Progress Notes

Canadian Wildlife Service

Progress Notes contain timely data and conclusions and are presented as a service to other wildlife biologists and agencies.

Disponible également en français

No. 205, July 1993

Spring migration of water birds in the North Arm of Great Slave Lake, Northwest Territories, 1990

Jacques Sirois[1]

Introduction

In May 1990, I surveyed the shoreleads (ice-free waters between the shore and the ice) of the North Arm of Great Slave Lake to determine the abundance and distribution of loons, grebes, ducks, geese, swans, and coots and to assess the significance of this area as a spring staging site for water birds. In previous spring surveys (1986–1989), I observed tens of thousands of water birds in parts of the North Arm, and in some years I recorded more than 1% of the eastern continental population of Tundra Swans[2] and of the short-grass prairie population of Canada Geese (Sirois and McCormick 1987; Sirois 1987; Sirois and Cameron 1989; Sirois and Westover 1990).

As a first step towards the designation of Migratory Bird Sanctuaries or National Wildlife Areas in the Northwest Territories (NWT), the Canadian Wildlife Service (CWS) recognizes sites that support at least 1% of the national population of at least one species or subspecies of migratory bird, for any portion of the year, as Key Habitat Sites. Recently, Alexander et al. (1991) identified the east side of the North Arm as a Key Habitat Site. This note provides further substantiation for this designation.

Study area

East and west shores of the North Arm

The east shore of the North Arm of Great Slave Lake (Fig. 1) lies within the Taiga Shield ecoregion (Wiken 1986). It features poorly vegetated Precambrian outcrops, myriad islands and islets, countless peninsulas, thousands of hectares of wetlands, and numerous shallow bays. In May, during spring breakup, islands and peninsulas protect ice-free, nearshore waters from offshore ice that persists well into June.

The east shore also lies along the western margin of an area known as the "Precambrian Edge," which comprises the edge of the Canadian Shield from Great Bear Lake to Lake Athabasca. This area features tens of thousands of productive marshes, ponds, and lakes, as well as higher than usual densities of nesting water birds for this type of boreal environment (Murdy 1964). Such high productivity is apparently caused by postglacial sedimentation and enrichment of glacial Lake McConnell, part of which is now Great Slave Lake.

The west shore of the North Arm lies within the Taiga Plains ecoregion (Wiken 1986). It features gently rolling relief typical of the northern Great Plains, dense forest cover, large bays with narrow shoreline wetlands, and a few large and treed islands. During spring breakup, nearshore waters are often invaded by windblown, offshore ice because of the lack of protective islands. Thus, waters and wetlands along the east shore provide better water bird spring habitat than those along the west shore.

Ice conditions

In 1986–1990, I observed that water appeared in rivers that empty into the North Arm during the second half of April. Under early to normal spring conditions (e.g., 1986, 1987, and 1989),[3] water appears in shallow wetlands in the last days of April. By 10 May, most shallow areas, including the vicinity of islands, are ice-free. On 15 May, shoreleads up to 10 m wide occur in several locations. The lower Beaulieu and Yellowknife rivers and the nearby ponds and small lakes of the Canadian Shield are also largely ice-free. The North Arm's small bays and Devil's Channel are usually ice-free on 20 May, when shoreleads can be 50 m wide at several locations. Large bays are usually ice-free, and shoreleads can be over 1 km wide on 30 May, when large leads have also developed offshore in the North Arm's ice pack. Drifting ice usually occurs in the North Arm until late June.

Under late spring conditions (e.g., 1988, 1990), ice melting patterns are somewhat different. For example, on 14 May 1990, shoreleads were less than 5 m wide in most bays. Scores of ponds and small lakes adjacent to the North Arm and some sections of the lower Beaulieu and Yellowknife rivers were still icebound on 17 May. Devil's Channel was still icebound on 25 May, and ice-free leads were absent offshore in the North Arm on 30 May. As a result, relatively little ice-free water bird habitat was available in northern Great Slave Lake during the 1990 spring migration. In 1990, spring conditions were late throughout the western NWT (Reynolds et al. 1990).

Methods

Aerial surveys and survey sites

I conducted six aerial surveys in the morning, every three to five days, weather permitting, between 10 and 30 May 1990. I surveyed 11 open-water areas along the east shore of the North Arm: the lower Beaulieu River, Goulet and Campbell bays, Devil's Channel, Matonabbee Bay, Cabin

[1] CWS, P.O. Box 637, Yellowknife, NWT X1A 2N5.

[2] See Appendix 1 for scientific names of all bird species mentioned in the text.

[3] The mean temperatures for the first 20 days of May 1986–1990 were 3.6, 2.8, −1.1, 3.9, and 0.9°C, respectively.

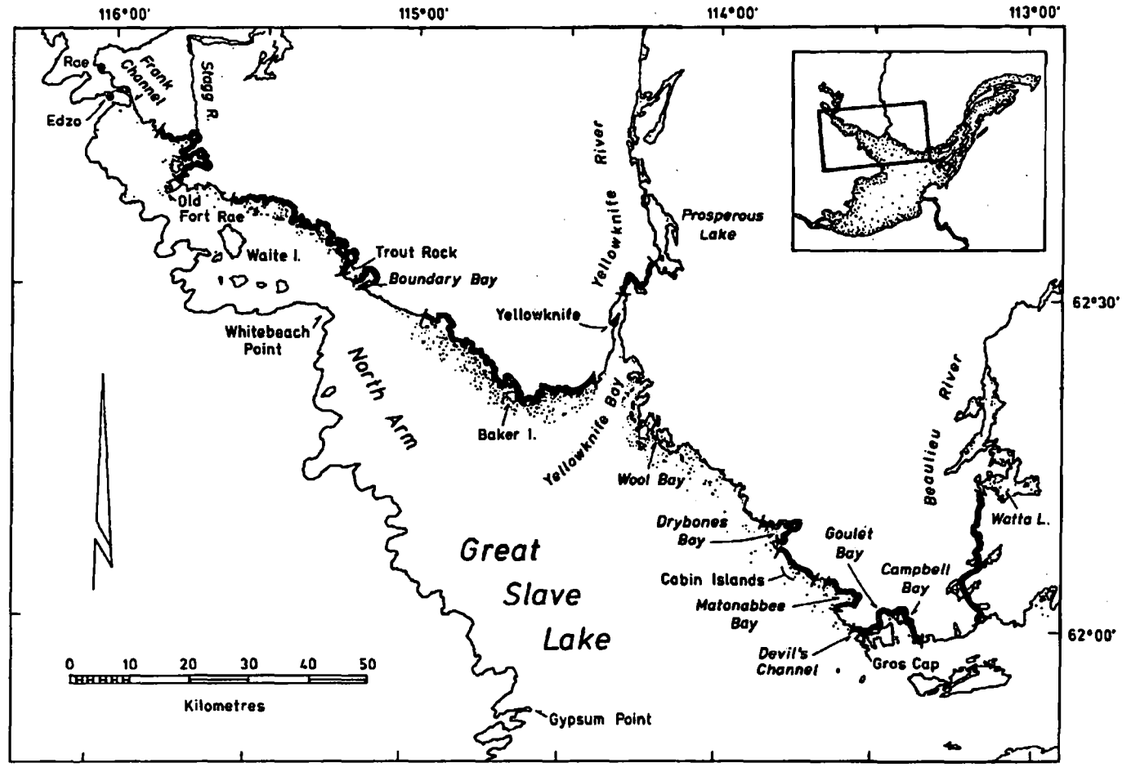
Canada

A member of the Conservation and Protection family

Environment Canada Canadian Wildlife Service

Environnement Canada Service canadien de la faune

Figure 1
The North Arm of Great Slave Lake (thick lines along east shore indicate survey sites)



Islands, Drybones Bay, lower Yellowknife River, Baker Island and adjacent wetlands, Boundary Bay, Trout Rock area and adjacent wetlands, and the wetlands at the mouth of the Stagg River (Fig. 1). Previous aerial surveys and ground reconnaissance had shown that these areas were heavily used by water birds. I conducted the last survey on 30 May because the number of birds had declined sharply and because the open-water areas had become too large to survey effectively.

On 18 May, I surveyed the shorelead along the entire west shore of the North Arm, from Frank Channel to Gypsum Point (Fig. 1). On that day, ice was still continuous offshore and most headlands were icebound. This area had never been surveyed before.

I flew all surveys in a PA-18 Piper Supercub, at approximately 125 km/h and 30 m above ground level. While the pilot flew and navigated the aircraft, I sat in the rear seat and recorded all sightings of loons, grebes, coots, ducks, geese, and swans on tape. I subsequently transferred these records onto forms. Large concentrations of birds were estimated by groups of 20, 50, 100, or 500. I recorded all birds, irrespective of their distance from the flight path. Species that I could not identify were recorded as unidentified water birds. I also took notes on the approximate width of shoreleads and size of open-water areas at all staging sites.

Methodological limitations and visibility correction factor

The accuracy and precision of aerial surveys depend on a number of factors, including the bird species, group size, behaviour, habitat type, weather, observer, and aircraft type (Caughley 1974; Cook and Jacobson 1979; Savard 1982). In general, aerial surveys underestimate animal numbers, often in an inconsistent manner. Thus, many authors have suggested using correction factors to compensate for inaccuracies (Anon. 1987). I used a correction factor of 2.0, as used by Stott and Olson (1972) for wintering waterfowl, for small water birds such as loons, grebes, ducks, and coots, but I did not correct the numbers of geese and swans, which are larger and more visible from an aircraft.

Ice conditions and albedo sometimes hindered the survey, so I resurveyed some areas immediately where I felt it was needed. Fog did not allow me to survey the entire study area on 10, 17, 21, and 29 May. Instead, I surveyed the remaining sites the following mornings and assumed that the birds had not moved significantly overnight.

Table 1
Estimated numbers[a] of water birds at 11 sites on the east shore of the North Arm of Great Slave Lake, May 1990

Species	10–11 May[b]	14 May	17–18 May	21–22 May	25 May	29–30 May	Total records[c]
Red-throated Loon	0	0	4	20	190	2	220
Pacific Loon	0	70	90	200	4	4	370
Common Loon	0	50	480	440	210	35	1 200
Yellow-billed Loon	0	0	0	0	4	2	6
Horned Grebe	0	14	40	0	70	4	130
Red-necked Grebe	18	1 200	2 100	680	290	170	4 500
Tundra Swan	480	550	1 200	2 000	1 400	520	6 200
Lesser Snow Goose	0	0	420	2 800	240	25	3 500
Canada Goose	620	1 000	3 300	32 200	1 500	18	38 600
Green-winged Teal	60	70	8	8	25	12	180
Mallard	4 700	2 200	1 400	480	610	660	10 100
Northern Pintail	9 300	10 800	13 200	11 400	2 000	660	47 400
Northern Shoveler	4	95	95	110	190	70	570
American Wigeon	1 700	2 800	3 000	950	670	620	9 700
Canvasback	500	800	1 000	1 000	370	290	4 000
Redhead	0	6	0	8	0	4	18
Ring-necked Duck	12	70	55	50	8	0	200
Unidentified scaup	0	2 100	6 100	24 100	7 500	1 300	41 100
Oldsquaw	0	0	35	510	150	100	800
Black Scoter	0	0	0	0	2	0	2
Surf Scoter	2	790	450	2 600	1 100	150	5 100
White-winged Scoter	0	0	2	0	14	12	30
Common Goldeneye	20	40	35	70	40	6	200
Barrow's Goldeneye	0	0	4	0	0	0	4
Bufflehead	170	230	300	200	40	110	1 100
Common Merganser	220	110	80	0	2	270	680
Red-breasted Merganser	0	6	40	280	330	70	730
Ruddy Duck	0	0	2	2	0	0	4
American Coot	0	2	0	0	0	2	4
Unidentified water birds	1 300	2 300	1 800	3 700	1 200	1 600	11 900
Total	19 100	25 300	35 200	83 800	18 200	6 700	188 300

[a] Adjusted with visibility correction factor of 2.0 for small species (see Methods) and rounded off as follows: figures <20 were left as is; those between 21 and 99 were rounded to the nearest unit of 5; those between 100 and 999 were rounded to the nearest unit of 10; and those >1000 were rounded to the nearest unit of 100, including totals.
[b] I could not survey the entire study area on 10, 17, 21, and 29 May because of fog. I surveyed the remaining sites the following mornings.
[c] Several birds may have been recorded more than once.

Results and discussion

Diversity of spring migrants

I recorded 29 species of water birds, including loons, grebes, ducks, geese, swans, and coots (Table 1). The 10 most common species were, in order of abundance (total number of records): Northern Pintail, scaup spp., Canada Goose, Mallard, American Wigeon, Tundra Swan, Surf Scoter, Red-necked Grebe, Canvasback, and Lesser Snow Goose. These species were recorded in past surveys (1986–1989), but in most cases their relative abundances varied greatly from year to year (Sirois and McCormick 1987; Sirois 1987; Sirois and Cameron 1989; Sirois and Westover 1990). Several other species, particularly larids and shorebirds (Appendix 1), were present, but I did not record them.

Abundance of spring migrants

I estimated that more than 90 000 water birds occurred in the study area when migration peaked on 21–22 May. This included over 46 800 loons, grebes, ducks, and coots, 2000 Tundra Swans, 2800 Lesser Snow Geese, and 32 200 Canada Geese at the 11 sites along the east shore (Table 1), plus approximately 8400 water birds[4] along the west shore. This excluded thousands of birds of approximately 50 additional species (Appendix 1) that I did not count.

Canada Geese, scaup, and Northern Pintails were particularly abundant along the east shore, with peaks of 32 200, 24 100, and 13 200 individuals, respectively (Table 1). The factor that most influenced the abundance of these birds appeared to be late spring conditions. Relatively little ice-free habitat was available to water birds in northern Great Slave Lake in May 1990. Tens of thousands of ponds and lakes that are adjacent to the North Arm were icebound until after mid-May, even later for large lakes. This forced staging water birds to concentrate in and near the North Arm, where some rivers, vast wetlands, and shallow turbid waters

[4] This was estimated as 10% of the total of birds on the east shore, as suggested by the survey of 18 May (Table 2).

Table 2
Estimated numbers[a] of water birds along the east and west shores of the North Arm of Great Slave Lake, 17–18[b] May 1990

Species	East shore	West shore
Red-throated Loon	4	0
Pacific Loon	90	0
Common Loon	480	0
Horned Grebe	40	0
Red-necked Grebe	2 100	0
Tundra Swan	1 200	230
Lesser Snow Goose	420	0
Canada Goose	3 300	290
Green-winged Teal	8	14
Mallard	1 400	470
Northern Pintail	13 200	1 380
Northern Shoveler	95	14
American Wigeon	3 000	450
Canvasback	1 000	70
Ring-necked Duck	55	0
Unidentified scaup	6 100	40
Oldsquaw	35	0
Surf Scoter	450	0
White-winged Scoter	2	0
Common Goldeneye	35	0
Barrow's Goldeneye	4	0
Bufflehead	300	0
Common Merganser	80	20
Red-breasted Merganser	40	30
Ruddy Duck	2	0
Unidentified water birds	1 800	170
Total	35 200	3 200

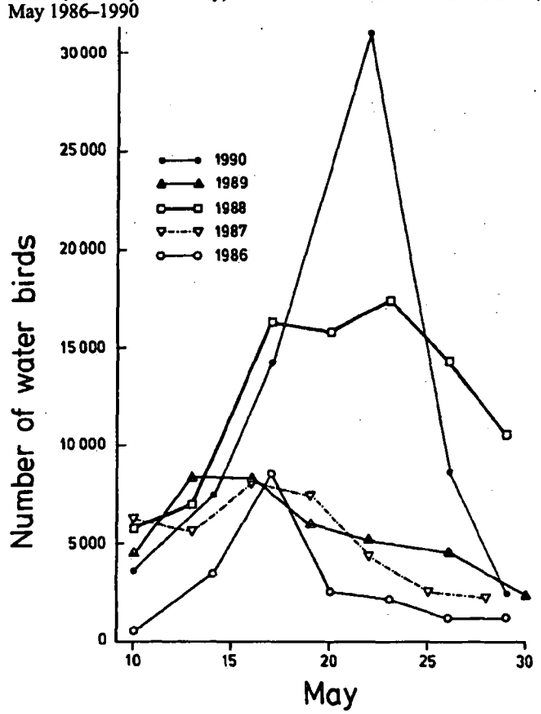
[a] Adjusted with visibility correction factor of 2.0 for small species (see Methods) and rounded off as follows: figures <20 were left as is; those between 21 and 99 were rounded to the nearest unit of 5; those between 100 and 999 were rounded to the nearest unit of 10; and those >1000 were rounded to the nearest unit of 100, including totals.
[b] I could not survey the entire east shore study area on 17 May because of fog. I surveyed half of the east shore on 17 May and the remaining sites on 18 May. The west shore survey was conducted on 18 May.

provide relatively abundant ice-free habitat even during late springs. This phenomenon also occurred in 1988, another year with a late spring (Fig. 2).

As I did not attempt to determine lengths of stay or turnover rates for any species, I cannot estimate how many birds staged in the study area during the entire migration. As suggested by Table 1, some birds apparently stayed longer than others. For example, the number of scaup increased steadily, peaked, and declined between 10 and 30 May, but pintails were relatively abundant from the first survey until 22 May. This suggests that many pintails that arrived in early May waited for spring conditions to improve in late May before moving farther north, and that the large number of pintail records was the result of birds being counted repeatedly.

On 17–18 May, I estimated that about 2100 Red-necked Grebes staged along the North Arm's east shore. This figure

Figure 2
Abundance of water birds at six sites (lower Beaulieu River, Goulet–Campbell bays, Devil's Channel, Matonabbee Bay, Cabin Islands, and Drybones Bay) in the North Arm of Great Slave Lake, May 1986–1990



is of interest in light of de Smet's (1982) estimate of the national population: over 5500 breeding adults, including 50+ adults in Yukon and the NWT. However, this author conceded that, in light of a lack of coverage in northern areas, the national population could exceed 20 000 individuals. This is also suggested by V. Stotts' estimate (unpubl. data) of a yearly average (1980–1982) of nearly 20 200 Red-necked Grebes in strata 13–18 (western NWT) of the Waterfowl Breeding Transects. Grebes were particularly abundant in stratum 18 (estimated yearly average of 13 618 grebes), which includes areas surrounding the North Arm.

Chronology of the water bird spring migration

Most water birds arrive in northern Great Slave Lake in May, but Common Mergansers and Mallards begin arriving in the second half of April. Most migrants have left this region by the end of May, but some, Yellow-billed Loons and Oldsquaw for example, may occur until mid-June (pers. obs.).

In 1990, I recorded a peak number of water birds during the 21–22 May aerial surveys (Table 1). Ground observations at the lower Yellowknife River indicated that the peak occurred between 21 and 23 May. The 1990 peak occurred approximately one week later than in 1986, 1987, and 1989, years without late springs, but more or less at the same time as in 1988, another year with a late spring (Fig. 2). Figure 2 also shows that water birds spent a longer time in the North Arm in 1990 and 1988 than in 1986, 1987, and 1989.

At the end of May, I also recorded ducks that appeared to be premoulters or early moult migrants. Starting on 21 May, most Mallards that I counted were males in small groups, and their numbers increased slowly until the last survey (Table 1). I suspect that they were birds from nearby areas that had abandoned incubating females and moved into the North Arm's wetlands to moult. Also, Common Mergansers began to reappear in noticeable numbers at the very end of May (Table 1). Nearly all of these birds were males, and they occurred in large (>80 birds) flocks. I suspect that they came from regions to the south or from nearby areas, either to moult or to stage during a moult migration that leads them farther north. In June, July, and August, I observed thousands of moulting ducks, including hundreds of Mallards and Common Mergansers, while boating in the North Arm.

Spatial distribution of spring migrants

Four sites along the east shore supported bird densities higher than average: Boundary Bay, lower Yellowknife River, Matonabbee Bay, and lower Beaulieu River (Table 3). Three other sites along the east shore's northern half — Trout Rock wetlands, Baker Island wetlands, and Stagg River wetlands — supported large numbers (>5000) of birds, but densities were lower than average.

The Yellowknife and Beaulieu rivers are the two largest rivers that empty into the North Arm. Their lower reaches provide relatively large areas of open water very early in May before all other sites and feature extensive wetlands along their shores. Boundary Bay consists of a large shallow bay fed by a small river (Boundary Creek) and surrounded by vast and lush wetlands that are also ice-free relatively early in May. Matonabbee Bay is another large shallow bay surrounded by wetlands. It is very similar to nearby Drybones, Goulet, and Campbell bays, which, as previous surveys (1986–1989) have shown, sometimes attract more birds.

Overall, birds were more abundant, albeit less concentrated, along the northern half of the North Arm's east shore, between the Yellowknife and the Stagg rivers. In this area, wetlands occupy most of the shoreline and are protected from offshore conditions by numerous islands. Wetlands are less abundant and disjunct along the southern half of the east shore. They are usually confined to bays, where protection from offshore conditions is provided by fewer islands.

I did not observe any significant concentration of birds along the west shore of the North Arm. Compared to the east side, water bird habitat was marginal there. There was relatively little open water along the shore, and there were only narrow wetlands along the shoreline.

Key Habitat Site

In May 1990, approximately 6% of the short-grass prairie population of Canada Geese and 2% of the eastern continental population of Tundra Swans staged in the ice-free waters and wetlands along the east shore of the North Arm of Great Slave Lake. These percentages exceed the 1% criterion used to designate a Key Habitat Site (Alexander et al. 1991).

Table 3
Relative importance of 11 staging sites along the east shore of the North Arm of Great Slave Lake, 21–22[a] May 1990

Sites	Number of water birds[b]	Length of survey route (km)	Density (birds/km)[c]
Lower Beaulieu River	15 500	25	620
Goulet–Campbell bays	3 700	12	310
Devil's Channel	2 000	6	335
Matonabbee Bay	5 000	8	625
Cabin Islands	1 200	8	150
Drybones Bay	3 600	13	280
Lower Yellowknife River	8 900	10	890
Baker Island wetlands	10 500	40	260
Boundary Bay	13 500	8	1 690
Trout Rock wetlands	13 500	40	340
Stagg River wetlands	6 400	20	320
Total	83 800	190	440

[a] I could not survey the entire study area on 21 May because of fog. I surveyed the remaining sites on 22 May.
[b] Adjusted with visibility correction factor of 2.0 for small species (see Methods) and rounded to the nearest unit of 100, including total.
[c] Rounded to the nearest unit of 5.

The short-grass prairie population of Canada Geese comprised 536 000 individuals in 1990 (Bortner et al. 1991). The geese that migrate through Great Slave Lake belong to this population, which breeds entirely in Canada (Bellrose 1976; Bortner et al. 1991). On 21–22 May, approximately 32 200 Canada Geese, or about 6% of this population, staged along the North Arm's east shore. Nearly one-third of these geese were in Boundary Bay, and more than 3000 geese occurred at each of the following sites: Matonabbee Bay, Drybones Bay, Baker Island area, Trout Rock area, and near the mouth of the Stagg River.

The eastern continental population of Tundra Swans comprised 90 000 individuals in 1990 (Reynolds et al. 1990). On 21–22 May, 2000 swans staged along the North Arm's east shore. This represents more than 2% of the eastern continental population. The largest concentration (460) of swans occurred in the lower Beaulieu River.

Conclusion

Aerial surveys in the North Arm in 1990 and in 1986–1989 have shown that the shoreleads and ice-free wetlands and rivers on the east side of the North Arm regularly support more than 10 000 ducks, geese, and swans during spring migration. Thus, this area qualifies as a "Wetland of International Importance" under the terms of the Ramsar Convention (International Union for Conservation of Nature and Natural Resources, n.d.). However, this large Key Habitat Site (1100 km²) attracts fewer spring staging birds

than the Slave Delta, another Key Habitat Site (425 km²) on the south shore of Great Slave Lake (Alexander et al. 1991).

As shown in May 1990 and in May 1988, the North Arm supports more spring staging water birds, and during a longer period, when late spring conditions occur. Then, ice-free habitat is less available in northern Great Slave Lake but is nonetheless relatively abundant along the east side of the North Arm, where some rivers, vast wetlands, and shallow, turbid waters favour the early appearance of ice-free habitat.

The east side of the North Arm is a Key Habitat Site for at least three species of migratory birds: Canada Goose, Tundra Swan, and Caspian Tern[5] (McCormick and Sirois 1988; Sirois et al. 1989). Additional surveys of spring and fall migrants and moulting and nesting waterfowl currently being carried out by CWS will help refine our understanding of the significance of the North Arm of Great Slave Lake and the adjacent wetland habitats.

Acknowledgements

Pilot B. Warner of Air Tindi, Yellowknife, provided excellent service. R.S. Ferguson, J.E. Hines, and K.J. McCormick reviewed the manuscript and provided numerous comments. Autumn Downey drafted the figures.

References

Alexander, S.A.; Ferguson, R.S.; McCormick, K.J. 1991. Key migratory bird terrestrial habitat sites in the Northwest Territories. Can. Wildl. Serv. Occas. Pap. No. 71, Ottawa. 184 pp.

American Ornithologists' Union. 1983. Check-list of North American birds. 6th ed. 877 pp.

American Ornithologists' Union. 1985. Thirty-fifth supplement to the American Ornithologists' Union check-list of North American birds. Auk 102: 680–686.

American Ornithologists' Union. 1989. Thirty-seventh supplement to the American Ornithologists' Union check-list of North American birds. Auk 106: 532–536.

Anonymous. 1987. Standard operating procedures for aerial waterfowl breeding ground population and habitat surveys in North America. U.S. Fish and Wildlife Service and Canadian Wildlife Service, Patuxent, Md.

Bellrose, F.C. 1976. Ducks, geese and swans of North America. 2nd ed. Stackpole Books, Harrisburg, Pa. 540 pp.

Bortner, J.B.; Johnson, F.A.; Smith, G.W.; Trost, R.E. 1991. Status of waterfowl and fall flight forecast. U.S. Fish and Wildlife Service, Laurel, Md.

[5] Although 1% of the Canadian population of Caspian Terns nests in the North Arm, this species occurs in low numbers during spring migration. Like all other larids, it was not recorded during these surveys.

Caughley, G. 1974. Bias in aerial survey. J. Wildl. Manage. 38: 928–933.

Cook, R.D.; Jacobson, J.O. 1979. A design for estimating visibility bias in aerial surveys. Biometrics 35: 735–742.

de Smet, K.D. 1982. Status report on the Red-necked Grebe *Podiceps grisegena*. Committee on the Status of Endangered Wildlife in Canada. 104 pp.

International Union for Conservation of Nature and Natural Resources. No date. The Ramsar Convention. Ramsar Convention Bureau, Gland, Switzerland. 14 pp.

McCormick, K.J.; Sirois, J. 1988. Larid breeding sites on the North Arm of Great Slave Lake, Northwest Territories, 1986. Can. Wildl. Serv. Tech. Rep. Ser. No. 30, Yellowknife. 44 pp.

Murdy, H.W. 1964. Population dynamics and breeding biology of waterfowl on the Yellowknife study area, Northwest Territories. Unpubl. rep., U.S. Fish and Wildlife Service, Jamestown, N.D. 61 pp.

Reynolds, R.E.; Blohm, R.J.; Johnson, F.A.; Bortner, J.B. 1990. 1990 status of waterfowl and fall flight forecast. U.S. Fish and Wildlife Service, Laurel, Md. 43 pp.

Savard, J.-P.L. 1982. Variability of waterfowl aerial surveys: observer and air–ground comparisons — preliminary report. Can. Wildl. Serv. Prog. Notes No. 127, Ottawa. 6 pp.

Sirois, J. 1987. Spring migration of waterfowl in the Yellowknife – Thor Lake area, NWT: 1987. Can. Wildl. Serv. Tech. Rep. Ser. No. 32, Yellowknife. 38 pp.

Sirois, J.; Cameron, G.B. 1989. Spring migration of waterfowl in the Yellowknife – Thor Lake area, NWT: 1988. Can. Wildl. Serv. Tech. Rep. Ser. No. 58, Yellowknife. 39 pp.

Sirois, J.; McCormick, K.J. 1987. Spring migration of waterfowl in the Yellowknife – Thor Lake area, NWT: 1986. Can. Wildl. Serv. Tech. Rep. Ser. No. 24, Yellowknife. 36 pp.

Sirois, J.; Westover, S.E. 1990. Spring migration of waterfowl in the North Arm of Great Slave Lake, 1989. Can. Wildl. Serv. Tech. Rep. Ser. No. 111, Yellowknife. 25 pp.

Sirois, J.; Cameron, G.B.; McCormick, K.J. 1989. Larid breeding sites between Yellowknife and Gros Cap, North Arm of Great Slave Lake, Northwest Territories, 1987. Can. Wildl. Serv. Tech. Rep. Ser. No. 69, Yellowknife. 42 pp.

Stott, R.S.; Olson, D.P. 1972. An evaluation of waterfowl surveys on the New Hampshire coastline. J. Wildl. Manage. 36: 468–477.

Wiken, E. (comp.). 1986. Terrestrial ecozones of Canada. Ecological Land Classification Series No. 19, Lands Directorate, Environment Canada, Ottawa. 25 pp.

Appendix 1
Water bird species recorded[a] during spring migration in or near the North Arm of Great Slave Lake, 1986–1990

Common name[b]	Scientific name	Abundance[c]
Red-throated Loon	*Gavia stellata*	F
Pacific Loon	*Gavia pacifica*	C
Common Loon	*Gavia immer*	C
Yellow-billed Loon	*Gavia adamsii*	O
Horned Grebe	*Podiceps auritus*	C
Red-necked Grebe	*Podiceps grisegena*	C
Tundra Swan	*Cygnus columbianus*	C
Greater White-fronted Goose	*Anser albifrons*	F
Lesser Snow Goose	*Chen caerulescens caerulescens*	C
Ross' Goose	*Chen rossii*	R
Canada Goose	*Branta canadensis*	C
Green-winged Teal	*Anas crecca*	C
American Black Duck	*Anas rubripes*	R
Mallard	*Anas platyrhynchos*	C
Northern Pintail	*Anas acuta*	C
Blue-winged Teal	*Anas discors*	F
Cinnamon Teal	*Anas cyanoptera*	R
Northern Shoveler	*Anas clypeata*	C
Gadwall	*Anas strepera*	O
Eurasian Wigeon	*Anas penelope*	R
American Wigeon	*Anas americana*	C
Canvasback	*Aythya valisineria*	C
Redhead	*Aythya americana*	O
Ring-necked Duck	*Aythya collaris*	F
Greater Scaup	*Aythya marila*	F
Lesser Scaup	*Aythya affinis*	C
Harlequin Duck	*Histrionicus histrionicus*	R
Oldsquaw	*Clangula hyemalis*	C
Black Scoter	*Melanitta nigra*	O
Surf Scoter	*Melanitta perspicillata*	C
White-winged Scoter	*Melanitta fusca*	F
Common Goldeneye	*Bucephala clangula*	C
Barrow's Goldeneye	*Bucephala islandica*	O
Bufflehead	*Bucephala albeola*	C
Hooded Merganser	*Lophodytes cucullatus*	O
Common Merganser	*Mergus merganser*	C
Red-breasted Merganser	*Mergus serrator*	C
Ruddy Duck	*Oxyura jamaicensis*	F
Sora	*Porzana carolina*	F
American Coot	*Fulica americana*	F
Sandhill Crane	*Grus canadensis*	F
Whooping Crane	*Grus americana*	R
Black-bellied Plover	*Pluvialis squatarola*	O
Lesser Golden-Plover	*Pluvialis dominica*	C
Semipalmated Plover	*Charadrius semipalmatus*	F
Killdeer	*Charadrius vociferus*	F
Greater Yellowlegs	*Tringa melanoleuca*	F
Lesser Yellowlegs	*Tringa flavipes*	C
Solitary Sandpiper	*Tringa solitaria*	R
Spotted Sandpiper	*Actitis macularia*	C
Whimbrel	*Numenius phaeopus*	R
Hudsonian Godwit	*Limosa haemastica*	R
Ruddy Turnstone	*Arenaria interpres*	O

Appendix 1 (continued)
Water bird species recorded[a] during spring migration in or near the North Arm of Great Slave Lake, 1986–1990

Common name[b]	Scientific name	Abundance[c]
Semipalmated Sandpiper	*Calidris pusilla*	C
Least Sandpiper	*Calidris minutilla*	F
White-rumped Sandpiper	*Calidris fuscicollis*	R
Baird's Sandpiper	*Calidris bairdii*	R
Pectoral Sandpiper	*Calidris melanotos*	O
Dunlin	*Calidris alpina*	R
Stilt Sandpiper	*Calidris himantopus*	O
Dowitcher sp.	*Limnodromus* sp.	O
Common Snipe	*Gallinago gallinago*	C
Wilson's Phalarope	*Phalaropus tricolor*	R
Red-necked Phalarope	*Phalaropus lobatus*	F
Red Phalarope	*Phalaropus fulicaria*	R
Parasitic Jaeger	*Stercorarius parasiticus*	O
Long-tailed Jaeger	*Stercorarius longicaudus*	R
Bonaparte's Gull	*Larus philadelphia*	C
Mew Gull	*Larus canus*	C
Ring-billed Gull	*Larus delawarensis*	F
California Gull	*Larus californicus*	C
Herring Gull	*Larus argentatus*	C
Glaucous Gull	*Larus hyperboreus*	O
Sabine's Gull	*Xema sabini*	R
Caspian Tern	*Sterna caspia*	F
Common Tern	*Sterna hirundo*	C
Arctic Tern	*Sterna paradisaea*	C
Black Tern	*Chlidonias niger*	F
Belted Kingfisher	*Ceryle alcyon*	F

[a] Most of these species were reported by ground observers from Yellowknife, NWT. I also observed many of them during aerial surveys.
[b] Common and scientific names from American Ornithologists' Union (1983, 1985, 1989).
[c] R = rare, reported only once or twice in 1986–1990; O = occasional, not observed each year and occurs in low numbers; F = fairly common, observed yearly but irregularly and in low numbers; C = common, observed yearly and regularly, often in large numbers.

CANADA'S GREEN PLAN

Published by Authority of the Minister of the Environment

Catalogue No. CW69-9/205E
ISBN 0-662-20681-9
ISSN 0069-0023