Inland colonial waterbird and marsh bird trends for Canada

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PREFACE

The Canadian Councils of Resource Ministers developed a Biodiversity Outcomes Framework[1] in 2006 to focus conservation and restoration actions under the *Canadian Biodiversity Strategy*.[2] *Canadian Biodiversity: Ecosystem Status and Trends 2010*[3] was a first report under this framework. It assesses progress towards the framework's goal of "Healthy and Diverse Ecosystems" and the two desired conservation outcomes: i) productive, resilient, diverse ecosystems with the capacity to recover and adapt; and ii) damaged ecosystems restored.

The 22 recurring key findings that are presented in *Canadian Biodiversity: Ecosystem Status and Trends 2010* emerged from synthesis and analysis of technical reports prepared as part of this project. Over 500 experts participated in the writing and review of these foundation documents. This report, *Inland colonial waterbird and marsh bird trends for Canada*, is one of several reports prepared on the status and trends of national cross-cutting themes. It has been prepared by experts in the field of study and reflects the views of its author and contributors.

Contributors

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[1] Environment Canada. 2006. Biodiversity outcomes framework for Canada. Canadian Councils of Resource Ministers. Ottawa, ON. 8 p. http://www.biodivcanada.ca/default.asp?lang=En&n=F14D37B9-1.

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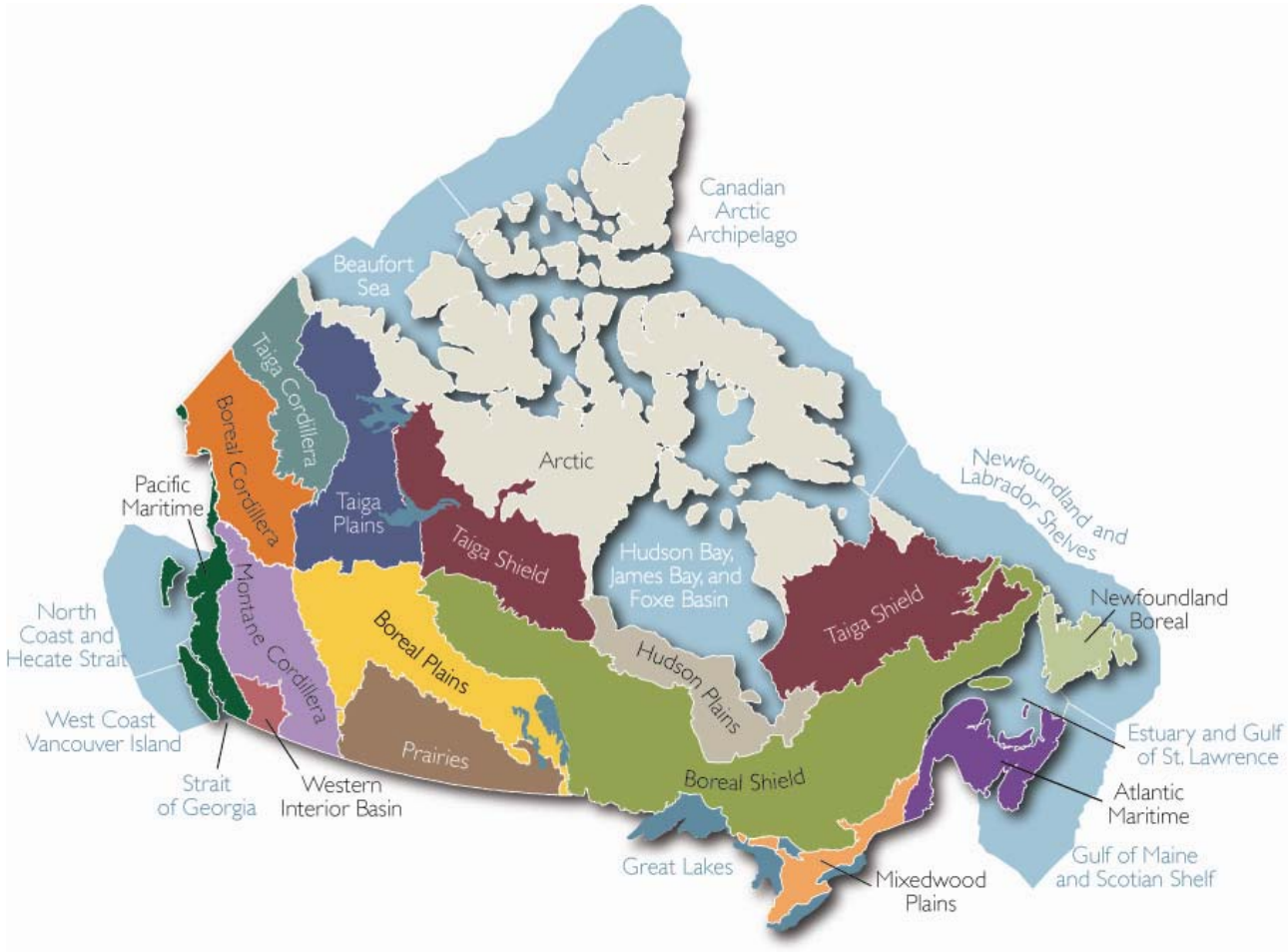
[3] Federal, Provincial and Territorial Governments of Canada. 2010. Canadian biodiversity: ecosystem status and trends 2010. Canadian Councils of Resource Ministers. Ottawa, ON. vi + 142 p. http://www.biodivcanada.ca/default.asp?lang=En&n=83A35E06-1

Ecological Classification System – Ecozones[+]

A slightly modified version of the Terrestrial Ecozones of Canada, described in the *National Ecological Framework for Canada,*[4] provided the ecosystem-based units for all reports related to this project. Modifications from the original framework include: adjustments to terrestrial boundaries to reflect improvements from ground-truthing exercises; the combination of three Arctic ecozones into one; the use of two ecoprovinces – Western Interior Basin and Newfoundland Boreal; the addition of nine marine ecosystem-based units; and, the addition of the Great Lakes as a unit. This modified classification system is referred to as "ecozones[+]" throughout these reports to avoid confusion with the more familiar "ecozones" of the original framework[5].



[4] Ecological Stratification Working Group. 1995. A national ecological framework for Canada. Agriculture and Agri-Food Canada, Research Branch, Centre for Land and Biological Resources Research and Environment Canada, State of the Environment Directorate, Ecozone Analysis Branch. Ottawa/Hull, ON. 125 p. Report and national map at 1:7 500 000 scale.

[5] Rankin, R., Austin, M. and Rice, J. 2011. Ecological classification system for the ecosystem status and trends report. Canadian Biodiveristy: Ecosystem Status and Trends 2010, Technical Thematic Report No. 1. Canadian Councils of Resource Ministers. Ottawa, ON. http://www.biodivcanada.ca/default.asp?lang=En&n=137E1147-0

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SUMMARY

The purpose of this report is to present data on temporal trends in populations and, where possible, vital rates for colonial waterbirds and marsh birds for Canada's 16 terrestrial ecozones+. Unfortunately, these kinds of data could not be found for three ecozones+ — the Taiga Cordillera, Taiga Shield, and Hudson Plains — and therefore these ecozones+ are not included in this report. Historical data, sometimes extensive, were available for four ecozones+ — Boreal Cordillera, Western Interior Basin, Montane Cordillera, and Prairies — but there are no recent data with which to compare to determine trends. The other nine ecozones+ have one or more dataset of five or more years that can be used to give preliminary data; some of these have much more data than others. The results for these nine ecozones+ are summarized here.

- Atlantic Maritime Ecozone+ – Data are reported for one species. The trend since the 1990s for the Great Blue Heron on the Magdalen Islands was stable.
- Great Lakes Ecozone+ – 30-year trends are available for at least ten colonial waterbird species. Four (American White Pelican, Double-crested Cormorant, Great Egret, and Caspian Tern) are increasing, four (Ring-billed, Herring, and Great Black-backed Gulls, and Common Tern) are decreasing, and two (Great Blue Heron and Black-crowned Night Heron) are stable. Among marsh birds, Pied-billed Grebe, Virginia Rail, Common Moorhen/American Coot, Black Tern, and Red-winged Blackbird all declined significantly over the last 13 years.
- Mixedwood Plains Ecozone+ – Black Tern populations in Quebec have shown a severe decline while the Ring-billed Gull have shown a slower decline. Five years of Marsh Monitoring data show preliminary declines for Sora and Virginia Rail and American Coot/Common Moorhen. The Great Egret is increasing while Great Blue Heron and Black-crowned Night-Heron are stable. A 36-year checklist database shows four species declining 46 to 77% and nine species increasing 40 to 80%.
- Boreal Shield Ecozone+ – Long-term data are available for the Great Blue Heron but the large size of the ecozone+ makes it difficult to identify trends. Sandhill Crane numbers have been documented during Black Duck Surveys and show a dramatic increase since 1990. Herring Gull, Great Black-backed Gull, and Common Loon numbers have also been recorded on these surveys and show the loons to be significantly increasing while the gull populations are stable. Double-crested Cormorants have increased on the north shore of the Gulf of St. Lawrence. In the Newfoundland Boreal Ecozone+, data have been collected jointly with the Boreal Shield Ecozone+, and share stable Herring and Great Black-backed Gull populations and an increasing Common Loon population.

- Boreal Plains Ecozone[+] – A recent 5-year trend for Western Grebes in Alberta shows significant population declines and low reproductive success. American White Pelicans in Saskatchewan were surveyed for 16 years and have been removed from the "Threatened" list; presumably because the population had increased. Breeding Bird Surveys (BBS) showed that Black Terns declined at a significant rate of – 5.4% per year over a 28 year period, 1980 to 2007.However, the applicability of BBS surveys to adequately census colonial waterbirds is often questioned. Historical data are also available for selected species.
- Taiga Plains Ecozone[+] – A strong long-term increase for the Whooping Crane at the Aransas National Wildlife Refuge in Texas is apparent and it is assumed that this is due to an increase on the Canadian breeding grounds. These birds breed only in Canada's Taiga Plains and this increase is reflective of habitat protection as well as favourable conditions on the plains. A long-term dataset (24 years) for a small geographical area near Yellowknife is also available that could yield local trends for Horned Grebes, but these data have not been analyzed for this report.
- Arctic Ecozone[+] – Nesting density of Sabine's Gulls was lower in 1996 on Prince Charles Island than it was in 1984, but there are no recent data. Current population levels of several other species have been established but no trends are yet available.
- Pacific Maritime Ecozone[+] – Trends were analyzed for 58 species (including waterfowl) from the Coastal Waterbird Survey that was initiated in 1999. Annual declines of -5 to -18% were found for Glaucous- winged, Herring, California and Bonaparte's Gulls and a continuing decline for Western Grebes, while annual increases were found for Double-crested (3%) and Pelagic (4%) Cormorants.

INTRODUCTION AND METHODS

The aim of this report is to present data on the trends in population numbers and other vital statistics for inland colonial waterbirds and marsh birds in Canada's 16 terrestrial ecozones⁺. The data were solicited from members of the Inland Colonial Waterbird and Marsh Bird Chapter of the Canadian Waterbird Technical Committee and other waterbird biologists from across the country. There were surprisingly few long-term datasets identified, particularly for some ecozones⁺. Some ecozones⁺ had no data (Taiga Cordillera, Taiga Shield, and Hudson Plains), some had historical data but no current data (Boreal Cordillera, Western Interior Basin, Montane Cordillera, and Prairies), some had data awaiting analysis, and some had recent but no historical data. Nine ecozones⁺ had one or more dataset of five or more years that was used to give preliminary data; some had much more data than others.

For each ecozone⁺, the availability of data is summarized and trends are presented for some species where data exists. In addition, for each ecozone⁺, potential or previously adopted indicator species are listed to draw attention to focal species which could, if sufficient data were available, provide an indication of ecosystem health for the ecozone⁺. Currently sufficient data do not necessarily exist to assess trends in all of these species.

Inland Colonial Waterbirds

The use of inland colonial waterbirds, including gulls, terns, herons, several grebes, and cormorants, as indicators of ecosystem health has been extensively reviewed by Kushlan (1993). Most species are piscivores to a large extent and, as such, are at the top of the aquatic food web making them good indicators of perturbations in the ecosystem. Equally important is the fact that these birds usually nest in relatively large numbers in discrete colonies, enabling easy location, identification, access, and censusing of the nesting sites. This is in direct contrast to other inland waterbirds such as rails, bitterns, loons, and cranes that nest more solitarily or cryptically, making them much more difficult to locate and census.

The main metric used in assessing trends of inland colonial waterbirds is colony size, such as how many nests or nesting pairs are present in the colony. This is because once the phenology of the species is known, the question of colony size can usually be answered by a single well-timed visit to the site. Data on colony size are used to answer basic questions, such as how many nesting individuals are there and are their numbers increasing or decreasing. Although these basic questions are often easy to answer for a single colony (site), they become more difficult when applied to large geographical areas. Methods for censusing waterbird colonies in most habitats have been standardized (Erwin, 1981; Kushlan, 1986; Blokpoel and Tessier, 1996; Morris et al., 2003; Steinkamp et al., 2003; Soos, 2004) while methods for censusing in the boreal forest have been suggested but not yet implemented (Morris, 2006; Weseloh and Moore, 2010).

Once the size of the breeding population size is known, other useful metrics can include productivity, diet, contaminant concentrations, migration arrival and departure dates, and other life-history features. Nevertheless, for most of these metrics, multiple visits, expensive equipment, or tedious identifications are necessary. As a result, very few of them are tracked to the extent that temporal population trends are documented.

Marsh Birds

Marsh-nesting birds are indicators of ecosystem health because they require wetland habitat to complete their life cycle. Wetlands, because of their unique location between upland/terrestrial and open water/pelagic habitats, are transitional ecosystems that are affected by terrestrial and aquatic environments. For example, water quantity and quality are affected by terrestrial attributes such as soil porosity which can lead to high sedimentation and turbidity through high runoff. In addition, land uses, such as agriculture within a watershed and adjacent to a wetland, affect wetland function through inputs such as fertilizer, herbicides, and pesticides (Environment Canada and Central Lake Ontario Conservation Authority, 2004; Great Lakes Coastal Wetlands Consortium, 2008). Similarly, aquatic effects such as invasive species and water-level regulation affect wetland function by significantly altering biotic communities (Timmermans et al., 2008). These stressors degrade wetland function and impair wildlife habitat. Marsh-nesting birds, as ecosystem indicators, reflect these habitat changes.

Many monitoring programs and conservation initiatives use marsh-nesting birds as ecosystem indicators. For example, State of the Lakes Ecosystem Conferences, which report on the health of the Great Lakes every three years, use marsh-nesting bird data from the Great Lakes Marsh Monitoring Program – a volunteer-based program administered by Bird Studies Canada in partnership with Environment Canada with funding support from the U.S. Environmental Protection Agency. A Prairie and Parkland Marsh Monitoring Program in the prairie provinces and administered by Bird Studies Canada began with a pilot study in 2008 and more extensive monitoring and site distribution in 2009-10. Regional and wetland-specific monitoring programs have implemented Indices of Biotic Integrity, which use a number of parameters, or metrics, to assess the health of a wetland or how well conservation efforts are working (Environment Canada and Central Lake Ontario Conservation Authority, 2004; Archer et al., 2006; Great Lakes Coastal Wetlands Consortium, 2008; Meyer and Grabas, 2008). These monitoring activities, in conjunction with stewardship activities (for example wetland restoration), facilitate the conservation of marsh-nesting bird populations, and other wildlife, by providing information to guide adaptive management as well as inform people about the important ecological goods and services that wetlands and marsh birds provide to society.

In assessing the value of different marsh-nesting bird species as ecosystem indicators for this report, the following criteria were used:

1) Abundant species that are characteristic of the ecozone[+];
2) Species for which population or other biological indicator data are available for multiple years;
3) Species that require marshes for nesting (marsh-nesting obligates such as grebes, rails, and bitterns);
4) Species that are marsh-nesting generalists; and,
5) Hierarchy in the food chain (species on the high end).

Among a variety of biological measures commonly utilized to monitor marsh-nesting birds, the following are particularly useful for assessing the state of the ecosystem:

- Population trends;
- Community structure and composition (loss or gain of some species);
- Changes in timing of breeding (an indicator of climate change effects); and,
- Reproductive success and nestling growth (an indicator of possible habitat contamination and food web changes).

Population changes integrate information on survival over the entire year. For migratory species, population trends may reflect conditions in both their non-breeding and breeding range. Consequently, population changes of migratory species should be examined in relation to other communities (such as, resident species) and abiotic conditions.

ECOZONE^{+} STATUS AND TRENDS

Atlantic Maritime

***Potential indicator species*: Double-crested Cormorant**

Populations of inland waterbirds in this ecozone^{+} are small and scattered. Great Blue Herons in the Magdelan Islands have been monitored every five years since the 1990s. The most recent data show that this small population is stable (Canadian Wildlife Service, unpublished data).

For marsh birds, the Marsh Monitoring Program has been in place since 2004 and some sites in this ecozone^{+} have been visited. Nevertheless, the limited number of the years surveyed and the small number of marshes included make trend analysis impossible for some species (Coughlan, unpublished data).

Great Lakes

***Potential indicator species:* Up to 12 species of colonial waterbirds (see below) and the following marsh birds: Pied-billed Grebe, American Bittern, Least Bittern, Virginia Rail, Common Moorhen, American Coot, Black Tern.**

Colonial Waterbirds

There has been a decadal monitoring scheme for colonial waterbirds on the Great Lakes since the mid-1970s (Blokpoel, 1977; Weseloh et al., 1986; Blokpoel and Tessier, 1991; Blokpoel and Tessier, 1993; Blokpoel and Tessier, 1998; Weseloh et al., 2003; Hebert et al., 2008; Morris et al., 2009). The survey covers 12 species: American White Pelican; Double-crested Cormorant; Great Blue Heron; Great Egret; Black-crowned Night-Heron; Ring-billed Gull; Herring Gull; Great Black-backed Gull; Caspian Tern; Common Tern; Forster's Tern; and Black Tern. Little Gulls have been censused whenever they have been found nesting on the Great Lakes (Weseloh,

1994; Ewins and Weseloh, 1999). The Canadian surveys are coordinated with the U.S. Fish and Wildlife Service who conducts similar simultaneous surveys on the U.S. side of the Great Lakes. The 30-year trends for these species are shown in Table 1.

Table 1. The number of nests of 12 species of colonial waterbirds breeding on the Great Lakes and connecting channels, counted during four 'decadal' surveys between 1976 and 2009.

Species	Survey				Source
	1976-1980	1989-1992	1996-2002	2007-2009	
American White Pelican	0	0	0	20	(Pekarik et al., 2009)
Double-crested Cormorant	427	11,614	36,423	58,288	(Weseloh et al., 2002; Weseloh et al., 2003)
Great Blue Heron	958	1,140	644	887	(Morris et al., 2003)
Great Egret	21	156	94	311	(Morris et al., 2003)
Black-crowned Night-Heron	1,846	1,835	2,313	1805	(Morris et al., 2003)
Ring-billed Gull	203,656	437,604	380,163	282,356	(Morris et al., 2003)
Herring Gull	41,779	42,358	38,720	31,869	(Morris et al., 2003)
Great Black-backed Gull	0	10	36	16	(Morris et al., 2009)
Caspian Tern	2,185	3,060	2,437	2,921	(Morris et al., 2009)
Common Tern	8,566	6,551	5,728	5,032	(Morris et al., 2009)
Forster's Tern	-	588	1,677	-	(Moore et al., 2010)
Black Tern	-	545	390*	-	(Austen et al., 1996); CWS unpublished data
Total	**259,438**	**505,461**	**468,625**	**383,505**	

*data for 2001

Recently, pelicans have started nesting on the Canadian Great Lakes but their numbers are low (Pekarik et al., 2009). Numbers of nesting cormorants and egrets have been increasing since the 1970s; cormorants are increasing much faster and in much greater numbers than egrets (Table 1 and (Weseloh, unpublished data)). Cormorant numbers plummeted during the 1960s and 1970s due to eggshell thinning and DDE levels (Weseloh et al., 1983; Price and Weseloh, 1986) but have rebounded since that time to become more numerous on the Great Lakes than at any time in recorded history (Weseloh et al., 2003). Both cormorants and pelicans are susceptible to some diseases (Newcastle's disease and botulism) and large numbers (thousands) of cormorants have died in some years (Glaser et al., 1999).

Ring-billed Gulls, Herring Gulls, and Great Blue Herons reached their peak numbers during the late 1980s and have declined slowly since (Blokpoel and Tessier, 1998; Morris et al., 2003; Morris et al., 2009). Gull numbers may have been positively stimulated in the 1970s and 1980s by the garbage practices at that time (Drury and Kadlec, 1974; Weseloh and Myers, 1981), when sanitary landfill sites were just being developed and much more food waste was available to the birds (due to inefficient coverage of landfills) (Belant, 1997). The subsequent slowly declining

waterbird numbers may be a result of more efficient landfill practices, with less waste food being available. Another factor may be declining forage fish populations, causing gulls to feed more terrestrially on less protein-rich foods (Hebert et al., 2000). The numbers of Caspian Terns have been relative stable with some fluctuations. The fluctuations may be the result of decreased populations of forage fish in some of the Great Lakes. Also, some colonies appear to have declined through predation from coyotes, foxes, or Great Black-backed Gulls (Weseloh and Shutt, 2008). Disease (botulism) may also be reducing numbers of some species in some areas (Shutt et al., 2010). The number of Great Blue Heron nests declined sharply between the 1980s and 1990s, especially in Lake Erie where two large heronries were inundated by cormorants, which are known to usurp nests of herons (Cuthbert et al., 2002; Weseloh et al., 2002). In Ontario, most Great Blue Herons nest inland, away from the Great Lakes (Naylor, 2007).

Nest numbers of both night-herons and Great Black-backed Gulls peaked in the 1990s. Night-herons are susceptible to nest take-overs by cormorants and no fewer than eight night-heron colonies on Lake Ontario have suffered in this way, with at least four being abandoned as a result (Weseloh et al., 2002). Night-heron numbers are influenced greatly by the very large colony in Toronto Harbour, which fluctuates between 600 and 1,200 nests (McDonald, 2008, pers. comm.). Black-backed gulls have been found to be very susceptible to botulism (Campbell et al., 2009; Shutt et al., 2010) and their numbers have declined recently because of it.

Only one colonial waterbird species has shown continual decline since the decadal surveys were initiated in the mid-1970s — the Common Tern. In the 1970s, there were over 8,500 pairs nesting on the Canadian Great Lakes. Estimates from the 1960s suggest there were 10,000 pairs on one colony alone and the total number on the Canadian lower Great Lakes may have been as high as 13,000 (Courtney and Blokpoel, 1983). At the end of the most recent survey, numbers had continued to decline to just over 5,000 nests (Table 1). This represents more than a 41% decline since the mid-1970s and more than a 60% decline since the 1960s. Competition for nest sites with Ring-billed Gulls is a major problem for the Common Tern. The two species nest in similar habitat and Ring-billed Gulls return on spring migration more than a month ahead of the terns and often take over their nesting sites. This alone does not completely explain the decline in the number of terns, however; other unknown factors must also be contributing (Morris et al., 2009).

Two species which are difficult to census on their breeding grounds, Little Gulls and Bonaparte's Gulls, were censused at a staging area on the Niagara River, 1986 to 1996 (Bellerby et al., 2000; Kirk et al., 2008). Temporal trends were more difficult to discern.

Marsh Birds

Portions of the Great Lakes and Mixedwood Plains ecozones[+] covering southern Ontario are examined together for marsh birds because their results, derived from the Marsh Monitoring Program, are not separated for coastal (primarily Great Lakes) and inland wetlands (primarily Mixedwood Plains). As such, the following results using marsh-nesting birds represent trends in both ecozones[+].

Overall, the health of the Great Lakes/Mixedwood Plains is "mixed" and "deteriorating" with respect to marsh-nesting birds (Archer et al., 2009). "Mixed" designation means that some species show positive long-term population trends, while others show negative long-term population trends; "deteriorating" means the number of species showing long-term population declines has increased relative to the previous reporting period. Pied-billed Grebe ($p<0.001$), Virginia Rail ($p<0.05$), Common Moorhen/American Coot ($p<0.001$), Black Tern ($p<0.001$), and Red-winged Blackbird ($p<0.001$) are significantly declining in the Great Lakes basin; results for American Bittern are mixed ($p<0.21$) (Figure 1) though they have declined 59% range-wide over the past 40 years (Audubon Society, 2008).

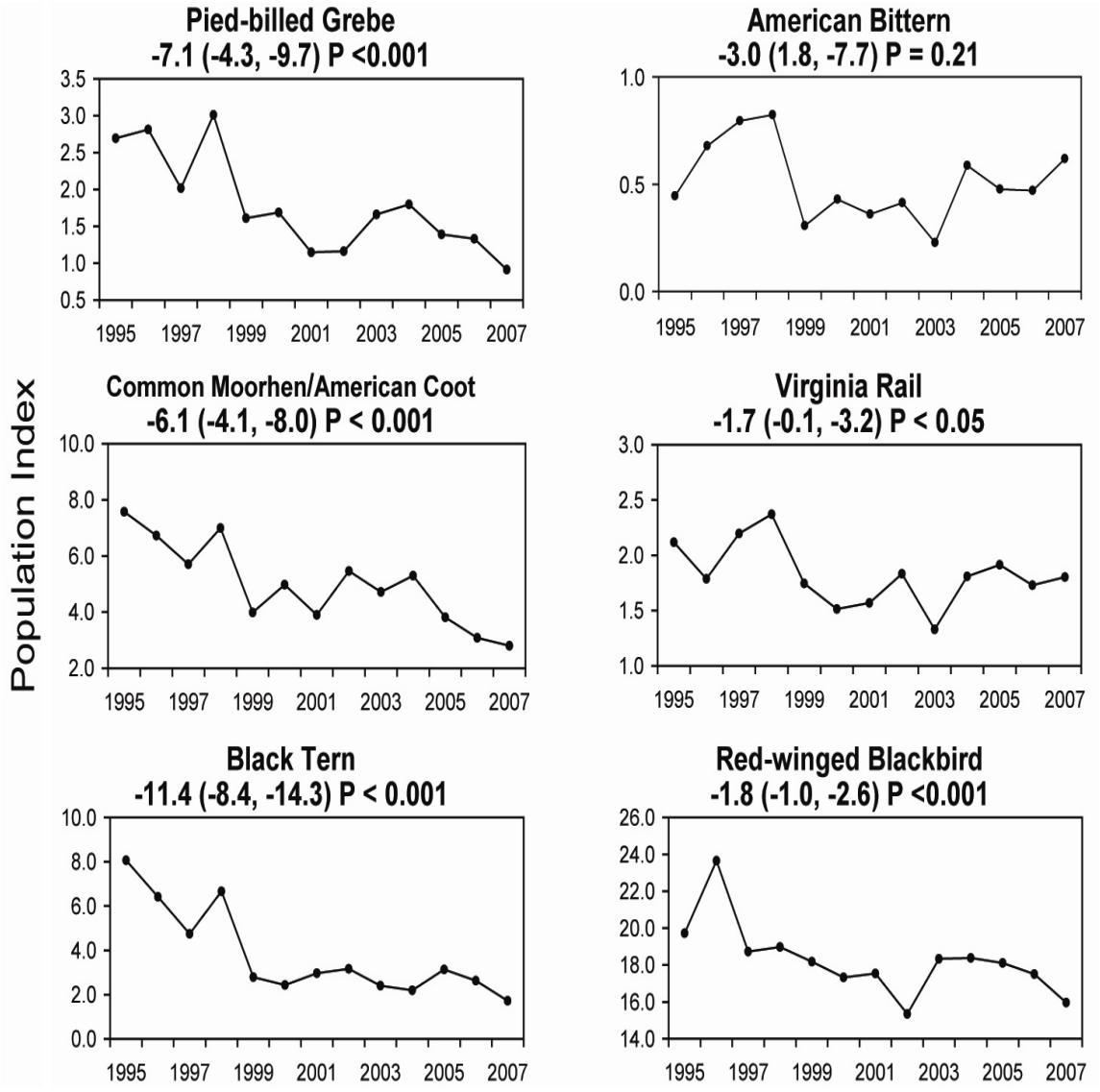

Figure 1. Trends (percent annual change) in relative abundance (population index) of marsh-nesting birds detected at Marsh Monitoring Program routes in the Great Lakes basin, 1995-2007.
Values in parentheses are upper and lower 95% confidence limits, respectively, for trend values given.
Source: data from the Marsh Monitoring Program, Bird Studies Canada, as cited in Archer et al. (2009)

In the Lake Erie, Lake Huron, and Lake Michigan basins, populations of most marsh-nesting bird indicator species, for which there are data, show declining population tendencies (Table 2). Significant population declines are evident for Virginia Rail and Common Moorhen in the Lake Erie basin; Black Tern and Red-winged Blackbird in the Lake Huron basin; Least Bittern in Lake Huron and Lake Erie basins and Pied-billed Grebe and Red-winged Blackbird in the Lake Michigan basin. Pied-billed Grebe and Black Tern showed significant declines on Lake Ontario. Insufficient data exists to report on the Lake Superior basin.

Table 2. Trends in the population index (percent annual change) for selected marsh bird species as derived from Marsh Monitoring Program surveys for each Great Lakes basin, 1995-2004.

Lake	Mallard	Common Yellowthrouat	Yellow Warbler	Swamp Sparrow**	Red-winged Blackbird	Marsh Wren*	Common Moorhen*	Virginia Rail**	Moorthen/Coot*	Sora**	Tree Swallow	Pled-billed Grebe**	American Bittern**	Least Bittern**	Black Tern**
Ontario	0.2	2.4	-1.7	2.5	-1.5	-0.3	0.0	0.8	0.9	0.0	-0.1	-11.4	-7.8	-6.7	-15.5
Erie	11.7	1.8	3.4	-2.5	-1.1	-6.7	-12.7	-9.6	-11.5	-7.9	-2.8	-4.8	-12.4	-12.8	-2.9
Huron	-15.0	2.6	4.6	-0.7	-6.4	-0.9	-4.3	-4.3	-4.8	-6.4	-14.3	-4.1	-3.7	-14.4	-19.3
Michigan	20.6	4.7	4.3	-0.1	-3.1	0.7	-	-7.1	-15.1	-11.9	-12.5	-16.8	-	-	-

Statistically significant trends are shown in green (increasing trend) and red (decreasing trend).
Area-sensitive marsh nesters are depicted by **; marsh-obligate nesters by *; others are general marsh nesters and marsh users.
Source: data from Crewe et al. (2006)

Within the Lake Huron-Erie Corridor, data from surveys conducted by the Canadian Wildlife Service indicate a "mixed" assessment. Generally, the St. Clair River and Lake St. Clair area is in "good" health, while results from the Detroit River suggest that this ecosystem is "poor" (Table 3). These data should be viewed with caution however, as they only represent a one-year assessment and not a trend over time. Current data gaps include, a lack of wetland monitoring in some areas (for example, the upper Great Lakes), insufficient years of data, and need to assess the influence of species-specific detection probabilities in estimating marsh-nesting bird populations. Further work is also required to develop analysis and reporting mechanisms of site-based indices of marsh bird community condition that are relevant for Great Lakes Basin wide reporting.

Table 3. Percent of indicator marsh-nesting birds that were present at each selected site (scored out of 10) on the St. Clair River, Lake St. Clair, and Detroit River in 2007 and 2008.

Wetland name	Percent of marsh nesting birds
St. Clair River /Lake St. Clair	
Roberta Stewart Marsh	4.74
Snye River Marsh	8.39
Bear Creek Unit – Snye Marsh	7.11
Bear Creek Unit – Maxwell Marsh	6.29
Bear Creek Unit – Lozon Marsh	7.05
Bear Creek Unit – OPG Marsh	10.00
Mitchell's Bay Marsh	10.00
Tic Tac Point / Moon Cove Marsh	7.11
Lake St. Clair Marsh	10.00
St. Clair National Wildlife Area – West Marsh	10.00
St. Clair National Wildlife Area – East Marsh	10.00
Detroit River	
Peche Island Marsh	0
Turkey Creek Marsh	0.71
Fighting Island Marshes – North and South	0.28
Detroit River Marshes	2.19
Turkey Island Marsh	0
Canard River Mouth Marsh	1.23
Canard River Marsh	0.94

Source: Meyer (unpublished data)

Mixedwood Plains

(Quebec portion; see Great Lakes Ecozone^{+} for Ontario portion)

Potential indicator species : Black Tern, Least Bittern, Great Blue Heron, Great Egret, Pied-billed Grebe, Virginia Rail, America Coot.

Good data on diet, reproductive success, and population trends for Black Tern and Ring-billed Gull are available for some colonies in the Quebec portion of the Mixedwood Plains. The Black Tern population shows a severe decline in distribution and number of colonies from 1980 to 2010 (Latendresse and Brousseau, unpublished data). Lost habitats and human disturbance are presumed to be the main factors affecting the population but many colonies disappeared without any apparent reason. This same kind of disappearance, with no obvious cause, has been noted in the Great Lakes in the 1990s to 2000s (Weseloh, unpublished data).

After a rapid demographic explosion during the 1970s and 1980s which culminated in 1991, (Canadian Wildlife Service, unpublished data) the Ring-billed Gull population showed slow, consistent decline to 2006 (Figure 2). Surveyed every three years, the population is largely distributed near urbanized areas.

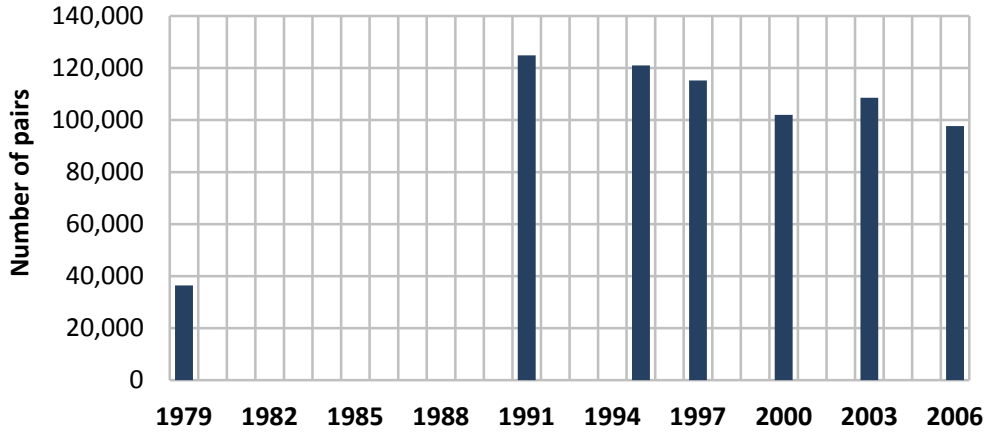

Figure 2. Ring-billed Gull population along the St. Lawrence River, 1979-2006. There were no census' between 1979 and 1990.
Source: Brousseau (unpublished data)

A long-term dataset for Great Blue Herons and Black-crowned Night-Herons, and recent data for the Great Egret, show that the populations of the first two species are stable while Great Egrets are increasing (Canadian Wildlife Service, Quebec Region, unpublished data).

The Quebec Marsh Monitoring Program has been in operation for five years and surveys the majority of inland/marsh birds. Given its short duration, assessing the trends of these species must be done cautiously. Preliminary data show a decline of American Coot, Common Moorhen, Sora, and Virginia Rail. Others species like Pied-billed Grebe show non-significant trends (Coughlan, unpublished data).

A 36-year dataset (1970 to 2005) is available from a checklist database for all of Quebec, though most records are from the south. These data indicate that American Bittern, Great Blue Heron, Black-crowned Night-Heron, and Virginia Rail have declined 46 to 77%. Nine species (Red-necked, Horned and Pied-billed grebes, Great Egret, Yellow Rail, American Coot, Sandhill Crane, and Black-headed and Bonaparte's gulls) showed a 40 to 80% increase (Jobin, unpublished data).

The Least Bittern (assessed by COSEWIC as Threatened) and Yellow Rail (assessed by COSEWIC as Special Concern) have been surveyed sufficiently in recent years to estimate their population distribution and size. Unfortunately, insufficient data exist to report on populations trends (Jobin, unpublished data; Robert, 2008, pers. comm.).

Boreal Shield and Newfoundland Boreal

***Potential indicator species for Boreal Shield*: Great Blue Heron, Sandhill Crane, Black-crowned Night-Heron, Double-crested Corrmorant, Bonaparte's Gull, and Yellow Rail.**

***Potential indicator species for Newfoundland Boreal*: Common Loon, Herring Gull, and Great Black-backed Gull.**

Data for Sandhill Crane were obtained from the annual Boreal Forest Waterfowl Survey and the Black Duck Survey which have been conducted since 1990 (Canadian Wildlife Service, Quebec Region, unpublished data). Data show an overall increase in the number of breeding pairs from 1990 to 2003 (Figure 3) with much fluctuations in the last six years.

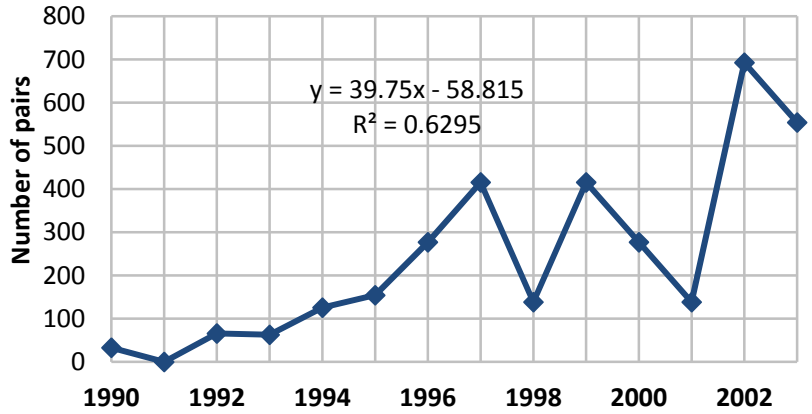

Figure 3. Population index of the Sandhill Crane in the Boreal Shield, 1990-2003.
Source: Canadian Wildlife Service, Quebec Region (unpublished data)

Data also are available from these surveys for other non-waterfowl inland breeding species. The surveys cover the Boreal Shield region from northeastern Ontario to Newfoundland with expanded coverage in Labrador in 1996 and 2002. For Newfoundland and Labrador (Figure 4), population trend estimates ($\lambda \pm$ SEE) for 1990 to 2002, showed a significant increase for Common Loons (1.073±0.022, P = 0.001), while Herring Gulls (0.980±0.023, P = 0.399) and Great Black-backed Gulls (1.020±0.033, P = 0.534) appeared to have been stable. Another population trend index, mean density of individuals seen within a 25 km^2 area, showed similar trends for Herring Gulls and Great Black-backed Gulls, and increases in Common Loons between 1990 and 2002; populations stabilized between 2002 and 2007 (Gilliland, unpublished data).

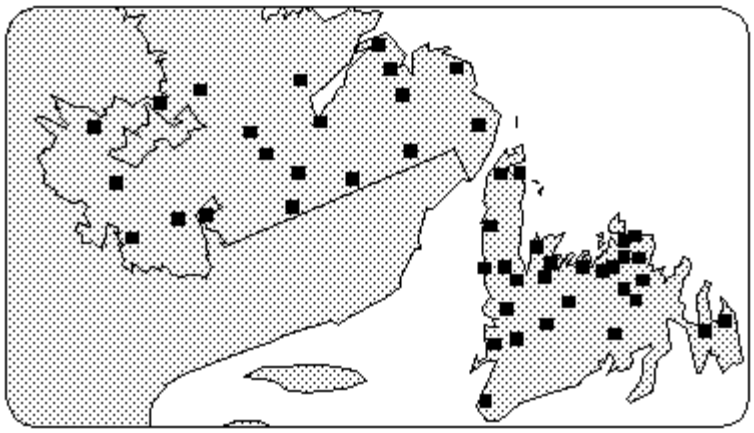

Figure 4. Map of study area in Newfoundland and Labrador showing plot locations up to 2002. Source: Gilliland (unpublished data)

In the interior, gulls nest singly or in small colonies and likely rely on natural food sources because of their remote locations. This is in contrast to marine areas where they nest in large colonies in close proximity to urban settings making them less useful as indicators for ecosystem health due to their high reliance on land-fills, offal, and other human-related wastes. Therefore, all three of these species (Common Loon, Herring Gull, and Great Black-backed Gull) are potentially good waterbird indicator species only for inland Newfoundland and Labrador.

Breeding success, distribution, and population data for Great Blue Herons are obtained from the Quebec Provincial Survey conducted every five years on colonies with more than five nests. In this ecozone[+], the colonies are small and their locations often change making it very difficult to assess a trend for such a large area (Desgranges and Desrosiers, 2006).

Great Blue Heron and Black-crowned Night-Heron are monitored every five years as well. Additional data on population status are available from Canadian Wildlife Service seabird surveys which are conducted on a five year basis and from the Canadian Wildlife Service Ring-billed Gull surveys conducted every three years. Data collected over the past 25 years indicate that breeding success varied little among years (Desgranges and Desrosiers, 2006). The Great Blue Heron population trend was negative between 1973 and 1990 but positive (+ 39%) since the 1990s (Desgranges and Desrosiers, 2006).

Surveys conducted for hydroelectric projects have shown that the Bonaparte's Gull is a common breeder (though difficult to census). Nevertheless, there is no monitoring program for this species during the breeding season. There is migration monitoring conducted every autumn at the Tadoussac Bird Observatory however, and counts conducted from 1996 to 2010 did not indicate any trend with peak numbers showing extensive variation from year to year (Figure 5) (Côte, 2009; OOT, 2011).

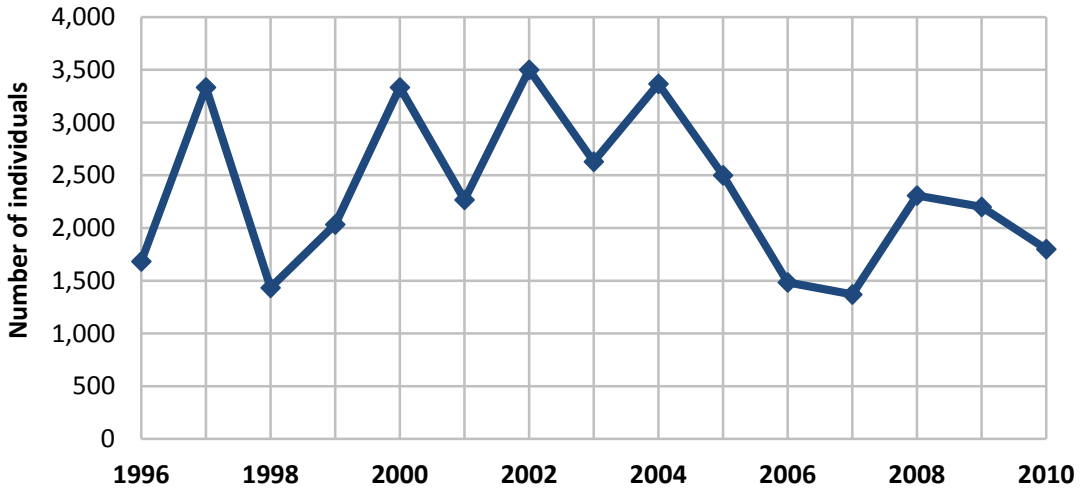

Figure 5. Number of Bonaparte's Gulls (shown as the average of the three highest daily counts) reported at Tadoussac Bird Observatory, 1996-2010.
Source: data from Observatoire d'oiseaux de Tadoussac (2011)

The population of Double-crested Cormorants is surveyed by Canadian Wildlife Service on a five year rotation in the migratory bird sanctuaries of the north shore of the Gulf of St. Lawrence. A sharp population increase was observed in the 1970s and 1980s there. This trend may not be fully representative of the whole area, however. Culling programs in the 1990s in many colonies have affected the dynamics of the population and the distribution of the species in this area (Rail, 2008, pers. comm.). Diet and breeding success were studied in the 1970s at some colonies (Cleary, 1977; Tremblay and Ellison, 1980a; Tremblay and Ellison, 1980b), but there are no new data available to assess changes in these parameters. Figure 6 shows data from 1925 to 2010 on the north shore of the Gulf of St. Lawrence.

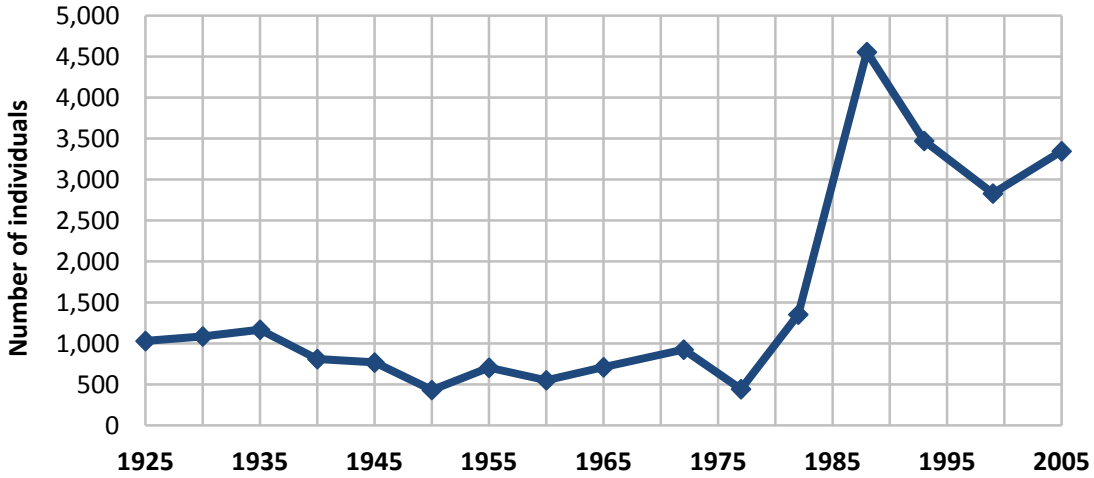

Figure 6. Numbers of Double-crested Cormorants in sanctuaries on the north shore of the Gulf of St. Lawrence, 1925-2005.
Source: data from Chapdelaine {4986 /d}, Chapdelaine and Brousseau (1991), and Rail and Cotter (2007)

The Great Cormorant (Figure 7) is the only other species that has been tracked. Recent data for this species and the Double-crested Cormorant are available from the seabirds survey carried out at five year intervals for the sanctuaries on the north shore of the Gulf of St. Lawrence (Rail and Cotter, 2007) and 10 year intervals for the Gaspe Peninsula (Cotter and Rail, 2007).

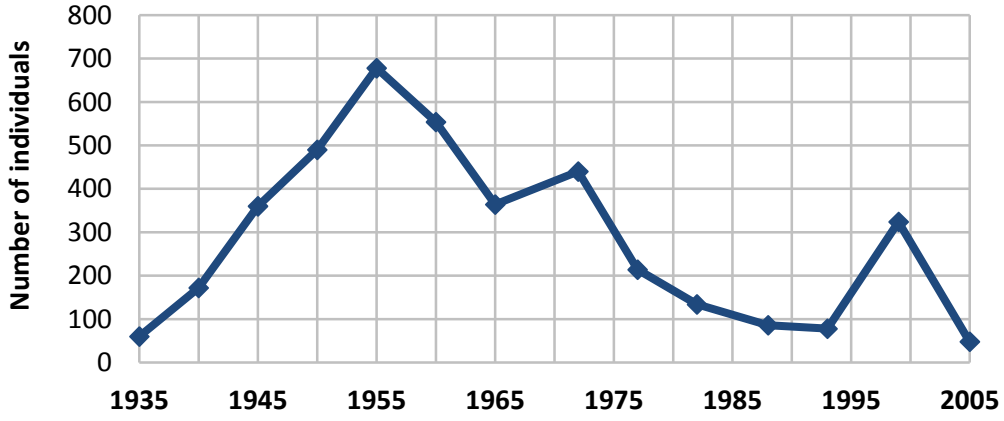

Figure 7. Numbers of Great Cormorants in sanctuaries on the north shore of the Gulf of St. Lawrence, 1935-2005.
Source: data from Chapdelaine {4986 /d}, Chapdelaine and Brousseau (1991), and Rail and Cotter (2007)

In northern Ontario, a pilot project is underway to assess how best to census colonial waterbirds in the boreal forest (Weseloh and Moore, 2010).

Hudson Plains

***Potential indicator species*: Sandhill Crane, Yellow Rail**

There are very few data available for this ecozone⁺ (Beyersbergen, 2008, pers. comm.), however, surveys conducted as part of environmental assessment studies indicate that Sandhill Crane and Yellow Rail nest there {72013, 72036}. These studies may form the basis for assessing future trends although there are no trend data at the time of writing this report.

Prairies

***Potential indicator species*: Franklin's Gull, American White Pelican, Double-crested Cormorant, Great Blue Heron, Herring Gull, California Gull, American Coot, Horned Grebe**

There is limited monitoring in the Prairies Ecozone⁺, and reliable trend data are not available.

For Franklin's Gull, previous global population estimates ranged between 315,000 and 990,000 breeding adults (Kushlan et al., 2002; Milko et al., 2003). Canada accounts for approximately 80% of the global range of this species (Burger and Gochfeld, 1994) and it is located entirely within the Prairies and Boreal Plains ecozones⁺. Canadian Wildlife Service surveys from 2005 to 2007 established a baseline population estimate and distribution of 1.176 million breeding adults in 36 colonies in the prairie provinces (Figure 8) (Beyersbergen et al., 2008). The Prairies

Ecozone⁺ hosts 25 of the colonies and 940,000 of the breeding adults. Franklin's Gull colonies flourish in healthy wetland environments with sustainable food resources in the surrounding landscape, but colonies shift among wetlands when conditions change (Burger and Gochfeld, 1994). Other waterbird species, especially Black-crowned Night-Heron, Eared Grebe, and Western Grebe, nest in association but not exclusively with Franklin's Gulls.

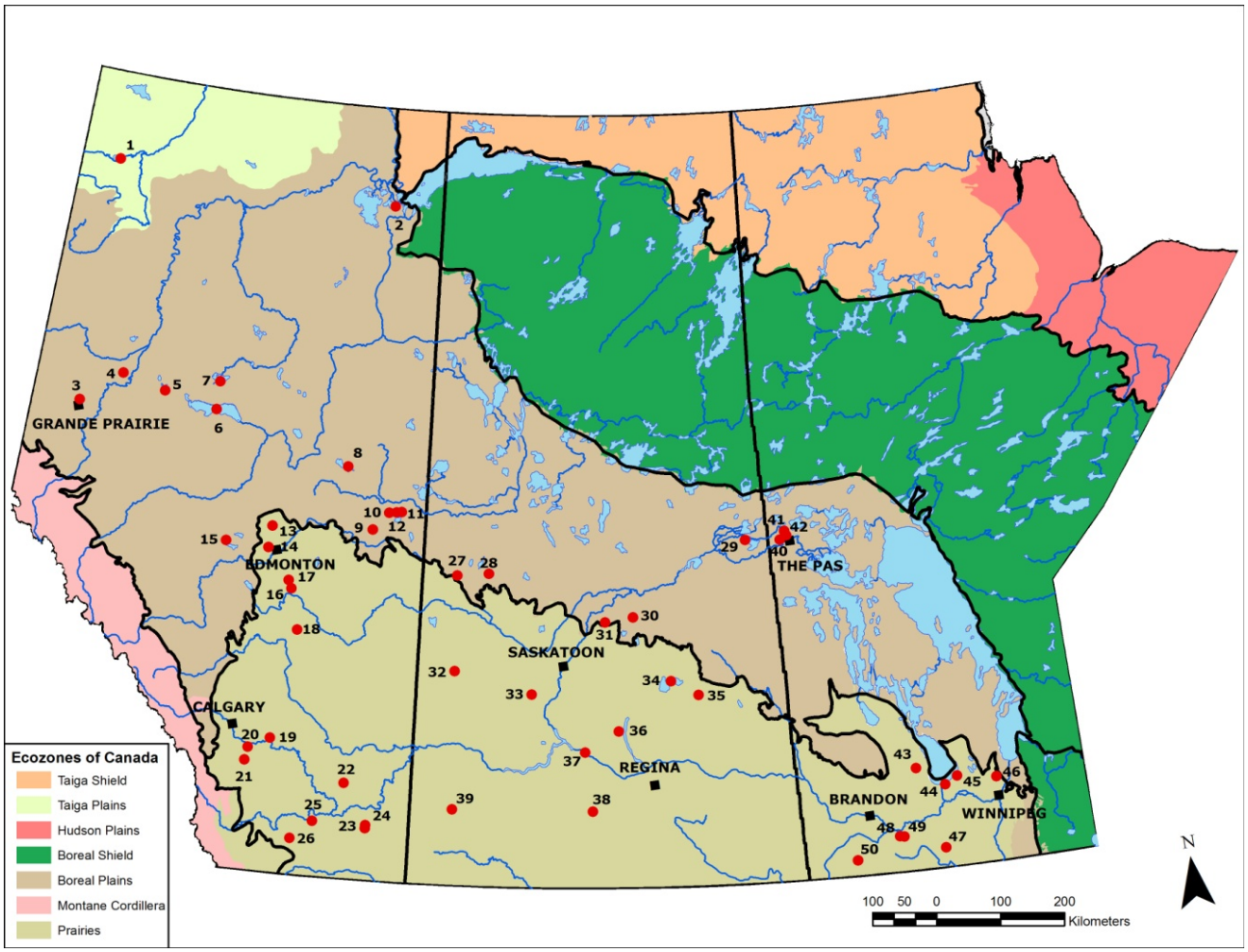

Figure 8. Distribution of lakes where Franklin's Gull colonies were observed in 2005-2007. Source: Beyersbergen et al. (2008)

Based on the proportion of the continental and global breeding range found within the ecozone⁺, the Prairies is very important for most of the species of waterbirds that breed there (Milko et al., 2003). Nonetheless, knowledge of population parameters is low. The highest priority conservation issue is the continued loss and degradation of wetlands and surrounding uplands. Beyersbergen et al. (2004) listed nine priority research and information needs that focused on the lack of accurate distribution, abundance, and population trend data for all waterbird species in the ecozone⁺.

Vermeer (1969; 1970a; 1970b; 1973a; 1973b) analyzed some quantitative historical data for selected colonial waterbirds in this ecozone⁺. New survey data would permit some long time span comparisons to be made.

Boreal Plains

***Potential indicator species*: American White Pelican, Franklin's Gull, Western Grebe, Black Tern, Yellow Rail**

There has been little consistent monitoring of waterbirds in the Boreal Plains Ecozone+ so reliable long-term trend information is minimal. Specific studies for some colonial species (American White Pelican, Western Grebe, and Franklin's Gull) have been undertaken on select sites/wetlands to establish population estimates and distribution but these are localized and of short-term duration (Hanneman and Heckbert, 2001; Hanus et al., 2002; Found and Hubbs, 2004; Kemper et al., 2008; Erickson, 2010). Neverthess, these studies can be indicative of initial trends.

The status of the American White Pelican in Alberta is listed as "sensitive" provincially and the number of breeding colonies remains low (Gutsell et al., 2005). The most northerly colony in the world is on the Slave River at the northern boundary between the Boreal Plains and Taiga Shield ecozones+. Other active colonies are found in the Boreal Plains and Prairie ecozones+. Although the colonies in Alberta are included in periodic waterbird counts and lakeshore surveys (Hanneman and Heckbert, 2001; Found and Hubbs, 2004), there is no systematic survey. Pelicans were surveyed in Saskatchewan from 1976 through 1991 (Royal Saskatchewan Museum, 2009). An increasing trend in numbers and distribution led to the species being removed from the COSEWIC Threatened list in 1987. The University of Regina initiated studies of pelican colonies at several lakes in 2005, but the data are preliminary (Somers, unpublished data).

Systematic surveys of Western Grebes in Alberta were initiated by the Alberta Fish and Wildlife Division in 2000 (Hanneman and Heckbert, 2001; Hanus et al., 2002; Found and Hubbs, 2004). All but one of the nine regionally important colonies found were in the Boreal Plains, although lakes throughout Alberta were found with breeding and non-breeding adults. Survey results up to 2005 suggest significant population declines and low reproductive success. A number of lakes that previously had colonies of more than 500 breeding pairs had 100 to 500 pairs in 2005. The most recent surveys (2010) and a document summarizing results to date are undergoing provincial review and expected to be published in 2011. The downward trend appears to be continuing (Kemper et al., 2008). Surveys of Western Grebe colonies were initiated also in Saskatchewan in 2008 by Environment Canada (Beyersbergen and Calvert, 2008) and continued in 2009 (Calvert, 2009). Good information on the species distribution was obtained, but potential population shifts from colony to colony negate the ability to define trends due to the lack of consistent and consecutive monitoring of all colonies across the region.

Monitoring grebe numbers on their wintering areas also has identified a decline but the linkages between wintering and breeding areas are currently unknown. Important threats to the Western Grebe on their breeding grounds include habitat degradation and disturbance (Storer and Nuechterlein, 1992).

Breeding Bird Survey data for Black Terns showed a negative trend of -5.4% per year ($P = 0.04$) from 1980 to 2007 in the southern regions of this ecozone+. However, because more recent data

are represented as having a deficiency, the trend is uncertain (U.S. Geological Survey, Patuxent Wildlife Research Centre, 2010). Waterbird surveys for colonially nesting species have located Black Tern colonies at several wetlands in this ecozone+, but no population data are available (Calvert, 2011, pers. comm.).

A recent survey of Franklin's Gulls found 11 colonies and approximately 236,000 breeding adults in this ecozone+ (Beyersbergen et al., 2008). See Figure 8 and the Prairies Ecozone+ for more information.

Vermeer (1969; 1970a; 1970b; 1973a; 1973b) provides some quantitative historical data for selected colonial waterbirds in this and the Prairies Ecozone+.

The Yellow Rail is listed as Special Concern under Canada's *Species at Risk Act*. A 2000 survey of historical sites in Alberta (Prescott et al., 2001) did not produce sufficient data to evaluate its status reliably, resulting in an "undetermined" ranking for the species by the Province of Alberta.

Taiga Plains

***Potential indicator species*: Whooping Crane, Horned Grebe, Yellow Rail**

The Aransas-Wood Buffalo Whooping Crane population has been monitored for 70 years and is listed as Endangered under Canada's *Species at Risk Act*. It has been growing at a rate of about 4.7% per year since the annual population surveys began in 1938. Growth since 2000 has been 4.2% annually (Figure 9). The nesting grounds of the Wood Buffalo Whooping Crane lies on the border between the Taiga Plains and the Boreal Plains. Further details are available in the recovery plan for this species .

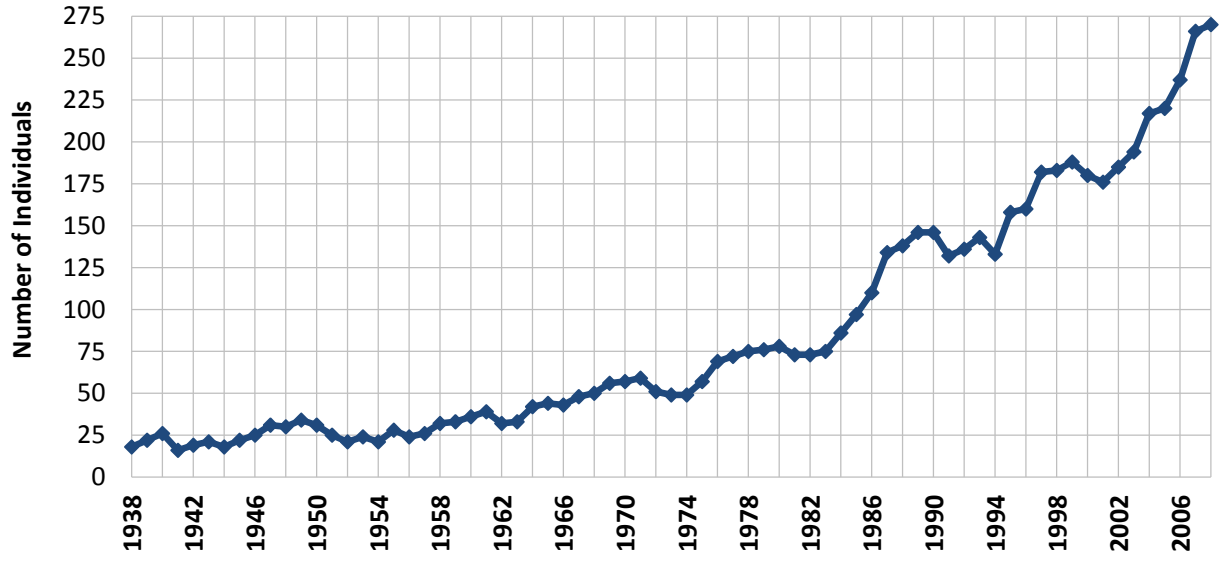

Figure 9: Growth of the Aransas Wood Buffalo Whooping Crane population, 1938-2008. Source: COSEWIC (2010)

From 1991to 2008, annual surveys of migratory birds were conducted on ponds in a 38 km^2 area bordering the highway near Yellowknife. Both Red-necked Grebes and Horned Grebes were found in relatively high densities, with a yearly average of 31 and 51 breeding pairs respectively (Canadian Wildlife Service, Yellowknife, unpublished data). The survey does not account for changes in production with changes in water levels or environmental conditions. It also only covers ponds visible from the road and thus cannot take into account movements between areas or infer trends for the region overall. Because Horned Grebes are at the northern limit of their range, and the adult and young are banded as part of this study, there is the potential for data on longevity and site fidelity (Canadian Wildlife Service, Yellowknife, unpublished data) and annual records of nesting pairs and young (Fournier and Hines, 1999).

With new data it could be possible to develop current trends for several waterbird species as the historical record for some areas is quite good (Sirois et al., 1989; Sirois et al., 1995).

The breeding range of the Yellow Rail extends into this ecozone+, but with no systematic monitoring for the species, its status is undetermined. Isolated pockets of suitable habitat likely host small populations as was evident with the discovery of Yellow Rails in a marsh in the Zama Lake area of northwest Alberta during survey in 2000 (Prescott et al., 2001). The Yellow Rail has been listed as Special Concern under Canada's *Species at Risk Act.*

Taiga Shield

Potential indicator species: **Various loons, grebes, gulls and terns, Sandhill Crane**

No trend data are available for this ecozone+, however Sirois et al. (1995) conducted surveys of colonial waterbirds nesting on Great Slave Lake from 1986 to 1995, half of which is found in the Taiga Shield. They reported locations and numbers of nests for the following inland colonial waterbirds: Bonaparte's Gull (6 nests); Mew Gull (446 nests); Ring-billed Gull (369 nests); California Gull (2496 nests); Herring Gull (1523 nests); Caspian Tern (236 nests); Common Tern (685 nests); Arctic Tern (410 nests); Common/Arctic Tern (103 nests); and Black Tern (not found nesting on Great Slave Lake but they were nesting on nearby lakes). Sirois et al. (1995) also report on the occurrence of other waterbirds in the area, including some that had been reported nesting previously — American White Pelican, Double-crested Cormorant, Great Blue Heron, Great Egret, Franklin's Gull, Thayer's Gull, Slaty-backed Gull, Glaucous-winged Gull, Glaucous Gull, and Sabine's Gull.

Arctic

***Potential indicator species*: Yellow-billed Loon, Red-throated Loon, Pacific Loon, Sabine's Gull, Arctic Tern, Sandhill Crane.**

Bart and Johnston (in press) provide good recent baseline data from the Arctic Program for Regional and International Shorebird Monitoring (Arctic PRISM) that were collected while conducting shorebird nesting surveys at various locations throughout the Arctic. It is expected that as monitoring continues information will be available that will allow the determination of temporal trends for 15 species, including eight species of gulls and terns, all three species of jaegers (Long-tailed, Pomarine, and Parasitic), three species of loons (Pacific, Red-throated, and Yellow-billed), and the Sandhill Crane.

Trends for some species in specific areas, such as Prince Charles Island and Victoria Island, where there are data are described below.

The distribution of Sabine's Gulls on Prince Charles Island was the same in 1984 and 1996, but there was a decrease in density between the 1984 and 1996 surveys (Johnston and Pepper, 2009). In 1984, roughly 75% of the island coastline had gull densities of more than five birds per km; in 1996, less than 10% of the coastal aerial transects reached that density (Figure 10). There is no obvious reason for this reduction in density nor is it known if this represents a population-wide decline (Johnston and Pepper, 2009). Helicopter surveys on western Victoria Island reported few Sabine's Gulls, however comparisons between 1992-94 and 2004-05 revealed that there were 50% fewer birds observed during the 2004-05 survey. The location of the birds remained consistent during both time periods, with 90% of observations occurring in the Kagloryuak River Valley and at Tahiryuaq Lake (Raven and Dickson, 2006). Similarly, there were few observations of Thayer's Gulls on western Victoria Island and numbers in 2004-05 were lower than those observed in 1992-94 (Raven and Dickson, 2006).

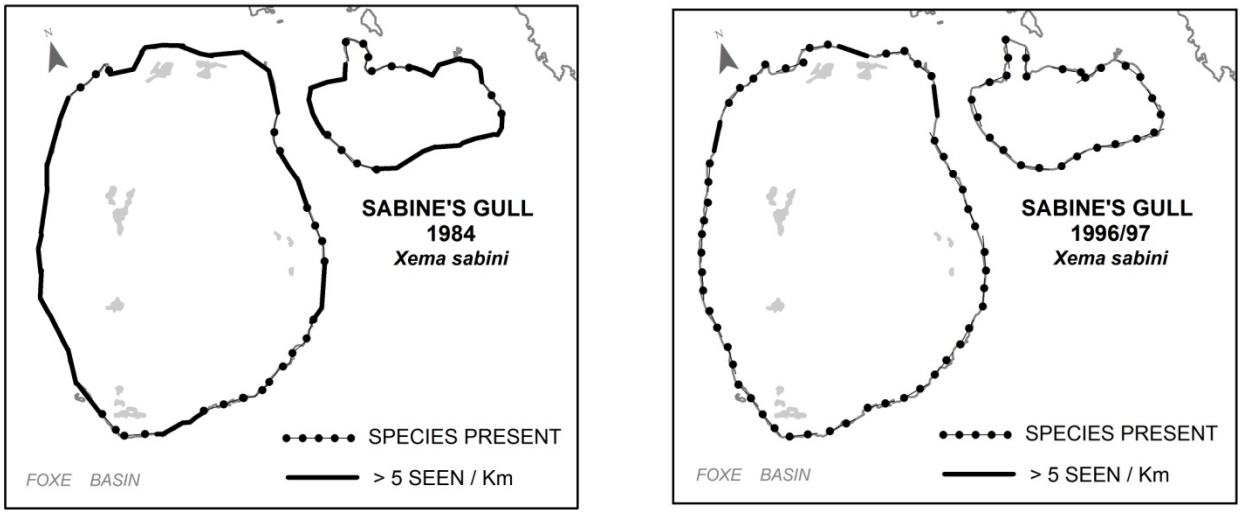

Figure 10. Change in density of Sabine's Gulls from 1984 (left) to 1996/97 (right).
Source: Johnston and Pepper, (2009). Data for 1984 from Gaston et al., (1986). Reproduced with permission of the Arctic Institute of North America.

Raven and Dickson (2006) compared population indices for Yellow-billed, Red-throated, and Pacific Loons on Victoria Island between 1992-94 and 2004-05. For all three species combined, results indicated close to a 50% decline in numbers for northwestern Victoria Island (mean population index of 7,115 in 1992-94 and 3,799 in 2004-05), however, there was no change for southwestern Victoria Island where the mean population index remained stable at approximately 1,500 birds. The authors indicate that the declines most likely pertain to Pacific Loons, but this is uncertain because approximately 47% of loons were unidentified to species level. By applying the proportion of Pacific Loons from surveys when they were identified to species to all the data, the authors estimated that for northwestern Victoria Island the population index declined from an average of 5,350 in 1992-94 to 1,245 in 2004-05 (Raven and Dickson, 2006).

Surveys on western Victoria Island revealed large fluctuations in the population indices for Glaucous Gulls. For example, the indices changed from 2,612 (±590) in 2004 to 6,048 (±1149) in 2005 on the northwestern portion of the island, and from 231 (±140) in 2004 to 2,563 (±468) on the southwestern portion of the island. Overall, comparisons between 1992-94 and 2004-05 indicated an approximate 50% decline, but due to the large fluctuations observed from year to year, it was concluded that there was uncertainty as to whether the population had actually declined, (Raven and Dickson, 2006).

Although Arctic Terns were widely distributed throughout western Victoria Island during surveys conducted in 1992-94 and 2004-05, population indices were more than 50% lower during the latter time period (Raven and Dickson, 2006). Elsewhere in Nunavut, local ecological knowledge from some communities indicated that Arctic Tern populations had declined around Whale Cove and Rankin Inlet and near Coats Island (Mallory, 2011, pers. comm.). In the early 1990s, research suggested that tern and gull populations had declined in southeastern Hudson Bay (Gilchrist and Robertson, 1999) but there has been no follow up on this in the last 15 years.

Sandhill Cranes also were surveyed on Victoria Island in 1992-94 and 2004-05. The population indices showed considerable variation among years with no discernable trend. Population indices ranged from 500 to 2,600 in the northwest and 300 to 700 in the southwest portions of the island. Highest densities were found at the southern end of the island (Raven and Dickson, 2006).

Three series of fixed-wing surveys have been conducted by the U.S. Fish and Wildlife Service in the central Arctic. Survey locations included the south coasts of Victoria and King William Islands and the adjacent north coast of mainland Nunavut (2006 and 2007) and western Victoria Island (2008) (Conant et al., 2007; Groves et al., 2009a; Groves et al., 2009b). Results from these surveys include population indices for: Sandhill Cranes; Pacific, Red-throated, and Yellow-billed loons; Sabine's, Glaucous, Thayer's, and Herring gulls; Arctic Terns; and jaegers.

Boreal Cordillera

***Potential indicator species*: Mew Gull, Horned Grebe, Red-necked Grebe**

Campbell et al. (1990; 1992) contains data that could be used as baseline information for inland waterbirds in the British Columbia portion of this ecozone+ (see summary information in the Pacific Maritime section).

In the Yukon portion of the ecozone+, trend data for some species are available dating from 1991 from the Yukon Roadside Waterfowl Surveys (Canadian Wildlife Service, Whitehorse, unpublished data). For 18 years these surveys counted breeding waterfowl and other waterbirds five times per year (weekly, May through early June) on approximately 162 wetlands in the southern and central Yukon Territory. A shorter 5-year (2004 to 2009) time-series has a larger sample size of approximately 275 wetlands distributed across the Yukon portion of the ecozone+. The survey was designed for breeding waterfowl but all other waterbirds (including colonial waterbirds, marsh birds, and shorebirds) are counted. The database has been redesigned recently and re-analyses of trends are ongoing. Nest data for colonial waterbirds and marsh birds have not been rigorously collected in this survey, but could be extracted from the database or collected in a more targeted way at specific wetlands in the future. Despite the large sample of wetlands, a relatively small subset are suitable for colonial waterbirds and marsh birds. Horned and Red-necked grebes appear to have the best potential as indicators based on this data set.

Specific parameters/comments for relevant waterbird species include:

- Pacific Loon: 4 to 10 individuals per survey (18 years), 10 to 20 individuals per survey (5 years)
- Horned Grebe: 20 to 30 individuals per survey (18 years), 60 to 80 individuals per survey (5 years). Some indication of breeding pairs and nests is available, but not as reliable as for waterfowl. Preliminary analysis of the 2004 to 2009 data suggests stable or increasing numbers in the more southern areas of the Territory, and possibly decreasing numbers in the central and western regions. The 1991 to 2009 trend for all areas (central Yukon not covered) is stable or slightly increasing.
- Red-necked Grebe: 15 to 25 individuals per survey (18 years), 20 to 35 individuals per survey (5 years). As with Horned Grebe, some information on breeding pairs and nests is available. Preliminary analysis of the 2004 to 2009 trend shows an overall decrease. The 1991 to 2009 trend is stable.
- Bonaparte's Gull: 20 to 150 individuals per survey (18 years), 10 to 50 individuals per survey (5 years). Little information on breeding pairs or nests.
- Mew Gull: 30 to 100 individuals per survey (18 years), 60 to 150 individuals per survey (5 years). Some information on breeding pairs and nests. Several wetlands in downtown Whitehorse support a large proportion of the birds counted overall, necessitating a careful analysis of possible trends from the entire dataset.

- American Coot: 1 to 4 individuals per survey (18 years), 2 to 12 individuals per survey (5 years)
- Sora: 1 to 3 individuals per survey (18 years), 1 to 7 individuals per survey (5 years).

Sinclair et al. (2003) report nesting and sighting information for these species as well as some additional inland waterbirds in the Yukon Territory. The information contained in this book is summarized here by species:

- Red-throated Loon: location and summary of nesting records (1860 to 1998); nests primarily in the northern portion of the Yukon Territory, but also found in the Boreal Cordillera during breeding season.
- Pacific Loon, Common Loon, Horned Grebe, Red-necked Grebe, Bonaparte's Gull, Arctic Tern: location and summary of nesting records (1860 to 1998); nest throughout the Yukon Territory portion of the Boreal Cordillera.
- Mew Gull, Herring Gull: location and summary of nesting records (1860 to 1998); nest throughout the Yukon Territory portion of the Boreal Cordillera.
- Thayer's Gull, Glaucous-winged Gull, Glaucous Gull: locations, primarily during migration, in the Yukon Territory portion of the Boreal Cordillera.
- Sandhill Crane: locations in the Yukon Territory portion of the Boreal Cordillera and summary of nesting records (1860 to 1998). Of note; more than half the world's population of "Lesser" Sandhill Cranes migrate through the Boreal Cordillera annually en route to breeding sites in Alaska. Sandhill Crane is confirmed nesting only in the northern portion of the Yukon Territory; there are no nest records from the Boreal Cordillera.
- Sora, American Coot/Common Moorehen: location and summary of nesting records (1860 to 1998); nests only in the southern portion of the Yukon Territory.
- Pied-billed Grebe: information on single breeding record on Rat Lake (1994).
- Double-crested Cormorant: information on single breeding record on Lake Laberge (1998).
- Black Tern: information on single colony at Blind Lake (1996).

Taiga Cordillera

***Potential indicator species*: Mew Gull, Horned Grebe**

No trend information could be found for this ecozone[+]. Some nesting and sighting information is found in Sinclair et al. (2003) and is summarized in the Boreal Cordillera section.

Pacific Maritime

Potential indicator species: Great Blue Heron

There is one waterbird in this ecozone+ that is listed under Canada's *Species at Risk Act* — the *fannini* subspecies of the Great Blue Heron (*Ardea herodias fannini*), also referred to as the Pacific Blue Heron, which was listed as Special Concern in 2002. Globally, this subspecies has a limited range, occurring only along the Pacific coast of North America, from Prince William Sound, Alaska, south to Puget Sound, Washington. The Canadian range occurs exclusively within the Pacific Maritime Ecozone+ and comprises 59% of the global extent of the range (COSEWIC, 2008). The reasons for its designation as Special Concern include the relatively small population (global population estimated to be between 9,500 and 11,000 nesting adults) and the concentration of breeding in a small number of sites in southern British Columbia (COSEWIC, 2008). There is evidence of declines in productivity since the 1970s but population trends have been difficult to determine. Christmas Bird Counts show population declines, BC Coastal Waterbird Surveys show increases, and colony surveys suggest a significant decline in productivity since the 1970s (COSEWIC, 2008). Primary threats include eagle predation, habitat loss, and human disturbance, particularly in the southern portion of the range where most birds are concentrated (Butler, 1997).

Campbell et al. (1990) discuss the status of Great Blue Herons in British Columbia and mention the presence of two subspecies, *fannini* and *herodias* — the former breeding along the coast and the latter breeding inland. Counts of major colonies (defined as >35 pairs for coastal sites and >20 pairs for inland sites) primarily from the early to mid-1980s, are presented by location as either coastal or inland, thereby making historical data available for colonies of both subspecies of Great Blue Heron (Campbell et al., 1990).

Campbell et al. (1990) report nesting and sighting information for inland waterbird species throughout British Columbia during the 1950s to 1980s. The area covered in Campbell et al. (1990) comprises the entire Pacific Maritime and Western Interior Basin ecozones+ and portions of the Boreal Cordillera and Montane Cordillera. A brief summary of the type of information available in Campbell et al. (1990) is:

- Red-throated Loon: location of nesting sites in the Chilkat Pass area
- Pacific Loon: location of breeding sites on the Teslin Plateau near Atlin
- Black-crowned Night-Heron: information for two records at Reifel Island
- California Gull: record for single colony on Grant Island
- Caspian Tern: two nesting records at Robert's Bank
- Forster's Tern: record for nesting colony at Duck Lake in the Creston Valley Wildlife Management Area
- Common Loon, Pied-billed Grebe, Horned Grebe, Red-necked Grebe, Eared Grebe, Virginia Rail, Sora, American Bittern, Green Heron, Arctic Tern, Sandhill Crane: maps of nesting locations

- Western Grebe, Double-crested Cormorant, Brandt's Cormorant, Pelagic Cormorant, Mew Gull, Ring-billed Gull, Herring Gull, Glaucous-winged Gull, Black Tern: location, history and size for major colonies
- Bonaparte's Gull, American Coot: location, history and size of major breeding concentrations.

Although Campbell et al. (1990) do not necessarily provide nest count information for all species, they do indicate the areas where these species were nesting, providing at least general information on abundance, geographic distribution, and general habitat information for nesting areas. For species where nest counts are provided, the data could be used as baseline information, should subsequent surveys be conducted.

More recent data indicate annual declines for some gulls — Glaucous-winged (-5%), Herring (-13%), California (-6%), Bonaparte's (-18%) — and a continuing decline in Western Grebe populations (Badzinski et al., 2008). There is a corresponding annual increase in cormorants — Double-crested (3%), Pelagic (4%) — as well as several waterfowl (Badzinski et al., 2008). This trend reflects the urbanization of the Pacific Maritime.

The Roberts Bank area continues to be used by large numbers of waterbirds with almost 1.6 million birds counted from September 2003 to August 2005, including over 100,000 birds per day in April at the peak of waterbird abundance (Elliott et al., In Prep.). Loons, grebes, and waterfowl are primarily winter visitors while gulls, terns, cormorants, and herons are primarily summer visitors (Elliott et al., In Prep.). There was also spatial heterogeneity in the distribution of different groups, with herons near the foreshore and cormorants, loons, and grebes using the outer regions of the jetties throughout the year. Gulls and terns were more equally distributed. These patterns reflect known distribution patterns for waterbirds in southwestern British Columbia (Campbell et al., 1990; Campbell et al., 1997; Campbell et al., 2001).

The BC Coastal Waterbird Survey was established in 1999 to monitor water birds in the Georgia Basin and other areas of the British Columbia coast which support many globally or continentally significant species. The survey involves nine years of monitoring at 167 to 180 sites, between September and April for non-breeding populations. Trends were prepared for 58 species. Western Grebe populations are of great conservation concern in this ecozone[+] due to the 90 to 95% declines prior to 1999 shown from Christmas Bird Counts. The BC Coastal Waterbird Survey suggests these populations may have stabilized. Two species, the Great Blue Heron and Pelagic Cormorant, were provincially-listed as at risk.

The Fraser River delta is one of the most important bird areas in Canada, with hundreds of thousands of wintering waterbirds and waterfowl (Butler and Campbell, 1987; Butler and Cannings, 1989). Reports up to 2001 indicate that bird populations in the Fraser River delta were below historical levels (Butler and Campbell, 1987; Campbell et al., 1990; Campbell et al., 2001). Urban and industrial development continues to be the greatest threats for bird populations in the delta {441183, 72010, 441184}.

Montane Cordillera

***Potential indicator species*: Eared Grebe, Great Blue Heron**

Campbell et al. (1990) provide baseline data, including colony counts from the 1950s to 1980s (see summary information in the Pacific Maritime section).

For Eared Grebes, determining populations trends through the monitoring of numbers on their wintering grounds, where they concentrate, could be suggestive of trends on their Canadian breeding grounds in this ecozone+ and on the prairies (Boyd and Jehl, 1998; Boyd, 2008, pers. comm.).

American White Pelicans nest at only one site in this ecozone+ — at Stum Lake within White Pelican Provincial Park. The species is listed as "endangered" under provincial legislation. The nesting colony at Stum Lake was first discovered in 1939; in 1993 there were over 400 nests reported on the lake (BC Conservation Data Centre, 2010).

Western Interior Basin

***Potential indicator species*: To be determined**

Campbell et al. (1990) provide baseline data, including colony counts from the 1950s to 1980s (see summary information in the Pacific Maritime section).

CONCLUSION

Three questions were posed that ideally would have described the current status for waterbirds in each ecozone+. Unfortunately, the lack of trend data for many of the ecozones+ precluded this. However, the three questions have been addressed for the Great Lakes Ecozone+, which appears to have the greatest amount of data available. It should be noted, however, that although the Great Lakes basin is an important area for inland waterbirds, the information below only applies to that location and may not apply to the vast areas of the country where information is lacking.

What is happening to waterbirds?

On the Great Lakes, five of ten colonial waterbird species are declining, three are increasing, and two are stable with fluctuations. This illustrates the dynamic nature of this group of birds and the dynamic nature of biodiversity (see below). Some species are reacting positively to recent environmental changes others are reacting negatively. The Great Lakes food web has undergone extensive changes from pre-settlement times, e.g. invasive species and habitat changes. The current state of colonial waterbirds is probably a reflection of this.

For marsh bird populations, it is a different story. All focal marsh bird populations are declining Great Lakes basin-wide (excluding Lake Superior). Many secondary species are also declining.

Many of these species are habitat specialists; as the area of their preferred habitat is diminished, so, too, are their populations. Outside forces are diminishing their biodiversity.

Why is the trend happening?

The three colonial waterbird species which are increasing (American White Pelican, Double-crested Cormorant, and Great Egret) are doing so probably because they are relatively recent new breeders on the Great Lakes or are making a come back after a serious population decline. In other words, they are occupying or re-occupying previously empty niches. Species which find themselves in that position often increase fairly quickly. Of the four species which are declining, the Great Black-backed Gull is doing so as a result of toxins (botulism type-E), the Common Tern is doing so probably because of competition with Ring-billed Gulls, and the two other gulls species, Herring and Ring-billed, might be declining as the result of populations being larger than the carrying capacity for that ecosystem during the 1980s as well as possible declines in food availability during the last 20 years. While it is difficult to determine the exact cause of declines in all marsh bird populations on the Great Lakes, some of the contributing factors include: habitat degradation within wetlands, watersheds, and riparian habitats; loss of habitat and ecosystem functioning through activities such as shoreline hardening; water levels; and invasive species.

Why is it important to biodiversity?

Long-term trends in population numbers and other vital metrics are the forces which shape biodiversity. Biodiversity is dynamic. Species decline and others increase, and/or new ones appear. This is what is happening with colonial waterbirds, and their populations are considered to be relatively healthy (except for Common Terns). On the Canadian Great Lakes, there are no colonial waterbirds listed as Species at Risk. However, this is not what is being observed with marsh birds. Population trends in the various species of marsh birds are almost all negative. Several species are listed in one or another Species at Risk category. The dynamics of their guild are no longer give and take, positive and negative. At that rate, species could be lost.

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