will provide a better understanding of the distribution and density of waterbird species, particularly those that are rare or poorly sampled by other surveys. The data will help us understand regional population dynamics in relation to habitat (upland, water, wetland) availability locally and elsewhere within the species' range, as well as understand population trajectories at continental, regional, and local scales. Used in conjunction with landcover information, survey data will enable development of spatially explicit maps for use in conservation planning such as identification of high priority areas, identification of high risk areas, and simulation of the impact of disturbance.

3.2.i.a Breeding Waterbirds

Of central importance is the need to assess temporal and spatial variability of breeding birds, as this will dictate the type and frequency of surveys necessary to provide the statistical power to detect population trends. The magnitude of the trend required to be measured needs to be determined at the outset. At a continental scale, the North American Waterbird Conservation Plan sets as a target the ability to detect a 50% change in population over 10 years or three generations.

Survey and monitoring strategies and techniques will differ somewhat for colonial and non-colonial breeders. However, programs directed at these groups should be integrated to the fullest extent possible, either with each other or with other bird groups. Existing monitoring programs should be assessed as to their ability to address waterbird species. Most significantly, the BBS has about 35 years of standardized data on birds across the United States and southern Canada (see also Section 1.4.ii). Although designed primarily for landbirds, the BBS records data on all bird species. Because wetlands and colony locations are highly localized, wetland-associated birds and colonial nesting species may or may not be adequately sampled by the BBS. Quantitative assessment is required to assess the potential uses and limitations of the BBS for monitoring waterbird numbers.

3.2.i.b Staging and Migrant Waterbirds

Initial efforts should update information on known and potential staging sites including:

- site information such as size, wetland type, and key habitat features (e.g., upland, islands, emergent and terrestrial vegetation, expanses of exposed shoreline);
- species and number of birds;
- timing and duration of use for migration, non-breeders, moult, post-fledging; and
- interaction of birds with adjacent areas.

Where monitoring of endangered species is being addressed by conservation plans or recovery teams, those species will not be targeted and will be recorded as incidental observations during monitoring efforts for priority species and waterbird sites under this plan. However, recovery plans should be reviewed to identify what other waterbird species may be targeted through planned monitoring activities.

3.2.ii Population Goals

As we presently have insufficient information on actual population estimates except for a few colonial species, it is impossible to set population goals. For colonial species where a fairly accurate population estimate exists within the NP&PR, a reasonable first step would be to refine that estimate and set a “no-net loss” of population size. For species identified as potentially over-abundant, management strategies should ensure these species are not detrimental to the environment or other bird species utilizing similar breeding habitats. The next step would require an accurate and range-wide survey of all existing and potential colonial breeding sites within the NP&PR to qualify or refine population estimates.

For species lacking concrete population estimates, the focus should be on determining population trends. This focus would cover most non-colonial species in the NP&PR. The baseline for all species should be “no net loss.” For some species where levels are extremely low and the NP&PR has a high level of responsibility, goals should be to better estimate populations and work to increase population levels where appropriate.

3.2.iii Priority Population Monitoring Action Needs

The following steps will provide a sound foundation for waterbird monitoring in the NP&PR:

- Assess the utility of existing monitoring programs for their potential uses and limitations. This includes the BBS, bird checklist programs, and nest record databases. The May Waterfowl Breeding Ground Surveys currently monitor American Coot, and several grebe species also are monitored on the Canadian ground-survey component. In addition to providing annual wetland data, these surveys may provide a foundation for developing additional waterbird surveys.
- Focus on priority species where capacity is limited, but develop partnerships to conduct multi-species surveys.
- Cooperate with North American Waterbird Conservation Plan partners to develop standardized, continental survey protocol for colonial and non-colonial species and to ensure that proposed continental monitoring programs meet the needs of the NP&PR.
- Encourage and support studies that contribute to the knowledge of waterbird population estimation in the NP&PR.

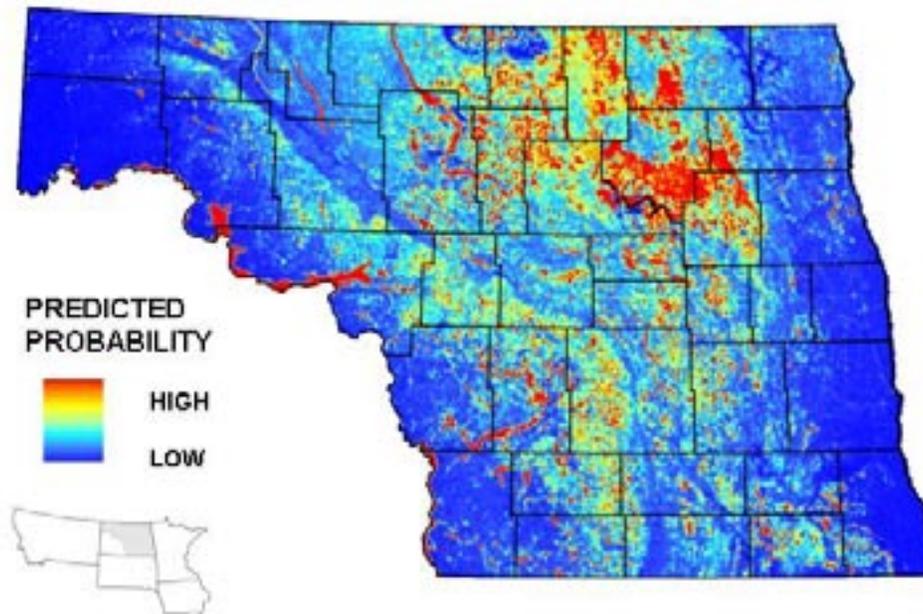
3.3 Habitat

3.3.i Habitat Conservation and Management Prioritization

Waterbird conservation is directly influenced by habitat quantity and quality. Prioritized waterbird conservation issues for the NP&PR (Table 6) identified loss and deterioration of wetland habitat as the highest priority issue in the NP&PR, followed by loss and deterioration of upland habitat. Consequently, identifying and preserving areas of high quality habitat are crucial for effective waterbird conservation. Habitat conservation and management strategies that influence broad landscapes will benefit the greatest number of water-dependent species and should be the major focus of habitat-related efforts, with primary emphasis on high priority species.

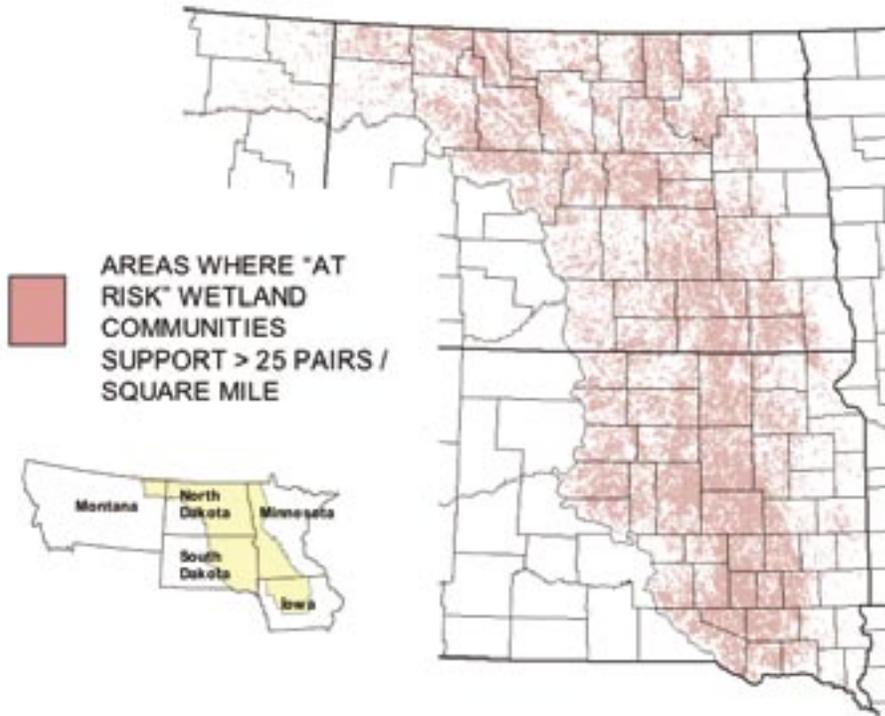
One way of identifying and prioritizing waterbird habitat is through spatially explicit models, which can be used to create maps showing potential habitat suitability at a landscape scale (e.g., Figure 3). Suitability may vary among years depending on water availability, and also will be influenced by local conditions such as vegetation composition and structure. Spatially explicit maps of this nature are another tool that can be used to identify key areas, as they can be overlaid to identify areas of value to multiple species. Implementing bodies of the PPJV and PHJV then can work to integrate management of waterbirds and other bird groups across political and geographic jurisdictions.

Figure 3. Predicted landscape suitability in east-river North Dakota for Black Tern in 1995. Model based on geo-referenced BBS data, NWI wetland information, and upland habitat data from classified LandSat imagery.



In addition to habitat suitability, prioritization of landscapes for waterbird conservation also should consider risk of habitat loss. For example, the U.S. Fish and Wildlife Service Habitat and Population Evaluation Team (HAPET) assessed risk of wetland conversion in the Prairie Pothole Region of North Dakota and South Dakota as it related to waterfowl conservation. Wetlands were considered at risk for conversion if they were (1) temporary or seasonal or < 1 acre; (2) totally or partially embedded in cropland; and (3) presently not protected. These wetlands were identified using digital landcover and National Wetlands Inventory data. This information was combined with spatial models predicting duck density to create a map showing areas where wetland communities at risk of drainage support >25 pairs of breeding waterfowl per square mile (Figure 4). Of the 3,973,161 acres of unprotected wetlands in the study area, 1,457,668 acres were considered at risk, and 993,909 were considered priority (i.e., part of wetland complexes supporting > 25 pairs of breeding waterfowl per square mile). It is likely that waterbirds with similar habitat requirements have conservation priority areas similar to those identified for waterfowl, and the same methodology also could be used with spatially explicit maps of waterbird habitat to identify conservation priority areas for priority waterbird species. Grasslands also are at risk of conversion, especially with the advent of genetically modified crops (e.g., “Roundup-Ready” soybeans) that can be seeded directly into sod that has been killed with herbicide. Grasslands surrounding wetlands directly contribute to wetland and habitat quality and should also be considered in conservation planning and prioritization.

Figure 4. Waterfowl wetland conservation priority areas in the U.S. Prairie Pothole Region where at risk wetland communities support >25 pairs of breeding waterfowl per square mile.



3.3.ii Inventory and Monitoring

In addition to acquiring better bird population data, one of the first needs of an effective habitat conservation effort is an inventory of existing landcover and wetlands. Data should be standardized whenever possible and accessible to all partners. This will increase use and consistent interpretation of data, as well as promote integrated conservation across species and political boundaries.

A major data need for waterbird conservation in Canada is acquisition of a digital wetlands database similar to the National Wetlands Inventory (NWI) developed in portions of the United States. NWI data is the foundation for landscape-level understanding of waterfowl distribution and production potential in the U.S. portion of the NP&PR, and NWI data will be equally important to understanding and managing waterbirds throughout the region. In the U.S. and Canada, landcover information will need to be updated periodically to ensure accurate modeling of waterbird/habitat relationships. Current landcover information will enable us to model the effect of changes in land use, such as those caused by farm programs that dramatically alter the amount of land under cultivation, on waterbird habitat and populations. In the U.S., these data are critical to development of predictive models and maps such as those in Figures 3 and 4.

In the Canadian portion of the NP&PR, a recently initiated Habitat Monitoring Program focuses on small wetland basins lying along the transects used during the waterfowl breeding ground surveys. A pilot phase of the project has been completed in which wetland habitat mapped in 1985 was revisited in 1999 to record changes in habitat. Data are being collected in a manner intended to be applicable to several bird groups and could be used to target priority habitats for waterbirds on the prairie landscape. Upon evaluation of the suitability of this program, key wetland/upland habitat complexes for non-colonial waterbirds should be identified and included in PHJV habitat initiatives for monitoring, protection and/or enhancement. Additionally, priority landscapes for non-colonial breeders should, where applicable, be established as IBA sites with specific management plans. This program is a good example of how information needs for multiple bird groups can be gathered by one integrated program. While this program is likely to generate useful information for non-colonial marshbirds, additional habitat monitoring for colonial species is necessary.

Important colonial breeding sites should be inventoried and pertinent habitat features (e.g., water levels, islands, treed areas) identified along with species using the site, as addressed under the population monitoring section, to provide a baseline for monitoring change in site occupancy or habitat condition. Standard protocol for monitoring habitat on the colonial sites should be developed and all data should be geo-referenced for use in a GIS.

Identification and eventual designation of an IBA site is followed by development of a management plan by the local community or conservation group with an interest in the site. A component of the plan should incorporate participation of these groups in monitoring of the site. This would strengthen the IBA site and expand the volunteer base in monitoring of waterbirds and their habitats.

3.3.iii Management

Birds select habitat on several scales, and it is important to consider all scales when managing habitat. In general, the number of management options increases as scale gets finer. The coarsest scale at which birds select habitat is their range, which can be subdivided into breeding and wintering areas. There are few management options at this scale, but range overlap of different species and annual variation in species distribution (e.g., in relation to water availability) can be important considerations when making management decisions at finer scales. Geographic scale values in Table 6 provide a separation point for conservation issues that would direct actions on a landscape or local level. The Management Toolbox (Appendix I) provides specific information and resources relating to management practices and conservation programs relating to waterbirds.

3.3.iii.a Landscape-level Conservation

Landscapes are important to waterbirds for many reasons. First, an increasing body of information indicates that many waterbird species respond to wetland complexes rather than to individual wetlands. There are many reasons for this including availability of nesting and foraging habitat within the same area, increased vegetation diversity, presence of deep-water

wetlands that persist through droughts, and presence of shallow basins that are suitable for wading/foraging during wet periods. The total area and availability of foraging habitat in proximity to nest sites is especially important for species that nest in large colonies.

The composition and condition of landscapes surrounding wetlands is important to ensure the ecological integrity of wetlands. Wetlands surrounded by row-crop fields are more susceptible to siltation, fluctuations in water level, and pesticide runoff than wetlands surrounded by grasslands. Composition of predator communities also is affected by land use surrounding wetlands. Finally, uplands provide nest sites for some species of waterbirds such as American Bittern. Landscapes can be managed to a degree through protection of native habitat, restoration of large blocks of habitat (e.g., prairie restoration or woodland removal where trees have encroached on grassland), and application of agricultural programs (e.g., targeting of lands for the Conservation Reserve Program or the PHJV's Permanent Cover Program).

3.3.iii.b Managing Wetlands and Water

Waterbirds differ greatly in their response to vegetation conditions (Table 5). In some areas, wetlands are choked by vegetation due to an unnatural lack of disturbance or presence of invasive species. If necessary, fire, cattle, or herbicides can be used to reduce vegetation structure and create more open conditions. Water level manipulation also is useful for managing vegetation. Periodic drawdowns allow growth of vegetation that can be re-flooded. Alternatively, extended high water levels will kill emergent vegetation, creating more open conditions.

The PHJV and PPJV are currently conserving wetlands for waterfowl, and the needs of waterbirds should be integrated into management of these wetlands where feasible. Ongoing research regarding local and landscape-level habitat selection should provide additional insight into the types of wetlands and wetland areas that need to be managed to provide habitat for a broad variety of waterbird species.

In regions where wetland mitigation is an issue, mitigation banks should provide all the habitats and processes of the wetlands they replace. This may require creating and maintaining complexes of wetlands of variable size, type, water depth, and cover type coupled with creating suitable upland habitat. Managing water levels on reservoirs may be important in preventing the creation of ecological traps, i.e., where island-nesting birds are exposed to predators when water levels are drawn down for other uses.

3.3.iii.c Managing Uplands

Uplands are an important habitat component for many waterbird species. For those waterbirds that nest in uplands, proper cover or structure is necessary for nest sites. Uplands also provide food resources for several wetland-nesting species that feed in upland habitat.

Non-agricultural or natural habitat surrounding wetlands provides for continuity of wetland complexes and reduces the risk of runoff from agricultural practices. Grazing is an issue

that needs to be investigated in terms of its benefits and drawbacks for waterbirds, as cattle can greatly influence vegetation structure in uplands, shoreline vegetation, riparian areas, and wetlands.

Development restrictions in upland habitats near wetlands may be important to reduce direct habitat loss as well as to prevent mortality from collisions with fences and utility lines or along roads and right-of-ways. Native prairie needs to be preserved and prairie upland nesting habitats need to be managed to meet waterbird needs. Habitat managers must work with all stakeholders (landowners, grazing associations, land managers, oil/gas industry, irrigation districts, policy makers, and regulators) to ensure conservation of upland habitat.

Fire is a tool that is often used to control woody vegetation, especially on lands where habitat is not managed by grazing or other means (Appendix G). Response to fire and altered vegetative structure likely varies among species and should be evaluated in terms of benefits to targeted species and effects on non-targeted species.

3.3.iii.d Specialized Management

Waterbirds respond to a variety of local factors, including predator community composition, vegetation structure and composition, and structure and presence of nest sites. Response to local factors varies among species, but many management options are available at the local scale. For example, nesting opportunities can be enhanced by erecting nest structures for structure-nesting species such as Great Blue Heron. However, tree-like structures should not be introduced where they do not naturally occur, such as within extensive grasslands. Floating nest platforms can be placed for Black Terns, grebes, and Common Loons, and nest islands can be created for gulls, terns, American White Pelicans, and herons. When islands are created, a plan should be developed to identify species that should be using the site and whether there can be detrimental effects to other species in the area. Predator removal or exclusion can be particularly effective at colonies during the breeding season, although this is a site-specific issue that is dependent on colony accessibility and composition of local predator communities. Predator control measures should be evaluated for their effectiveness as well as their effects on other species.

3.3.iv Priority Habitat Needs

A detailed list of habitat information needs is presented in Appendix H. Priority habitat needs are as follows:

- Identify and prioritize landscapes for habitat protection for priority species.
- Identify areas providing greatest habitat benefits for multiple species.
- Prevent wetland loss through legal protection, acquisition, and conservation easements.
- Prevent upland habitat loss through legal protection, agricultural program incentives, acquisition, and conservation easements.
- Acquire digital wetlands and uplands data for all portions of the NP&PR to facilitate development of spatial planning tools.

- Manage water where appropriate to provide suitable habitat for waterbirds.
- Manage water quality by preventing runoff (siltation) and contamination.
- Reduce disturbance and recreation impacts on waterbirds.

3.4 Priority Research Needs

A primary conclusion of the NPPWCP is the realization that very little is known about waterbirds in the region. Considerable research is needed to provide better direction for conservation planning. Because of their similar needs, we have combined colonial and non-colonial species in the section below. A further—but by no means complete—listing of potential research questions is noted in Appendix H. Priority research needs for the NP&PR include:

- Development of accurate distribution, abundance, and population trend data for all species, particularly non-colonial waterbirds.
- Determination of habitat requirement at the local and landscape levels for all waterbirds with focus on priority species.
- Developing an understanding of factors affecting adult survival and productivity.
- Establishing and evaluating standard protocols for surveys, especially in relation to regional issues and local challenges.
- Understanding the impacts of diseases such as avian botulism.
- Increase our understanding of the influence of environmental conditions, particularly water conditions, on dispersal and population shifts of waterbirds.
- Developing an understanding of the relative role of breeding, staging, and wintering grounds on waterbird populations (e.g., knowing where the bottlenecks are and who will address them). These issues will need to be addressed at a broader scale than the NP&PR waterbird plan.
- Acquire knowledge of the response of different waterbirds to various management treatments.
- Creating an expanded spatial context for waterbirds, e.g., how they respond to natural and human-induced environmental changes, and how changing waterbird populations, especially new, large colonies of gulls, affect other species, particularly shorebirds.

3.5 Integration

A key component of the plan is integration of conservation planning. Integration has many components, including species, scales, and jurisdictions. State and provincial status listings were very similar for many priority species in the NP&PR, and our planning promotes a common approach to conservation of these species. However, integrated waterbird planning across borders is not entirely new in the region. The U.S. Fish and Wildlife Service, Canadian Wildlife Service, Central Flyway, and state and provincial wildlife agencies already cooperate in planning and surveying for migratory bird species that are hunted. The PHJV and the PPJV coordinate wetland conservation across landscapes for waterfowl and non-game species. Development of one waterbird plan under the PPJV and the PHJV will ensure international consistency, but joint ventures will need to tailor implementation according to different realities in the U.S. and Canada. Integrated conservation in the two joint ventures is only part of the story, though,

as waterbirds breeding in the NP&PR spend only a portion of their annual cycle there, and migration corridors, staging areas, and wintering grounds also are vital to their conservation. Continental planning efforts must recognize and support conservation linkages between different geographic regions.

The waterbird conservation approach with the greatest potential in the NP&PR will be integration with conservation plans for other species. As mentioned previously, one of the primary planning tools is the development of landscape-level habitat models. Spatially explicit maps predicting presence and density of waterbirds can be combined with maps predicting presence of other species of interest such as waterfowl, shorebirds, and grassland birds. Preliminary analyses indicate considerable potential for waterbird conservation efforts to overlap with conservation efforts for waterfowl, shorebirds, and grassland birds in the region, but planning also must consider areas where there is little or no overlap to ensure that all species of conservation concern are adequately covered. Integration among bird conservation plans can be achieved in many ways, such as present efforts in Alberta to determine waterbird habitat relationships by combining waterbird surveys with wetland and habitat information from waterfowl surveys. Conservation planning in the NP&PR focuses on a landscape approach and broad-scale relationships, but local effects and management also must be considered, as fine-grained habitat selection in a given landscape can differ among species. For instance, wetlands with large amounts of tall, dense, emergent vegetation used by rails will be avoided by breeding shorebirds such as Marbled Godwit, which prefer wetlands with little or no tall emergent vegetation.

Because of the diversity of the waterbird group, limited knowledge of waterbirds, and limited funds for understanding waterbird populations and habitat relationships, it will be necessary for waterbird conservation planning and management to make use of existing programs and data wherever possible. Many lessons can be learned from waterfowl conservation planning and management, which has been taking place in the NP&PR for more than half a century. May waterfowl breeding ground surveys can provide information on wetland characteristics and pond numbers, and the variety of existing waterfowl surveys can provide considerable information on survey and sampling techniques, some of which may be applicable to waterbirds. The BBS can provide much useful information, especially if all routes are surveyed annually and BBS data can be linked to water conditions and habitat. Habitat modeling can be used to assess the importance of landscapes and wetland complexes to waterbirds. For species where landscape-level modeling is appropriate, spatially explicit models and maps can identify priority areas for conservation, similar to those presently used for waterfowl. Overlays of multiple models will allow planners to identify areas of value to multiple species, which will help integrate conservation across species. Sharing data and protocol among agencies will help integrate conservation planning across political boundaries.

Integrated conservation will not happen by itself. Individuals and organizations must be dedicated to improvement and implementation of the plan. Whenever possible, linkages with other species and conservation efforts must be identified and developed. Consumptive and non-consumptive recreational opportunities involving waterbirds should be cultivated and promoted. Waterfowl hunters contribute huge amounts of money for wetland conservation, and

waterfowl organizations are already considering waterbirds in their conservation efforts. By working cooperatively with consumptive users and conservation agencies, habitat can be secured for many waterbird species, including non-game species. Sustainable hunting is dependent, of course, on careful regulation to ensure that harvest does not detrimentally impact populations of hunted waterbirds. The NP&PR is vitally important to many waterbird species, just as it is to many waterfowl species; that realization must be communicated to non-consumptive users as well as to consumptive users. Promoting bird watching in the NP&PR could mesh well with programs to develop a broader economic base in the region. Identification of Important Bird Areas is one step in promoting non-consumptive use of waterbirds.

4.0 COMMUNICATION

Implementing the NPPWCP will require the inclusion of partners from private and governmental sectors. Little is known about waterbirds even within the scientific community, and it will be necessary to communicate goals and key messages to target audiences. In the course of plan development, we have identified the following goals, audiences, and messages along with potential activities to aid communication.

4.1 Communication Goals

- Increase understanding, awareness, and appreciation of wetlands and waterbirds in the NP&PR and the plight of wetland ecosystems in general. Build support for waterbird conservation efforts and wetland and upland habitat protection.
- Increase awareness of conservation initiatives that not only benefit waterbirds but all water-dependent species.

4.2 Target Audiences

- Habitat delivery and management agencies.
- Various levels of government (i.e., regulators, resource managers, and policy makers).
- Resource users, land management agencies, municipalities, and non-governmental organizations.
- Private landholders and community leaders.
- General public.

4.3 Key Messages

- Benefits of wetlands to ecosystem functions.
- Activities of conservation groups/agencies.
- Importance of the wetland complex.
- The dynamic and ephemeral nature of prairie wetlands.
- Importance of the NP&PR to continental waterbird populations.
- Ease of involvement, including surveys, IBA designation, wetland enhancement, habitat preservation, and ecotourism development.
- The importance of upland management to wetland ecosystems and waterbird populations.

- Facts behind fisheries issues.
- Change in predator communities.
- Availability of key resources, including the U.S. Fish and Wildlife Service's Partners for Fish and Wildlife program and the U.S. Department of Agriculture's Natural Resources Conservation Service.
- Communication within the natural resources professions.

4.4 Communication Activities

An extensive list of communication activities is provided on page 36 of the continental waterbird plan, available at www.waterbirdconservation.org.

- Many agencies, organizations, and groups are involved with communication of wetland issues. Efforts should be coordinated to maximize communication efficiency and encourage frequent communication through relevant media. Media releases involving other partners should be reviewed by them in advance. Articles should be shared with the team in a timely fashion.
- Recruitment through outreach programs: local naturalists, IBA local community, and conservation groups can assist in inventory and monitoring of waterbirds.
- Development of information kits or websites, possibly including a PowerPoint presentation.
- Workshops to promote and advance waterbird monitoring.
- Promote other group or agency activities on monitoring of all bird species (e.g., bird checklist programs or nest record schemes).

5.0 PARTNERSHIPS AND NEXT STEPS OF THE NORTHERN PRAIRIE AND PARKLANDS WATERBIRD CONSERVATION PLAN

5.1. Working Group Organization, Leadership, and Partnerships

Implementation of the NPPWCP provides the opportunity for many groups and individuals to partner and develop an integrated, landscape approach to waterbird conservation. The PHJV and PPJV are committed to integrated bird conservation and will form the base upon which implementation of the plan will be built and expanded to include a broader range of stakeholders. Given the voluntary nature of joint ventures and present lack of support for waterbird conservation, it is difficult to identify specific roles and assign duties for more than a few tasks. In the U.S., the Habitat and Population Evaluation Team (HAPET) offices in Bismarck, North Dakota and Fergus Falls, Minnesota will be responsible for development of spatial planning tools and evaluation and implementation of regional waterbird surveys. In Canada, the lead on Species At Risk waterbirds will be the Canadian Wildlife Service. Gerald McKeating of Bird Studies Canada will serve as the liaison between the Northern Prairie and Parkland Region and the continental Waterbird Conservation Council. Priority tasks from Section 3 will be assigned and duties assumed as resources become available and partners step forward.

5.2. Implementation Process and Adaptive Planning

The purpose of this plan was to synthesize and assess information, identify information needs,

and prioritize conservation issues with the end goal of guiding waterbird conservation in the NP&PR. Actual implementation of the plan is an additional step that will need to be undertaken by partners within the NP&PR. As mentioned above, an excellent conservation base and partnership network exists in the NP&PR with the Prairie Habitat and Prairie Pothole joint ventures, both of which are committed to the conservation of waterbirds as well as waterfowl. In addition, programs such as NAWCA are available to support conservation efforts. In many cases, local treatments (see Management Toolbox, Appendix I) can help conserve waterbirds. However, given the breadth and scope of this plan, widespread implementation will be gradual as regional money and opportunities become available and continental programs are developed and coordinated.

Throughout the implementation process, it must be remembered that the NPPWCP was developed with limited information, and that goals, methodologies, and expectations will change as new information becomes available. In addition, environmental and economic conditions in the NP&PR are highly variable. For these reasons, it is imperative that the plan be flexible and updated periodically. Ideally, assumptions and uncertainties should be addressed in an adaptive fashion where experimental treatments can be assigned and responses assessed, rather than simply reacting to changes.

5.3 Measuring the Success of Implementation of the Northern Prairie & Parkland Waterbird Conservation Plan

The ultimate measure of success of the NPPWCP will be how well it meets the stated goal “To provide guidelines for conservation that, when implemented, result in maintaining and managing healthy populations, distributions, and habitats of waterbirds throughout the Northern Prairie & Parkland Region of North America.” Of course, accurately assessing healthy populations, distributions, and habitats for all species of waterbirds throughout the NP&PR is, at this point, an impossibility. However, given the historic lack of interest in waterbirds in the region, achievement of any of several key tasks will be milestones in implementation of the plan, including:

- Initiation of a standardized, region-wide monitoring program for colonial and non-colonial species that is linked to national and North American strategies.
- Development of statistically sound, defensible estimates of distribution, abundance, and population trends for key waterbird species in the NP&PR, particularly marshbirds.
- Understanding habitat requirements at local and landscape levels for priority waterbird species.
- Development of a standardized, readily accessible database in which to store population survey data.
- Completion of NP&PR-wide wetland inventory.
- Completion of NP&PR-wide upland habitat inventory, to be updated at regular intervals.
- Development of NP&PR-wide spatially explicit habitat models for non-colonial waterbirds.
- Obsolescence of large portions of the NPPWCP due to acquisition of new information.

6.0 GLOSSARY

Bird Conservation Region (BCR) 11: one of 37 physiographic regions defined by the North American Bird Conservation Initiative as a geographic unit for planning and implementation of bird conservation efforts. BCR 11 approximates the NP&PR.

Colonial Waterbird: waterbird species that nests in groups, typically on islands, bare spits of land, emergent wetland vegetation, trees, or other structures. Colonies may consist of one or multiple species, and may range from a few to tens of thousands of individuals. The degree of coloniality varies, even within a species, as inter-nest distance may vary from less than a meter to tens of meters. Pelicans, cormorants, gulls, terns, and most grebes and herons are colonial. These species were addressed at the continental level by Volume I of the NAWCP.

Joint Venture (JV): joint ventures are regional, cooperative entities set up as part of the North American Waterfowl Management Plan to coordinate waterfowl management by member groups and agencies. The duties of joint ventures have since been expanded to coordinate conservation of non-waterfowl species covered by other bird conservation initiatives. The NP&PR contains the Prairie Habitat Joint Venture in Canada and the Prairie Pothole Joint Venture in the U.S. Joint ventures are particularly important to waterbirds because of their emphasis on wetland habitats and their role in implementing conservation plans.

Marshbird: a waterbird that nests in wetland vegetation. Marshbirds are often considered non-colonial (e.g., rails, American Coot, Common Moorhen, cranes, and some grebes) but some colonial species (e.g., Black Tern, Eared Grebe, and Western Grebe) are marsh-nesting species.

Non-colonial Waterbird: a waterbird that nests singly, typically in extensive wetland vegetation. Rails, American Coot, Common Moorhen, cranes, and some grebes and herons are non-colonial waterbirds, although they are often referred to as marshbirds. Some species may appear semi-colonial when they are concentrated in pockets of good habitat. Noncolonial waterbirds will be addressed at the continental level by volume II of the NAWCP.

North American Bird Conservation Initiative (NABCI): an umbrella organization for continental bird conservation plans including Partners in Flight, the North American Waterbird Conservation Plan, the North American Waterfowl Management Plan, and the Canadian and U.S. shorebird conservation plans.

North American Waterbird Conservation Plan (NAWCP): the NAWCP was developed to provide a framework for the conservation and management of 210 species of seabirds, coastal waterbirds, wading birds, and marshbirds. The plan area includes the interests of 29 nations and international waters surrounding North America, Central America, and the northern tip of South America. See www.waterbirdconservation.org for more information.

North American Waterfowl Management Plan (NAWMP): NAWMP is a joint effort by Mexico, the U.S., and Canada designed to ensure the recovery and perpetuation of waterfowl habitat and populations in North America. Because of its focus on wetland habitat, NAWMP is of critical importance to waterbirds.

Northern Prairie & Parkland Region (NP&PR): a physiographic region extending roughly from central Alberta to central Iowa, characterized by numerous wetland basins created by glacial action. The NP&PR is a planning region defined by the North American Waterbird Conservation Plan and consists of those areas covered by the Prairie Pothole Joint Venture (PPJV) in the United States and the Prairie Habitat Joint Venture (PHJV) in Canada. The NP&PR approximates the boundary of BCR 11.

Permanent Wetland: a wetland in which surface water is present throughout the year in all years.

Prairie Habitat Joint Venture (PHJV): the joint venture or partnership implementing waterfowl and wetland conservation under NAWMP on the Canadian prairies.

Prairie Pothole Joint Venture (PPJV): the joint venture or partnership implementing waterfowl and wetland conservation under NAWMP on the Northern Prairie & Parkland Region of the United States.

Seasonal Wetland: a wetland in which surface water is present for extended periods, especially early in the growing season, but is absent by the end of the season in most years.

Semi-permanent Wetland: a wetland in which surface water persists throughout the growing season in most years. When surface water is absent, the water table is at or near the soil surface.

Temporary Wetland: a wetland in which surface water is present for brief periods during the growing season, but the water table is otherwise well below the soil surface.

Waterbird: for purposes of the North American Waterbird Conservation Plan, the term “waterbird” includes all colonial and non-colonial seabirds, wading birds, gulls, terns, pelicans, and marshbirds. Waterfowl, shorebirds, and wetland-associated passerines (e.g., Marsh Wren, Nelson’s Sharp-tailed Sparrow) and raptors (e.g., Osprey, Bald Eagle) are not included in continental or regional waterbird plans.

7.0 REFERENCES

This section contains references used in the preparation of this document; see the bibliography at www.npwrc.usgs.gov/resource/literatr/wbirdbib/wbirdbib.htm for a comprehensive listing of literature pertinent to waterbirds in the NP&PR. The Northern Prairie Wildlife Research Center website (www.npwrc.usgs.gov) hosts further bibliographic listings for waterbirds.

1.3.ii Ecological Importance of the Northern Prairie & Parkland Region

Alexander, S. A., K. A. Hobson, C. L. Gratto-Trevor, and A. W. Diamond. 1996. Conventional and isotopic determinations of shorebird diets at an inland stopover: the importance of invertebrates and *Potamogeton pectinatus* tubers. *Canadian Journal of Zoology* 74:1057-1068.

Armentato, R. V., and E. S. Menges. 1986. Patterns of change in the carbon balance of organic soil wetlands of the temperate zone. *Journal of Ecology* 74:755-774.

Aselmann, I., and P. J. Crutzen. 1989. Global distribution of natural freshwater wetlands and rice paddies, their net primary productivity, seasonality and possible methane emissions. *Journal of Atmospheric Chemistry* 8:307-358.

Batt, B. D. J., M. G. Anderson, C. D. Anderson, and F. D. Caswell. 1989. The use of prairie potholes by North American ducks. Pages 204-227 *in* A. van der Valk, editor. *Northern prairie wetlands*. Iowa State University, Ames.

Burger, J., and M. Gochfield. 1994. Franklin's gull. *The Birds of North America*, No. 116 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, and the American Ornithologists' Union, Washington, D.C.

Collins, S. L., and L. L. Wallace, eds. 1990. *Fire in the North American tallgrass prairies*. University of Oklahoma Press, Norman. 188pp.

Crissey, W. F. 1969. Prairie potholes from a continental viewpoint. Pages 151-171 in *Saskatoon wetlands seminar*. Canadian Wildlife Service Report 6. Ottawa.

DeLeon, M. T., and L. M. Smith. 1999. Behavior of migrating shorebirds at North Dakota prairie potholes. *Condor* 101:645-654.

Duebbert, H. F. 1981. Breeding birds on waterfowl production areas in northeastern North Dakota. *Prairie Naturalist* 13:19-22.

Dunn, E. H., and D. J. Agro. 1995. Black tern (*Chlidonias niger*). *The Birds of North America*, No. 147 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, and the American Ornithologists' Union, Washington, D.C.

- Estes, J. R., R. J. Tyrl, and J. N. Brunken, eds. 1982. Grasses and grasslands: systematics and ecology. University of Oklahoma Press, Norman. 312pp.
- Evans, R. M., and F. L. Knopf. 1993. American White Pelican. The Birds of North America, No. 57 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, and the American Ornithologists' Union, Washington, D.C.
- Grue, C. E., L. R. DeWeese, P. Mineau, G. A. Swanson, J. R. Foster, P. M. Arnold, J. N. Huckins, P. J. Sheehan, W. K. Marshall, and A. P. Ludden. 1986. Potential impacts of agricultural chemicals on waterfowl and other wildlife inhabiting prairie wetlands: an evaluation of research needs and approaches. Transactions of the North American Wildlife and Natural Resources Conference 51:357-383.
- Haig, S. M., D. W. Mehlman, and L. W. Oring. 1998. Avian movements and wetland connectivity in landscape conservation. Conservation Biology 12:749-758.
- Hubbard, D. E. 1982. Breeding birds in two dry wetlands in eastern South Dakota. Prairie Naturalist 14:6-8.
- Hubbard, D. E. 1988. Glaciated prairie wetland functions and values: a synthesis of the literature. U.S. Fish and Wildlife Service Biological Report 88(43). 50pp.
- Igl, L. D., and D. H. Johnson. 1988. Wetland birds in the northern Great Plains. Pages 454-455 in M. J. Mac, P. A. Opler, C. E. Puckett Haeker, and P. D. Doran, eds. Status and trends of the nation's biological resources. U.S. Department of the Interior Geological Survey, Reston, Virginia.
- Kantrud, H. A., J. B. Millar, and A. G. van der Valk. 1989. Vegetation of wetlands of the Northern Prairie & Parkland Region. Pages 132-187 in A. van der Valk, editor. Northern prairie wetlands. Iowa State University, Ames.
- Knopf, F. L. 1996. Prairie legacies—birds. Pages 135-148 in F. B. Samson and F. L. Knopf, eds. Prairie conservation: preserving North America's most endangered ecosystem. Island Press, Covelo, California.
- Leitch, J. A., and L. E. Danielson. 1979. Social, economic, and institutional incentives to drain or preserve prairie wetlands. Department of Agricultural and Applied Economics, University of Minnesota, St. Paul. 78pp.
- Likens, G. E., and F. H. Bormann. 1974. Linkages between terrestrial and aquatic ecosystems. BioScience 24:447-456.
- Mengel, R. M. 1970. The North American central plains as an isolating agent in bird speciation. Pages 280-340 in W. Dort and J. K. Jones, eds. Pleistocene and recent environments of the central Great Plains. University of Kansas Press, Lawrence.

Mitsch, W. J., and J. G. Gosselink. 1993. *Wetlands*. Van Nostrand Reinhold, New York. 722pp.

Samson, F. B., and F. L. Knopf, eds. 1996. *Prairie conservation: preserving North America's most endangered ecosystem*. Island Press, Washington, D.C.

Samson, F. B., F. L. Knopf, and W. R. Ostlie. 1998. *Grasslands*. Pages 437-472 *in* M. J. Mac, P. A. Opler, C. E. Puckett Haeker, and P. D. Doran, eds. *Status and trends of the nation's biological resources*. U.S. Department of the Interior Geological Survey, Reston, Virginia.

Sugden, L. G. 1973. *Feeding ecology of pintail, gadwall, American wigeon, and lesser scaup ducklings*. Canadian Wildlife Service Report 24.

Stewart, R. E. 1975. *Breeding birds of North Dakota*. Tri-College University Center for Environmental Studies, Fargo. 295pp.

Swanson, G. A., and H. F. Duebbert. 1989. *Wetland habitats of waterfowl in the Northern Prairie & Parkland Region*. Pages 228-267 *in* A. van der Valk, editor. *Northern prairie wetlands*. Iowa State University, Ames.

Weller, M. W. 1999. *Wetland birds: habitat resources and conservation implications*. Cambridge University Press, New York. 271 pp.

1.3.iii Threats to the Ecological Integrity of the Northern Prairie & Parkland Region

Anonymous. 2001. *Report on Saskatchewan law and policy on wetland and upland conservation to Ducks Unlimited Canada, Phases I & II*. Unpublished report by Centre for Studies in Agriculture, Law and the Environment. 111pp.

Brady, S. J. 2000. *Highly erodible land and Swampbuster provisions: conservation compliance and wetlands conservation provisions of the Omnibus Farm Acts of 1985, 1990, and 1996*. Pages 5-17 *in* W.L. Hohman and D. J. Halloum, eds. *A comprehensive review of Farm Bill contributions to wildlife conservation, 1985-2000*. U.S. Department of Agriculture, Natural Resources Conservation Service, Wildlife Habitat Management Institute, Technical Report USDA/NRCS/WHMI-2000.

Dahl, T. E. 1990. *Wetlands losses in the United States: 1780s to 1980s*. U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. 13pp.

Edwards R., S. Brechtel, R. Bromley, D. Hjertaas, B. Johns, E. Kuyt, J. Lewis, N. Manners, R. Stardom, and G. Tarry. 1994. *National recovery plan for the Whooping Crane*. Report No. 6 Ottawa: Recovery of Nationally Endangered Wildlife Committee. 39 pp.

Forsyth, D. J. 1989. Agricultural chemicals and Prairie Pothole wetlands: meeting the needs of the resource and the farmer—Canadian perspective. *Transactions of the North American Wildlife and Natural Resources Conference* 54:59-66.

Government of Canada. 1991. The Federal policy on wetland conservation. Environment Canada, Ottawa, Ontario. 14 pp.

Grue, C. E., M. W. Tome, T. A. Messmer, D. B. Henry, G. A. Swanson, and L. R. DeWeese. 1989. Agricultural chemicals and Prairie Pothole wetlands: meeting the needs of the resource and the farmer—U.S. perspective. *Transactions of the North American Wildlife and Natural Resources Conference* 54:43-58.

Kwasniak, A. 2001. Alberta's wetlands: a law and policy guide. Report by Environmental Law Centre (Alberta). Edmonton, Alberta. 196pp.

Sauer, J. R., J. E. Fallon, and R. E. Johnson. 2003. Use of North American Breeding Bird Survey data to estimate population change for bird conservation regions. *Journal of Wildlife Management* 67:372-389.

Tyrchniewicz, A. 2001. Conservation of wetland and native upland areas: impacts of legislation and policies (Manitoba). Unpublished report for Ducks Unlimited Canada. 70pp.

1.4.i History and Legal Framework

AOU Wetlands Conservation Sub-committee. 1996. The state of waterbird and wetland conservation in the United States: a review. American Ornithologists' Union. 112pp.

Anonymous. 1991. Birds protected in Canada under the Migratory Birds Convention Act. Occasional Paper Number 1, 1991 edition. Canadian Wildlife Service, Ottawa, Ontario. 32 pp.

Commission of Conservation Canada. 1919. National conference on conservation of game, fur-bearing animals and other wildlife. *In* 10th Annual Report and Wildlife Conference, Commission of Conservation Canada. 183pp.

Hewitt, C. G. 1921. The conservation of the wildlife of Canada. Charles Scribner's Sons, New York. 344pp.

Kantrud, H. A., and R. E. Stewart. 1984. Ecological distribution and crude density of breeding birds on the prairie wetlands. *Journal of Wildlife Management* 48:426-437.

Murray, L. H. 1966. Bird sanctuaries in Saskatchewan 1887-1965. *Blue Jay* 24:110-120.

Nelson, H. K., and F. B. Lee. 1966. A new center for waterfowl research. *Naturalist* 17:29-32.

1.4.ii Existing Monitoring and Research

Sauer, J.R., S. Schwartz, B.G. Peterjohn, and J.E. Hines. 1996. The North American Breeding Bird Survey Home Page. Version 95.1. USGS Patuxent Wildlife Research Center, Laurel, MD. Website: www.mbr.nbs.gov/bbs/bbs.html

1.4.iii Conservation Initiatives

Anonymous. 2000. An action plan for Manitoba's network of protected areas: Manitoba's protected areas initiative. Manitoba Conservation. 17 pp.

Kushlan, J.A., M. J. Steinkamp, K. C. Parsons, J. Capp, M. Acosta Cruz, M. Coulter, I. Davidson, L. Dickson, N. Edelson, R. Elliot, R. M. Erwin, S. Hatch, S. Kress, R. Milko, S. Miller, K. Mills, R. Paul, R. Phillips, J. Saliva, B. Sydeman, J. Trapp, J. Wheeler, and K. Wohl. 2002. Waterbird conservation for the Americas: the North American waterbird conservation plan, Version 1. 78 pp. www.waterbirdconservation.org

Nykoluk, C. and K. Scalise (compilers). 2000. Saskatchewan prairie conservation action plan: partner update number two. 38 pp.

Lewis, J. C., G. Archibald, R. C. Drewien, R. Edwards, G. Gee, B. Huey, L. A. Linam, R. A. Lock, S. Nesbitt, and T. Stehn. 1994. Whooping Crane recovery plan. U.S. Fish and Wildlife Service, Albuquerque, New Mexico.

Migratory Shore and Upland Game Bird Technical Committee. 1993. Management guidelines for mid-continent Sandhill Cranes. Central Flyway Waterfowl Council, Denver, Colorado.

Prairie Conservation Forum. January 2001. Alberta prairie conservation action plan: 2001-2005. Prairie Conservation Forum, Lethbridge, Alberta. 34 pp.

PCAP Committee. 1998. Saskatchewan prairie conservation action plan. Canadian Plains Research Center, University of Regina, Regina, Saskatchewan. 32 pp.

Sidle, J. G., and W. F. Harrison. 1990. Recovery plan for the interior population of the Least Tern (*Sterna antillarum*). U.S. Department of the Interior, Fish and Wildlife Service, Denver, Colorado. 90pp.

Shuford, W. D. 1999. Status assessment and conservation plan for the Black Tern (*Chlidonia niger surinamensis*) in North America. U.S. Department of the Interior, Fish and Wildlife Service, Denver, Colorado. 129pp. www.r6.fws.gov/blacktern/index.html

Shuford, W. D., and D. P. Craig. 2002. Status assessment and conservation recommendations for the Caspian Tern (*Sterna caspia*) in North America. U.S. Department of the Interior, Fish and Wildlife Service, Portland, Oregon. 84pp. + appendices.

Tacha, T. C., and C. E. Braun. 1994. Migratory shore and upland game bird management in North America. International Association of Fish and Wildlife Agencies and the U. S. Fish and Wildlife Service. Allen Press, Lawrence, KS. 223pp.

U.S. Fish and Wildlife Service. 1986. Whooping Crane recovery plan. U.S. Fish and Wildlife Service, Albuquerque, New Mexico.

U.S. Fish and Wildlife Service. 1996. 1996-1997 contingency plan: federal-state cooperative protection of Whooping Cranes. U. S. Fish and Wildlife Service, Albuquerque, New Mexico.

U.S. Fish and Wildlife Service. 2003. Final environmental impact statement: Double-crested Cormorant management in the United States. U.S. Fish and Wildlife Service Division of Migratory Bird Management, Arlington, Virginia. migratorybirds.fws.gov/issues/cormorant/finaeis/CormorantFEIS.pdf

2.1.ii Staging and Migrant Waterbirds

Baumgartner, F. M., and A. M. Baumgartner. 1992. Oklahoma bird life. University of Oklahoma Press, Norman. 532 pp.

Belanger, L., and J. Bedard. 1990. Energetic cost of man-induced disturbance to staging Snow Geese. *Journal of Wildlife Management* 54:36-41.

Cullen, S. A., J. R. Jehl, and G. L. Nuechterlein. Eared Grebe. 1999. *In* The Birds of North America, No. 433 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologist's Union, Washington, D.C.

Dinsmore, J. J., T. H. Kont, D. Koenig, P. C. Petersen, and D. M. Roosa. 1984. Iowa birds. Iowa State University, Ames.

Griese, H. J., R. A. Ryder, and C. E. Braun. 1980. Spatial and temporal distribution of rails in Colorado. *Wilson Bulletin* 92:96-102.

Krapu, G. L., and D. H. Johnson. 1990. Conditioning of Sandhill Cranes during fall migration. *Journal of Wildlife Management* 54:234-238.

McIntyre, J. W., and J. F. Barr. 1983. Pre-migratory behavior of Common Loons on the autumn staging grounds. *Wilson Bulletin* 95:121-125.

Pospichal, L. B., and W. H. Marshall. 1954. A field study of Sora Rail and Virginia Rail in central Minnesota. *Flicker* 26:2-32.

Reinecke, K. J., and G. L. Krapu. 1986. Feeding ecology of Sandhill Cranes during spring migration in Nebraska. *Journal of Wildlife Management* 50:71-79.

Roberts, R. S. 1932. *The birds of Minnesota, Vol. 1.* University of Minnesota Press, Minneapolis. 691pp.

Stout, B. E., and G. L. Nuechterlein. 1999. Red-necked Grebe. *In The Birds of North America*, No. 465 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, Pennsylvania, and The American Ornithologist's Union, Washington, D.C.

Tsipoura, N. and J. Burger. 1999. Shorebird diet during spring migration stopover on Delaware Bay. *Condor* 101:635-644.

2.2.iv Spatial and Temporal Variability in Breeding

Alisauskas, R. T., and T. W. Arnold. 1994. American Coot. Pages 127-143 *in* T. C. Tacha and C. E. Braun, eds. *Migratory shore and upland game bird management in North America.* International Association of Fish and Wildlife Agencies, Washington, D.C.

Kushlan, J. A. 1981. Resource use strategies of wading birds. *Wilson Bulletin* 93:145-163.

Kushlan, J. A. 1986. Responses of wading birds to seasonally fluctuating water levels: strategies and their limits. *Colonial Waterbirds* 9:155-162.

Niemuth, N. D., and J. W. Solberg. 2003. Response of waterbirds to number of wetlands in the Prairie Pothole Region of North Dakota, U.S.A. *Waterbirds* 26:233-238.

Peterjohn, B. G., and J. R. Sauer. 1997. Population trends of Black Terns from the North American Breeding Bird Survey, 1966-1996. *Colonial Waterbirds* 20:566-573.

2.3.ii Whooping Crane: The Northern Prairie & Parkland Region's Migrant

Austin, J. E., and A. L. Richert. 2001. A comprehensive review of observational and site evaluation data of migrant whooping cranes in the United States, 1943-1999. U.S. Geological Survey, Northern Prairie Wildlife Research Center, Jamestown, ND. 157pp. www.npwrc.usgs.gov/resource/2003/wcdata/wcdata.htm.

3.3.i Habitat Conservation and Management Prioritization

Beule, J. D. 1979. Control and management of cattails in southeastern Wisconsin wetlands. Wisconsin Department of Natural Resources Technical Bulletin 112, Madison. 39 pp.

Brown, M., and J. J. Dinsmore. 1986. Implications of marsh size and isolation for marsh bird management. *Journal of Wildlife Management* 50:392-397.

- Fairbairn, S. E., and J. J. Dinsmore. 2001. Local and landscape-level influences on wetland bird communities of the Prairie Pothole Region of Iowa, USA. *Wetlands* 21:41-47.
- Frederickson, L. H., and F. A. Reid. 1986. Wetland and riparian habitats: a nongame management overview. Pages 59-96 in J. B. Hale, L. B. Best, and R. L. Clawson, editors. *Management of nongame wildlife in the Midwest: a developing art*. North Central Section of The Wildlife Society, Chelsea, Michigan.
- Fredrickson, L. H., and M. K. Laubhan. 1996. Managing wetlands for wildlife. Pages 623-647 *in* *Research and management techniques for wildlife and habitats*, T. A. Bookhout, ed. The Wildlife Society, Bethesda, Maryland.
- Johnson, D. H., R. L. Kreil, G. B. Berkey, R. D. Crawford, D. O Lambeth, and S. F. Galipeau. 1994. Influences of waterfowl management on nongame birds: the North Dakota experience. *Transactions of the North American Wildlife and Natural Resources Conference* 59:293-302.
- Naugle, D. E., R. R. Johnson, M. E. Estey, and K. F. Higgins. 2001. A landscape approach to conserving wetland bird habitat in the Prairie Pothole Region of eastern South Dakota. *Wetlands* 21:1-17.
- Niemuth, N. D., M. A. Bozek, and N. F. Payne. 2004. Management concerns of intermountain West palustrine habitats. Pages 154-184 *in* *Wetland and riparian areas of the intermountain West: their ecology and management*, M. C. McKinstrey, W. Hubert, and S. H. Anderson, eds. Texas Press. 330 pp.
- Reid, F. A. 1993. Managing wetlands for waterbirds. *Transactions of the North American Wildlife and Natural Resources Conference* 58:345-350.
- Rundle, W. D., and L. H. Fredrickson. 1981. Managing seasonally flooded impoundments for migrant rails and shorebirds. *The Wildlife Society Bulletin* 9:80-87.