

AMERICAN WHITE PELICANS AND DOUBLE-CRESTED CORMORANTS IN SASKATCHEWAN: POPULATION TRENDS OVER FIVE DECADES

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Abstract

We conducted a province-wide census of breeding American White Pelicans and Double-crested Cormorants in Saskatchewan in 2006. Pelican numbers have increased from a low of 4,560 pairs in 1976 to a high of 31,991 pairs in 2006. Approximately 73% of the current breeding pelican population is found on lakes in the central Boreal Plain ecozone (major colonies on Primrose, Lavallee, and Suggi Lakes). Double-crested Cormorant numbers have increased from a low of 1,080 pairs in 1968 to a high of 34,057 pairs in 2006. Approximately 91% of the current breeding cormorant population is found on lakes in the central Boreal Plain ecozone, with colonies on Dore Lake alone containing over one-third of Saskatchewan's cormorants (other major colonies are on Kazan and Suggi Lakes). Dore Lake breeding populations of cormorants and pelicans have fluctuated dramatically over recent years (1996 to 2009). The causes of recent population changes at the provincial or individual colony level are unclear; however, larger populations of cormorants and pelicans have heightened perceived conflicts between fishermen and these piscivorous birds.

Introduction

American White Pelicans (hereafter pelicans, Fig. 1) and Double-crested Cormorants (hereafter cormorants, Fig. 2), two of Saskatchewan's largest waterbirds, have breeding colonies on many lakes in the province. These species were historically relatively rare in Saskatchewan, and therefore of significant interest from a conservation perspective. Thus, sporadic aerial surveys were conducted to estimate population sizes of these birds over the period spanning 1968 to 1991.^{7-12,14,15} In 1987, pelicans were delisted as a species threatened with extinction by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), and interest in provincial population trends (and thereby aerial surveys for both species) diminished shortly thereafter.

Since the last of the sporadic aerial surveys in 1991, cormorants have increased in number in virtually all parts of their North American range.¹⁶ The presence of large numbers of these fish-eating birds in locations where they were historically less numerous or absent has generated significant conflict over fisheries resources.^{2,3} Recent



Figure 1. Nearly fledged juvenile American White Pelicans from a breeding colony on Reed Lake, near Morse, SK. Pelicans have recently increased in numbers over much of their North American range.

Chris Somers

complaints regarding increasing numbers of cormorants on Saskatchewan lakes suggested that populations may be growing here as well (K. Murphy, pers. comm.). Pelicans were also reported to be increasing in numbers in North America,⁵ and are the subject of control measures due to fisheries conflicts in some areas of the U.S.A.⁴ Fisheries conflicts combined with some alarming events, such as the temporary abandonment of the Chase Lake, North Dakota, breeding colony by nearly 16,000 pairs of pelicans in 2004,¹³ renewed interest in Saskatchewan pelican population trends.

Here we report the results of the most recent province-wide census of pelicans and cormorants in Saskatchewan conducted in 2006, and analyze long-term population trends beginning in 1968. In addition, we report a specific case study on recent population trends for pelicans and cormorants nesting on Island A, Dore Lake, which is the largest single breeding colony of cormorants in Saskatchewan.

Methods

To estimate 2006 population sizes of breeding cormorants and pelicans, we aerially surveyed potential colonial bird nesting islands on 19 Saskatchewan lakes during late May and early June of 2006. The locations surveyed (Fig. 3) were selected based on the most recent previously published provincial census conducted by the Royal Saskatchewan Museum.¹²

At occupied sites, aerial photographs of nesting areas were taken from a fixed-wing aircraft as it circled over the islands at an altitude of 250–330 m. We used a Canon EOS digital SLR camera equipped with either a 55–75 mm or 100–300 mm zoom lens to take photographs. In general, we took multiple frames to cover the entire surface area containing nesting birds. These images were later enlarged in Adobe Photoshop, edited to eliminate overlap between frames, and enlarged further before being printed so that detailed nest counts could be



Figure 2. Sub-adult Double-crested Cormorant foraging in Wascana Lake, Regina, SK. Cormorants have recently become more numerous across most of their North American range and are often visible in urban settings like this one. Chris Somers

conducted. Figure 4 shows an example of a frame taken of a mixed colony in the Last Mountain Lake National Wildlife Area. For all locations we counted birds that appeared to be incubating eggs, and excluded individuals that were standing near nests, loafing near the colonies, or flying. Thus, all population size estimates are expressed as the number of active nests, rather than the number of birds.

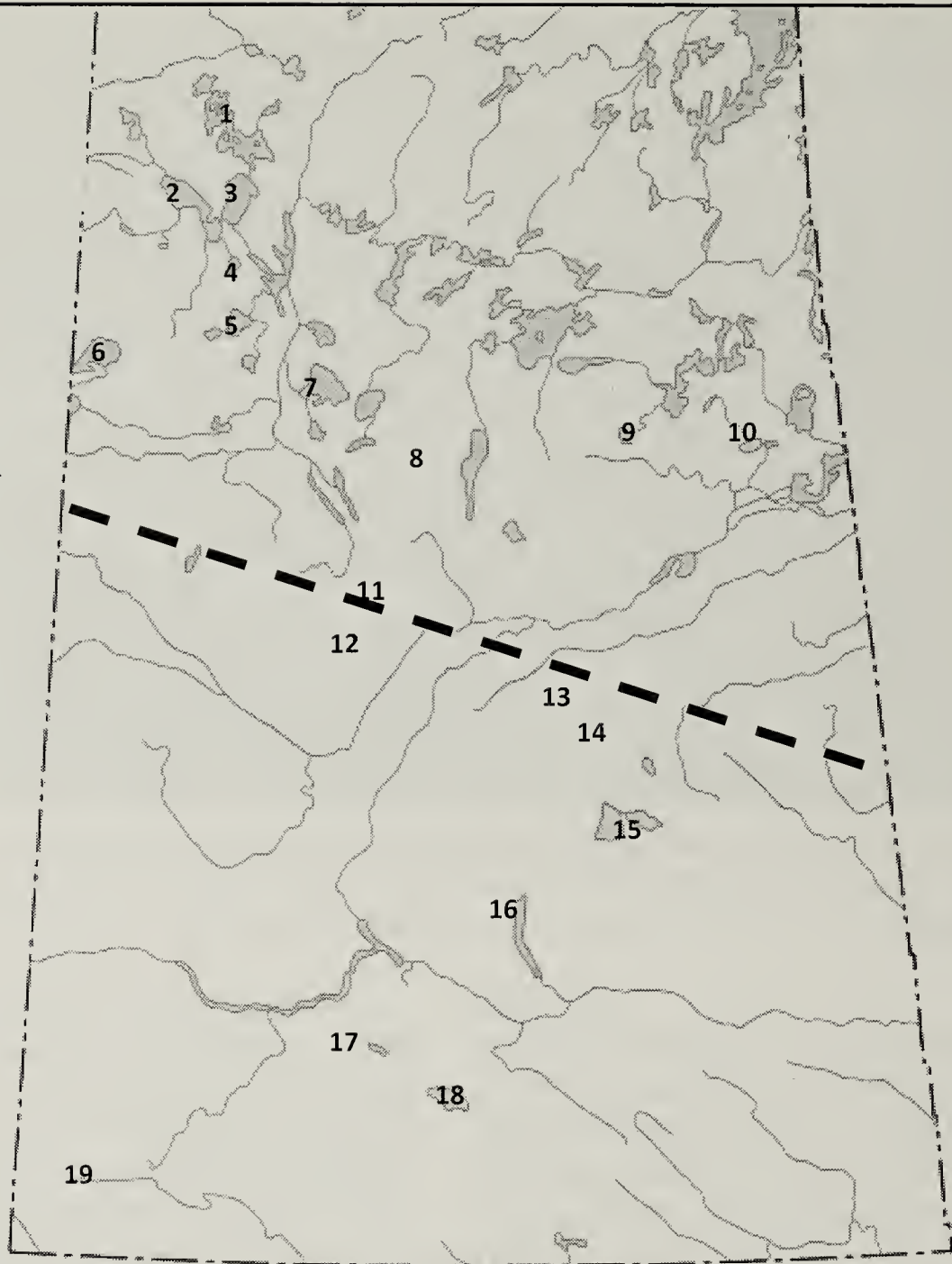
In addition to the province-wide census of pelicans and cormorants described above, we also estimated the population size of breeding cormorants and pelicans on Island A (Bazil Bay) of Dore Lake annually from 1996 to 2009. This colony is of particular interest due to its large size, history of perceived fisheries conflicts between the birds and local fishermen, and long-term studies of cormorant-pathogen interactions.^{1,6} Aerial photographs for these annual counts were taken from a helicopter hovering at approximately 300 m altitude slightly

offset from the breeding island. This approach results in photographs being taken at a slightly oblique angle, but prevents the helicopter from disturbing the colony. Counts of nesting birds were conducted from photographs in a manner similar to that described above.

Provincial Census Results

American White Pelicans - The total number of pelican nests in Saskatchewan has increased significantly over the past 38 years (linear regression, $r^2 = 0.866$, $P < 0.001$; Fig. 5) to an estimated total of 31,991 nests in 2006 (Table 1). The observed average rate of increase for the province was 669.² nests per year.

When analyzed by major ecozone, pelican nest numbers have increased significantly over time in both the southern Prairie ecozone ($r^2 = 0.661$, $P = 0.009$; Fig. 6) and the central Boreal Plain ecozone ($r^2 = 0.849$, $P = 0.001$; Fig. 6). The percentage of nesting birds in Boreal



- | | |
|--------------------|-----------------------------|
| 1. Wasekamio Lake | 11. Iroquois Lake |
| 2. Peter Pond Lake | 12. Redberry Lake |
| 3. Churchill Lake | 13. Basin Lake |
| 4. Kazan Lake | 14. Lenore Lake |
| 5. Canoe Lake | 15. Mud (Middle Quill) Lake |
| 6. Primrose Lake | 16. Last Mountain Lake |
| 7. Dore Lake | 17. Reed Lake |
| 8. Lavallee Lake | 18. Old Wives Lake |
| 9. Big Sandy Lake | 19. Cypress Lake |

Figure 3. Location of Saskatchewan lakes surveyed for Double-crested Cormorant and American White Pelican nesting colonies during the 2006 provincial population census. Sites were selected based on previous surveys conducted by the Royal Saskatchewan Museum. The dashed line indicates the approximate transition between Boreal Plain and Prairie ecozone colonies as discussed in the text.



Figure 4. Example of an aerial photograph used to count American White Pelican and Double-crested Cormorant nests in the Saskatchewan provincial survey, 2006. This frame shows approximately one-third of the main breeding island for these two species in the Last Mountain Lake National Wildlife Area. Chris Somers

Plain colonies increased from 1976 through 1991, but a minor resurgence in the percentage of prairie nesters occurred in 2006. In general, colonies on Boreal Plain lakes have consistently had a higher percentage of the province's nesting pelicans, and in 2006, 23,414 of 31,991, or 73.2% of pelican nests were in colonies on Boreal Plain lakes, compared to 8,577 of 31,991, or 26.8% on Prairie lakes. In the 2006 survey, colonies on Lavallee (22.5%), Primrose (16.4%), and Suggi (15.5%) Lakes were by far the largest in the province and collectively supported more than half of Saskatchewan's nesting pelican population.

Double-crested Cormorants – The total number of cormorant nests in

Saskatchewan has increased significantly over the past 38 years ($r^2 = 0.948$, $P < 0.001$; Fig. 7) to an estimated total of 34,057 nests in 2006 (Table 2). The observed average rate of increase for the province was 867.8 nests per year. Cormorant nest numbers have increased significantly over time in both the Prairie ($r^2 = 0.476$, $P = 0.035$; Fig. 8) and Boreal Plain ecozones ($r^2 = 0.941$, $P < 0.001$; Fig. 8). There has been a marked shift over time away from an approximately even distribution of cormorant nest numbers in Prairie and Boreal Plain ecozones, such that in 2006, 31,110 of 34,057, or 91.3% of Saskatchewan's cormorant population nested on Boreal Plain lakes, compared to only 2,947 of 34,057, or 9.7% on Prairie lakes. In the 2006 survey, Boreal

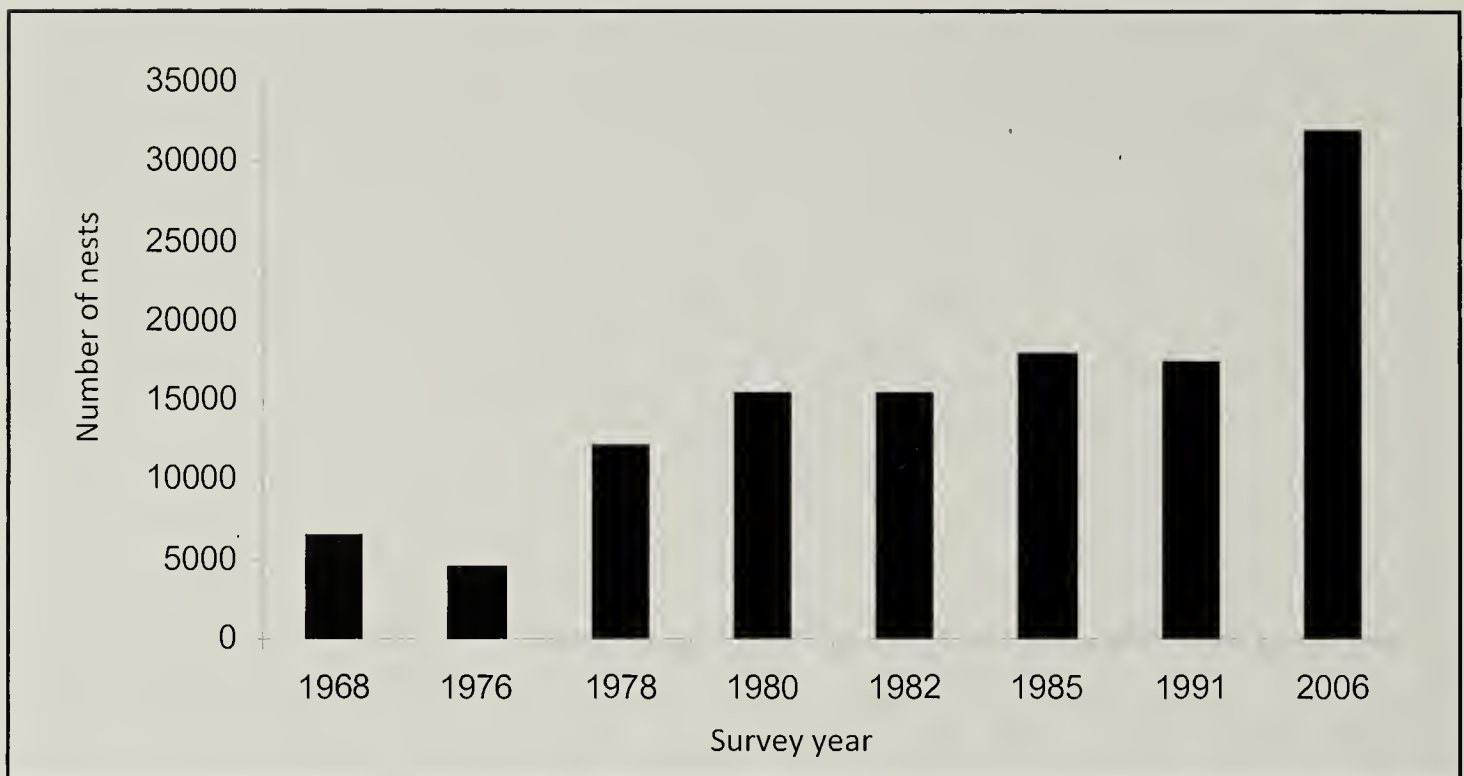


Figure 5. Numbers of breeding American White Pelicans (nests) counted in Saskatchewan during the period 1968–2006. Counts for the 1968–1991 period are from previously published censuses conducted using similar methods.

Plain colonies on Dore (33.8%), Kazan (23.3%), and Suggi (13.0%) Lakes were by far the largest in the province and collectively supported more than 70% of Saskatchewan’s breeding cormorant population.

Dore Lake (Island A) Annual Counts

The number of pelicans nesting on Island A fluctuated over the survey years, ranging from a low of 901 breeding pairs in 1999, to a high of 2,824 pairs just 2 years before (Fig. 9). Since 2005, the general trend has been for a slight increase in pelican numbers. Cormorant numbers on the same island have fluctuated even more dramatically, with a low of 4,171 pairs in 1999, and a high of 11,094 just 1 year prior (Fig. 9). There has been a slight decrease in the number of breeding cormorants on Island A each year since 2006. In 2006, aerial photos of Island A were taken using both the fixed-wing aircraft and the helicopter as described above. Counts from the two sets of photos were different. The fixed-wing version yielded 9,557 cormorant nests, and 1,632 pelican nests, whereas

the photo from the helicopter showed only 8,129 cormorant nests and 1,544 pelican nests. The cause of this difference between methods is unclear.

Implications of Population Trends

The American White Pelican has a history of conservation issues in Canada and was considered threatened with extinction by the Committee on the Status of Endangered Wildlife in Canada until 1987. In Saskatchewan, pelican numbers reached a historic low in the mid-1970s and have consistently increased since that time. In 2006, there were more breeding pelicans in the province than at any other time surveyed. Thus, measures taken to protect pelicans in Saskatchewan have been extremely effective, and their population growth over the past three decades should be considered a conservation success story. It is currently unclear whether the pelican population will continue to grow, and what factors will determine the ultimate population size in the province. From the perspective of long-term pelican conservation and management in Saskatchewan, it is

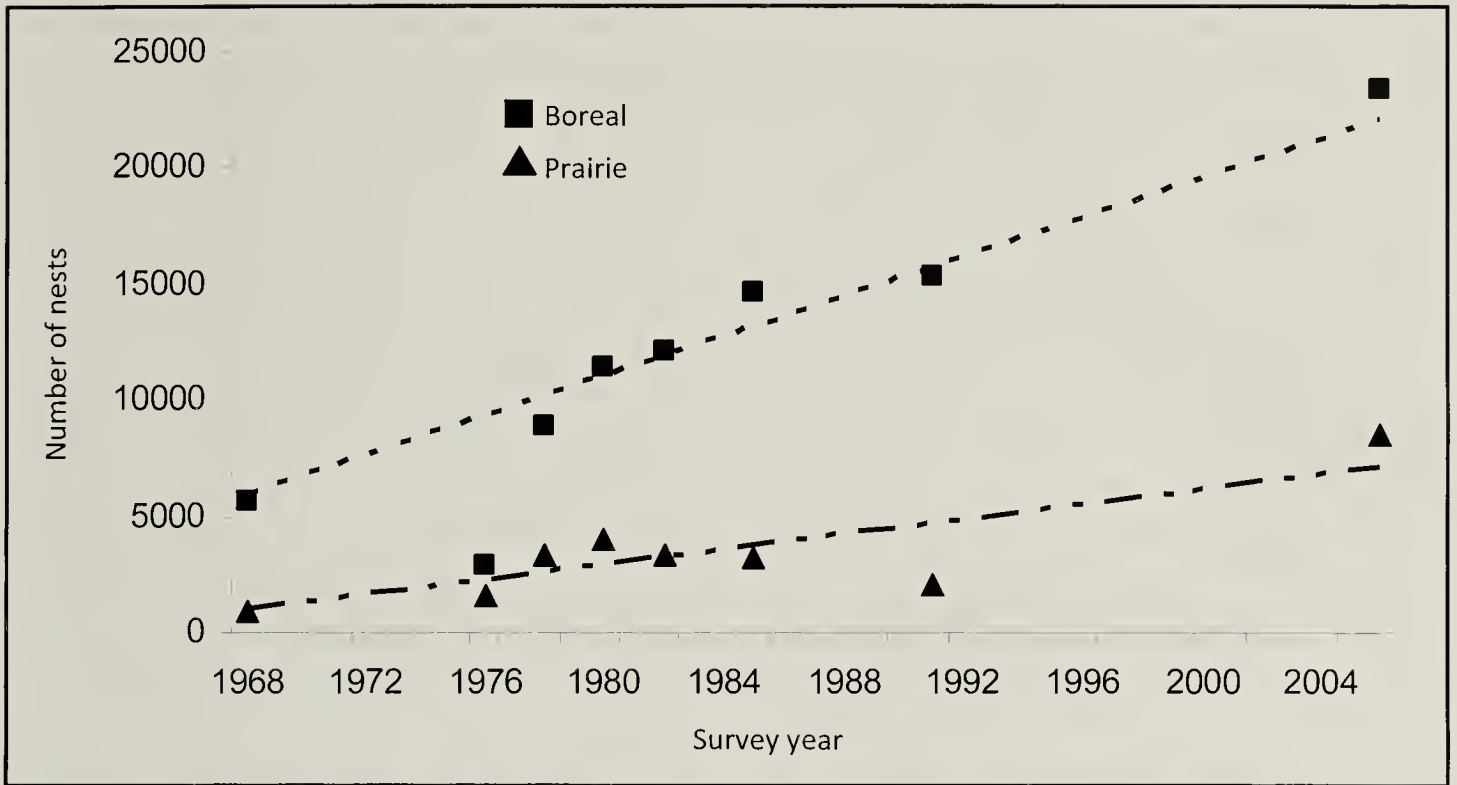


Figure 6. Population trends for American White Pelicans (number of nests) in Saskatchewan based on the location of colonies in either the central Boreal Plain or southern Prairie ecozones. Data from 1968–1991 are from previously published reports.

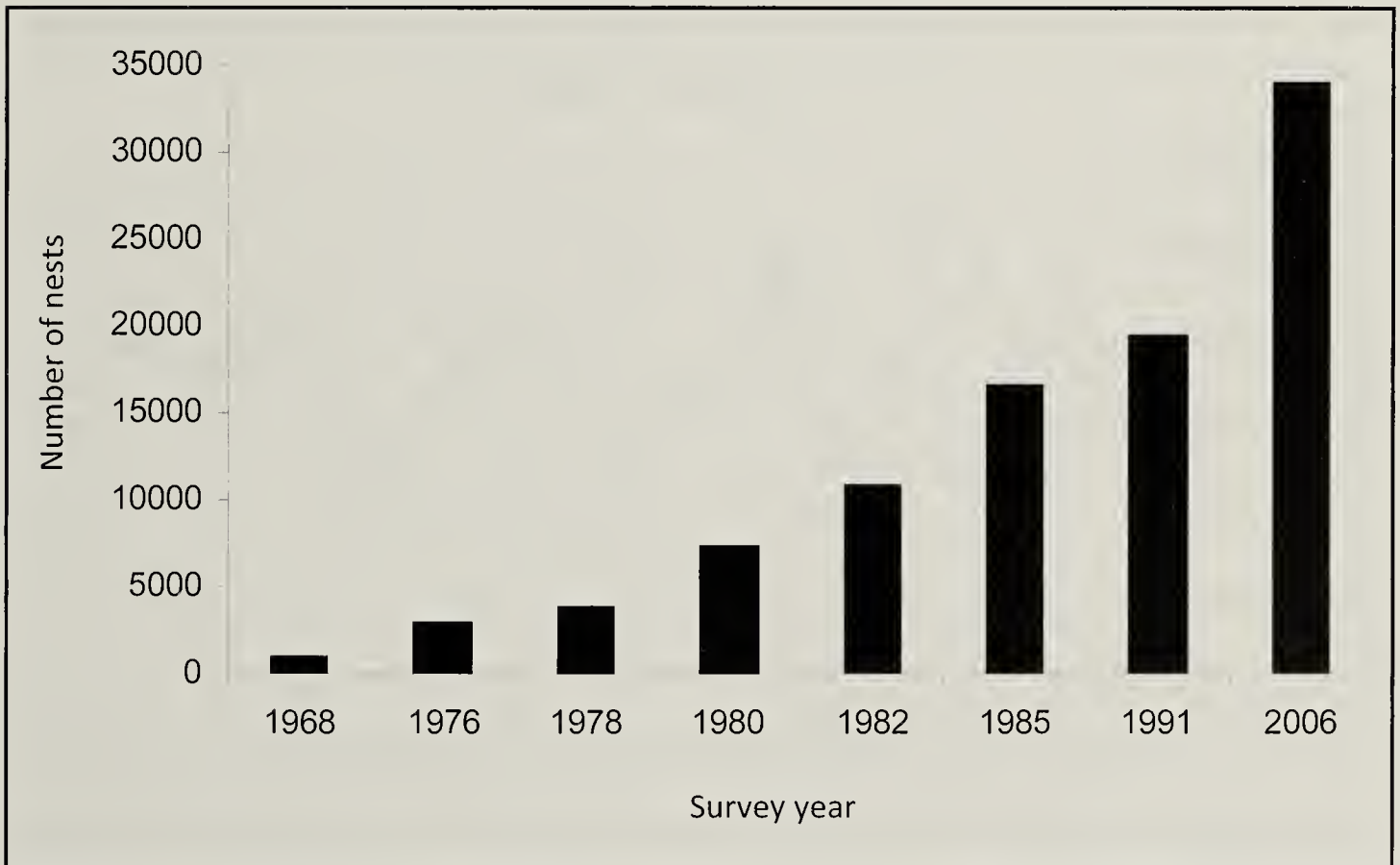


Figure 7. Numbers of breeding Double-crested Cormorants (nests) counted in Saskatchewan during the period 1968–2006. Counts during 1968–1991 were taken from previously published reports.

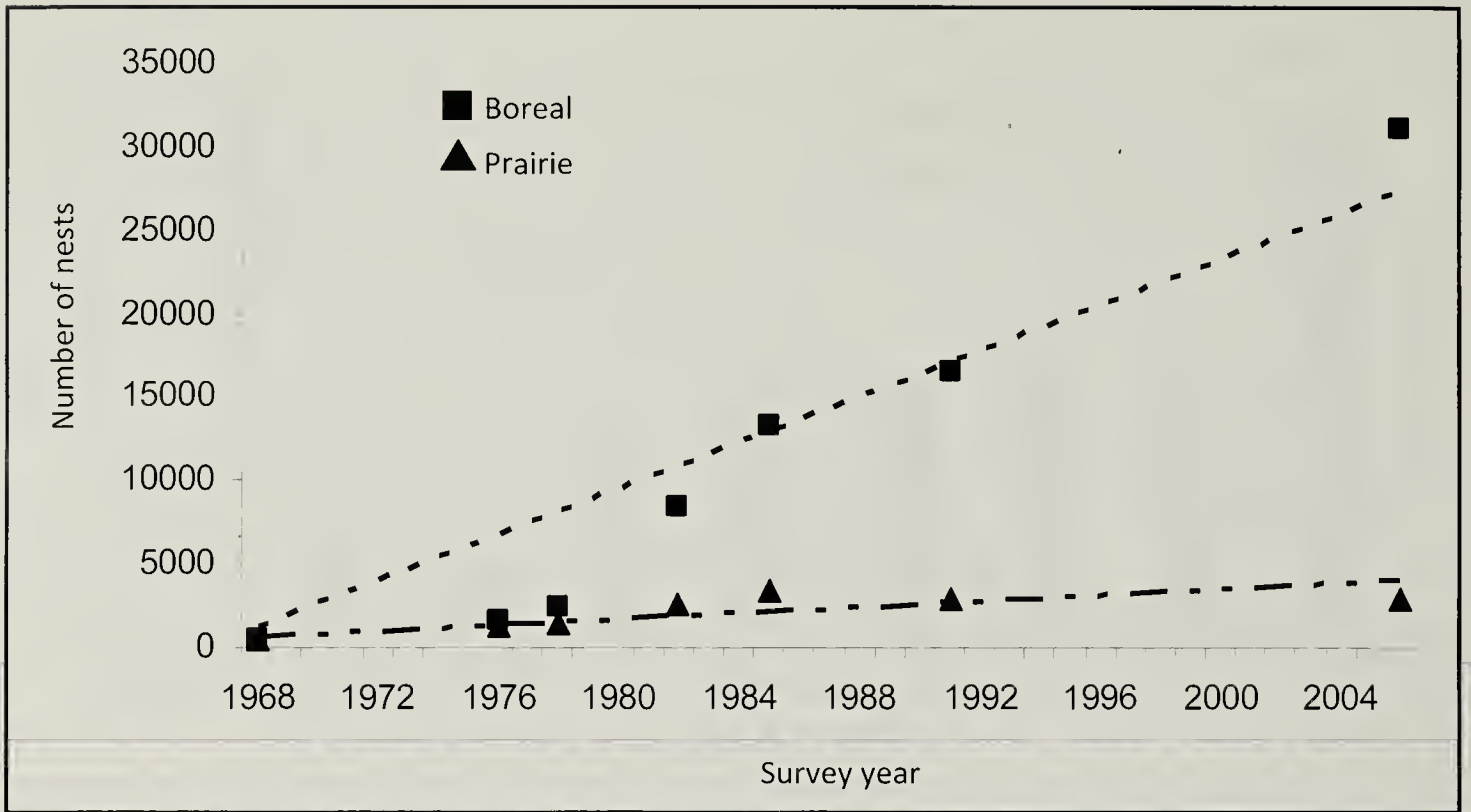


Figure 8. Population trends for Double-crested Cormorants (number of nests) in Saskatchewan based on the location of colonies in either the central Boreal Plain or southern Prairie ecozones. Data from 1968–1991 are from previously published reports.

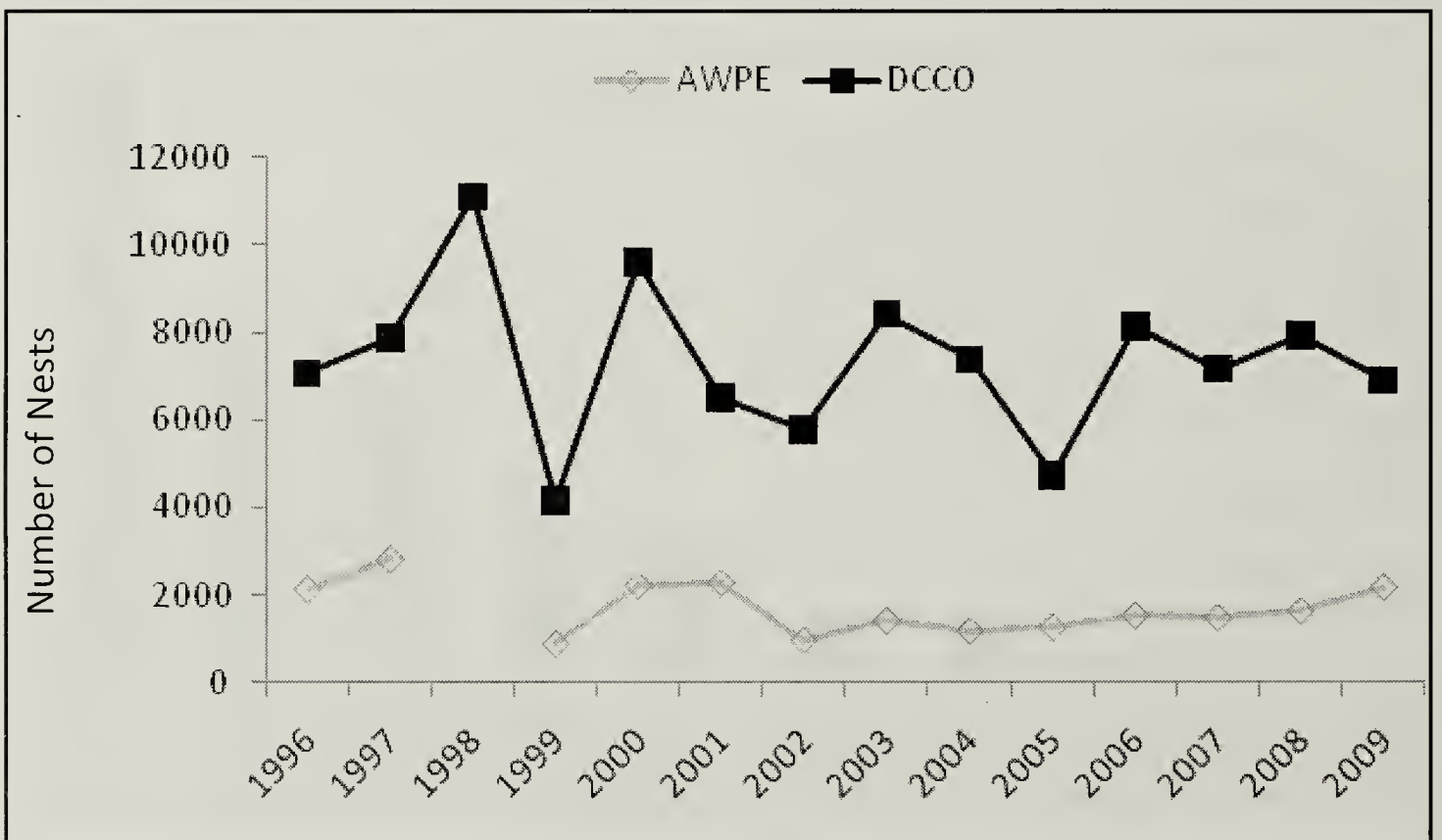


Figure 9. Recent population trends for American White Pelicans (AWPE) and Double-crested Cormorants (DCCO; number of nests) in the breeding colony on Island A in Dore Lake, Saskatchewan. Historical records indicate approximately 3,000 cormorant nests on Dore Lake in 1922; breeding pelicans were present but not counted in 1932.¹

noteworthy that the majority of breeding birds in the province (54.4%) are currently located in just three colonies on Lavallee, Primrose, and Suggi Lakes in the central Boreal Plain ecozone. These sites share the common feature of having no road access and a nearly complete lack of human activity on the water or surrounding shoreline during the nesting season. If the fourth-largest colony on Kazan Lake (12.0%), which also does not have road access, is included, this brings the proportion of pelicans that nest at sites inaccessible to humans up to two-thirds of the provincial population total. This distribution of nesting birds suggests that: (1) undisturbed colony sites are critically important for maintaining the Saskatchewan pelican population, and (2) 66.4% of the pelican population is concentrated at just four breeding sites. Thus, this species remains potentially vulnerable to human disturbance or other events at breeding colonies despite currently having a large population size.

The situation is much the same for the Saskatchewan cormorant population, which was at a recorded low when the first provincial survey was conducted in 1968, and has increased consistently ever since. In 2006, more cormorants were nesting in the province than at any other time surveyed. Cormorants were severely affected by DDT-related egg shell thinning in the mid-1900s and were considered rare in west-central Canada for many years.¹⁶ The cause of recent cormorant population growth over the past three decades is unknown, but indicates that aquatic environments in Saskatchewan must have suitable conditions, including abundant prey fish, to support large numbers of fish-eating birds. Thus, from a biological and environmental perspective, growing cormorant numbers should perhaps also be viewed as a conservation success story. However, setting the cormorant situation in a conservation

context is problematic because these birds are not revered by the public as pelicans are (perhaps because of a negative perception of cormorant appearance), and both stakeholders and resource managers tend to view cormorant population growth negatively because of a perceived conflict over fisheries resources.^{e.g.2,3} In addition, lakes that support large or increasing cormorant numbers may do so because human over-exploitation of top-predator fish (e.g., pike and walleye) causes a shift in food webs, favouring high abundance of forage species that are prey for cormorants but are of little value to anglers or commercial fishermen. Thus, cormorants may be an indicator (rather than the cause) of failing commercial and recreational fisheries, and their presence is highly correlated with stakeholder dissatisfaction. Because systematic recording of cormorant population size in Saskatchewan only began in 1968, we have no historical data for comparison. As an exception, some early data for Dore Lake indicate 3,000 cormorant nests on that lake in 1922.¹ The lack of a province-wide historical perspective on cormorant populations makes it impossible to know whether recent growth represents a resurgence to pre-human settlement numbers, or an unusual range and population expansion triggered by as yet unexplained ecological events.

Nevertheless, some of the same insights above for pelicans are also relevant for cormorants. Like pelicans, a large proportion (~70%) of the provincial cormorant population is currently located in three major colonies, in this case on Dore, Kazan, and Suggi Lakes in the central Boreal Plain ecozone. Suggi and Kazan Lakes are also major colony sites for pelicans, although the order of importance is different for each species. In contrast to pelicans, the largest cormorant colony in Saskatchewan on Dore Lake

Table 1. Colony and population size estimates for breeding American White Pelicans in two eco-regions of Saskatchewan based on aerial photographs. Data from 1968 through 1991 are from previously published reports. The symbol 'x' indicates that a site was not surveyed.

Lake Name	1968	1976	1978	1980	1982	1985	1991	2006
BOREAL PLAIN								
Basin	x	x	x	x	x	227	0	144
Canoe	x	x	x	x	x	x	x	0
Churchill	0	x	x	0	0	0	x	0
Iroquois	x	x	x	x	x	x	0	0
Dore	600	0	x	0	0	0	742	1995
Kazan	902	275	952	768	609	1145	1004	3833
Lavallee	1020	x	3019	3790	3569	4897	4890	7229 ^a
Peter Pond	x	x	x	x	x	x	x	0
Preston	x	x	x	275	95	157	70	x
Primrose	2459	2313	4007	4834	6822	6652	5247	5248 ^b
Suggi	680	325	913	1752	1049	1608	3386	4965 ^b
Wasekamio	x	x	x	x	x	x	x	0
SUBTOTAL	5661	2913	8891	11419	12144	14686	15339	23414
PRAIRIE								
Cypress	12	0	x	0	0	90	0	424
Last Mountain	x	0	x	0	0	0	804	3356
Lenore	x	x	x	110	42	162	0	0
Mud	x	138	232	665	437	462	210	1450
Old Wives	746	1420	3084	3075	2617	2184	582	256
Reed	x	x	x	0	0	0	x	1760
Redberry	139	89	72	168	240	347	524	1331
South SK river	x	x	x	x	0	0	x	x
SUBTOTAL	897	1647	3388	4018	3336	3245	2120	8577
SK TOTAL	6558	4560	12279	15437	15480	17931	17459	31991

^aPhotos and nest counts by Parks Canada staff; ^bAerial photos taken when some pelican chicks were in crèches.

Table 2. Colony and population size estimates for breeding Double-crested Cormorants in two eco-regions of Saskatchewan based on aerial photographs. Data from 1968 through 1991 are from previously published reports. The symbol 'x' indicates that a site was not surveyed.

Location	1968	1976	1978	1980	1982	1985	1991	2006
BOREAL PLAIN								
Basin	x	x	x	x	x	745	0	144
Big Sandy	x	x	x	x	x	x	x	23
Canoe	x	x	x	x	x	x	x	299
Churchill	4	x	104	0	790	2508	2506	457
Iroquois	x	x	x	x	x	x	x	0
Dore	70	130	270	849	1464	2204	2497	11513
Kazan	152	1300	753	1587	2544	3120	3862	7929
Lavallee	122	x	651	747	899	1615	2263	3750
Peter Pond	x	x	x	x	x	x	0	0
Preston	x	x	x	0	0	0	85	x
Primrose	136	43	124	459	1041	1217	2336	2476
Suggi	55	220	579	1153	1666	1837	2648	4439
Wasekamio	x	x	x	x	x	x	394	80
SUBTOTAL	539	1693	2481	4795	8404	13246	16591	31110
PRAIRIE								
Alkali	x	x	x	x	15	0	x	x
Cypress	434	535	395	283	329	553	0	120
Last Mountain	x	117	337	789	1202	1764	2854	2182
Lenore	x	x	x	670	651	853	0	0
Mud	x	267	72	75	27	26	0	38
Old Wives	45	319	658	693	147	96	0	88
Redberry	62	29	24	43	53	43	102	24
Reed	x	x	x	62	141	45	0	495
South SK river	x	x	x	x	2	0	x	x
SUBTOTAL	514	1267	1486	2615	2567	3380	2956	2947
SK TOTAL	1080	2960	3967	7410	10971	16626	19547	34057

(33.8% of provincial total) is accessible to humans, and the lake is commonly used by anglers throughout the nesting season. However, the most densely populated cormorant nesting island in Bazil Bay is on a portion of the lake that is closed to all fishing activities and thus is effectively in a disturbance-free area. This distribution of nesting birds in the province suggests that: (1) undisturbed colony sites are important for maintaining the Saskatchewan cormorant population, and (2) 81.1% of the cormorant population is concentrated at just four breeding sites; thus, this species remains potentially vulnerable to human disturbance or other events at breeding colonies despite currently having a large population size.

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