4.4.1 Canvasback *Aythya valisineria* (Mr, We)
(by Pierre Brousseau and Christine Lepage)

The Canvasback breeds exclusively in North America. In Canada, the species' breeding range extends from Yukon and British Columbia east to Manitoba and extreme southern Ontario (Tardif and Gagnon 1996; Mowbray 2002). However, its core breeding range is in the Prairie pothole and aspen parkland region of Canada and the United States (Mowbray 2002; Hohman 2005a). In Eastern North America, it winters along the Atlantic Coast from Massachusetts to Florida, with the greatest concentrations occurring in the Chesapeake Bay (Maryland), Pamlico and Currituck sounds (North Carolina) and lakes Ontario, Erie and St. Clair in Ontario (Mowbray 2002; American Ornithologists' Union 1998).

Breeding

There are only two breeding records for the species in Quebec, one in Lake Chicobi in the Abitibi region (BCR 8) and the other in the Ashuapmushuan Wildlife Reserve northwest of Lac Saint-Jean (BCR 8). These records are somewhat questionable, however, due to the lack of supporting information (Tardif and Gagnon 1996). Aside from these two anecdotal records, there is no evidence that the Canvasback breeds in Quebec. According to ÉPOQ data, however, the species is occasionally present for certain periods in June, July and August in the province (1990: Baie-du-Febvre [BCR 13]; 1997: Cacouna [BCR 13]).

Migration

According to ÉPOQ data, the species was present regularly during migration, albeit in small numbers, in the 1960s and 1970s. In the spring of 1976, unusual records of 1,000 and 1,500 birds were obtained around Île Perrot and Île aux Noix, respectively. The following years, up to 200 and 500 birds were seen in the spring and fall of 1978 at Oka, 400 in April 1981 off Île Perrot, 500 in December 1983 in Vaudreuil, 850 in October 1984 off Île Perrot, and 150 in March 1985 at Valleyfield. Since then, there have been no groups observed larger than 40 birds and most contained 1–3 individuals (ÉPOQ). The reasons for this change are unknown.

In the fall, aerial surveys carried out by CWS in the 1970s reported large flocks, or rafts, of 2,000–3,000 birds—even as many as 50,000 birds in 1973—in lakes Saint-François and Saint-Pierre (Lehoux et al. 1985). These are probably exceptional records, although the lack of recent aerial surveys in fall on these riverine lakes makes it impossible to determine to what extent the St. Lawrence is currently being used as a stopover site for the species.

Nowadays, the Canvasback is seen during migration in southwestern Quebec but only in small numbers, both in spring and fall. In spring, recent records involving only one or two individuals have been obtained in the following locations: Verdun in the Montréal region (David et al. 2000; Bannon et al. 2005a); Noyan, Saint-Jean-sur-Richelieu and the Sorel Islands in the Montérégie region (Bannon et al. 2005a; WSHO); Victoriaville in the Centre-du-Quebec region (David et al. 2000); Baie-Sainte-Catherine in the Charlevoix region (Aubry et al. 1999); Métabetchouan in the Lac-Saint-Jean region (David et al. 2000); and Cacouna in the Bas-Saint-Laurent region (David et al. 2000). In fall, records have been obtained exclusively in the Montréal (Pointe-Claire and Île Perrot) (Bannon et al. 2003b; Bannon et al. 2006a), Centre-du-Quebec (Baie-du-

Febvre) (Bannon et al. 2000) and Saguenay (La Baie) regions (Bannon et al. 2000), all involving one to six individuals; this is not an annual occurrence, however.

Wintering

Since 1990, there has only been one known case of the Canvasback overwintering in Quebec, during the winter of 2001–2002 in the Montréal region (Bannon 2008; ÉPOQ). Although Cyr (Cyr 1995l) stated that, because of the species' regular occurrence in fairly large numbers in winter, Quebec should be considered as part of the Canvasback's winter range, there is very little recent ÉPOQ data (up to 2006) to support this hypothesis, since the species has only wintered exceptionally in the province in recent years.

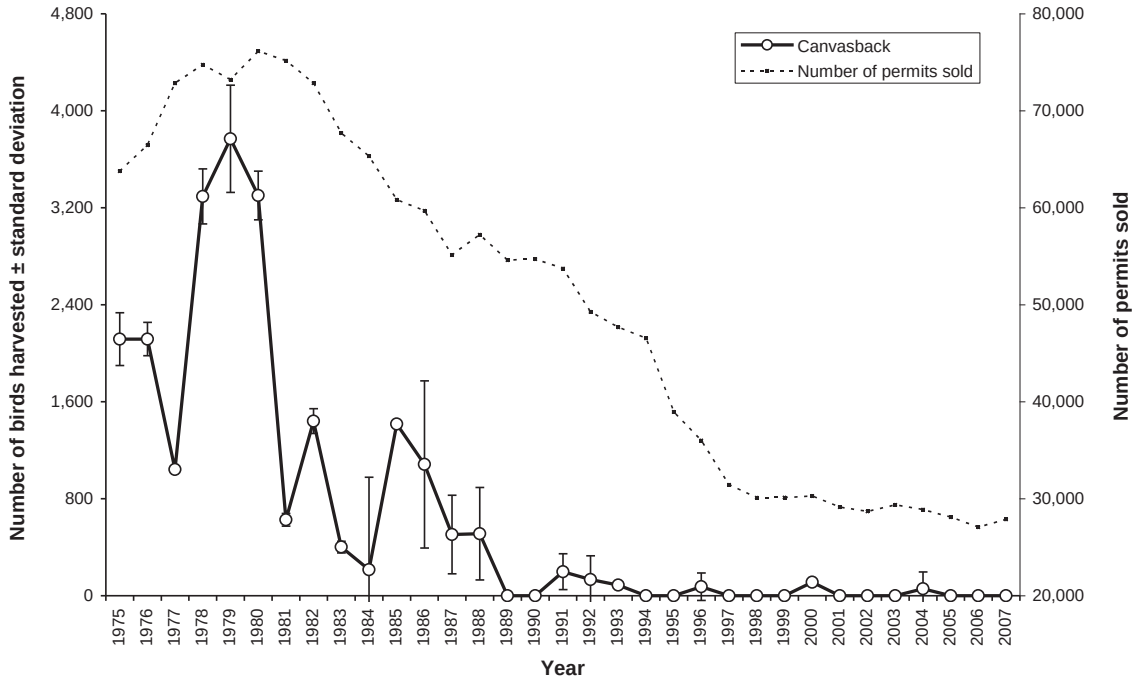
Conservation

The Canvasback population is one of the smallest among ducks not considered at risk under North American species at risk legislation. In recent years, the population has hovered around 500,000 to 700,000 individuals (U.S. Fish and Wildlife Service 2008), which is very small compared to the North American populations of the Mallard (13.0 million) and Lesser Scaup (4.4 million), for example (Table 2). According to USFWS winter surveys, Canvasback numbers in the Atlantic Flyway have been declining steadily since the surveys began in 1955. At that time, the average count was 167,300 individuals (1955–1960), while only 65,800 birds were observed on average during the 2001–2005 period (Serie and Raftovich 2005).

The species' migratory pattern may have changed because of habitat losses or modifications, or changes in the availability or abundance of food resources (Hohman 2005a). In fact, the distribution of this species is very closely linked to the availability of its main food source outside breeding season, *Vallisneria americana,* or wild-celery (Mowbray 2002; Hohman 2005a). Habitat loss or drought in the Prairies, coastal development in the wintering grounds, and water quality are some of the factors suggested to explain the decline in North American populations (Hohman 2005a).

The species is hunted in Canada and the United States, although severe restrictions have been imposed on the Canvasback hunt in the U.S. in the past. The annual Canadian harvest, which takes place mainly in Saskatchewan, Manitoba and Ontario, is around 7,000 birds (Canadian Wildlife Service Waterfowl Committee 2007). On average, 5,600 Canvasbacks were taken annually by U.S. hunters along the Atlantic Flyway in 2000–2007 (Padding and Klimstra 2008). In Quebec, although the average annual harvest between 1975 and 1984 was 1,800 birds, the harvest is now marginal (Table 3; Figure 56).

Figure 56. Estimated Canvasback sport harvest in Quebec and number of Migratory Game Bird Hunting Permits sold, 1975–2007 (data taken from Gendron and Collins 2007)



Since this western bird is strictly a migrant in the province, occurring in very small numbers, Quebec plays a very minor role in the conservation of this species. Although the province hosted several thousand migrants annually in the 1970s, this no longer occurs.

4.4.2 Redhead *Aythya americana* (Mr, Br, We)
(by Pierre Brousseau and Christine Lepage)

The Redhead, an exclusively North American species, breeds mainly in the Canadian Prairies and U.S. Great Plains and Western states. It also nests locally in Alaska, the Great Lakes states, and southern Ontario and Quebec (Shaffer and Rail 1996; Woodin and Michot 2002; Michot and Woodin 2005; Sandilands 2005). The species winters mainly in the western, southern and eastern United States and in Mexico and Central America, with the largest winter concentrations occurring along the Gulf of Mexico (Woodin and Michot 2002; Michot and Woodin 2005).

Breeding

The Redhead is a relatively recent addition to the breeding anatids of Quebec. Although breeding was suspected as early as the late 1950s, it was not confirmed until 1961 on Lake Saint-François (Alliston 1979). Since then, the species has expanded its breeding range in Quebec but is still mainly restricted to the southwestern part of the province (BCR 13). The Redhead prefers building its nest near lakes or large freshwater marshes, in dense emergent vegetation (e.g., bulrushes, cattails and sedges) where the nest is well concealed. Although it is a diving duck, it feeds primarily on aquatic vegetation and plant seeds in bodies of water almost always less than 2 m deep (Shaffer and Rail 1996).

The Redhead is found mainly in Lake Saint-François (BCR 13), the islands downstream from Montréal (BCR 13), Lake Saint-Pierre (BCR 13), and the Saint-Gédéon and Saint-Fulgence marshes (Saguenay–Lac-Saint-Jean; BCR 8) (Shaffer and Rail 1996; ÉPOQ). Although the species has been observed in summer at Cap Tourmente (Québec City; BCR 13) and in the Plaisance area (Outaouais; BCR 13) (Shaffer and Rail 1996), breeding has never been confirmed at either location. The sighting of a group of three drakes and two hens in June 2002 at Brisay, near the Caniapiscau Reservoir (BCR 7), is an usual record at this northern latitude (Bannon et al. 2002b).

Migration

During migration, the Redhead is found mainly in the St. Lawrence lowlands (including Baie-du-Febvre and the Vaudreuil-Oka sector; BCR 13) and the Estrie (BCR 14), Lac-Saint-Jean (BCR 8) and Bas-Saint-Laurent (BCR 14) regions (ÉPOQ; Cyr 1995m). Sightings most often consist of small groups of 2 to 5 individuals, although there are a small number of exceptional records of over 100 birds. According to the ÉPOQ database, there are only 8 records between 1958 and 2005 of flocks of 100 or more Redheads, including a raft of 500 in Anse de Vaudreuil in 1983. More recent spring sightings include 100 birds in 2001 and 200 birds in 2005 at Baie-du-Febvre (ÉPOQ). Fall 2005 also saw sizeable groups observed in the Abitibi (BCR 12), Lac-Saint-Jean (BCR 8), Lower St. Lawrence (BCR 14) and Gaspé (BCR 14) regions (Bannon et al. 2006a), with a peak of 180 individuals at Métabetchouan (Lac-Saint-Jean region) in late September of the same year (Bannon et al. 2006a). The large numbers of Redheads observed in migration in 2005 was also reflected in the harvest numbers for the species (see below). In addition, the species has been reported as far east as the Mingan Islands and Magdalen Islands during migration (ÉPOQ), although records are rare in general east of the Saguenay River.

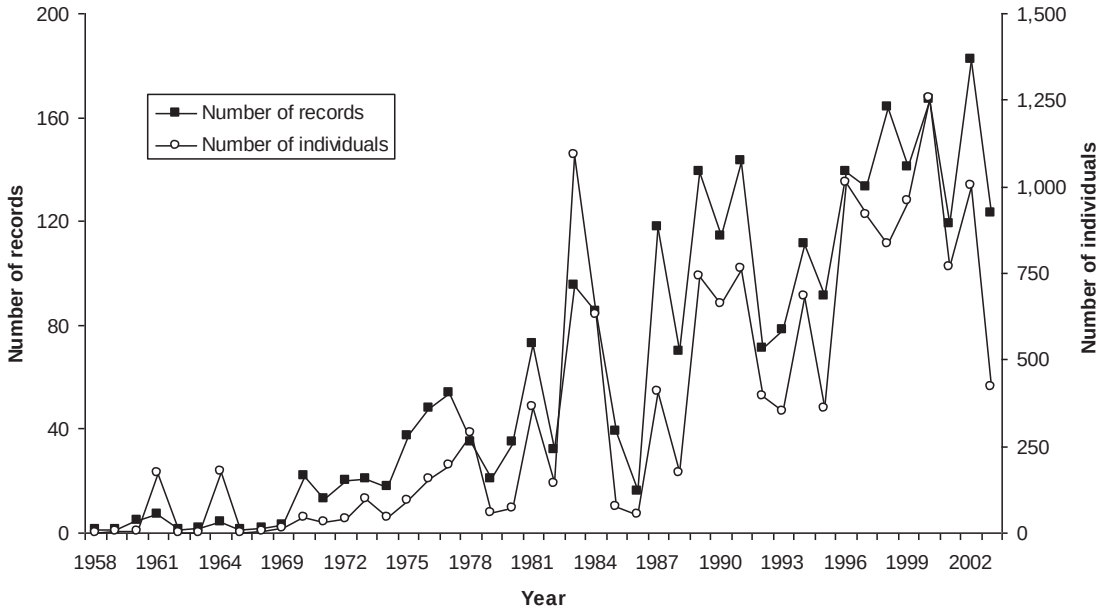
Wintering

The species, which is considered exceptional in winter in the province, occasionally overwinters here, mainly in the Montréal region (Cyr 1995m; David 1996; Bannon et al. 2001b; Bannon 2008).

Conservation

The North American Redhead population is estimated at roughly 1.2 million birds (1994–2003 average; Table 2), which is about average for North American waterfowl populations. There is no specific information about the Quebec population but, according to rough estimates, it is likely fewer than 100 breeding pairs (Table 2). Long-term surveys show significant fluctuations in the continent-wide population over the last 20 years, including a fairly steep decline from 1999 to 2006 following a drought in the U.S. and Canadian prairies (U.S. Fish and Wildlife Service 2008). In Quebec, there has been a clear increase over the years in both the number of records and individuals per record, despite some major fluctuations (Figure 57) (ÉPOQ).

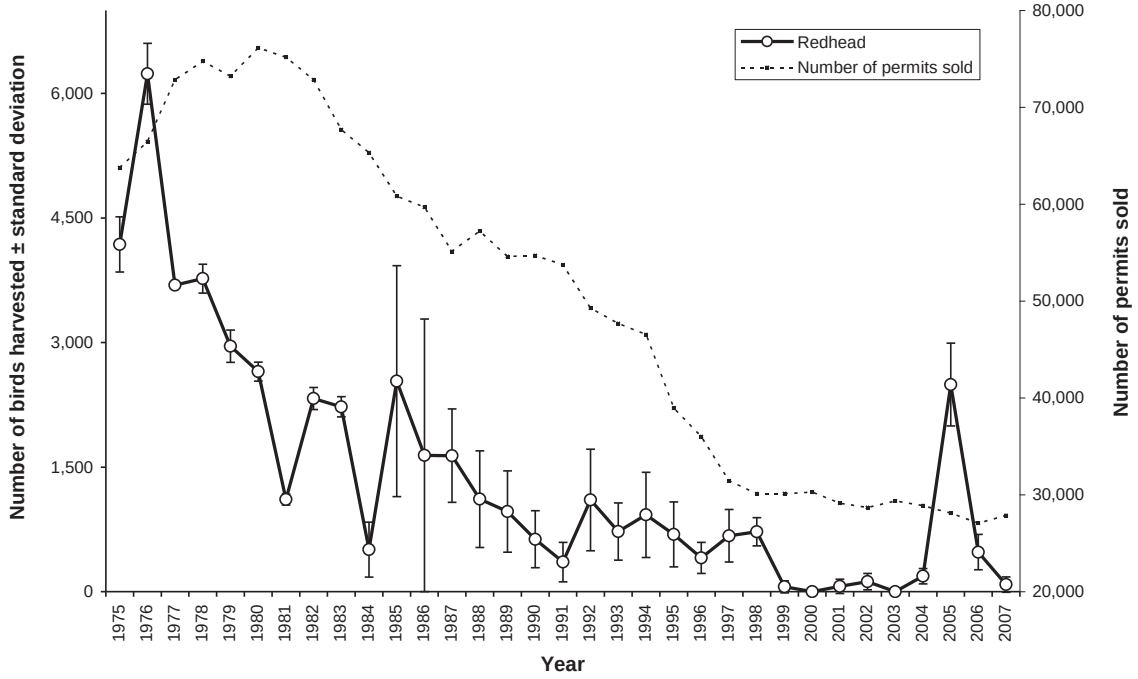
Figure 57. Number of Redhead records and individuals observed according to ÉPOQ data



Although the conservation issues discussed here mainly affect the Redhead in the species' core breeding and wintering ranges, they may also have an impact on breeding populations in eastern North America or at the very least point to potential areas of concern in Quebec. One of the main issues affecting the species is the conversion of wetlands to farmland in the Prairies (Michot and Woodin 2005). On the species' southern wintering grounds (United States and Mexico), food availability and the loss of coastal ponds are probably limiting factors (Michot and Woodin 2005). In addition, annual mortality in the species appears to be very high, particularly in immature birds (75%) (Michot and Woodin 2005), and hatching success and productivity are low (Shaffer and Rail 1996). Lastly, females make up a smaller percentage of the population than males, and some females do not nest in years when conditions are unfavourable (Woodin and Michot 2002).

In Canada, Redheads are hunted mainly in Ontario and the Prairie provinces (Gendron and Collins 2007). Although estimated harvests fluctuate from year to year, there is a clear long-term downward trend in harvests, which obviously echoes the decline in the number of migratory bird hunters in both Quebec and Canada as a whole (see Figure 58). In 1980, the estimated Redhead harvest in Canada was 53,000 birds, compared with 19,800 and 18,700 birds in 2006 and 2007 respectively (Gendron and Collins 2007). In Quebec, 10-year annual averages for harvests of the species were as follows: 3,000 individuals in 1975–1984, 1,200 in 1985–1994 and 300 in 1995–2004 (Table 3; Figure 58). In the autumn of 2005, high numbers of Redheads resulted in an exceptional harvest, with an estimated 2,500 birds being shot during the hunting season (Figure 58; Table 3). Out of 42 wings received in the Species Composition survey, 39 were from immature birds. Lastly, in the Atlantic Flyway, U.S. hunters shot 5,600 birds annually on average in 2000–2007 (Padding and Klimstra 2008).

Figure 58. Estimated Redhead sport harvest in Quebec and number of Migratory Game Bird Hunting Permits sold, 1975–2007 (data taken from Gendron and Collins 2007)



Quebec's role in the conservation of the Redhead can be described as modest. The Redhead is a Prairie native and Quebec is on the eastern edge of its breeding range. Since this is a species of moderate and declining numbers in North America, however, caution is still required in managing it on a continental scale. In addition, estimates of the Quebec harvest seem high compared with the province's population, during both the breeding season and migration.

4.4.3 Ring-necked Duck *Aythya collaris* (Mr, Br, Wo) (by Daniel Bordage)

The Ring-necked Duck breeds exclusively in North America. Although it is typical of the boreal forest and aspen parklands, it is also found in prairie pothole habitat. It breeds mainly in the northern United States, from Maine to the Dakotas and from the Great Lakes to northern Montana, as well as in Alaska, and in the southern half of Canada from the Maritimes to British Columbia (Hohman 2005b). The species winters inland along the Gulf of Mexico from Florida to the Yucatan (Mexico), along the Atlantic Coast from Rhode Island to Florida, and along the Pacific Coast from southern British Columbia to southwestern Mexico (Hohman and Eberhardt 1998; Hohman 2005b). It is also observed in winter in the Caribbean, Panama, United Kingdom and several other European countries, from Iceland to Portugal and Austria to the Azores (Hohman 2005b).

Breeding

The Ring-necked Duck frequents shallow ponds and small lakes characterized by abundant emergent plants along the shoreline and open-water zones with floating or submerged plants, along with stable water levels (Hohman and Eberhardt 1998). Breeding pairs and ducklings forage along the edges of mats of floating vegetation or in

sparser submerged or floating vegetation in open water (Hohman and Eberhardt 1998), at depths of 1.5 m or less (Mendall 1958 in Hohman and Eberhardt 1998). Animal food consumption is greatest in ducklings and hens during the brood-rearing period, when benthic organisms (e.g., aquatic earthworms, midges, snails and clams) or those attached to vegetation (e.g., dragonflies or caddis flies) make up over 90% (dry mass) of the diet (Hohman and Eberhardt 1998). The rest of the diet is composed mainly of plant materials, particularly seeds or tubers of submerged plants (pondweed, coontail, water milfoil, hydrilla), floating plants (waterlilies and cow lily), emergent vegetation (wild rice) and other types of wetland plants (reed canary-grass and arrowhead) (Hohman and Eberhardt 1998).

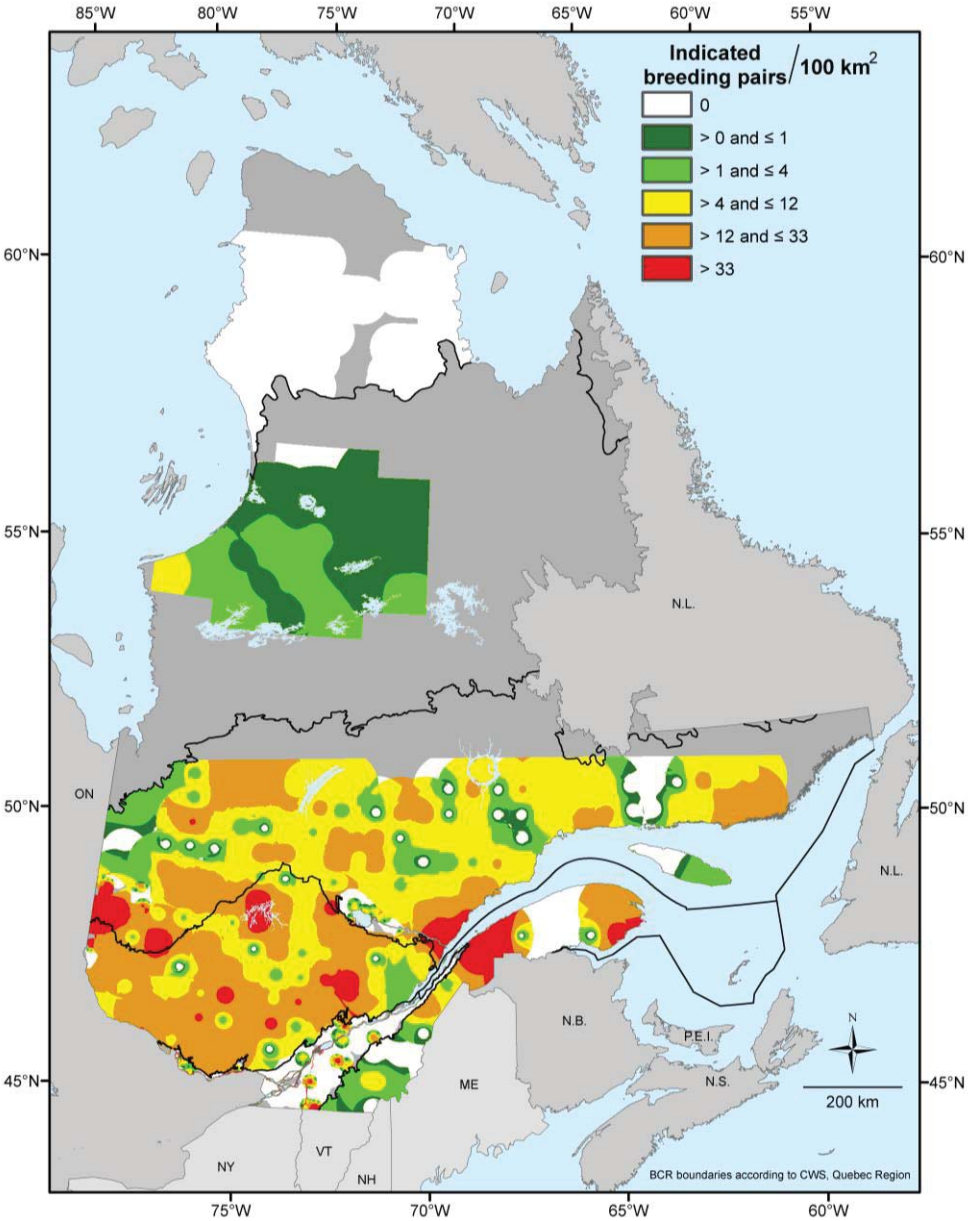
In Quebec, the Ring-necked Duck breeds mainly in mixed and coniferous forests (Lepage and Doyon 1996). Slightly over 80% of breeding pairs were found in the Boreal Softwood Shield (BCR 8) and the Boreal Hardwood Transition (BCR 12), with 56,500 and 30,000 IBP respectively (CWS, unpubl. data). The species is uncommon on the St. Lawrence Plain (1,000 IBP; BCR 13) and moderately abundant in the Atlantic Northern Forest (10,500 IBP; BCR 14) (Lepage et al., in prep.).

Roughly 5,500 IBP occur in the Taiga Shield and Hudson Plains BCR (BCR 7) (Lepage et al., in prep.), and the species was confirmed as a breeder in most sites surveyed in this BCR, particularly in the Eastmain River region (Bordage 1985), the northeast coast of James Bay (Benoit et al. 1992; Benoit et al. 1993; Benoit et al. 1994; 1995; Reed et al. 1996), the Laforge 1 Reservoir area (Morneau 1998), the Caniapiscau Reservoir area (Morneau 1999b), and the area around the Grande rivière de la Baleine and Petite rivière de la Baleine (Great Whale and Little Whale rivers) (Consortium Gauthier & Guillemette – G.R.E.B.E. 1990a; CWS, unpubl. data). No records have been reported in the Arctic Plains and Mountains BCR (BCR 3) (WNOR and ÉPOQ). The northern limit of the species' breeding range corresponds roughly to the 56th parallel (David 1996).

In the extreme eastern part of the province, one brood was reported in Robertson Reservoir, just north of La Tabatière (BCR 8) (Morneau 1998). The Abitibi-Témiscamingue lowlands (BCR 12), with their abundant beaver populations, and the Saguenay–Lac-Saint-Jean lowlands (BCR 8) also provide favourable breeding habitat for the species, with densities of 12.1 and 6.9 IBP/100 km² respectively, which are similar to those observed in upland forested habitats in the same BCRs (13 IBP/100 km² in BCR 12 and 10 IBP/100 km² in BCR 8) (WUPL; Lepage and Doyon 1996).

Figure 59 shows the distribution of indicated breeding pairs of Ring-necked Ducks in Quebec according to various surveys and inventories carried out primarily by CWS.

Figure 59. Breeding distribution of the Ring-necked Duck in Quebec (by indicated breeding pair density); please read the explanatory note at the last paragraph of Section 2.4



Spring migration

In Quebec, the first spring migrants arrive in mid-March and migration peaks during the last two weeks of April (ÉPOQ; David 1996). Interestingly, in this species, there is only one significant annual peak in migration, in spring, according to constancy data (in this document, the term constancy refers to the percentage of ÉPOQ checklists on which the species is recorded in relation to the total number of checklists for the period under analysis, in this case, a period of seven days), while most other waterfowl species have two migration peaks, one in spring and the other in fall (ÉPOQ; David 1996). In spring,

groups of up to 2,000 individuals can be seen in Lake Saint-Pierre, particularly at Baie-du-Febvre (Centre-du-Quebec region, BCR 13) (ÉPOQ).

Moulting

The moulting areas used by the species in Quebec are poorly known, except for the sector along the northeast coast of James Bay (BCR 7), where a few thousand birds probably moult (Benoit et al. 1992; Benoit et al. 1993). Elsewhere in North America, the species' traditional moulting areas are generally located a few hundred kilometres north of the breeding grounds, where the species gathers in small groups of usually no more than 300 individuals, unlike most other waterfowl species, which often have more impressive moulting concentrations (Hohman and Eberhardt 1998).

Fall migration

The fall migration period for the species extends from mid-October to mid-November in Quebec (ÉPOQ; David 1996). ÉPOQ data point to several important fall staging areas for the species, all in BCR 13: Parc national d'Oka (Oka provincial park) (Laurentides region), hosting up to 5,000 individuals; Gatineau (Outaouais region), hosting up to 4,000 individuals; Saint-Louis-de-Gonzague (Beauharnois Canal; Montérégie region), where up to 4,000 individuals congregate; and Baie-du-Febvre, which hosts up to 3,000 individuals. This suggests that the Ring-necked Duck is less widespread in fall than in spring (lower constancy) but that fall concentrations are greater (greater number of individuals per record on average).

Wintering

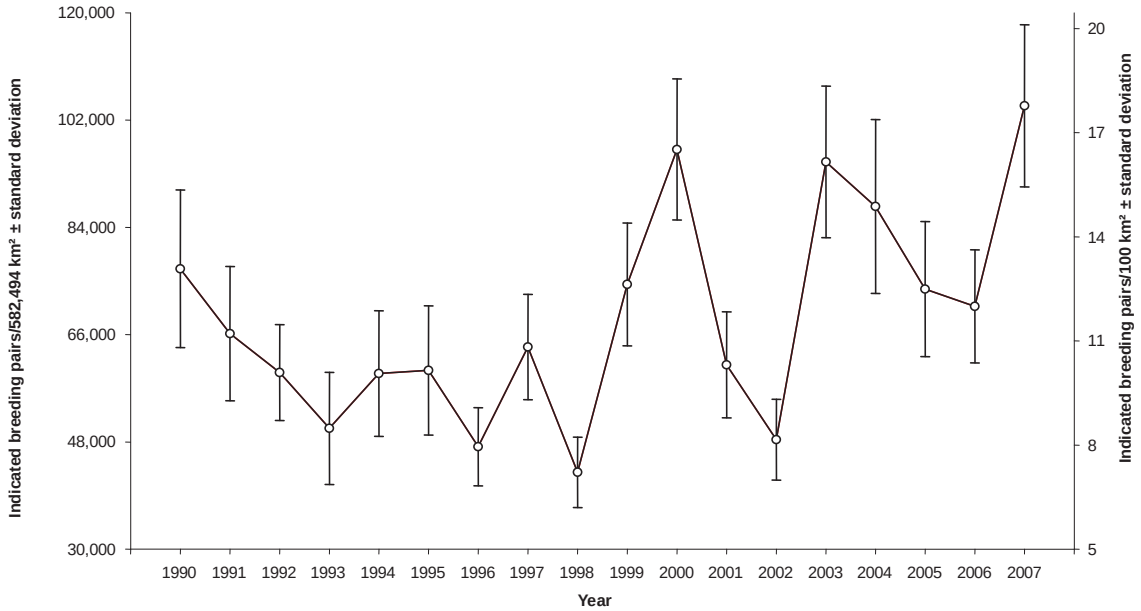
The Ring-necked Duck occasionally overwinters in southern Quebec, about every two to five years. Winter records involving more than one individual (up to four) have been obtained from time to time in southwestern Quebec (BCR 13 and 14), particularly in the Outaouais, Montréal, Montérégie and Estrie regions (ÉPOQ; David 1996; Bannon et al. 2002c; 2004b; Bannon et al. 2006c; Bannon 2008). The first winter record in the Gaspésie (Chandler, BCR 14) was obtained in 1999 (Aubry et al. 1999).

Conservation

The North American population of the Ring-necked Duck has been estimated at 2.0 million individuals (Table 2), with a higher proportion of males than females, which is characteristic of the species (Hohman and Eberhardt 1998). The estimated Quebec population is 273,000 individuals (Table 2). The species began to expand its range east of the Great Lakes in the 1930s, while its northwestern expansion into Alaska and Yukon is more recent, beginning in the 1980s (Hohman and Eberhardt 1998). A long-term positive trend in mid-continent populations is suspected (North American Waterfowl Management Plan 2004). Data from helicopter plots in the Breeding Waterfowl Plot Survey of Eastern Canada (BWPSEC) shows a slight significant annual increase of 1.7% in the number of breeding pairs during the 1990–2003 period (CWS, unpubl. data). In Quebec, surveys in the WUPL study area show significant population fluctuations (Figure 60); despite an average population of 79,700 IBP in 2000–2007, compared with 60,100 IBP in 1990–1999, no long-term trends for 1990–2003 can be detected at this scale (BWPSEC; CWS, unpubl. data). However, at the BCR scale, three significant annual increases ($P < 0.05$) for the 1990–2007 period can be ascertained: 3.9% in BCR 12, 3.1% in BCR 8 and 5.5% in BCR 14 (Lepage et al., in prep.). Among waterfowl species breeding in mixed and coniferous forests in Quebec (south of 51° 15' N, the WUPL study area), the Ring-necked Duck ranks second in

abundance, just behind the American Black Duck (CWS, unpubl. data). Lastly, the species is also doing well in Ontario, where a significant increase (58%) in numbers was found between the periods 1981–1985 and 2001–2005 (Leckie 2007).

Figure 60. Trends in the Ring-necked Duck breeding population in southern Quebec uplands, 1990–2007 (WUPL data); total number of indicated breeding pairs (left axis) and density per 100 km² (right axis)

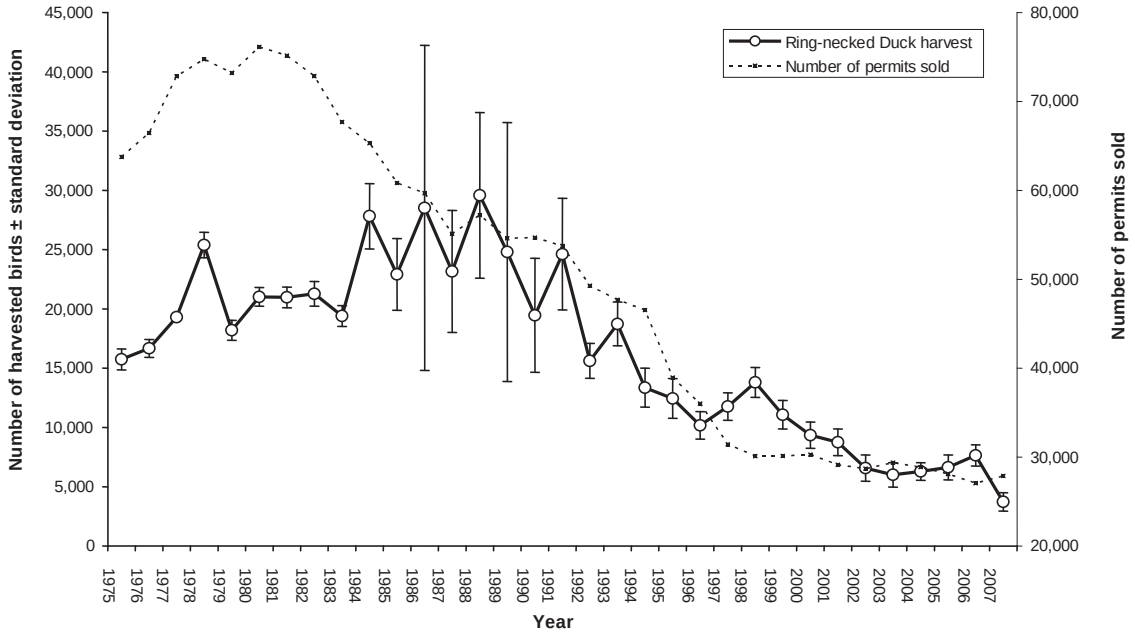


Unlike most other species of waterfowl, the Ring-necked Duck has a very small home range (1 breeding pair/2.4–9.3 ha depending on the habitat) and shows little aggressivity to conspecifics (Lepage and Doyon 1996). According to Mendall (1958 in Lepage and Doyon 1996), the Ring-necked Duck may nest as close as 1.5 m from another pair. In addition, this diving duck may exhibit a number of behaviours (e.g., foraging, flight style, brood rearing, habitat use) similar to those seen in dabbling ducks. In Quebec, the species' ecological requirements during the breeding season cover a broad spectrum and, in some cases, are similar to those of the American Black Duck and Common Goldeneye, suggesting that the Ring-necked Duck is a generalist species able to occupy the spatial niches of the two other species (DesGranges and Darveau 1985). For example, the Ring-necked Duck and American Black Duck both prefer small lakes with abundant riparian vegetation; however, they do not seem to avoid each other but instead are observed together more often than dictated by sheer chance (DesGranges and Darveau 1985). A similar association has been found between the Ring-necked Duck and Common Goldeneye on acid-sensitive lakes (DesGranges and Darveau 1985). These characteristics probably contribute to the fact that there are no obvious conservation issues linked to the species, at least during the breeding season in Quebec.

The Ring-necked Duck ranks seventh among waterfowl species (and fifth among ducks) in Quebec's sport hunt, with an average annual harvest of roughly 6,000 individuals (2003–2007; Table 3). As in the case of many waterfowl species in Quebec, the annual Ring-necked Duck harvest, which hovered around 20,000 birds between 1975 and 1991, has declined since then, closely paralleling the drop in the

number of sport hunters (Figure 61). Given the size of the Quebec population (an estimated 273,000 individuals) (Table 2), there is no evidence that current levels of sport hunting (here or elsewhere) could have a significantly negative impact on the conservation of the species in Quebec. The average annual sport harvest by U.S. hunters along the Atlantic Flyway in 2000–2007 was 110,100 individuals (Padding and Klimstra 2008).

Figure 61. Estimated Ring-necked Duck sport harvest in Quebec and number of Migratory Game Bird Hunting Permits sold, 1975–2007 (data taken from Gendron and Collins 2007)



Quebec plays a quite significant role in the conservation of the Ring-necked Duck, with 14% of the North American population breeding in the province (Table 2). The species seems to be thriving in Quebec since there is a significant upward trend in populations here, both in mixed forests and in coniferous forests, which offer good breeding habitats for the species. The Ring-necked Duck ranks fifth in abundance among waterfowl species breeding in Quebec (Table 2).

4.4.4 Greater Scaup *Aythya marila mariloides* (Mr, Br, Wr)
(by Pierre Brousseau and Christine Lepage)

The Greater Scaup has both a Nearctic and Palearctic distribution. There are two subspecies: *Aytha marila marila* of northern Europe and western Russia and Siberia and *A. m. mariloides* of eastern Siberia and northern North America (Wetlands International 2006). In Europe, the Greater Scaup breeds in the tundra and boreal forests, from Iceland to the northern regions of Scandinavia, Russia and Siberia (Quinn 2005). In North America, the species breeds mainly in Alaska, Yukon, southern Northwest Territories and Nunavut, northern Quebec, Labrador, and along the coast of Hudson Bay (Kessel et al. 2002; Quinn 2005). It winters on marine waters along the Atlantic Coast (particularly in Delaware Bay and Chesapeake Bay), the Gulf of Mexico and the Pacific Coast (particularly off California and Washington) (Kessel et al. 2002).

For several decades, an increasing number of birds have also been overwintering on the Canadian side of Lake Ontario (Petrie et al. 2006).

Breeding

The Greater Scaup breeds along shallow ponds and small lakes on the taiga and tundra, preferring to build its nest on a small island if possible (Benoit and Rail 1996). Adults feed primarily on plant materials (aquatic plants and seeds) and animal prey (small molluscs and crustaceans, aquatic insects, small fish, fish eggs, etc.), while the ducklings' diet consists mainly of adult and larval insects and seeds (Kessel et al. 2002). In Quebec, breeding has been confirmed on the Ungava Peninsula, on the coastal strips of James and Hudson bays and further inland in the James Bay region. The species also occurs further south in the boreal forest, mainly in the western part of the province (Lemelin et al. 2004). Lastly, a small isolated population breeds on the Magdalen Islands (Fradette 1992), and the same may be true of Anticosti Island (Benoit and Rail 1996; Cyr 1995n; WSHO).

In northern Quebec, breeding has been confirmed on the tundra in the Polemond River and Puvirnituq Lake region near the Hudson Bay coast (BCR 3) (R. Cotter, CWS, unpubl. data) and in the Tasiujaq and Aupaluk area (BCR 3) on the coast of Ungava Bay (ÉPOQ; P.B., pers. obs.). During the WNOR surveys, average breeding density (2004–2006) was estimated at 3.1 IBP/100 km² in BCR 3 as a whole (CWS, unpubl. data).

A little further south, the Greater Scaup breeds in the watersheds of the Grande rivière de la Baleine (Great Whale River), Petite rivière de la Baleine (Little Whale River) and Nastapoka River (BCR 7). The species is considered a common breeder in the Nastapoka River watershed, where the estimated density of Greater and Lesser scaup broods combined was 2.7 broods/100 km² in the coastal strip and 3.3 broods/100 km² on the inland plateau (Consortium Gauthier & Guillemette – G.R.E.B.E. 1990a). Along the northeast coast of James Bay (BCR 7), high brood densities were observed in the coastal lakes near Kakassituq Point (6.8 broods/100 km², Great and Lesser scaups combined) and Pointe Louis-XIV (19.0 broods/100 km², Great and Lesser scaups combined) (Benoit et al. 1993). Furthermore, Lesser Scaup and Greater Scaup are probably the most abundant species of waterfowl breeding in the Pointe Louis-XIV area (Benoit et al. 1993). The breeding of the Greater Scaup has even been confirmed on the islands in northeastern James Bay (Benoit et al. 1993; Reed et al. 1996). In the centre of the province, densities of 3.0 breeding pairs/25 km² have been reported in the Laforge 1 Reservoir area (BCR 7) (Morneau 1998), and broods have also been observed in the Caniapiscau Reservoir sector (0.1 brood/25 km²) (Morneau 1999b). In the Rupert diversion bay sector south of Eastmain 1 Reservoir (BCR 7), the estimated breeding density of the species is 3.2 IBP/25 km² (Tecsult Environnement Inc. 2004).

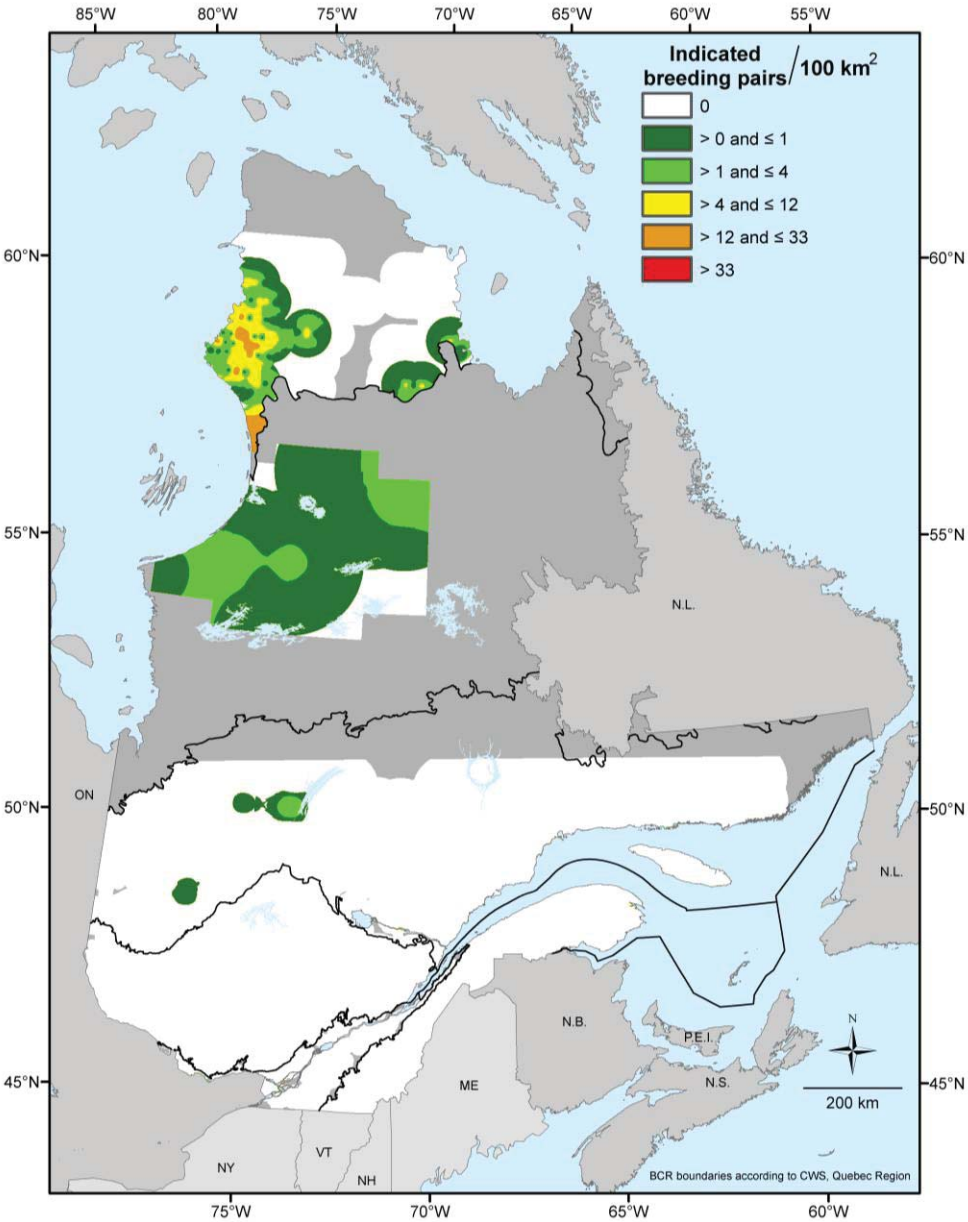
The species probably also breeds in the boreal forest. According to surveys in the WUPL study area in 1990–2007, estimated breeding densities in the area as a whole were 0.18 IBP/100 km² (CWS, unpubl. data); the surveys also identified the areas with the highest concentrations of breeding scaup (1.7–6.0 IBP/100 km²), which were south and west of Lake Mistassini (BCR 8) (Lemelin et al. 2004). It should be noted, however, that the annual WUPL surveys are conducted early in the breeding season and the Greater Scaup is a late nester; therefore, densities may be underestimated or include breeding pairs that are in transit to breeding grounds further north. A single breeding record (female and young) was obtained in Chibougamau in 1975 (ÉPOQ). Further

east, the Greater Scaup also breeds in the Basse-Côte-Nord region (BCR 8), where densities of 0.3 breeding pair/25 km² were reported in the La Tabatière area, although no actual broods were observed (Morneau 1998). There is no recent data on breeding on Anticosti Island (Ouellet 1969; Godfrey 1986), although records of a single individual in July 1989 (Benoit and Rail 1996) and pairs in late May (WSHO) suggest that the species may breed there.

A small, highly unusual population breeds on the Magdalen Islands (BCR 14). On the islands, breeding evidence has been obtained around Havre aux Basques Bay (Portage Bay and La Martinique Pond, among others), Étang-du-Nord and Pointe de l'Est (East Pond) (Fradette 1992; ÉPOQ), although no recent breeding evidence has apparently been obtained at the last site (CWS, unpubl. data). The Magdalen Island breeding population was estimated at 30–40 breeding pairs in the early 1990s (Fradette 1992), but the presence of terrestrial predators (foxes and coyotes, which are fairly abundant) in recent years suggests that current numbers are similar if not lower (F. Shaffer, CWS, pers. comm.). Lastly, a hen with young was observed in three different years (1994, 2000 and 2003) at Baie-du-Febvre (BCR 13) (ÉPOQ), which is quite unusual at this latitude.

Figure 62 shows the distribution of indicated breeding pairs of Greater Scaup in Quebec according to various surveys and inventories carried out primarily by CWS (see Chapter 3).

Figure 62. Breeding distribution of the Greater Scaup in Quebec (by indicated breeding pair density); please read the explanatory note at the last paragraph of Section 2.4



Migration

Most of the Greater Scaup that migrate along the St. Lawrence in spring can be seen on Lake Saint-François (at Valleyfield) and Lake Saint-Louis (around Île Perrot), as well as at the eastern end of the Ottawa River and in the St. Lawrence itself (BCR 13) as far as the mouth of the Saguenay River (BCR 8) (Benoit et Rail 1996; Cyr 1995n; ÉPOQ; WSHO). According to ÉPOQ data, the area around the Île d'Orléans bridge (BCR 13)—where previously several thousand birds could be seen—has been partially abandoned by the species. A smaller number of birds take a more easterly migration route through the lower estuary and Gulf of St. Lawrence, including the Gaspé Peninsula (Cyr 1995n). Surveys of the St. Lawrence shoreline (WSHO) have allowed areas further east in the Gulf that are used by the birds to be identified, including the Rivière-au-

Tonnerre region and the Mingan Islands (BCR 8) in particular, where rafts of 30–60 individuals have been spotted (CWS, unpubl. data).

In fall, the most recent ÉPOQ data shows that the species is present in good numbers on the riverine lakes (Lake Saint-François, Lake Saint-Louis and Lac des Deux Montagnes) (BCR 13), although in concentrations not as great as those found in the 1970s, when over 50,000 birds could be seen (Lehoux et al. 1985). In the mid-1980s, an estimated 39,600 Greater and Lesser scaup could be seen on Lac des Deux Montagnes and 22,000 on Lake Saint-Louis (Paris 1985). These data must be viewed with caution, however, since the results cited from the 1970s and 1980s come from aerial surveys, while ÉPOQ data was contributed by observers on the shore.

In the St. Lawrence estuary, it was possible to observe between 5,000 and 10,000 scaup (both species combined) in the 1970s, but surveys in 1999 reported no more than 400 scaup in Saint-Vallier Bay and 250 in Anse de Berthier (Brousseau and Rodrigue 2001).

In recent years, changes in the species' migratory pattern have undoubtedly occurred. The presence of large numbers of zebra and quagga mussels in lakes Ontario and Erie since the late 1980s has resulted in a strong increase in numbers of diving ducks there, including the Greater Scaup (Petrie et al. 2006). Winter surveys carried out since 2002 on both lakes show that scaup make up 17–26% of diving ducks surveyed (200,000 individuals in the winter of 2007) (Long Point Waterfowl and Wetlands Research Fund 2007a). A portion of these birds may stop over in this region instead of the St. Lawrence Valley before continuing to their northern Quebec breeding grounds in spring, or their wintering grounds on the U.S. East Coast in fall. Lastly, an individual fitted with a satellite transmitter left Lake Ontario in the spring of 2007 and travelled down the St. Lawrence as far as Sept-Îles, then turned inland to head to its breeding grounds near the Quebec–Labrador border (Long Point Waterfowl and Wetlands Research Fund 2007b).

Moulting

Along the northeastern shore of James Bay (BCR 7), there are records of moulting Greater Scaup in inland freshwater habitats (Reed et al. 1996), as well as along the coast and around the islands; some individuals have also been seen fairly far offshore (Benoit et al. 1992; 1994). Moulting individuals were particularly abundant in the coastal lakes in the Chisasibi and Kakassituq Point areas, with respective densities of 185 individuals/100 km² and 592 individuals/100 km² in these two locations for all three "bluebill" species (Lesser and Greater scaup and Ring-necked Duck) combined (Benoit et al. 1993). Greater Scaups probably also moult in the lentic reaches of the Roggan River and Rivière au Phoque (Seal River) (Benoit et al. 1994). On the Magdalen Islands (BCR 14), rafts of moulting males consisting of no more than 20 individuals have been observed around Île de l'Est (East Island) and Havre aux Basques Bay (Fradette 1992). More recently, groups of 50–130 individuals (mostly males) observed in late June and early July off Point de l'Est (East Point) and in Havre aux Basques Bay (ÉPOQ; F. Shaffer, CWS, pers. comm.) suggest that the Magdalen Islands may contain a greater number of moulting individuals than previously thought or that the islands may serve as pre-moult aggregation areas for local or non-local birds.

Wintering

Every year, 100 or so Greater Scaup, sometimes more, overwinter in Tadoussac Bay or Sainte-Catherine Bay (BCR 8) (Bannon et al. 2006c; ÉPOQ). Other cases of overwintering birds have been reported, some involving numerous individuals, in the Montréal region (60 individuals in the winter of 2001–2002 in Lachine, BCR 13) (Bannon et al. 2002c) and the Gaspé region (Chaleur Bay and Grande-Rivière, BCR 14) (Aubry et al. 1999). In the Montréal region, the species is often present in winter but in very small numbers (1–4 individuals) (Bannon 2008).

Conservation

It is difficult to obtain exact numbers on the size of the Greater Scaup population, since most aerial surveys do not distinguish between it and the very similar Lesser Scaup, since identification is even more difficult from an aircraft. In the spring of 2008, the combined scaup population (Greater and Lesser) in North America was estimated at 3.7 million birds, compared with an estimated 5.0–5.7 million in the 1970s (U.S. Fish and Wildlife Service 2008). Although the Greater Scaup only makes up roughly 11% of the combined continental population of the two species (Austin et al. 1998; Austin et al. 2000), studies carried out outside the breeding season suggest that this percentage is greater in the Northeast, where the Greater Scaup may proportionally outnumber the Lesser Scaup (*cf.* Bellrose 1976; Lehoux et al. 1985; Dionne 2004; Petrie et al. 2006).

The Greater Scaup, like the Lesser Scaup, is one of the species with populations below the objectives set in NAWMP (6.3 million birds of both species combined) (North American Waterfowl Management Plan 2004). In Quebec, there is little information on the species at the provincial scale: first, because it is difficult to differentiate from its congener, the closely related Lesser Scaup and, second, because its core breeding range is in the northern half of Quebec (forest tundra). However, according to WNOR data, there are an estimated 6,300 IBP in BCR 3; the Grande-Baleine Complex waterfowl survey, carried out in 1991 by CWS, estimated 8,700 IBP in BCR 7 (CWS, unpubl. data). Therefore, during the breeding season, the entire province probably has a population of roughly 43,000 individuals (Table 2).

At the scale of North America as a whole, the overall decline in the Greater Scaup population since the early 1970s (Afton and Anderson 2001; Kessel et al. 2002) has prompted government agencies and universities to conduct research into the reasons for the decline (Austin et al. 2000; Anderson et al. 2006). In Quebec, no overall trends in the breeding population have been discerned due to the lack of data. During migration, ÉPOQ data shows a marked drop in the number of birds in transit through the St. Lawrence Valley in both spring and fall; however, this may simply mean that birds have shifted to the Great Lakes rather than an actual decline in numbers here.

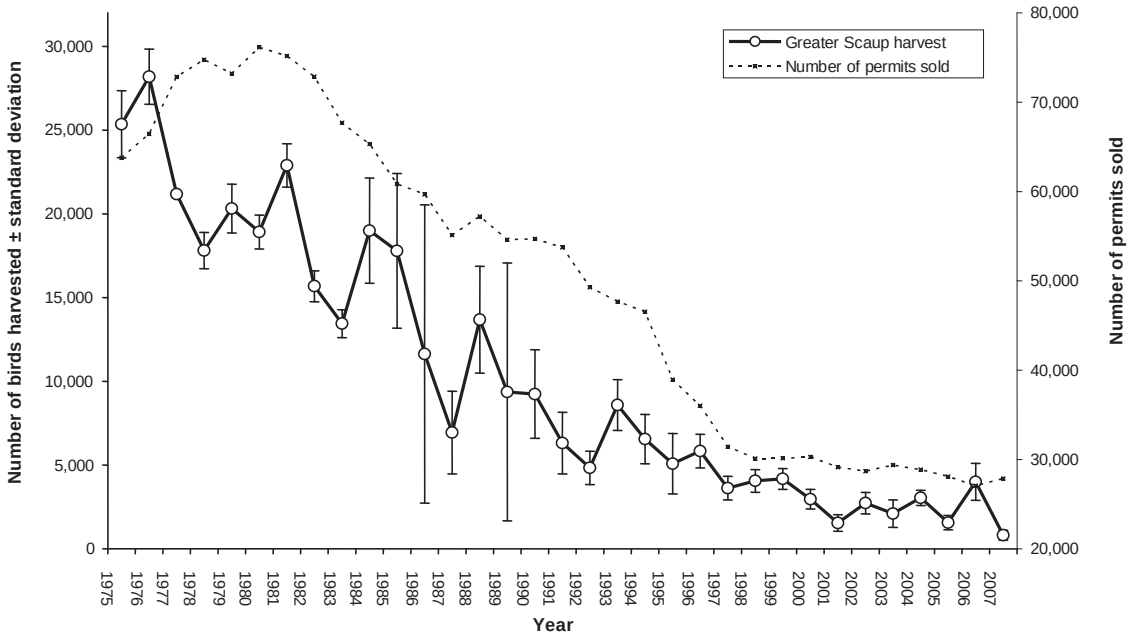
Although there is a serious problem of Greater Scaup predation on cultivated mussels on Prince Edward Island (Dionne et al. 2006), this issue has never been studied in Quebec. The small number of birds present in the parts of the Magdalen Islands and Gaspé region where most mussel farming operations are located may explain the apparent lack of predation.

In addition, Greater Scaup staging in the Great Lakes in spring probably have high levels of selenium contamination (Long Point Waterfowl and Wetlands Research Fund 2007b). Since this toxin has a fairly brief half-life in the organism, most females have time to eliminate the selenium during spring migration before they lay their eggs.

However, the reproduction of individuals that undertake a shorter spring migration, mainly because of the proximity of the breeding grounds, could be affected (Long Point Waterfowl and Wetlands Research Fund 2007b). On their wintering grounds along the Atlantic Flyway, many Greater Scaup overwinter in urban or industrialized areas and are potentially exposed to contaminants (Austin et al. 2000; Kessel et al. 2002; Petrie et al. 2007).

Owing to the decline in the size of the fall flight in the St. Lawrence Valley combined with the decreasing number of hunters in Quebec, harvests of the species have been dwindling almost every year since 1975 (Figure 63). The Quebec annual harvest by decade is as follows: 20,300 individuals in 1975–1984; 9,500 in 1985–1994; and 3,500 in 1995–2004 (Table 3). The Greater Scaup ranks 12th among waterfowl species harvested and 10th among ducks (Table 3). In the United States, a downward trend in the harvest has also been observed; however, waterfowlers face major regulatory restrictions on their daily bag limits and number of hunting days. In all the states making up the Atlantic Flyway, the average annual harvest in 2000–2007 was around 13,700 birds (Padding and Klimstra 2008). The Greater Scaup ranks 19th among species hunted on the U.S. East Coast (U.S. Fish and Wildlife Service 2007).

Figure 63. Estimated Greater Scaup sport harvest in Quebec and number of Migratory Game Bird Hunting Permits sold, 1975–2007 (data taken from Gendron and Collins 2007)



There is a great deal of concern over the decline in North American Greater Scaup populations, with a number of research projects underway to determine the reasons for this decline (Austin et al. 2000; Afton and Anderson 2001; Kessel et al. 2002; Anderson et al. 2006). In Quebec, since the species' core breeding range is in the northern half of the province, the Greater Scaup is currently not a research priority. It would be prudent, however, to begin regular monitoring of population numbers either on the breeding grounds (particularly in BCR 7) or during migration in southern Quebec, to obtain an accurate picture of the species' status in the province.

4.4.5 Lesser Scaup *Aythya affinis* (Mr, Br, We) (by Pierre Brousseau and Christine Lepage)

Unlike its cousin the Greater Scaup, which has an almost circumpolar distribution in the Northern Hemisphere, the Lesser Scaup breeds exclusively in North America. The species' breeding range includes Alaska, Yukon, Northwest Territories, southern Nunavut, British Columbia, the Prairie provinces, Ontario, Quebec, Labrador and the northwestern and north-central United States (Godfrey 1986; Austin et al. 2005; Gilliland et al. 2009). However, its core breeding range is in northwestern North America (from Alaska to Manitoba), where it is abundant in the aspen parkland and boreal forest regions (Austin et al. 1998). In Quebec, the Lesser Scaup breeds from the St. Lawrence Valley north to roughly the 56th parallel and from the Ontario border east to Labrador (Godfrey 1986), giving it a less northerly distribution in the province than the Greater Scaup. Lesser Scaup winter mainly on the Atlantic Coast (from Delaware Bay to Florida), the Gulf of Mexico (including the Mexican side), and the Pacific Coast from southern British Columbia to southern Mexico (Austin et al. 1998). The species also overwinters around the islands in the Caribbean (Austin et al. 1998; Long Point Waterfowl and Wetlands Research Fund 2007b).

Breeding

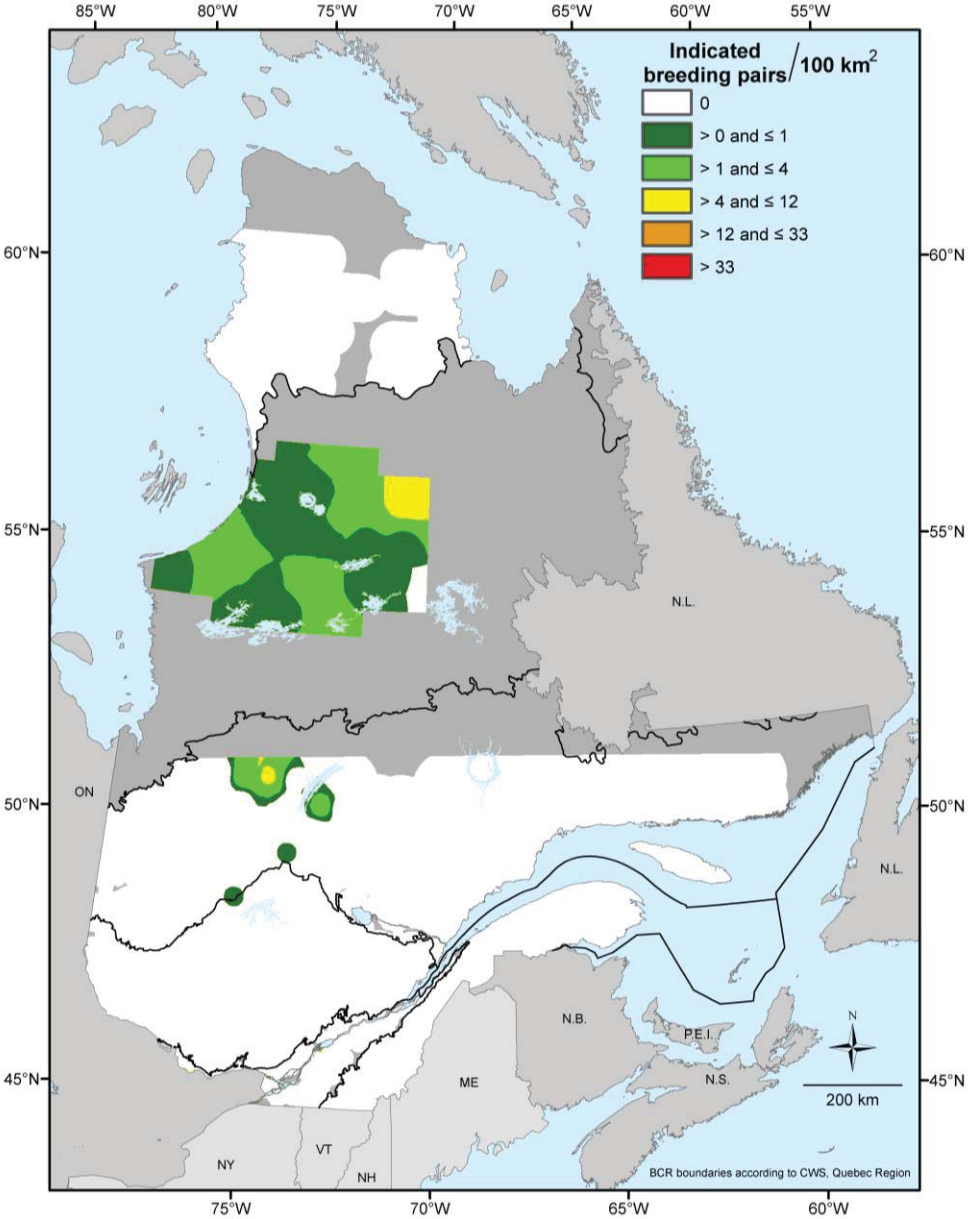
Despite the fact that it is timid and retiring in nature and is found in small numbers in Quebec, the Lesser Scaup has a fairly extensive range in the province. It breeds in a wide variety of wetlands: the shores and islands of small lakes and ponds in the tundra, taiga and boreal forest, and large marshes in the fluvial section of the St. Lawrence (Godfrey 1986; Barrette and Titman 1996). Adults feed on plant materials (particularly the seeds of aquatic plants) and aquatic invertebrates (insects and molluscs), while the ducklings' diet consists mainly of insects (Austin et al. 1998).

In the northern half of Quebec, Lesser Scaup broods have been observed in the watersheds of the Grande rivière de la Baleine and Petite rivière de la Baleine (Great Whale and Little Whale rivers). In the area between the Great Whale and Nastapoka rivers (BCR 7), estimated brood densities of Greater and Lesser scaups combined were 2.7 broods/100 km² in the coastal strip and 3.3 broods/100 km² on the inland plateau (Consortium Gauthier & Guillemette – G.R.E.B.E. 1990a). In the James Bay region (BCR 7), high brood densities were found along the coastline around Kakassituq Point (6.8 broods/100 km² for both scaups combined) and around Pointe Louis-XIV (19.0 broods/100 km², both species combined) (Benoit et al. 1993). The Lesser Scaup, along with the Greater Scaup, is the most abundant species of waterfowl breeding in the Pointe Louis-XIV area (Benoit et al. 1993). As well as breeding in the coastal strip, the Lesser Scaup also breeds on the islands off the northeast coast of James Bay (BCR 7) (Benoit et al. 1992; Benoit et al. 1993; Reed et al. 1996). Aside from the James Bay coast and Great Whale and Little Whale watersheds, the species has also been observed on water bodies near the Rupert diversion bays constructed for the Eastmain-1-A powerhouse project (Tecsult Environnement Inc. 2004), where brood densities for both scaup species combined were roughly 0.2 brood/25 km² (Tecsult Environnement Inc. 2004). Lastly, further inland, Lesser Scaup breeding density was estimated at 1.0 breeding pair/25 km² in the Laforge 1 Reservoir area (BCR 7) (Morneau 1998), and broods (0.2 brood/25 km²) were observed on Caniapiscau Reservoir (Morneau 1999b). During the breeding season, in the Quebec portion of BCR 7, the estimated Lesser Scaup population is roughly 50,400 individuals according

to data from the Grande-Baleine Complex waterfowl survey carried out in 1991 (CWS, unpubl. data).

In the southern half of Quebec, breeding records come most often from the Abitibi (Rouyn-Noranda; BCR 8) and Lac-Saint-Jean (Saint-Gédéon; BCR 8) regions and the fluvial section of the St. Lawrence (BCR 13), including the Lac Saint-François NWA, Yamachiche Bay, Île du Moine and Baie-du-Febvre areas (Barrette and Titman 1996; ÉPOQ). Three other more isolated records have been obtained in La Mauricie National Park of Canada (BCR 12), Saint-Adolphe-de-Dudswell (BCR 14) and Rivière-Ouelle (BCR 13) (ÉPOQ). In the WUPL study area, breeding density was estimated at roughly 0.07 IBP/100 km² in the boreal forest (2000–2007 average) (CWS, unpubl. data); the highest densities occurred in the area from Decelles Reservoir (south of Val-d'Or, BCR 8) to Lake Mistassini (BCR 8; 2.0–7.4 IBP/100 km²) (Lemelin et al. 2004). The WUPL survey targets early migrants and probably does not accurately reflect the status of scaup in the boreal forest. Figure 64 shows the distribution of indicated breeding pairs of the Lesser Scaup in Quebec according to various surveys and inventories, carried out primarily by CWS (see Chapter 3).

Figure 64. Breeding distribution of the Lesser Scaup in Quebec (by indicated breeding pair density); please read the explanatory note at the last paragraph of Section 2.4



Migration

According to ÉPOQ data, the number of Lesser Scaup seen during migration has decreased sharply since the late 1970s. The vast majority of individuals passing through the St. Lawrence Valley in spring are seen on Lake Saint-François and Lake Saint-Louis (BCR 13) (Lehoux et al. 1985). However, Lesser Scaup can be observed along the entire length of the St. Lawrence, from the Ottawa River (BCR 13) to the lower estuary (BCR 8 and 14) and even in the Gaspé region, although this is quite rare (BCR 14) (Cyr 1995o). Sizeable numbers of migrants can also be observed in the Abitibi region in both spring and fall (ÉPOQ). Lastly, Rupert Bay (BCR 7) is a staging area for migrants in spring; in May 2002, 1,250 Greater and Lesser scaup were

observed there, at a density of 30.3 individuals/10 km of shoreline (Tecsult Environnement Inc. 2004).

In the 1970s and 1980s, concentrations of Greater and Lesser scaup numbering in the several tens of thousands could be seen in fall on the riverine lakes (Lake Saint-François, Lake Saint-Louis, Lake Saint-Pierre and Lac des Deux Montagnes), as well as in the estuary, in the Portneuf region, Saint-Vallier Bay and Anse de Berthier (all in BCR 13) (Lehoux et al. 1985). At the last two sites, however, 1999 surveys showed no more than 400 and 250 scaup (both species combined) respectively (Brousseau and Rodrigue 2001). Although, according to the most recent ÉPOQ data from the Montréal region, Lesser Scaup are still present during migration on the large riverine lakes, their numbers cannot be compared to those seen in the 1970s. It must be remembered, however, that ÉPOQ data are contributed by observers on the shoreline in most cases, and rafts further offshore may have gone undetected.

Recent studies and surveys in lakes Ontario and Erie (Petrie et al. 2006; Long Point Waterfowl and Wetlands Research Fund 2007a) show that the Lesser and Greater scaup are now abundant there during migration and in winter, very likely due to the explosion in zebra and quagga mussels in the Great Lakes. Although Greater Scaup no doubt make up the majority of these birds (Petrie et al. 2006), one can indeed wonder whether the Lesser Scaup has also modified its migration route in favour of the Great Lakes. Recent telemetry studies have shown that, among Lesser Scaups fitted with a satellite transmitter, 45% (17 out of 38) left the Great Lakes in spring to breed in the taiga and forest tundra in Quebec and Labrador (Long Point Waterfowl and Wetlands Research Fund 2007b). None of the 17 individuals used a route along the St. Lawrence to migrate to their breeding grounds but instead took an inland route (Long Point Waterfowl and Wetlands Research Fund 2007b).

Moulting

Some Lesser Scaup moult offshore along the northeastern coast of James Bay; however, most use inland freshwater habitats (Reed et al. 1996) or coastal areas (Benoit et al. 1992; 1994). Scaup densities (Lesser, Greater and Ring-necked Duck) of roughly 185 individuals/100 km² and 592 individuals/100 km² were obtained on the coastal lakes in the Chisasibi and Kakassituq Point areas respectively (Benoit et al. 1993). Moulting Lesser Scaup are also found in large numbers in the lentic stretches of the Roggan River and Rivière au Phoque (Seal River) (Benoit et al. 1994). Density data on the Lesser Scaup is very scarce, as it is for the Greater Scaup, owing to the problem of distinguishing between the two species in the field; consequently, most studies report densities for both species combined (e.g., Benoit et al. 1992; Benoit et al. 1993).

Wintering

A few, very infrequent, cases of overwintering by the species have been reported in Quebec, primarily in the Outaouais (BCR 13), Montréal (BCR 13) and Estrie (BCR 14) regions (Cyr 1995o; David 1996; Bannon 2008). Recent records include two individuals that overwintered successfully in 2002 in Lachine (BCR 13) (Bannon et al. 2002c), and a drake that overwintered three winters in a row in Alma in the Lac-Saint-Jean region (BCR 8) (Aubry et al. 1999). Winter on-the-ground surveys carried out in the Montréal region since 1982 have revealed only five cases of overwintering in a 26-year period, involving one or two individuals only (Bannon 2008). The Lesser Scaup frequenting the St. Lawrence River in October and November generally leave the area to migrate to their wintering grounds along the Atlantic Coast.

Conservation

Since most surveys do not distinguish between the Lesser and Greater scaup, it is difficult to determine the size of the population of either species. However, the Lesser Scaup is known to be the most abundant diving duck in North America (Austin et al. 1998) and is estimated to constitute 89% of the combined continental population of Lesser and Greater scaup (Austin et al. 1998; Austin et al. 2000). Harvest data in the U.S. and Canada shows that the number of Lesser Scaup bagged always greatly exceeds Greater Scaup harvests in all flyways, which confirms that the North American Lesser Scaup population is significantly greater than that of its congener (U.S. Fish and Wildlife Service 2007; Gendron and Collins 2007). In 2008, the continental population of the Greater and Lesser scaup combined was estimated at 3.7 million individuals, a marked decrease compared to estimates of 5.0–5.7 million in the 1970s (U.S. Fish and Wildlife Service 2008). In addition, the combined population of both species is below the objective (6.3 million individuals) set in NAWMP (North American Waterfowl Management Plan 2004). The Quebec population is estimated at roughly 57,000 individuals during the breeding season (Table 2).

Owing to the overall decline in the continental Lesser Scaup population since the early 1970s (Afton and Anderson 2001; Kessel et al. 2002), a great deal of research has been conducted on the potential causes of this decline (Austin et al. 2000; Anderson et al. 2006). There is no information on population trends in the species in Quebec, partly because of the scarcity of information during the breeding season and partly because of the small percentage of birds breeding here (1% of the North American population; Table 2). According to ÉPOQ data for 1970–1989, constancy of occurrence data for the species was already showing signs of a decline at that time (Cyr 1995o).

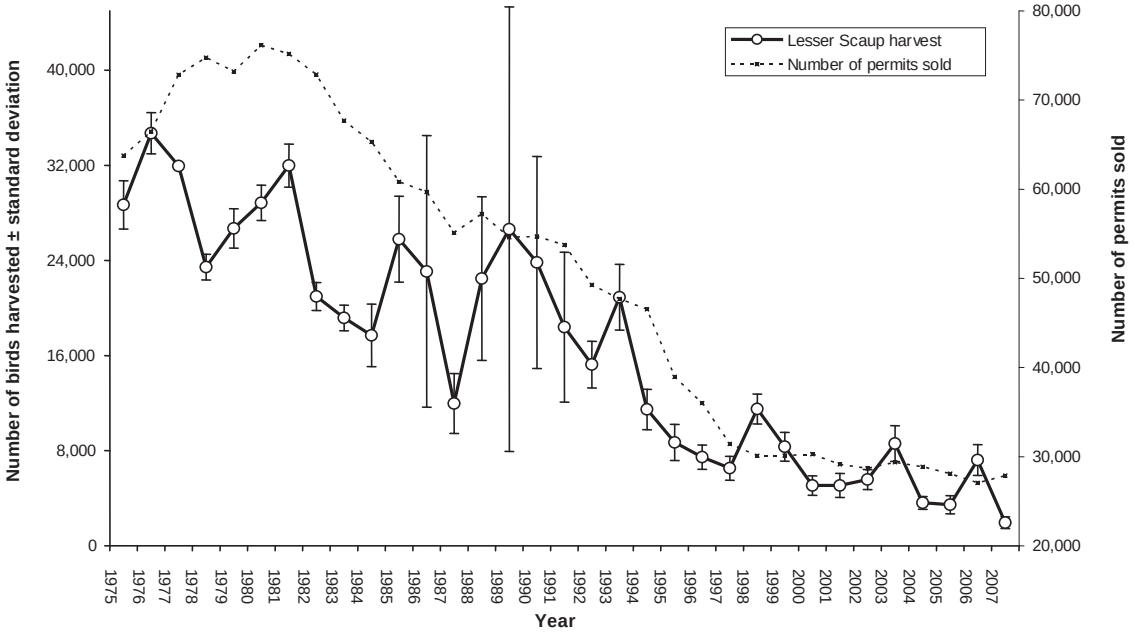
After the Lesser Scaup began frequenting the Great Lakes in greater numbers in migration and in winter, research was conducted on possible contamination in the species (Long Point Waterfowl and Wetlands Research Fund 2007b). Lesser Scaup appear to suffer high levels of selenium contamination during spring migration in the Great Lakes (Long Point Waterfowl and Wetlands Research Fund 2007b). Despite the fairly short half-life of the toxin in the birds and the fact that most females have the time to eliminate the toxin in spring before they breed, reproduction in individuals with nesting grounds that are fairly close to the Great Lakes staging areas may be affected (Long Point Waterfowl and Wetlands Research Fund 2007b).

Other issues involving the Lesser Scaup include the fact that, in the U.S. harvest, the sex ratio is skewed towards males, suggesting that female survival has declined in relation to that of males (Afton and Anderson 2001). The number of juveniles in the U.S. harvest has also declined, indicating that recruitment rates in the species have decreased over the last 20 years (Afton and Anderson 2001). In addition, large-scale losses of wetlands supporting rich populations of amphipods appear to have limited females' ability to accumulate sufficient energy stores during spring migration (Anteau 2006), and consequently females arrive too late or in poor physical condition at their breeding grounds, limiting their reproductive success.

In Quebec, the Lesser Scaup harvest has declined almost every year since 1975, in parallel with a concomitant decline in the size of the fall flight and a decline in the number of hunters (Figure 65; Table 3). The Quebec annual harvest of the species was

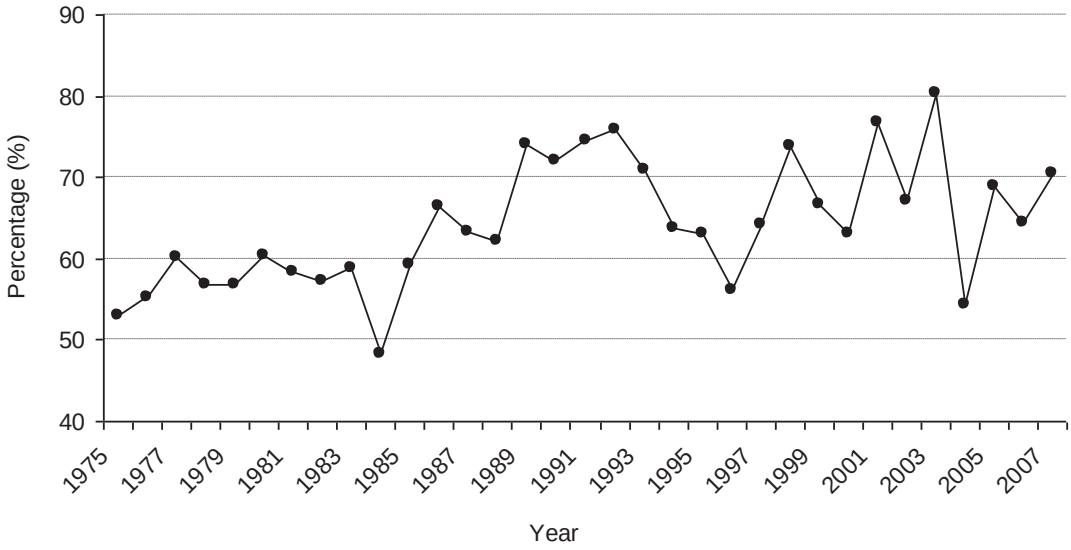
26,400 birds in 1975–1984, 20,000 birds in 1985–1994, and only 7,000 birds in 1995–2004 (Table 3).

Figure 65. Estimated Lesser Scaup sport harvest in Quebec and number of Migratory Game Bird Hunting Permits sold, 1975–2007 (data taken from Gendron and Collins 2007)



Another change observed over the last 30 years is the ratio of Lesser Scaup to Greater Scaup in the Quebec harvest. In 1995–2007, the Lesser Scaup accounted for 67% of the combined harvest, compared with 57% in 1975–1985 (Figure 66). This shift is also reflected in the species' ranking in the Quebec sport harvest: the Greater Scaup ranked 12th while the Lesser Scaup was 9th among species of waterfowl harvested in Quebec in 2003–2007 (Table 3).

Figure 66. Percentage of Lesser Scaup in the Quebec harvest of Lesser and Greater Scaup, 1975–2007 (taken from Gendron and Collins 2007)



In the United States, the Lesser Scaup harvest has been declining steadily for over 20 years. The decline in the population, drop in the number of hunters and severe regulatory restrictions are among the factors contributing to this trend. Despite this, it is estimated that close to one quarter million birds were harvested in 2006 (U.S. Fish and Wildlife Service 2007), particularly in the states in the Mississippi Flyway, which accounted for over 50% of the U.S. harvest (Austin et al. 1998).

Originally a bird of Western North America, the Lesser Scaup is a relatively recent breeder in Quebec, with the first breeding records in the province dating back to 1950 in James Bay and 1969 in southwestern Quebec (in Barrette and Titman 1996). Since the heart of the species' range is in the boreal forests and parklands of the West, Quebec appears to play a secondary role in the conservation of the species. Nevertheless, the regular monitoring of populations of the species should be instituted, whether during migration or during the breeding season, to get a clearer picture of long-term population trends and distribution in the province. The Breeding Waterfowl Plot Survey of Eastern Canada only covers southern Quebec and is carried out too early in the breeding season to accurately depict the species' status in the province. Lastly, particular attention must be paid to distinguishing between the two scaup species during the surveys.

4.5 Sea ducks (Mergini)

(by Christine Lepage)

This is a highly variable group generally associated with marine environments during a sizeable portion of their annual cycle. Most species congregate in large flocks during migration, moulting and wintering. Depending on the species, individuals feed on aquatic invertebrates, molluscs, crustaceans and fish. The species in this tribe have a wide range of ecological requirements and raise numerous conservation concerns. A total of 13 species in the tribe Mergini occur regularly in Quebec (Table 2), with a number of them present even in winter. All 13 breed in Quebec and, depending on their affinities, some prefer the boreal forest (Surf Scoter, Bufflehead, Common Goldeneye,

Barrow's Goldeneye, Hooded Merganser and Common Merganser), others the taiga or tundra (King Eider, Harlequin Duck, White-winged Scoter, Black Scoter, Long-tailed Duck and Red-breasted Merganser) and still others island and coastal environments (Common Eider). Five species are cavity nesters (Bufflehead, Common Goldeneye, Barrow's Goldeneye, Hooded Merganser and Common Merganser) and one breeds in colonies (Common Eider). Lastly, two species are considered of special concern on the List of Wildlife Species at Risk in Canada: Harlequin Duck (Eastern Population) and Barrow's Goldeneye (Eastern Population).

4.5.1 King Eider *Somateria spectabilis* (Mr, Br, Wr)
(by Richard Cotter and Christine Lepage)

The King Eider breeds in the Arctic regions of Eurasia and North America. In Canada, the species' main breeding grounds are on Banks and Victoria islands in the Western Arctic, and on Boothia Peninsula, Southampton Island and the shoreline of Foxe Basin in the Eastern Arctic. Elsewhere in Canada, breeding densities of this sea duck, which nests mainly in solitary, widely scattered pairs, are low, from northern Quebec north to Ellesmere Island in the east and in Yukon in the west (Suydam 2000). The species has two distinct wintering areas in North America. Since individuals form pair bonds on the wintering grounds, the species may have distinct Eastern and Western populations (Canadian Wildlife Service Waterfowl Committee 2007), although some authors have argued against this hypothesis (Mehl et al. 2004). Western King Eiders winter for the most part in the Bering Sea and North Pacific (Pearce et al. 2004), while the eastern birds winter mainly at sea off the coast of Greenland (Durinck and Falk 1996; Mosbech and Boertmann 1999; Mosbech and Johnson 1999; Boertmann et al. 2004), Labrador and Newfoundland, with a small number of individuals in the Gulf of St. Lawrence (Bourget et al. 1986). King Eiders have also been reported among rafts of Common Eiders around the Belcher Islands in winter (Gilchrist and Robertson 2000). The Western Population breeds inland west of the Adelaide Peninsula, and on Victoria and Banks islands, while the Eastern Population breeds further north and east (Dickson et al. 1997; Suydam 2000).

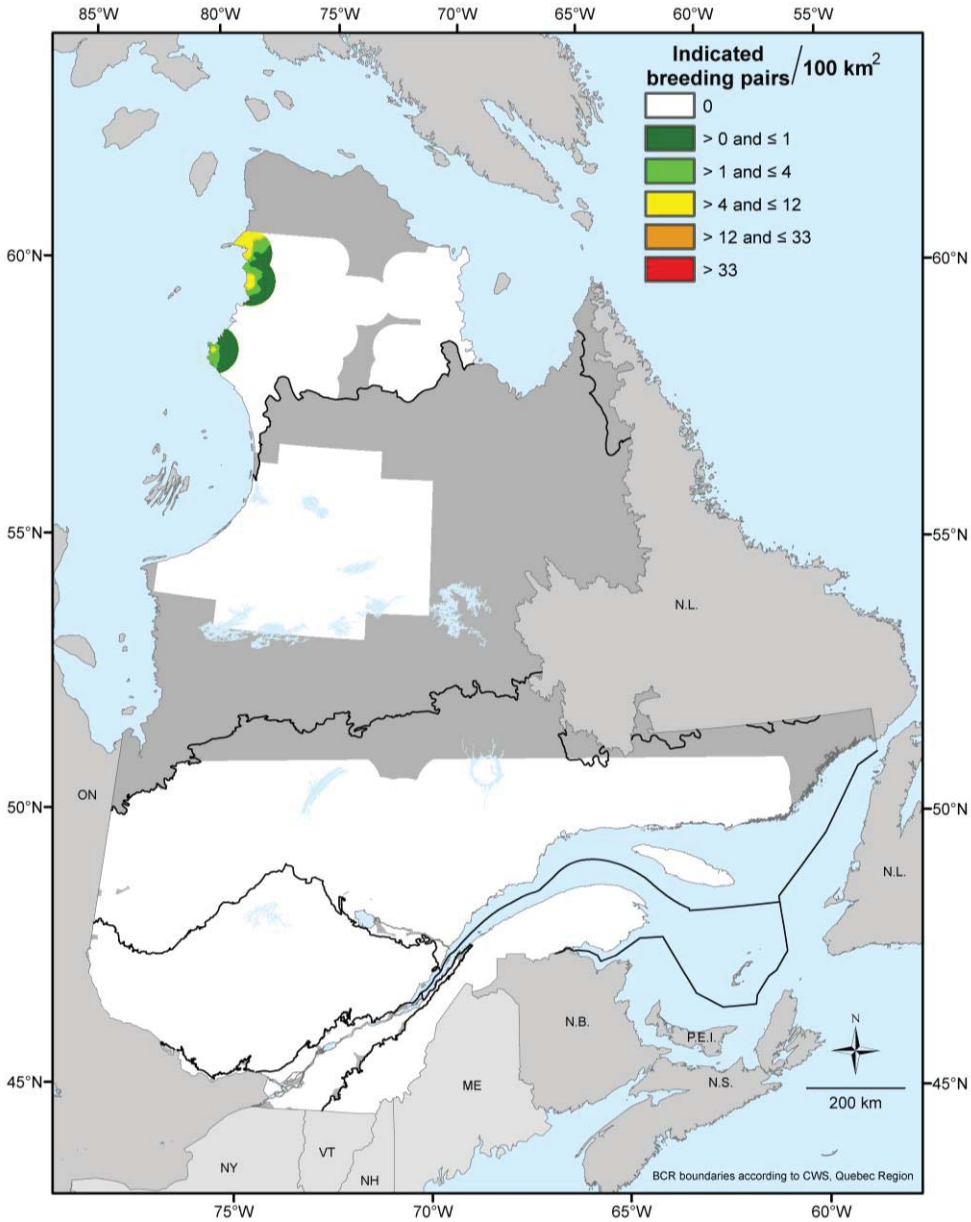
Breeding

In Quebec, breeding records for the species come mainly from the coasts of Ungava Bay and Hudson Bay (Lamothe and Choinière 1996; CWS, unpubl. data). More specifically, the King Eider nests on the edge of freshwater ponds in the tundra, in the coastal strip no more than 50 km from the coast (Lamothe and Choinière 1996). King Eider nests and broods were regularly found near the Polemond and Kogaluc rivers, 60 km south of Puvirnituq, during a 1996–2003 Canada Goose breeding ground study, and one nest was also found near the Sorehead River, 50 km north of Puvirnituq (BCR 3) (R. Cotter, CWS, unpubl. data).

In the southern half of Quebec, a small number of the eiders occasionally summer along the St. Lawrence estuary (Lamothe and Choinière 1996; Bannon et al. 1998; ÉPOQ). In the summer of 1998, two records of adults with young were reported: a breeding pair with four ducklings off Le Bic (BCR 14) and a female with young around Île aux Basques (BCR 14) (Bannon et al. 1998). However, some doubt remains over the actual species of the ducklings observed given the frequent crèching behaviour in eiders (Common and King); consequently, breeding confirmation must be obtained for the species at this latitude to lend credence to these possible breeding records in the estuary.

Figure 67 shows the distribution of indicated breeding pairs of King Eider in Quebec based on WNOR data.

Figure 67. Breeding distribution of the King Eider in Quebec (by indicated breeding pair density); please read the explanatory note at the last paragraph of Section 2.4



Migration and moulting

There is little information on migration and moulting in this species in Quebec. The west coast of Greenland probably hosts moulting individuals breeding in northern Quebec since it is a major moulting area for birds from Eastern Canada in general (to 110° W longitude) (Mosbech et al. 2006a). In Greenland, moulting eiders gather in fjords and coastal waters from July to October, with peak numbers occurring in late August (Mosbech and Boertmann 1999). Two King Eiders fitted with radio transmitters at their

nest site on Southampton Island (Nunavut) in 2003 moulted in Ungava Bay, one near Kangiqsujuaq and the other near Quaqtaq (BCR 3) (Mosbech et al. 2006a). They lingered around Aupaluk and Akpatok Island respectively from October to December (Mosbech et al. 2006a). There is also a record from August 31, 1958, of 2,000 King and Common eiders (moulting adults and broods) in the False River estuary (BCR 7) (Driver 1958).

In southern Quebec, most records of migrating or wintering King Eiders come from the estuary and Gulf of St. Lawrence (BCR 8 and 14). The ÉPOQ database received 38 records of the species on average every year from 1974 to 2003. The mean number of individuals per record is 1.4, but the actual range is from 1 to 14 birds. According to ÉPOQ, the most frequent records of King Eiders in spring come from Les Bergeronnes on the north shore of the river and the stretch between Le Bic and Matane on the south shore.

Wintering

Most of the 300,000 King Eiders wintering along the west coast of Greenland are individuals that breed in the Canadian Arctic (Mosbech et al. 2006a); consequently, some of the birds that breed in Quebec may also overwinter in this location. In Nunavut, several thousand eiders of both species (King Eiders and Common Eiders [*S. mollissima borealis*]) overwinter off Killiniq, at the very northern tip of Labrador (Nakashima 1986). More recently, the use of this site has been confirmed in winter: in June 2003, three birds radio-tagged at East Bay, on Southampton Island, came to overwinter in this location the following winter (Mosbech et al. 2006a). In February 2010, aerial surveys confirmed that the area around Killiniq Island and the Button Islands is still being used as a wintering ground, with an estimated 15,000 King Eiders found there (CWS, unpubl. data). A small number of King Eiders can also probably be found in winter near Aupaluk (Ungava Bay) and Kangiqsujuaq (Hudson Strait) (Nakashima 1986).

In 1980, an estimated 2,500 King Eiders overwintered in the Gulf of St. Lawrence in small groups, in the company of Common Eiders, most in the Mingan Archipelago and around Anticosti Island (Bourget et al. 1986). According to COEIS surveys in 2003, 2006 and 2009, there are now probably fewer than 100 King Eiders overwintering in the two sectors (CWS, unpubl. data). According to the ÉPOQ database, some individuals occasionally overwinter in the Gaspé region (Percé in 1996, Matane in 2002 and Pointe-Saint-Pierre in 2003) and along the North Shore (Cayes de la rivière Magpie [small islands at the mouth of the Magpie River] in 2004, 2005 and 2006). Lastly, there are two winter records in the Montréal region, one in 1971 and a more recent one in 2002 (David 1996; Bannon et al. 2002c).

Conservation

No annual surveys covering the King Eider are carried out in North America. The 2004 update to the North American Waterfowl Management Plan (North American Waterfowl Management Plan 2004) estimated the average size of the continental population to be around 575,000 birds in 1994–2003 (Table 2). Winter surveys along the southwest coast of Greenland—which reported 275,000 individuals in 1981 and 1982 (Mosbech and Johnson 1999) and 280,000 individuals in 1989 (Durinck and Falk 1996)—probably provide a rough indication of the size of the Eastern population, since the majority of these birds probably breed in the eastern Canadian Arctic (Boertmann et al. 2004).

There is little information on trends in the Eastern population. Spring counts of migrating birds at Point Barrow, Alaska, showed a 54% decline from 1976 (803,000 King Eiders) to 1996 (370,000 King Eiders) (Woodby and Divoky 1982; Suydam et al. 2000). More recently, surveys of the breeding grounds on Victoria Island in 2004 and 2005 found half as many eiders as surveys on the same part of the island from 1992 to 1994 (Dickson et al. 1997; Dickson 2005). In the Rasmussen Lowlands in Nunavut, the number of breeding King Eiders in 1994–1995 was 73% lower than in 1975–1976 (Johnston et al. 2000). Finally, an estimated 200,000 King Eiders moulted along the west coast of Greenland in the 1950s, compared with 30,000–40,000 birds in 1993–1995 (Mosbech and Boertmann 1999). Although a decrease of at least 50% in the population could have occurred, it is also possible that the birds simply moved to new moulting areas (Mosbech and Boertmann 1999); however, the hypothesis of a population decline is supported by declines observed on the breeding grounds.

The Aboriginal harvest and sporadic losses due to mass starvation are two major causes of mortality in the species. In 1994, an estimated 20,000 birds from the Western population were taken in the subsistence harvest (Fabijan et al. 1997), or 5% of the population. In Greenland, the estimated Aboriginal and commercial harvests total 10,000–20,000 eiders every year (Sea Duck Joint Venture 2003c). In Canada, given the low numbers of birds present in the south, sport harvests have always been very low, totalling less than 1,500 birds a year in the country as a whole (Gendron and Collins 2007). The sport harvest of the species in Quebec is even more marginal with King Eiders only being harvested in two years since 1990 (1997 and 2004) (Table 3).

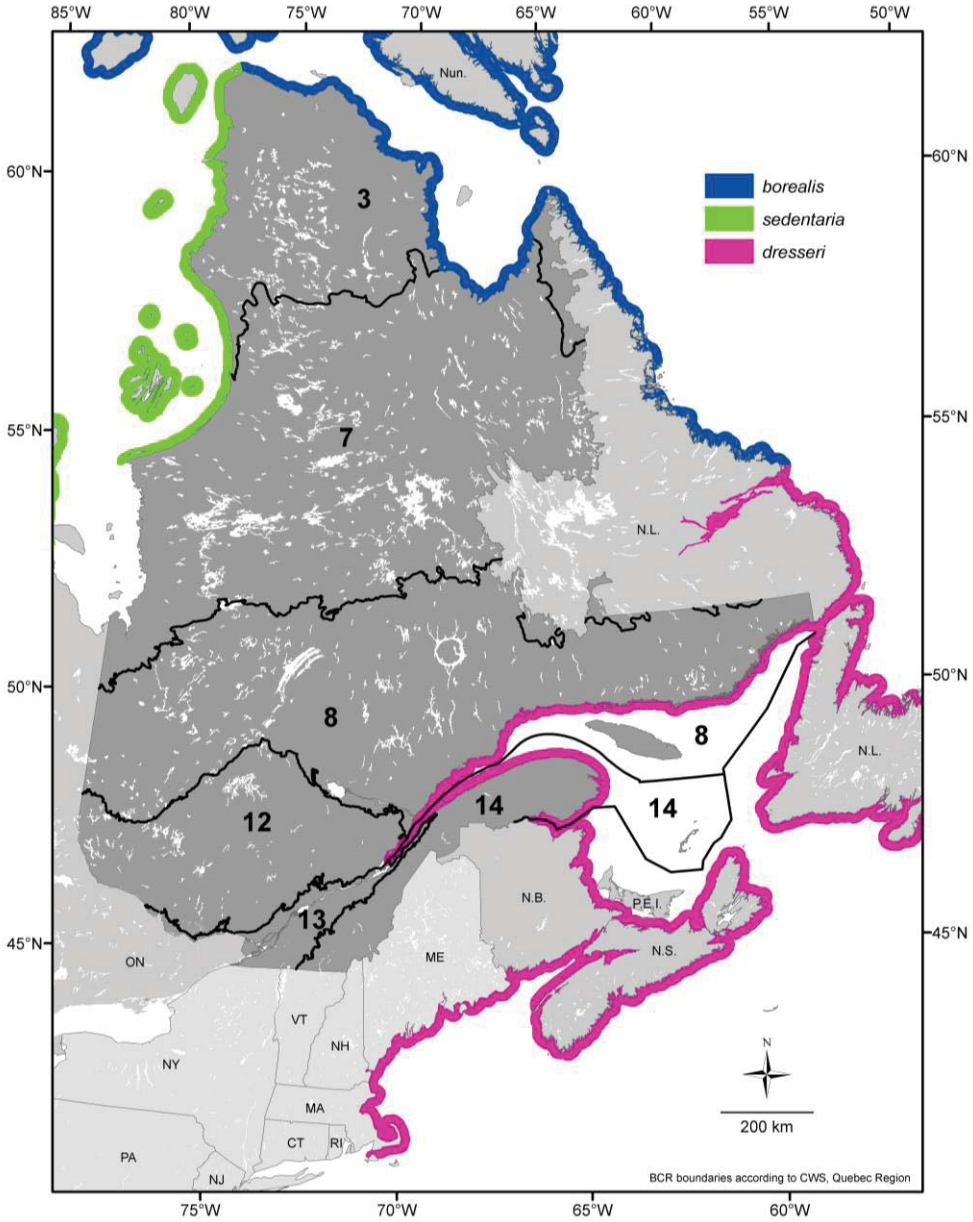
Mass starvations causing significant mortality may occur, particularly during spring migration: in 1964, 100,000 King Eiders (Western population) perished due to the lack of open water between the ice (Barry 1968). Lastly, disturbance in the moulting areas and wintering grounds also poses a threat to the species. In western Greenland, increased shipping traffic since the 1950s has resulted in fewer and fewer undisturbed areas where the species can moult (Mosbech and Boertmann 1999). In addition, many birds are still moulting when the hunting season opens in Greenland (August 15) (Mosbech and Boertmann 1999); although hunters are forbidden from herding flightless birds, hunting clearly contributes to the disturbance of these birds. In Greenland, it has also been reported that disturbance on the wintering grounds during the few hours of daylight in winter may have a significant impact on foraging (Mosbech et al. 2006a). Petroleum exploration activities, which are increasing in Greenland, are considered another source of possible disturbance to the species (Mosbech and Boertmann 1999; Mosbech et al. 2006a). Lastly, King Eiders are vulnerable to chemical spills, particularly during periods when the birds are concentrated (moulting and wintering) (Mosbech and Boertmann 1999; Roberge and Chapdelaine 2000).

Since a small percentage of the population breeds (<1%; Table 2) and winters in the province, Quebec's potential contribution to the conservation of the King Eider is very modest. As in the case of other northern species, it would be prudent to institute a survey of the birds on their breeding grounds in order to determine population trends and the extent of their use of Quebec territory.

4.5.2 Common Eider *Somateria mollissima* (by Christine Lepage)

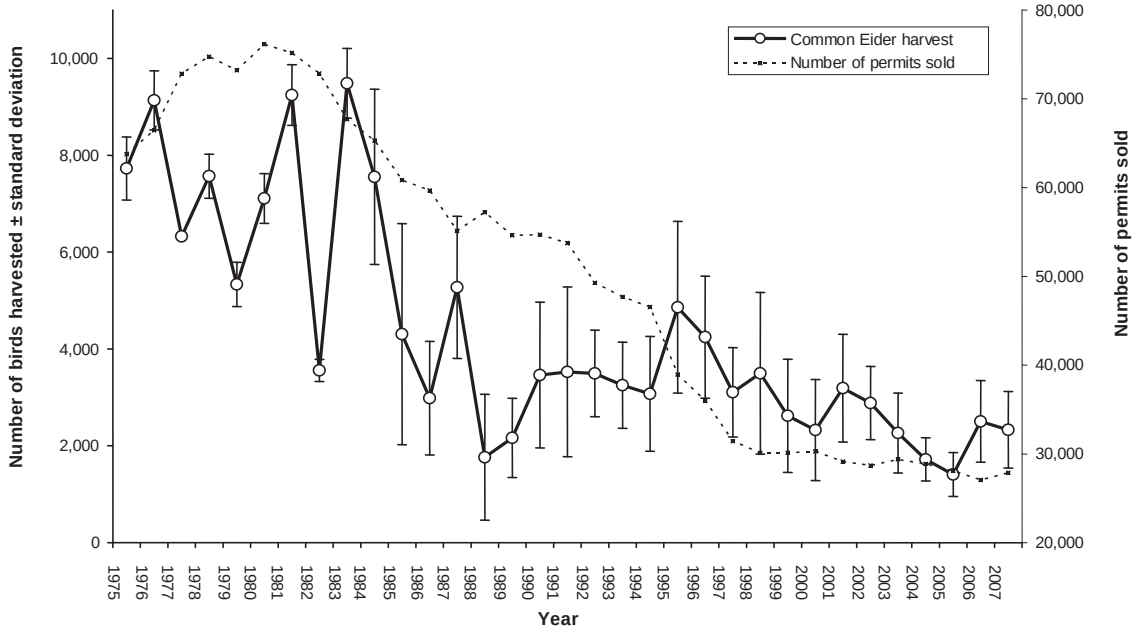
The sturdy Common Eider frequents coastal marine habitats in temperate and arctic portions of the Northern Hemisphere. Six subspecies of this sea duck have been identified (Ogilvie 2005), three of which inhabit Quebec's coastal areas (see Figure 68): *Somateria mollissima sedentaria* in Hudson Bay, *S. m. borealis* in Ungava Bay and *S. m. dresseri* in the estuary and Gulf of St. Lawrence (Joint Working Group on the Management of the Common Eider 2004). Given the different distributions, life cycles and needs of these subspecies in Quebec, each is discussed in a separate section (4.5.2.1 to 4.5.2.3).

Figure 68. Distribution of the three subspecies of the Common Eider in Quebec



National Harvest Survey data (see Section 3.8) allows the number of migratory birds harvested by species to be estimated, but do not break down harvests by subspecies. Consequently, the data on the Common Eider harvest in Quebec (Figure 69; Table 3) shows the number of birds shot in the province, without associating them with the *dresseri* or *borealis* subspecies. While 7,300 eiders were harvested on average annually in 1975–1984, this dropped to around 3,000 eiders the following decade, and to only 2,000 birds in recent years (2003–2007), so that the Common Eider ranks 14th among waterfowl harvested (Table 3). In the Atlantic Flyway, U.S. hunters harvested 22,900 individuals on average during the 2000–2007 period (Padding and Klimstra 2008).

Figure 69. Estimated Common Eider sport harvest in Quebec and number of Migratory Game Bird Hunting Permits sold, 1975–2007 (data taken from Gendron and Collins 2007)



4.5.2.1 Subspecies *dresseri* *Somateria mollissima dresseri* (Mr, Br, Wr) (by Jean-Pierre L. Savard and Christine Lepage)

This subspecies, also known as the American Eider or Southern Eider, breeds along the seacoasts of North America, from the southern half of Labrador to the estuary and Gulf of St. Lawrence in Quebec, in the Atlantic provinces (except Prince Edward Island), Maine and finally Massachusetts, where only a few dozen pairs breed (Joint Working Group on the Management of the Common Eider 2004). Although a small number of the *dresseri* subspecies overwinter in the Gulf of St. Lawrence, around Newfoundland and Labrador, and in the Maritimes, most individuals winter along the Atlantic Coast (Reed 1986a; Goudie et al. 2000).

Breeding

Common Eiders nest mainly in colonies on islands that have no terrestrial predators (Joint Working Group on the Management of the Common Eider 2004; Goudie et al. 2000). In Quebec, the *dresseri* subspecies breeds on the south shore of the St. Lawrence from Battures aux Loups Marins (BCR 13) to Matane (BCR 14) and on the north shore as far east as Blanc-Sablon (BCR 8). A few breeding pairs can also be found around the Gaspé Peninsula, and a few no doubt breed on Brion Island, as well as a single pair found nesting on Île aux Goélands in the Magdalen Islands (J.-F. Rail, CWS, pers. comm.). Colony size varies, ranging from a few nests to approximately 10,000 nests found on Bicquette Island near Rimouski. Colonies are generally larger in the southern part of the breeding range than in the northern part. For example, in the St. Lawrence, colonies are much larger and denser in the upper (southern) half of the estuary than in the lower (northern) half of the Gulf (Joint Working Group on the Management of the Common Eider 2004; Rail and Chapdelaine 2002). The Common

Eider is very flexible in its choice of breeding habitat and may use bare areas with sparse vegetation, small grassy islands or densely forested islands (Goudie et al. 2000). The nest is often located near structures (e.g., rocks, dead trees or mounds) protecting it from the prevailing winds and is most often on fairly dry ground (Goudie et al. 2000). Eiders also use artificial nest boxes on the ground, which protect the nest from inclement weather and avian predators (Joint Working Group on the Management of the Common Eider 2004). Hens rely mainly on assiduous nest attendance during incubation to protect the clutch from diurnal predators (Bolduc and Guillemette 2003a; b). The distance between the nest and shore may also be important in avoiding predation both during the incubation period, when the hen takes rare breaks from the nest, and after the ducklings leave the nest (Bolduc et al. 2005).

There are approximately 60 colonies in the St. Lawrence estuary, which contained an estimated 19,100 breeding pairs in 2009 (500 pairs in BCR 13, 15,900 pairs in BCR 14 and 2,700 pairs in BCR 8) (CWS, unpubl. data). Seven of these colonies house 82% of the breeding population (Bicquette Island, Blanche Island, Île aux Pommes, Île aux Oeufs, Ragueneau Islands, Île aux Fraises and Îles du Pot à l'eau-de-vie [Brandypot Islands]; BCR 8 and 14). The Gulf of St. Lawrence colonies (BCR 8 and BCR 14) are much smaller, most containing fewer than 500 nests (Rail and Chapdelaine 2002). Unlike the colonies in the estuary, those on the Lower North Shore have been, and are still being, affected by disturbance from poaching (spring hunting and egging), the disturbance of broods and the Aboriginal hunt (Chapdelaine et al. 1986b; Blanchard 2004). The creation of the Mingan Archipelago National Park Reserve of Canada (BCR 8) in 1984 brought about increased surveillance—at least until 2000—which resulted in an increase in the breeding population in the protected areas (Rail and Chapdelaine 2002; Roberge 2002; Rail and Cotter 2007). The Gulf population was estimated at 18,400 breeding pairs in 2009 (17,900 pairs in BCR 8 and 500 pairs in BCR 14) (CWS, unpubl. data), compared with 10,000 pairs in 2002 (Joint Working Group on the Management of the Common Eider 2004).

In the estuary and Gulf of St. Lawrence, laying begins in the first weeks in May, and the first eggs hatch towards the end of May or beginning of June. Laying usually occurs over a period of several weeks: the most experienced hens lay earlier than females nesting for the first time (Baillie and Milne 1982). Nesting chronology may vary from year to year by one or two weeks depending on the temperature and rapidity of snow melt (Spurr and Milne 1976). Preferred brood-rearing sites in the Mingan Archipelago consist of areas around islands with coastal shoals or submerged reefs (Roberge and Chapdelaine 2000). In the St. Lawrence estuary, brood-rearing areas are concentrated along the shoreline, in bays rich with periwinkles and amphipods (Cantin et al. 1974; Diéval 2006). Adults without ducklings tend to frequent habitats with plentiful blue mussels (Cantin et al. 1974; Gauthier and Bédard 1976; Diéval 2006).

Reproductive success in the species varies significantly from year to year and from colony to colony (Milne and Reed 1974; Gauthier and Bédard 1976; Diéval 2006). For example, in a study carried out in 2003 and 2004 on the south shore of the lower estuary, the vast majority of ducklings perished in the first few days and, among the survivors, more than half died during the first two weeks after hatching (Diéval 2006). Two factors contribute to duckling mortality in the estuary: gull predation and weather conditions at hatching and during the time the ducklings travel from the nesting islands to the brood-rearing sites. In eiders, broods have a propensity to amalgamate into

crèches, which may have a positive impact on duckling survival in some circumstances (Munro and Bédard 1977a; Goudie et al. 2000).

Spring migration

Individuals of the *dresseri* subspecies leave their wintering grounds along the Atlantic Coast around the end of March or early April and head northeast along the coast. Some birds travel around the Gaspé Peninsula towards the St. Lawrence estuary or the north shore of the Gulf, while others migrate up the coast of Maine and then head overland at night to reach the St. Lawrence estuary (Gauthier et al. 1976). A hen fitted with a satellite transmitter left her wintering grounds 160 km east of New York between April 11 and 14, 2007, and headed to the coast of Maine, stopping 130 km east of Boston on April 18. Three days later, on April 21, she was located near Rivière-du-Loup (BCR 14) where she had bred the previous year (CWS, unpubl. data). The spring migration is short and the birds head quickly to their breeding sites. It is not known what first-year birds do in spring; it is suspected that they go directly from their wintering grounds to their moulting areas, but this hypothesis has not yet been confirmed. Adult females return to breed in or near the colony where they hatched and tend to return to the same island in subsequent years (Reed 1975; Goudie et al. 2000). Pair formation occurs in fall or winter, and the drake accompanies the hen to her nesting island (Goudie et al. 2000).

Moulting

As soon as the females begin incubation, the males gather in flocks and leave the nesting islands to go to their moulting areas. There, they gradually shed their immaculate white plumage in favour of a duller, blackish garb, which they retain during the flightless period (Goudie et al. 2000). The males are unable to fly from the end of July to the end of August or beginning of September. The eiders use a number of moulting areas in the estuary and Gulf of St. Lawrence. The main known sites include the southern and southwestern coastline of Anticosti Island (up to 42,000 individuals; BCR 8), the area between Les Escoumins and Pointe à Boisvert on the north shore of the lower estuary (up to 9,500 individuals, mainly offshore from Mille-Vaches Bay; BCR 8), the area between Sainte-Geneviève Island and Watshishou MBS in the Gulf (BCR 8), and the sector between Cape Marteau and Mitis Point on the south shore of the lower estuary (BCR 14) (Rail and Savard 2003). Small numbers of moulting eiders are also found in a number of other locations in the St. Lawrence.

Little is known about moulting in the females; some moult in the same sites as the males while others disperse in small groups all along the estuary and Gulf of St. Lawrence, often nearer the breeding sites than the males. Two important moulting areas for females are Mille-Vaches Bay and the southern and southwestern coasts of Anticosti Island. In addition, a few hundred moulting females were observed in late August 2009 in Pontbriand Bay, east of Baie-Johan-Beetz on the Middle North Shore (F. St-Pierre, UQAM, pers. comm.). Some males and females go to the coast of Maine and Nova Scotia to moult (CWS, unpubl. data). According to recent studies, females nesting in the same colony may moult in different locations; three females that nested on Innu Island in the Mingan Archipelago (BCR 8) moulted along the southern and southwestern coasts of Anticosti Island (BCR 8), roughly 70 km to the south, while two other females nesting on the same island moulted off the coast of Maine, over 800 km to the south (J.-P.L.S., unpubl. data).

Fall migration

Eiders from the *dresseri* population that breed or moult in the estuary and Gulf leave the St. Lawrence in fall to head to the New England coast. These birds adopt two different migration strategies in fall that are related to the ones they use in spring: one part of the population travels along the coast of Gaspé and Cape Breton, while the other flies overland across the Gaspé Peninsula, at roughly the level of Montmagny and Rivière-du-Loup (Reed 1975; Gauthier et al. 1976). Owing to the different moulting areas used by males and females and different moulting chronology in the sexes (the females moult later than the males), it is very likely that migration in these two segments of the population is not synchronized, exposing them to different hunting pressures. Some birds most probably travel around Nova Scotia, while others go through the Bay of Fundy (J.-P.L.S., unpubl. data).

Wintering

In winter—and particularly in mid-winter (January and February)—the eiders concentrate in large flocks. Pair formation occurs at this time (Goudie et al. 2000). Individuals of the *dresseri* subspecies overwinter along the southern coast of Newfoundland (S. Gilliland, CWS-Atlantic Region, pers. comm.), around Saint-Pierre-et-Miquelon (B. Letournel, ONCFS, pers. comm.), along the coast of New Brunswick and Nova Scotia, and down the U.S. East Coast as far south as Massachusetts, Rhode Island and the eastern tip of Long Island, New York (Reed 1986a; Goudie et al. 2000; Sea Duck Joint Venture 2003b; Joint Working Group on the Management of the Common Eider 2004). Most of the eiders wintering in the Gulf of St. Lawrence belong to the *borealis* subspecies (see Section 4.5.2.2), although a certain percentage of *dresseri* are probably also present (Reed et al. 1986; Roberge and Chapdelaine 2000). Although the percentage of *dresseri* in the Gulf has been estimated variously at 43% (Reed et al. 1986) and 17% (Roberge and Chapdelaine 2000), this is thought to not accurately reflect the actual ratios of the subspecies present in winter because of the date of the surveys in question.

Conservation

The breeding population of *dresseri* has been estimated at 107,200 breeding pairs, of which roughly 38,000 breed in Quebec (Joint Working Group on the Management of the Common Eider 2004; CWS, unpubl. data). The continental population hovers around 300,000 individuals (Table 2). Trends in the continental *dresseri* population are not known, but in Quebec, the breeding population appears to be stable in the estuary (despite significant periodic fluctuations; J.-F. Rail, CWS, unpubl. data) and increasing in the Gulf (close to 10% annually from 1999 to 2005) (Rail and Cotter 2007).

In recent decades, there have been a number of proposals on conserving eiders in Quebec, particularly in the St. Lawrence estuary (Huot and Giroux 1985; Bédard et al. 1987; Bédard 1988; Drolet 1989; Filion and Bédard 1989; Bédard and Nadeau 1994; Bélanger and Bédard 1997; Huot 1999; Nadeau and Bédard 2001) and on the Lower North Shore (Rail and Chapdelaine 2002; Roberge 2002; Blanchard 2004). These efforts culminated in 2004 with the publication of the *Quebec Management Plan for the Common Eider Somateria mollissima dresseri* (Joint Working Group on the Management of the Common Eider 2004). The main anthropogenic threats to eider populations in Quebec cited include petroleum spills (Lehoux and Bordage 1999), sport hunting and the First Nations harvest, human disturbance in the breeding colonies and brood-rearing areas (Bolduc and Guillemette 2003a), accidental trapping of birds in

fishing nets, overfishing of molluscs, and disturbance and habitat loss from aquaculture activities. The commercial mussel and sea urchin fisheries are expanding, with a real potential for conflicts with the species (Krohn et al. 1992). Overfishing of molluscs in the Netherlands has been linked to significant eider mortality in winter (Wadden Sea Newsletter 2001; Camphuysen et al. 2002). The commercial seaweed harvest may also have an effect on the survival of young ducklings, which forage extensively in this type of vegetation (Hamilton 2001). Lastly, hunting pressure on eiders is very high—particularly in the Atlantic provinces and Maine—resulting in a high rate of lead or steel shot embedded in the flesh of living birds (Hicklin and Barrow 2004).

Natural threats to the species include recurrent outbreaks of avian cholera in colonies (Joint Working Group on the Management of the Common Eider 2004; Reed and Cousineau 1967; Korschgen et al. 1978; Filion and Bédard 1989), gull predation on ducklings (Munro and Bédard 1977b; Hicklin 1989) and the presence of foxes on nesting islands.

Eiders may also cause significant damage to commercial blue mussel farming operations. The birds seem to prefer cultivated mussels to wild ones because of their thinner shell (Milne and Galbraith 1986; Galbraith 1992; Burnett et al. 1994). Lastly, predation by eiders may have an influence on the composition of intertidal communities and resource abundance (Hamilton 2000).

Quebec has a high degree of responsibility for the conservation of the *dresseri* subspecies since a third of the world population breeds in the province (Table 2). Given the vulnerability of the subspecies—due to its gregarious nature (breeds in colonies and moults and winters in large groups) and the fact that its breeding range is limited to the estuary and Gulf of St. Lawrence—monitoring, research and management requirements for the subspecies are extensive.

4.5.2.2 Subspecies *borealis* *Somateria mollissima borealis* (Mr, Br, Wr)
(by Jean-Pierre L. Savard and Christine Lepage)

The *borealis* subspecies of the Common Eider breeds on the northeast coasts of Canada and Greenland (Joint Working Group on the Management of the Common Eider 2004; Goudie et al. 2000; Ogilvie 2005). Individuals of this subspecies winter in Greenland (Merkel et al. 2002; Lyngs 2003; Merkel 2003; Mosbech et al. 2006b), the Gulf of St. Lawrence (Bourget et al. 1986; Bordage et al. 1998) and the Atlantic coast of Newfoundland. Some individuals also overwinter along the extreme northern tip of Labrador (Nakashima 1986; CWS, unpubl. data).

Breeding

In Canada, the *borealis* population breeds mainly in Nunavut and Nunavik, along the coast of Ungava Bay and the northern tip of Labrador to northern Baffin Island. It is not known which subspecies of the Common Eider breed along the east coast of Labrador since the ranges of the *borealis* and *dresseri* subspecies seem to overlap at this location (Mendall 1980; Reed 1986a). In Quebec, *borealis* individuals breed mainly in colonies on coastal islands in Ungava Bay (facing BCR 3 and 7) with no terrestrial predators (Goudie et al. 2000; Falardeau et al. 2003; Joint Working Group on the Management of the Common Eider 2004). In 1980, based on counts of eiders on several islands in Ungava Bay, the estimated breeding population in coastal habitats was 48,700 breeding pairs (Chapdelaine et al. 1986a). This subspecies also nests on

small islands in some large freshwater lakes near Ungava Bay, including lakes southwest of the Eider Islands, near Quaqtaq (323 nests in 1980; BCR 3); Qamanialuk and Virgin lakes north of Kangirsuk (1,800 nests on 68 islands surveyed in 1982 and 303 nests on 11 islands surveyed in 1980 respectively; BCR 3); lakes south of Anse De Villiers near Aupaluk (238 nests in 1980; BCR 3); and lakes in the Diana Lake and Nepihjee River region, near Kuujjuaq, in the southern end of Ungava Bay (BCR 7) (Nakashima and Dumas 1984; Chapdelaine et al. 1986a; Nakashima 1986). Eiders nesting in freshwater habitats regularly travel to saltwater foraging sites, particularly at low tide (Nakashima and Dumas 1984). Hatching success in 407 nests monitored on three islands was 66.1%, with the main predator being Herring Gull (Nakashima and Dumas 1984).

Colony size ranges from a few nests to close to 2,000. The *borealis* subspecies builds its nest on a wide variety of substrates including bare ground, ground with sparse vegetation, small grassy islands and small islands with low-growing shrubs. It even nests on grassy cliff ledges on some islands (Chapdelaine et al. 1986a; Goudie et al. 2000). The nest is placed in a fairly well-drained location in the shelter of a rock or mound protecting it from the prevailing winds. It may also use artificial nest boxes that protect the nest from inclement weather and avian predators (Cooch 1965; Kuujjuaq Research Center 1986). The Ungava Bay colonies are somewhat reminiscent of those in the Gulf of St. Lawrence in terms of size, with most containing fewer than 300 nests (Chapdelaine et al. 1986a; Falardeau et al. 2003). The eiders nest mainly on the islands in the western part of Ungava Bay, divided among several archipelagos. In 2000, four island groups that had been surveyed in 1980 (Chapdelaine et al. 1986a) were resurveyed to determine if the abundance of the species in Ungava Bay had changed (Falardeau et al. 2003). The results are not easy to interpret since numbers appear to be stable or even increasing in three of the archipelagos, but probably declining in the fourth (Falardeau et al. 2003). The study's primary conclusion was to highlight the weakness of existing data on eider populations in the region and the urgent need to set up efficient survey mechanisms to monitor these populations (Falardeau et al. 2003).

The timing of laying varies from year to year in a given archipelago, depending on how quickly the snow melts as well as when the ice bridges that may link some islands to the mainland disappear. Laying phenology also varies greatly among archipelagos; in 1980, the laying initiation date was June 5 on the Gyrfalcon Islands and June 14 on the Eider Islands (Chapdelaine et al. 1986a). Laying generally begins in June and the first eggs hatch in early July (Chapdelaine et al. 1986a). Lastly, laying phenology varies even within a given archipelago, with islands that are more isolated from other islands and the mainland generally become ice-free earlier (J.-F. Rail, CWS, pers. comm.).

Spring migration

According to a satellite telemetry study, a *borealis* female wintering in coastal waters off the Magdalen Islands (BCR 14) left this region on May 7 to head up to the coast of Labrador. By May 24, she had reached the level of Goose Bay, and on June 2, she had arrived in Ungava Bay (J.-P.L.S., unpubl. data). Two males and a female that wintered near Anticosti Island (BCR 8) in the Gulf of St. Lawrence and two males that wintered off the east coast of Newfoundland were fitted with radio transmitters and tracked to their colony off East Bay, near Southampton Island, on the western end of Hudson Strait (Mosbech et al. 2006b). The median migration initiation date for the Anticosti Island eiders was May 24, compared with April 30 for the Newfoundland eiders

(Mosbech et al. 2006b). This is surprising considering that the Anticosti eiders have much farther to travel to their colony in the North than the Newfoundland and Labrador birds. After moving up the coast of Labrador, three of the five birds reached their colony on June 6, 14 and 23 respectively (Mosbech et al. 2006b).

For five eiders wintering off Greenland and breeding in a colony in East Bay, spring migration extended from May 2 to 29 (mean: May 15) (Mosbech et al. 2006b). Two females breeding in the Gyrfalcon Islands in Ungava Bay and wintering in southern Greenland left their wintering quarters after May 12 and May 17 respectively (J.-P.L.S., unpubl. data). The last bird reached its nesting site in Ungava Bay on May 20. The first one, which left the wintering grounds earlier, spent roughly a week along the south coast of Baffin Island (May 15 to 21) and then headed to Ungava Bay.

In the Gulf of St. Lawrence, the timing of departure for the breeding grounds by *borealis* individuals (May) appears to overlap with the period during which *dresseri* birds arrive on their breeding grounds. Seeing that *dresseri* individuals arrive in the Gulf in late April and begin laying in mid-May, the two subspecies may mingle in the Gulf at this time (Roberge 2002). However, the detailed distribution of these subspecies during this period is not known and *dresseri* individuals may very well be concentrated around the nesting islands while *borealis* individuals remain on their wintering grounds, at a greater distance from the nesting islands.

Individuals of the *borealis* subspecies have a more prolonged migration in spring (average: 27.3 days for all flyways) than in fall (average: 16.1 days), with birds probably stopping to feed more frequently (energy requirements are particularly great in pre-laying females) and also being delayed by the rate of break-up (Mosbech et al. 2006b). It is not known what first-year birds do in spring. Adult females try to return to nest on the island where they hatched, and males accompany them to their nest site (Goudie et al. 2000).

Moulting

Once the hens begin incubating, the drakes abandon the nesting islands, congregate in flocks and head to their moulting areas. Males lose their ability to fly in late July and do not regain it again until late August or early September. Some of the *borealis* eiders that breed in Ungava Bay also moult there, although all the major moulting areas used by the subspecies have not yet been identified. Bell Inlet, a deep bay on the east coast of Ungava Bay, is known for attracting large concentrations of moulting males (BCR 3) (Nakashima 1986). On the west coast of Ungava Bay, concentrations of males are found in such places as the False River estuary (east of Kuujjuaq; BCR 7) (Driver 1958) and the deepwater bays between Jean-Talon and De Champigny points (west of Quaqtaq; BCR 3) (Nakashima 1986). In a satellite telemetry study, the vast majority of eiders that were tracked moulted in Canada before going to Greenland to spend the winter, although an individual moulted in Greenland, thus confirming the possibility that birds may undertake a long moult migration (Mosbech et al. 2006b).

The departure date for the moult migration is highly variable, extending from July 10 to August 24 (Mosbech et al. 2006b). Females tend to moult near their breeding colonies (< 100 km) (Mosbech et al. 2006b). In general, *borealis* moulting areas appear to be located between the breeding and wintering grounds, so that birds that do not moult near their colony are closer to their wintering grounds when they begin their fall migration.

Fall migration

In 2006, nine *borealis* eiders (eight hens and a drake), captured on their nesting island and fitted with a radio transmitter, remained in Ungava Bay until early November (J.-P.L.S., unpubl. data). It is thought that they wait until the last minute to leave the bay. Migration to the wintering grounds off Greenland is a fairly quick affair, with the birds following the east coast of Ungava Bay before crossing over to Greenland. Birds overwintering in the Gulf of St. Lawrence (BCR 8) also travel along the east coast of Ungava Bay and then head south along the coast of Labrador. Some birds move slowly, while others are quicker. Some individuals also overwinter along the coast of Labrador (Mosbech et al. 2006b). Eiders' migratory behaviour in fall is poorly understood, and some individuals may take an inland route across Nunavik and Labrador (Nakashima 1986). Some eiders spend a few days along the northeast coast of Labrador before crossing over to Greenland (J.-P.L.S., unpubl. data).

Wintering

The *borealis* subspecies winters mainly in Greenland (Boertmann et al. 2004; Mosbech et al. 2006b), the Gulf of St. Lawrence (Mingan Islands [BCR 8], Anticosti Island [BCR 8], the Magdalen Islands [BCR 14]) (Bourget et al. 1986; Bordage et al. 1998; CWS, unpubl. data), along the Atlantic coast of Newfoundland and Labrador and around Saint-Pierre-et-Miquelon (CWS, unpubl. data). An undetermined number of individuals also winter in northern Quebec, in open water leads and polynyas (Nakashima 1986). Among 25 eiders captured in a colony near Southampton Island in Nunavut in 2001 and 2003, 60% overwintered along the coast of Greenland and 40% along the coast of Canada (Labrador, Newfoundland and Gulf of St. Lawrence). Out of nine eiders captured on the Gyrfalcon Islands in Ungava Bay in 2006, 66% wintered in Greenland and 33% in Canada (J.-P.L.S., unpubl. data).

A few thousand eiders (Common Eider, *borealis* subspecies and King Eider [*S. spectabilis*]) overwinter off the northern tip of Labrador, near Killiniq (Nakashima 1986; CWS, unpubl. data). These individuals are probably mainly juveniles and young adults. In the Gulf of St. Lawrence, the greatest concentrations are found in the Mingan Islands (roughly 40,000 individuals) and Anticosti Island (roughly 18,000 individuals) (Bourget et al. 1986; Bordage et al. 1998; CWS, unpubl. data). During surveys in February 2003 and 2006, groups of eiders were recorded wintering for the first time in the Magdalen Islands (including 8,000 birds near Brion Island and 750 near Bird Rocks in 2003; BCR 14) (CWS, unpubl. data); these birds are probably *borealis* (Savard et al., in prep.). According to winter surveys in 2006, there were roughly 63,000 eiders in the northern portion of the Gulf (BCR 8) and 14,000 in the southern portion (BCR 14), for a total of 77,000 eiders in the Gulf of St. Lawrence (CWS, unpubl. data).

Studies on the ecology of eiders in winter have revealed that they feed mainly on blue mussels and green sea urchins, and frequent shallow areas where the density of these prey is highest (Guillemette et al. 1992; Guillemette et al. 1993). It is possible that the different *borealis* populations have distinctive characteristics, since there appears to be a relation between the region where a population overwinters and individuals' morphology. There are probably morphometric differences (head length) between eiders wintering in Canada and those wintering in Greenland (Mosbech et al. 2006b).

Conservation

The *borealis* subspecies is the most abundant of the three subspecies in Quebec in winter, with a population of roughly 200,000 individuals in the Gulf of St. Lawrence and along the Newfoundland coast (Bourget et al. 1986; Bordage et al. 1998; CWS, unpubl. data). The remainder of *borealis* birds (460,000) winter mainly in Greenland (Mosbech and Johnson 1999; Merkel et al. 2002; Boertmann et al. 2004; Gilliland et al. 2007a). The North American population of *borealis* is estimated at 550,000 individuals, including 128,000 in Quebec (Table 2).

The Common Eider is a keystone species in the coastal ecosystems of Ungava Bay and for the Inuit communities that depend on them. This duck generates significant revenues for the inhabitants of these communities, with annual spinoffs estimated at over $400,000 (harvesting of down, eggs and meat). Although the Common Eider is an abundant species, intensive exploitation of the *borealis* subspecies occurs during several periods of its life cycle; moreover, the populations exploited in winter in Greenland are the same exploited by the Nunavik and Nunavut Inuit in summer and during migration (Nakashima 1986; Reed 1986b). Aside from down collection, large-scale commercial and sport hunting also takes place (Merkel 2004b). For example, the commercial harvest in Greenland is estimated at 68,000–82,000 eiders per year (Merkel 2003), which is probably not sustainable over the long term (Boertmann et al. 2004; Gilliland et al. 2007a). Indeed, the Greenland authorities have recently lowered the daily bag limit for hunters (G. Gilchrist, S & T, pers. comm.). An estimated 3,200 eiders were bagged annually in Ungava Bay in the past (Reed 1986b). A decline of 67% was observed over a 20-year period in the number of eiders breeding on the West Foxe Islands, near Cape Dorset in Nunavut, owing to hunting and egging (Cooch 1986). Eiders wintering in the Gulf of St. Lawrence, around Newfoundland and Saint-Pierre-et-Miquelon, are hunted intensively by sport hunters and Innus from the Lower North Shore and Labrador. A special enquiry revealed that the winter harvest of eiders in Newfoundland was quite substantial (Wendt and Silieff 1986). It became obvious that better harvest data was required.

The collection of eiderdown is a traditional activity in a number of coastal communities in Nunavut (Reed 1986b). However, the transition from local to commercial exploitation could have adverse effects on the species' reproductive success if harvesting is not carefully monitored (Bédard et al. 2008). In the past, conflicts have arisen between the Nunavut Inuit and Nunavik Inuit over the collection of eiderdown (CWS, unpubl. data). Adopting management measures for eiderdown harvesting in these two northern territories similar to those used in the St. Lawrence estuary, where harvesting activities have become an effective management and public awareness tool, would be helpful (Bédard et al. 2008). Collecting eider eggs was a common activity in the past in a number of communities; for example, an estimated 13,000 eggs were collected annually from 1976 to 1980 along the entire coastline of Ungava Bay and the south shore of Hudson Strait (Reed 1986b). This activity is probably still popular. Human disturbance and exploitation in some breeding colonies has been a problem in the past, even leading to the elimination of colonies (Cooch 1965; 1986); these issues could still be a problem in certain northern regions.

Regarding non-anthropogenic threats to the species, an increased frequency of avian cholera outbreaks has been observed in northern colonies in recent years (Gaston 2004; Gilchrist et al. 2006). This increase is worrisome since adult mortality has a much greater potential impact on the population—due to the species' low reproductive rates,

delayed sexual maturity (2–4 years) and fairly long life span (7.4 years) (cited in Goudie et al. 1994)—than the loss of eggs or chick mortality (Goudie et al. 1994).

As we can see, the conservation issues surrounding the *borealis* subspecies of the Common Eider are highly complex, and are exacerbated by the lack of information on the ecology, harvest rates and productivity of the subspecies. The management of northern eider populations must be approached at a number of spatial scales simultaneously (local, regional, provincial, national and international). The number of users and the diverse uses of the "eider resource" in the North make managing the *borealis* subspecies a colossal challenge. Conservation efforts involving the subspecies are beginning to take shape, but so far have been limited to a few monitoring and research activities (Bordage et al. 1998; Lehoux and Bordage 1999; Falardeau et al. 2003; Mosbech et al. 2006b; Gilliland et al. 2007a) that are a continuation of previous efforts (Nakashima and Dumas 1984; Chapdelaine et al. 1986a; Kuujjuaq Research Centre 1986; Nakashima 1986). The implementation of conservation measures is urgently needed to maintain this avian resource at levels that can withstand its intensive use by a variety of communities. Quebec therefore has a major role to play in the conservation of the *borealis* subspecies, which breeds (roughly 23% of *borealis* populations; Table 2), migrates, moults and winters in the province. Traditional exploitation by many First Nations communities makes it a management priority.

4.5.2.3 Subspecies *sedentaria* *Somateria mollissima sedentaria* (Br, Wr) (by Jean-Pierre L. Savard and Christine Lepage)

The *sedentaria* subspecies of the Common Eider occurs basically in Hudson Bay and James Bay on a year-round basis (Joint Working Group on the Management of the Common Eider 2004; Goudie et al. 2000). Although the islands in Hudson Bay and James Bay where *sedentaria* individuals breed (Reed 1986a) are under the jurisdiction of Nunavut, the responsibility for this subspecies also lies, to varying degrees, with the other adjacent provinces and territories (Quebec, Ontario, Manitoba and Nunavik). However, the fact that the entire population remains in Canada throughout the year facilitates its management in some ways. In summer, the eiders breed along the coast of Hudson Bay: on the west coast, from Chesterfield Inlet in the north to James Bay in the south and, on the east coast, from Cape Smith in the north to James Bay in the south. The breeding ranges of the *sedentaria* and *borealis* subspecies overlap in the region of Cape Fullerton and Chesterfield Inlet, but the precise area of intergradation between the two subspecies remains to be determined (Abraham and Finney 1986).

Breeding

As previously mentioned, *sedentaria* eiders nest in colonies on the coastal islands in Hudson Bay and James Bay (Joint Working Group on the Management of the Common Eider 2004; Goudie et al. 2000). This subspecies is particularly abundant on the Belcher Islands, Sleeper Islands and Ottawa Islands, all offshore archipelagos located off the east coast of Hudson Bay (BCR 3) (Snyder 1941). Individuals may also breed in the northern end of Hudson Bay, on Southampton, Coats and Mansel islands (BCR 3) (Robertson and Gilchrist 1998). It is not known if there are colonies where both subspecies (*sedentaria* and *borealis)* nest (Abraham and Finney 1986). Colonies populated by *sedentaria* individuals are in general less dense than those with *dresseri* or *borealis* birds (Abraham and Finney 1986). Females of the *sedentaria* subspecies seem to prefer nesting on higher elevations on these islands, in areas dominated by bushes (Freemark 1977; Schmutz 1981). However, a wide variety of habitats are used

by the birds, and the physical characteristics of the site appear to be more important than the vegetation itself (Freemark 1977). As is the case for the other two subspecies, the nest is built in a fairly dry area, often near structures providing shelter from the prevailing winds (boulders, mounds, etc.). In northern areas, the first hens to arrive on the breeding grounds in spring very likely seek areas where the snow melts quickest. As in the case of the other subspecies, broods sometimes become amalgamated and form crèches. However, this tendency appears to be less frequent in *sedentaria* (Guild 1974; Schmutz 1981; Schmutz et al. 1983), perhaps due to the greater spacing between nests and smaller colony size in the subspecies.

Spring migration

Very little is known about spring migration in this subspecies, which frequents polynyas and open water leads along the edge of ice floes in winter. The birds' arrival near the breeding colonies coincides with the appearance of open water and is consequently correlated with the timing of break-up (Freeman 1970; Schmutz 1981). Most eiders arrive near the colonies in mated pairs (Abraham and Finney 1986).

Moulting

Most *sedentaria* drakes leave the nesting islands around the middle of the incubation period (Guild 1974; Manning 1976) to head to their moulting areas. Flocks of males congregate in the Belcher, King George and Sleeper islands after breeding, but leave these sites in early August (Manning 1976). All the moulting areas in Hudson Bay have not yet been identified. Groups of up to 100 individuals have been observed in several locations in James Bay: Cape Henrietta Maria, Bear Island, Gasket Shoal and the sector from Walrus Point to Kakachischuan Point. A number of eiders also moult in Chesterfield Inlet (a deep bay in Nunavut) (Abraham and Finney 1986). The *sedentaria* eiders moult in small groups on the breeding grounds, and no significant moult migration occurs in the subspecies (Abraham and Finney 1986). However, to date, no targeted surveys have been carried out to locate moulting areas, and it is highly possible that there are major ones, but this hypothesis remains to be confirmed. Large numbers of eiders, mainly consisting of drakes, have been reported off the western side of the Belcher Islands in September (Manning 1976). These birds are probably still moulting at this time of year. Males lose their ability to fly in late June and regain it in late August or early September; females probably moult a few weeks later.

Fall migration

Eiders of the *sedentaria* subspecies spend the entire winter in Hudson Bay and their movements in fall have not yet been documented. Since the other subspecies leave their moulting areas in late fall just before freeze-up, the *sedentaria* birds' movements are probably also influenced by the pattern of ice formation in Hudson Bay. In the Belcher Islands, large rafts of eiders have been reported in Eskimo Harbour, Coats Bay and Churchill Sound until these water bodies freeze over; the eiders then move in large flocks toward the open water to the west and north of the Belcher Islands (Freeman 1970).

Wintering

The *sedentaria* birds overwinter in polynyas in Hudson Bay, where they feed mainly on blue mussels and sea urchins. Winter conditions in the Bay are extreme and may result in significant mortality in the population (Robertson and Gilchrist 1998). Over

2,300 eiders have been observed in late March–early April between the Belcher Islands and Sleeper Islands (Manning 1976). A number of *sedentaria* also overwinter in leads in the pack ice along the west coast of Hudson Bay (Guild 1974). The distribution of eiders under these extreme winter conditions varies according to the temperature, winds, presence of storms and ice conditions, which fluctuate throughout the winter and from year to year.

Conservation

The *sedentaria* population has been estimated at 75,000 breeding pairs (Joint Working Group on the Management of the Common Eider 2004), for a continental population of around 255,000 individuals (Table 2). The nearshore islands off the east coast of Hudson Bay (between Akulivik in the north and James Bay in the south) supported roughly 10,700 breeding pairs in 1988, when the total *sedentaria* subpopulation was estimated at 41,500 breeding pairs (Nakashima and Murray 1988). Another study conducted in the early 1980s estimated the number of pairs along the east coast of Hudson Bay at closer to 20,800 (Chapdelaine et al. 1986a). The breeding population on the Belcher Islands has declined sharply since the 1980s, with 75% fewer nests in 1997 than in 1980 (Robertson and Gilchrist 1998).

Up to now, conservation efforts targeting *sedentaria* have been limited to a few monitoring and research activities (Bordage et al. 1998; Gilchrist et al. 1999). The traditional subsistence harvest of these birds for their meat, down and eggs by the Hudson Bay Inuit still continues (Reed 1986b; Nakashima 1991; Oakes 1999). Although the impacts on this subspecies of the Aboriginal harvest and of human disturbance in the breeding colonies and brood-rearing areas are probably quite significant, the scope of these impacts remains to be quantified.

On the Belcher Islands, the community of Sanikiluaq harvests eiderdown, from which the inhabitants make down comforters and garments to be sold in Canada and Europe (McDonald and Flemming 1990). Although down collection has relatively little impact on eider populations (Bédard et al. 2008) and is sustainable, this is not true of egg collection and particularly hunting, which, without strict controls, can considerably reduce or even eliminate certain populations (Cooch 1986; Hansen 2002; Merkel 2004a). The overharvesting of eiders could endanger the eiderdown industry. The *sedentaria* subspecies is hunted year-round by coastal communities on James and Hudson bays (Reed and Erskine 1986).

Irregular episodes of severe cold that deprive birds of access to their foraging sites (Robertson and Gilchrist 1998) also represent a potential threat. Since the eiders concentrate in large numbers in polynyas, die-offs of thousands of birds may occur during these episodes due to the lack of food and birds' greater vulnerability to terrestrial predators and hunters.

Since the *sedentaria* subspecies remains in the Hudson Bay region throughout the year and is limited to coastal areas adjacent to Quebec, Quebec's potential role in its conservation is rather modest. However, management of this subspecies requires joint action and cooperation by all responsible authorities, given its intensive exploitation and the extremely adverse conditions the subspecies faces in winter.

4.5.3 Harlequin Duck *Histrionicus histrionicus* (Mr, Br, Wo) (by Michel Robert)

The Harlequin Duck's range includes Europe (Iceland), Asia (Russia) and North America. The largest population of the species in North America, consisting of roughly 250,000 individuals, is in the West, specifically Alaska and British Columbia (Robertson and Goudie 1999; North American Waterfowl Management Plan 2004). The Harlequin Duck also occurs in eastern North America (Eastern population), where it is much rarer and has consequently been designated a species of special concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (Committee on the Status of Endangered Wildlife in Canada 2009).

The Eastern population of the Harlequin Duck is divided into two subpopulations: one breeding in southern Quebec (Gaspésie and Côte-Nord regions), New Brunswick, Newfoundland and southern Labrador and wintering in the Atlantic provinces and along the U.S. East Coast, and the other breeding in Nunavik, northern Labrador and Baffin Island and wintering along the southwest coast of Greenland (Thomas and Robert 2001; Brodeur et al. 2002). Since these subpopulations can also be differentiated by their genetic characteristics, they are targeted by specific conservation measures (Thomas and Robert 2001).

Breeding

The Harlequin Duck spends most of the year at sea, along the edge of rocky, wave-battered reefs. The birds travel inland in spring and nest along fast-flowing rivers with abundant rapids where they forage for insect larvae (Robert and Cloutier 2001). In Quebec, the species breeds along rivers in the Gaspésie (BCR 14) and Côte-Nord (BCR 8) regions and in the vast watersheds of Hudson Bay (BCR 7) and Ungava Bay (BCR 7).

In southern Quebec, the Harlequin Duck breeds in the Gaspé region on the Bonaventure, Bonaventure Ouest, Cascapedia, Dartmouth, du Diable, Grande Fourche, Grande Rivière, Hall, Madeleine, Nouvelle, Petite Cascapedia Est, Petite Cascapedia Ouest, Port-Daniel, Sainte-Anne, Sainte-Anne-Nord-Est and York rivers (Savard et al. 2008; SOS-POP 2008). The region has an estimated breeding population of several dozen pairs; in 1996, 19 breeding pairs were found during surveys in the breeding season (Brodeur et al. 2008). Although few surveys have been carried out in the Côte-Nord region, the species is known to at least frequent the L'Abbé-Huard, Aguanish, Aguanish Nord, Mistanipisipou, Moisie, Romaine, Toulnustouc, Wabouchagamou, Wacouno and Olomane rivers (Robert et al. 2001; Savard et al. 2008; SOS-POP 2008). The North Shore rivers are thought to host at least several dozen breeding pairs (Robert et al. 2001).

In northern Quebec, the Harlequin Duck occurs in good numbers in the Hudson Bay watershed, particularly the Petite rivière de la Baleine (Little Whale River), Lacs des Loups-Marins, the Nastapoka and Boutin rivers, and the Rivière à l'Eau Claire (BCR 7) (Consortium Gauthier & Guillemette – G.R.E.B.E. 1993a; Morneau et al. 2008). No surveys have been done yet north of the Nastapoka River, where numerous Harlequin Ducks probably breed. The species also seems to be fairly widespread in the Ungava Bay watershed, although few surveys have been conducted there to date, So far, records come mainly from the George, False, Koksoak, Qurlutuq, Aux Mélèzes, Caniapiscau and Dancelou rivers, and their tributaries (Brodeur et al. 2002; Savard et

al. 2008; SOS-POP 2008). The Harlequin Duck may also breed in the James Bay watershed as far south as La Grande River (Consortium Gauthier & Guillemette – G.R.E.B.E. 1993b) and even the Eastmain River, where a hen and five ducklings were observed in 1982 (David and Gosselin 1983). The most northerly record in the province to date is the observation of two breeding pairs in July 2007, just outside Parc National des Pingualuit (Pingualuit provincial park), at 61° 15' N latitude (BCR 3) (Robert 2007). Breeding has not yet been confirmed, however, in BCR 3. Several thousand individuals are thought to breed in Nunavik (Morneau et al. 2008).

Quebec is undoubtedly the most important breeding area in eastern North America for the species, since a significant percentage of the birds wintering along the Atlantic Coast and in Greenland breed here (Morneau et al. 2008; Savard et al. 2008).

Migration, moulting and wintering

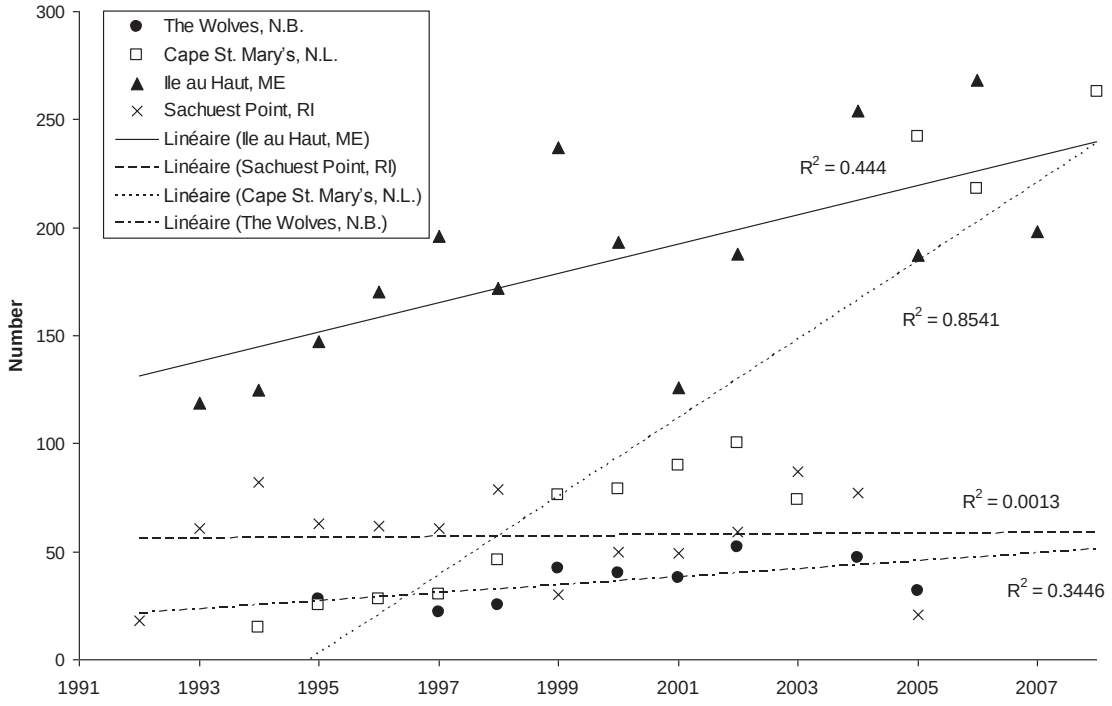
Many Harlequin Ducks also frequent the Quebec coastline during migration and the moulting period. The main staging and moulting areas used by the species are in the Gaspé region (BCR 14)—at the tip of the Forillon Peninsula, around Bonaventure Island and between Port-Daniel and Newport (Gilliland et al. 2002; Langlois 2005)—as well as around Pointe du Sud-Ouest (Southwest Point) on Anticosti Island (BCR 8) (Gilliland et al. 2002; Robert et al. 2008b; Savard et al. 2008). The stretch between Newport and Port-Daniel is a particularly important area for the species, especially in fall, when close to 300 individuals congregate there (Langlois 2005). Although a few dozen individuals of both sexes go there to moult in August and September, numbers are particularly high between mid-October and mid-November (Langlois 2005). Lastly, between 5,000 and 10,000 males moult along the southwest coast of Greenland (Boertmann and Mosbech 2002), a large percentage of which are thought to breed in Nunavik (Boertman 2008; Morneau et al. 2008).

The number of Harlequin Ducks found along the section of the coast between Newport and Port-Daniel gradually drops off between early November and mid-December (Langlois 2005). Although a few individuals occasionally overwinter in Chaleur Bay or elsewhere in southern Quebec (Savard et al. 2008), particularly during mild winters, almost all Harlequin Ducks spending the fall along the coastlines of southern Quebec leave the province to spend the winter in Maine or the Atlantic provinces. In February 2009, 40 individuals were counted between Newport and Port-Daniel (BAGOS; CWS, unpubl. data). In spring, individuals reach the Gaspé coast and their breeding rivers by late April (Brodeur et al. 2008; Robert et al. 2008b).

Conservation

The Eastern population is estimated to be roughly 6,800 individuals, 5,400 of which are probably present in Quebec during the breeding season (Table 2). These are conservative estimates, based on the minimum number of males observed (5,200) during the moulting period in Greenland (Boertmann and Mosbech 2002). There is no reliable data on population trends in Quebec, although the number of individuals wintering along the coast has been increasing for more than a decade (Figure 70) (Thomas and Robert 2001; Mittelhauser et al. 2002). This increase can probably be attributed to the fact that the hunting of the species has been outlawed everywhere in eastern North American since 1990 (Thomas and Robert 2001). In addition, campaigns to make the public aware of the species' precarious status in Eastern Canada have probably also contributed to the increase.

Figure 70. Population trends in the Harlequin Duck in eastern Canada (P. Thomas, CWS-Atlantic Region, unpubl. data)



The main threats to the Harlequin Duck include hydroelectric development, poaching, the Aboriginal harvest, coastal development (aquaculture and fisheries) and use (boat traffic), and recreational activities on rivers near where the species breeds.

Since nearly 80% of the Eastern population birds breed in Quebec (Table 2) and the Harlequin Duck has been designated a species of special concern by COSEWIC, Quebec plays an unquestionably crucial role in the conservation of the species.

4.5.4 Surf Scoter *Melanitta perspicillata* (Mr, Br, We) (by Christine Lepage and Jean-Pierre L. Savard)

Unlike the two other scoter species, the Surf Scoter has an exclusively North American distribution. In the west, it breeds mainly in Alaska, Yukon and the Northwest Territories, and in the east, in Ontario's Hudson Bay lowlands as well as in Quebec and Labrador (Consortium Gauthier & Guillemette – G.R.E.B.E. 1992a; Savard et al. 1998; Perry et al. 2004; Reed 2005; Ross 2007b). Between these two disjunct ranges, breeding has also been reported in the northern portions of British Columbia, Alberta, Saskatchewan and Manitoba (Savard et al. 1998; Perry et al. 2004). Rafts of several hundred individuals spend the winter along the Pacific Coast, mainly in Alaska, British Columbia and Washington State. In the east, the species winters from Nova Scotia to Florida (American Ornithologists' Union 1998; Savard et al. 1998; Reed 2005).

Breeding

The Surf Scoter generally nests along shallow lakes less than 10 ha in size (Décarie et al. 1995; Dryade 1996), typical of the boreal forest and taiga. Therefore, it is mainly

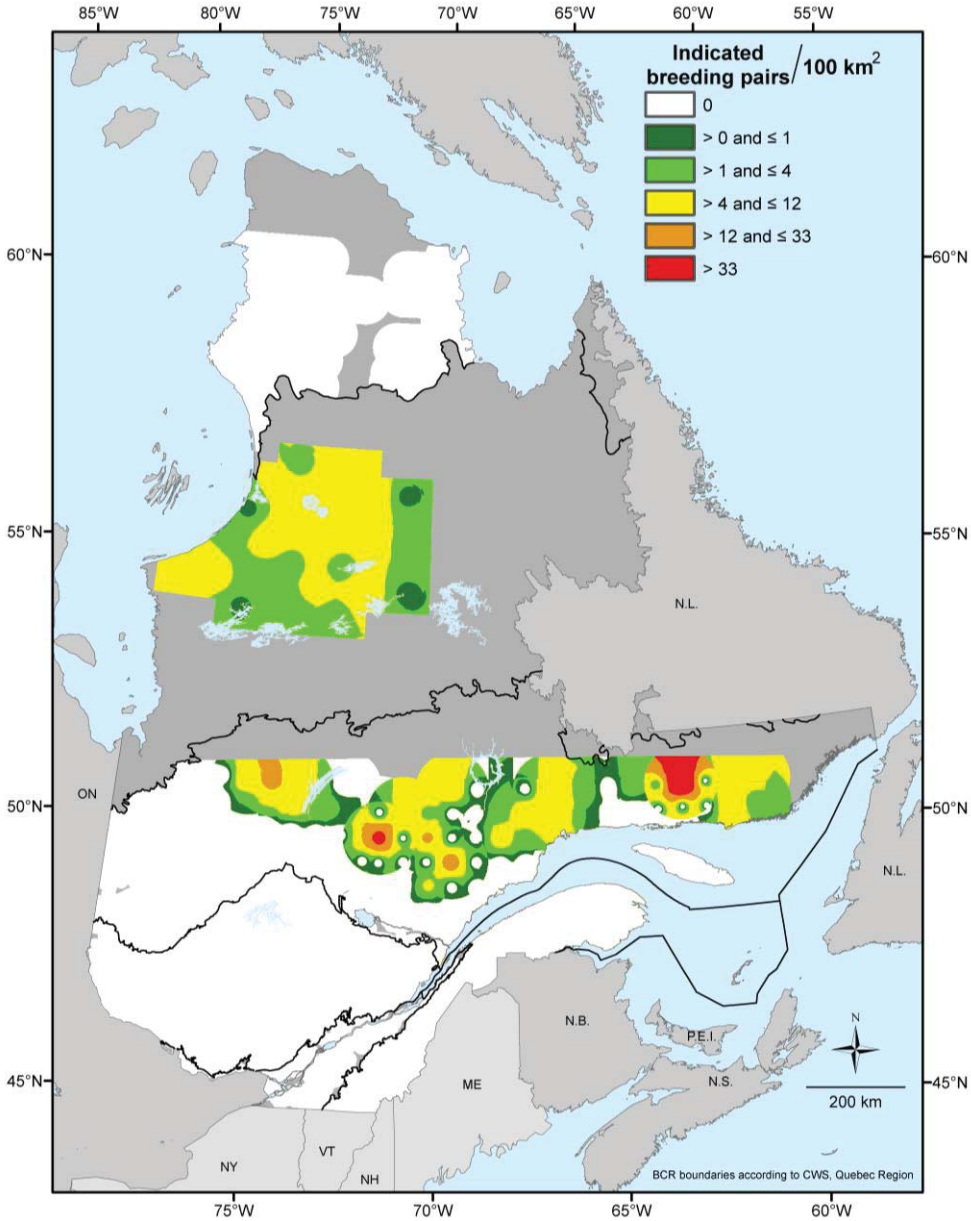
found between 50° and 57° N latitude, in the coastal strips of James Bay and Hudson Bay (BCR 7), as well as further inland. The species is a confirmed breeder as far north as the Nastapoka River (BCR 7) and as far east as the Caniapiscau River and Labrador border (BCR 7) (Consortium Gauthier & Guillemette – G.R.E.B.E. 1992a), and also occurs further southeast to around Brisay, on the edge of the Caniapiscau Reservoir (BCR 7), where a number of broods were observed in July 2002 (ÉPOQ). Around Laforge 1 Reservoir, Surf Scoters are one of the most abundant breeding species of waterfowl, and numerous broods were observed there from 1991 to 1995 (Dryade 1992; 1994; 1995; 1996). Lastly, many breeding pairs have been found south of Kuujjuaq during WNOR surveys (CWS, unpubl. data).

According to surveys carried out in 1976, 1989 and 1990, estimated breeding densities ranged between 3.5 and 6.0 broods/100 km² near the coast between Grande rivière de la Baleine and Petite rivière de la Baleine (Great Whale and Little Whale rivers), 5.0 broods/100 km² in the Lake Bienville area, 5.2 broods/100 km² in the Caniapiscau River region (Consortium Gauthier & Guillemette – G.R.E.B.E. 1990a; Savard and Lamothe 1991) and lastly 4.9 broods/100 km² in the Amichinatwayach Lake sector, northeast of Lake Bienville (Consortium Gauthier & Guillemette – G.R.E.B.E. 1993c). Along the coast of James Bay (BCR 7), brood densities of 2.1 broods/100 km² have been reported (Benoit et al. 1992). In the Laforge 1 Reservoir area, brood density was estimated at 6.0 broods/100 km² in 1993, 4.2 broods/100 km² in 1994 and 3.4 broods/100 km² in 1995 (Dryade 1994; 1995; 1996). A little farther south, in the Nottaway, Broadback and Rupert river region, density was estimated at 0.5 IBP/100 km² (Consortium Gauthier & Guillemette – G.R.E.B.E. 1992b). As is the case for all survey data, caution must be used in comparing these brood densities, since they may vary considerably from region to region due to differences in survey effort and timing, and reproductive success.

During the WUPL surveys, breeding pairs of Surf Scoters were sighted regularly west of Lake Mistassini (up to 4.6 IBP/100 km²), northeast of Lac Saint-Jean (up to 19 IBP/100 km²), northwest of Sept-Îles (up to 26 IBP/100 km²) and northeast of Havre-Saint-Pierre (up to 44 IBP/100 km²). The numerous Barrow's Goldeneye surveys carried out by CWS during the breeding season revealed the regular presence of Surf Scoter breeding pairs as far south as the Saguenay River and Côte-Nord regions (CWS, unpubl. data). Broods have also been reported in several lakes (Docteur, Gosselin and Rouvray) in the Mont Valin area (ÉPOQ). The presence of broods also allowed breeding to be confirmed around the Sainte-Marguerite 3 Reservoir (west of Sept-Îles, BCR 8) (Morneau 2003). The southernmost records of breeding pairs and broods in the province are in the Laurentide Wildlife Reserve (47° 34' N latitude; BCR 12) (Gosselin et al. 1988; Reed et al. 1994; Morrier et al. 2008). This reserve, which is situated quite far south of the species' core breeding range in Quebec, supports a large concentration of breeding pairs. In the reserve, Lake Malbaie (664 ha) no doubt has the greatest number of breeding pairs (up to 65 pairs in 1995) and broods (up to 41 in 1995) of all the reserve lakes (Reed et al. 1994; Morrier et al. 2008; L. Lesage, CWS, pers. comm.), although breeding pairs were also observed on a number of other lakes, and broods in particular on Des Neiges, Carroll, Nouvel, Archambault and Alyse lakes (Morrier et al. 2008).

Figure 71 shows the distribution of indicated breeding pairs of Surf Scoters in Quebec according to various surveys and inventories carried out primarily by CWS (see Chapter 3).

Figure 71. Breeding distribution of the Surf Scoter in Quebec (by indicated breeding pair density); please read the explanatory note at the last paragraph of Section 2.4



Spring migration

From mid-April to late May, Surf Scoters leave their wintering grounds and travel up the Atlantic Coast to Chaleur Bay (BCR 14) and the estuary and Gulf of St. Lawrence (BCR 8), where they stop over for a certain period of time before heading to their breeding grounds (Savard and Falardeau 1997; Falardeau and Savard 2003; Rail and Savard 2003; Perry et al. 2004; WSHO). According to aerial surveys on May 9, 2005, there were an estimated 69,500 individuals in the northern part of the lower estuary alone (McAloney et al. 2005). Surveys on May 13 and 14, 1998, showed an estimated 220,000 or more scoters (all three species combined) along the north shore of the

estuary and Gulf of St. Lawrence (Rail and Savard 2003). Spring migrants have also been observed along the north shore of the upper estuary (including the Île aux Lièvres Passage) (Falardeau et al. 2000), on the north side of the Gaspé Peninsula, in western Chaleur Bay, and southeast of Anticosti Island (CWS, unpubl. data). On the Middle North Shore, rafts of at least several thousand individuals can be observed as far as Natashquan (WSHO). The Surf Scoter is the most common of the three scoter species in the St. Lawrence in spring (Falardeau and Savard 2003; CWS, unpubl. data). Breeding pairs leave the St. Lawrence during the third week of May to head to their breeding grounds, while unpaired males and juveniles linger until it is time to go to their moulting areas (CWS, unpubl. data).

Moulting

Areas frequented by the species during the moulting period include the estuary and Gulf of St. Lawrence (Savard and Falardeau 1997; Rail and Savard 2003) and the northeast coast of James Bay (Benoit et al. 1991; 1993; 1994; Perry et al. 2004). Moulting occurs in general between mid-July and mid-August for the drakes, although most males that bred are already back in marine waters by the end of June. Drakes moult their primaries beginning in mid-July and are flightless for three to four weeks (Bordage and Savard 1995; Bédard et al. 1997; Falardeau et al. 2000; Savard et al. 2007). The first females arrive in the moulting areas towards the end of July, joining the males there (Bordage and Savard 1995; Rail and Savard 2003); these are mainly failed breeders. Females that raised a brood leave the breeding lakes later, around mid-August (Savard et al. 2007). An estimated 20,000 Surf Scoters moult in the estuary and Gulf (J.-P.L.S., pers. obs.), nearly 75% in the lower estuary and 13% in the upper estuary (BCR 8 and 12) (Rail and Savard 2003). In the lower estuary, scoters are concentrated along the north shore between Sainte-Anne-de-Portneuf and Pointe-aux-Outardes—particularly between the Portneuf Sandbank and Patte de Lièvre Island, around the Jérémie Islets and off Papinachois—and on the south shore upstream from Rimouski, near Razade d'en Bas and Razade d'en Haut (Upper and Lower Razades) and Les Pèlerins islands (Bédard et al. 1997; Rail and Savard 2003). Small groups of Surf Scoters (70–500 individuals) were observed in July and August of 2005 and 2006, near the mouth of the Jupiter River and Anse aux Fraises (Strawberry Cove) on the south shore of Anticosti Island (CWS, unpubl. data).

In Nunavik, close to 35,000 scoters were reported along the coast of James Bay in August 1993, from the Bay of Many Islands to Pointe Louis-XIV (BCR 7), with all three scoter species present in this area (Benoit et al. 1994). Two years later, Surf Scoters were estimated to make up only 6% of scoters moulting in this sector (Benoit et al. 1995). In Hudson Bay, Manitounuk Sound (BCR 7) is probably a major moulting area for Surf Scoters, since birds remain in this location for an extended period of time, from early summer to early fall (Consortium Gauthier & Guillemette – G.R.E.B.E. 1990b). A telemetry study carried out in 2001, 2002 and 2003 confirmed the use of known moulting areas in the estuary and Gulf of St. Lawrence, northeast coast of James Bay, and near Inukjuak in Hudson Bay, and also revealed a new area used by the species along the southeast coast of James Bay (Perry et al. 2004). Some of the birds breeding in central Quebec also moult along the Labrador coast (Perry et al. 2004; Gilliland et al. 2007b). Lastly, a certain number of birds are thought to moult in Ungava Bay (J.-P.L.S., pers. obs.). Like most other sea ducks (Brodeur et al. 2002; Robert et al. 2002), Surf Scoters remain in the vicinity of their moulting areas for several weeks after regaining their ability to fly (CWS, unpubl. data).

Fall migration

In fall, from September to November, Surf Scoters are concentrated mainly in the estuary and Gulf (Gosselin 1995a; ÉPOQ; CWS unpubl. data). Important fall staging sites include the area around Patte de Lièvre Island and Jérémie Islets on the north shore of the lower estuary (BCR 8) and the Rimouski–Trois-Pistoles sector and Saint-André-de-Kamouraska area on the south shore of the upper estuary (BCR 14) (Bédard et al. 1997). At this time of the year, Surf Scoters are more abundant along the south shore of the St. Lawrence than they are in spring (J.-P.L.S., unpubl. data). The eastern scoters appear to use two main migration routes to the wintering grounds along the Atlantic Seaboard, an overland one (probably through the Bas-Saint-Laurent and Chaudière-Appalaches regions) and a coastal one around the Gaspé Peninsula (Perry et al. 2004). Over 50,000 scoters are thought to pass through the St. Lawrence estuary in fall (Bédard et al. 1997). The species is also a regular fall migrant in the Magdalen Islands (BCR 14) (Fradette 1992).

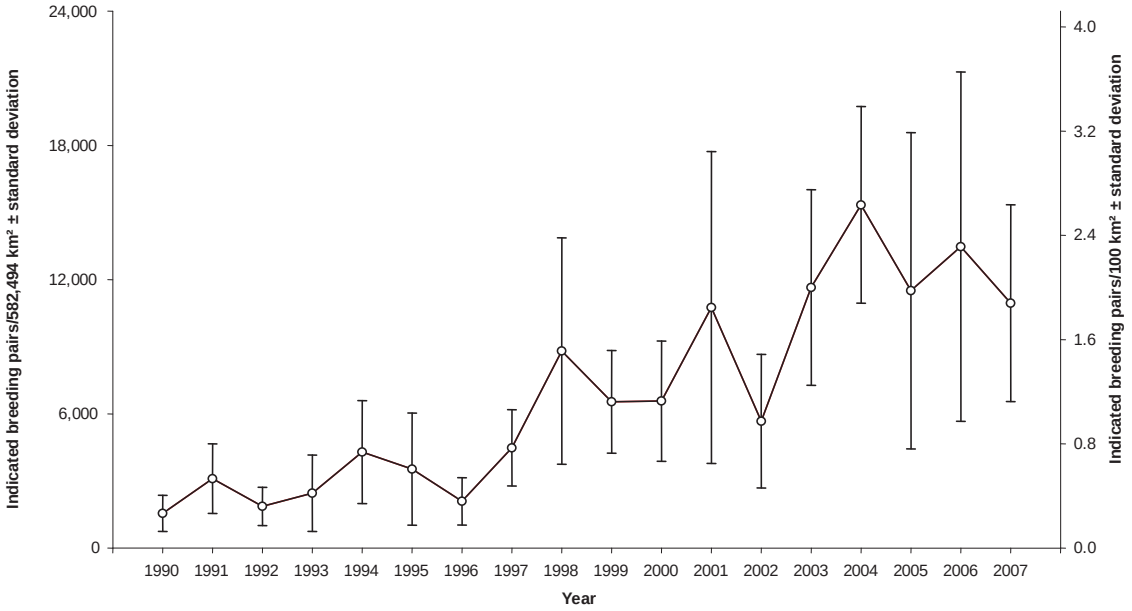
Wintering

Winter records of scoters in Quebec are rare (Gosselin 1995a), and no successful cases of overwintering have been reported to date. In February 2003, during COEIS surveys in the Gulf of St. Lawrence, a group of 80 Surf Scoters were observed near Brion Island, off the Magdalen Islands (BCR 14) (CWS, unpubl. data), suggesting that the species may overwinter in this area. Recent satellite telemetry data (Perry et al. 2004; CWS unpubl. data) shows that a number of Surf Scoters that winter in the Chesapeake Bay (Maryland) frequent the estuary and Gulf of St. Lawrence in spring and fall, and moult along the coast of Labrador as well as the east coast of Hudson Bay.

Conservation

The North American population of Surf Scoters is estimated at roughly 600,000 individuals (Table 2) and over 1 million individuals on the wintering grounds (Reed 2005). On the Atlantic Coast, the population is estimated to be between 150,000 and 250,000 individuals (Wetlands International 2006). The estimated population in Quebec is 102,000 individuals (Table 2), or roughly 40,000 breeding pairs (17,100 in BCR 8 and 22,900 in BCR 7) (CWS, unpubl. data). There is likely a long-term downward trend in the North American population (North American Waterfowl Management Plan 2004). However, the Breeding Waterfowl Plot Survey of Eastern Canada (helicopter plots; carried out on the southern edge of the species' breeding range) points to a significant increase of 8.0% ($P < 0.05$) in the number of breeding pairs from 1990 to 2003 (CWS, unpubl. data). In Quebec, a significant annual increase of 7.3% was also observed in BCR 8 from 1990 to 2007 (partially visible in Figure 72) (Lepage et al., in prep.). These two results must be viewed with caution, however, since they were obtained from surveys targeting early nesting ducks and not Surf Scoters, which nest from one to several weeks later.

Figure 72. Trends in Surf Scoter breeding population in Southern Quebec uplands, 1990–2007 (WUPL data); total number of indicated breeding pairs (left axis) and density per 100 km² (right axis). The high standard deviation can probably be attributed to the fact that the survey was not optimally synchronized with the breeding of Surf Scoters.



During the breeding season, the Surf Scoter's diet consists primarily of freshwater invertebrates such as mayfly larvae (Ephemeridae) (including *Hexagenia limbata*, L. Lesage, CWS, unpubl. data), while it subsists on bivalves and molluscs during migration and moulting and in winter. During the brood-rearing period, ducklings feed mainly on leeches, dragonfly larvae and caddis flies (Consortium Gauthier & Guillemette – G.R.E.B.E. 1990a). The Surf Scoter is a bit more catholic in its tastes than the other two scoters, since it feeds both on blue mussels (rocky habitats) and various species of molluscs associated with sandy habitats. In British Columbia, it was discovered that Surf Scoters foraging in blue mussel beds in winter move along after they have depleted a food source, while scoters wintering in sandy habitats remain there the entire winter (Lacroix 2001; Lewis 2005).

Since mussel farming may reduce birds' access to certain natural habitats and even have an effect on the composition of adjacent habitats (Savard et al. 1998), this activity must be taken into account in the conservation of the Surf Scoter. There is also the added problem of scoter predation on cultivated mussels and quahogs (Dionne 2004). In Quebec, data on mariculture and mussel culture show that these are growing industries, particularly in the Magdalen Islands, Gaspésie, Côte-Nord and Bas-Saint-Laurent regions (Fournier and Montminy-Munyan 2003; Ministère de l'Agriculture des Pêcheries et de l'Alimentation du Québec 2006). If the sea farming industry expands significantly in the province, the possibility should be explored of establishing protected marine areas in sections of the coastline used by scoters during migration and moulting, to ensure that these areas remain suitable for the birds.

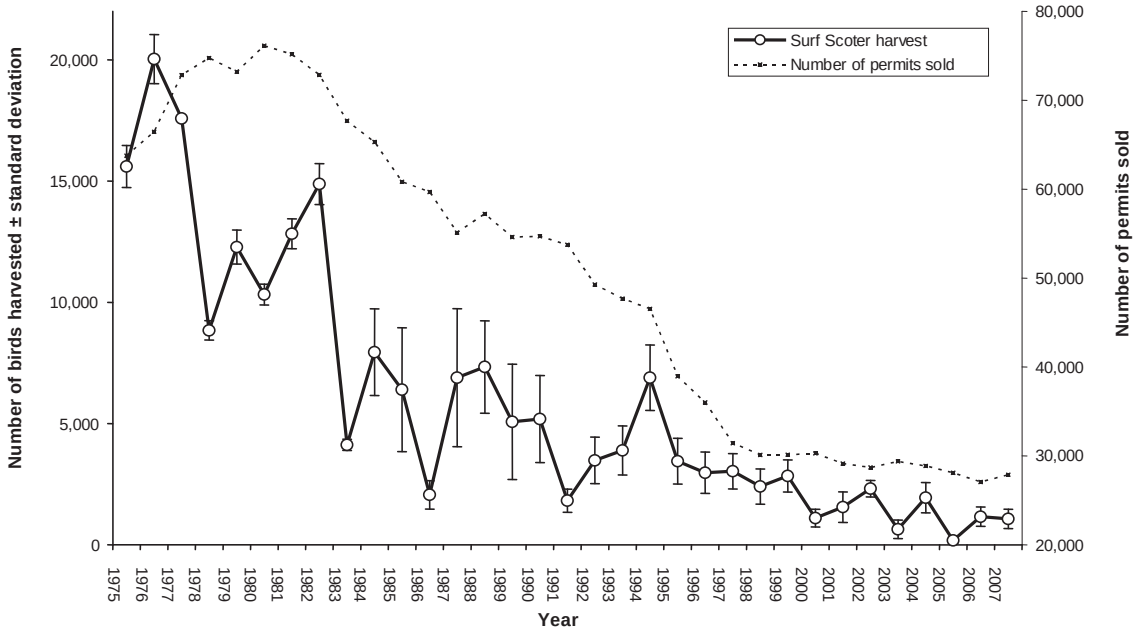
The tendency of the Surf Scoter to congregate in large concentrations in saltwater habitats makes it highly vulnerable to potential toxic spills in the estuary and Gulf of St. Lawrence (Daigle and Darveau 1995; Reed 2005), particularly during the moulting

period when individuals' mobility is reduced. Hydroelectric development may also be a conservation issue, particularly when lakes on the species' breeding grounds are flooded. For the time being, the development of wind energy in the province is mainly land-based, but should wind farms be envisaged in the marine environment in shallow coastal areas (Kaiser et al. 2006), care must be taken to ensure that the turbines are not sited in scoters' foraging or loafing areas. A plan to establish a new year-round shipping channel along the Labrador coast to service mining development is causing some concern among the region's biologists due to the large number of Surf Scoters that moult in these waters, which usually are relatively undisturbed (S. Gilliland, CWS-Atlantic Region, pers. comm.).

Contamination in birds does not appear to be a major conservation issue in this species. An analysis of Surf Scoter carcasses collected in Labrador showed metal concentrations in tissues and organs below critical levels, which did not pose a danger to birds' health (Gilliland et al. 2007b).

The species experiences only moderate hunting pressure. In the United States, hunters harvested 22,200 scoters on average in 2000–2007 in the Atlantic Flyway (Padding and Klimstra 2008). In southern Quebec, the annual sport harvest is estimated at 1,000 individuals on average for 2000–2007, or less than 1% of the total Quebec harvest of all waterfowl species combined (Table 3; Figure 73). To this harvest must be added the Cree subsistence harvest, estimated at 3,300 Surf Scoters in 2006 (Cree Regional Authority and Cree Trappers Association 2008). It should be noted that estimates of the sea duck sport harvest are probably inaccurate, and more reliable data on this group of ducks is required (Sea Duck Joint Venture 2003e).

Figure 73. Estimated Surf Scoter sport harvest in Quebec and number of Migratory Game Bird Hunting Permits sold, 1975–2007 (data taken from Gendron and Collins 2007)



Quebec plays a major role in the conservation of the Surf Scoter, since many breeding pairs (17% of the North American population; Table 2) nest in the boreal forest and taiga in the province, and significant numbers of migrants and moulting birds use the estuary and Gulf of St. Lawrence and the coasts of James and Hudson bays.

4.5.5 White-winged Scoter *Melanitta fusca deglandi* (Mr, Br, Wo) (by Christine Lepage and Jean-Pierre L. Savard)

The White-winged Scoter is divided into three subspecies according to their distribution: *Melanitta fusca fusca* in Europe, *M. f. stejnegeri* in Asia and *M. f. deglandi* in North America (American Ornithologists' Union 1998; Brown and Fredrickson 1997; Pihl and Fox 2005). In North America, the White-winged Scoter breeds from Alaska to Quebec and Labrador, with the core of its breeding range in the northwestern part of the continent (Alaska and Northwest Territories) (Brown and Fredrickson 1997). Breeding has also been reported in North Dakota, southern Alberta and Manitoba in the past, but most recent records are from farther north (Sea Duck Joint Venture 2003f). The White-winged Scoter winters along the Atlantic and Pacific coasts and along the U.S. side of the Gulf of Mexico (Brown and Fredrickson 1997), as well as in Lake Ontario (roughly 1,100 individuals) (Petrie et al. 2006).

Breeding

The White-winged Scoter has a much more limited breeding range and smaller breeding population in Northern Quebec than the Surf and Black scoters. The White-winged Scoter builds its nest near a shallow lake surrounded with shrubs or trees (typically spruce) (Benoit et al. 1995). Along the northeast coast of James Bay, shallow lakes used by the species contain roughly three times as much aquatic vegetation as unused lakes, and adults' diet consists of 65% amphipods (crustaceans) (Benoit et al. 1996). The species often builds its nest on an island to protect it from predators (Traylor et al. 2004).

The first breeding record in the province was a brood observed in 1976 near the Saindon Lakes, in the Petite rivière de la Baleine (Little Whale River) watershed (BCR 7) (Savard 1977), which was also the first breeding record east of Manitoba. In 1989, a second brood was also observed in the headwaters of the same watershed, providing the second breeding record in Quebec (Consortium Gauthier & Guillemette – G.R.E.B.E. 1990a). To date, breeding has been confirmed in the following regions (all in BCR 7): the sector between Grande rivière de la Baleine (Great Whale River) and Petite rivière de la Baleine (Little Whale River) (Savard 1977; Consortium Gauthier & Guillemette – G.R.E.B.E. 1990a; 1992a), the northeast coast of James Bay (Benoit et al. 1991; Benoit et al. 1992; Benoit et al. 1993), and the Caniapiscau River region east of Petite rivière de la Baleine (Consortium Gauthier & Guillemette – G.R.E.B.E. 1992a). Although the species would also nest farther south, breeding there is marginal, with only one confirmed breeding record obtained on the Rupert River (BCR 7), consisting of the observation of broods in July 1990 (Yank et al. 1991). In the same year, breeding pairs were observed in the Nottaway, Broadback and Rupert river area (Consortium Gauthier & Guillemette – G.R.E.B.E. 1992b). However, surveys in 2005 in the same sector and as far north as the Eastmain and Opinaca rivers did not find any breeding pairs of White-winged Scoters (Tecsult Inc. 2006).

Brood density was estimated at 0.03 broods/100 km² in the sector between the Great and Little Whale rivers (Consortium Gauthier & Guillemette – G.R.E.B.E. 1990a) and

1.3 broods/100 km² in the Amichinatwayach Lake area northeast of Lake Bienville (Consortium Gauthier & Guillemette – G.R.E.B.E. 1993c). Breeding pair density along the northeast coast of James Bay was estimated at 48 IBP/100 km² (Benoit et al. 1993). In this last region, breeding pair densities of the White-winged Scoter were greater than those of the other two species of scoters combined (Benoit et al. 1991; 1992; 1993; 1994), making it probably the region with the highest brood density in Quebec.

Spring migration

The White-winged Scoter is less abundant than Surf and Black scoters in the St. Lawrence system during spring migration (Falardeau and Savard 2003; Rail and Savard 2003). White-winged Scoters tend to skirt most of the province, flying over extreme southwestern Quebec (Outaouais region; BCR 13) to reach their core breeding range in western North America (Gosselin 1995b; Brown and Fredrickson 1997). In addition, the species frequents areas farther offshore in spring than the other two scoter species, making it more difficult to detect (J.-P.L.S., pers. obs.). The scarcity of White-winged Scoters in the East during spring migration has also been noted in New Brunswick, where, in surveys distinguishing between the three scoter species, only 5% of scoters were White-wings (Hicklin and Bunker-Popma 2001). Despite the fact that the species tends to use a more westerly migration route in the province, large flocks have been reported recently during spring migration (15,000 individuals in June 1998 and 3,550 individuals in June 1996) along the north shore of the lower estuary, near Sainte-Anne-de-Portneuf (BCR 8) (ÉPOQ).

Moulting

Little is known about the White-winged Scoter moulting in Quebec. In the southern half, two areas have been found along the lower estuary (BCR 8): Pointe à Boisvert (> 2,000 individuals) and the Jérémie Islets (> 2,000 individuals) (Lepage and Savard 2007; J.-P.L.S., unpubl. data). An estimated 5,000 individuals moult in the estuary and Gulf, with the greatest concentrations occurring along the north shore of the lower estuary (J.-P.L.S., unpubl. data). In July 2003, 6,000 birds were observed near Pointe à Boisvert, which juts into the lower estuary (ÉPOQ), although it could not be determined if these were moulting individuals. In 2005, 20 moulting birds were observed off Pointe Sud-Ouest (Southwest Point) on Anticosti Island (BCR 8) in early July, followed by 75 in mid-July, 160 in early August and 300 in late August (CWS, unpubl. data). In 2006, however, only a few individuals were seen in the same location during this period (CWS, unpubl. data). Small groups (up to 40 individuals) may moult in the Magdalen Islands (BCR 14) (Fradette 1992). The species moults along the eastern shoreline of James Bay (BCR 7) (Benoit et al. 1994; 1995). Lastly, the species is also thought to moult in Ungava Bay (J.-P.L.S., pers. obs.).

Fall migration and wintering

During fall migration, White-winged Scoters occur in the estuary and Gulf of St. Lawrence, including the Magdalen Islands (Fradette 1992; Gosselin 1995b). Winter records of the species are rare, although more frequent than the other two species of scoters (Gosselin 1995b). There are a few winter records of birds present for 10 days to 3 weeks, in such locations as the Gaspé region, Magdalen Islands and north shore of the lower estuary (David 1996; ÉPOQ). During a Common Eider survey in the Gulf of St. Lawrence in February 2003 (COEIS), a group of 125 White-winged Scoters were observed in the waters around Brion Island off the Magdalen Islands (CWS, unpubl.

data). A sighting of 30 individuals in flight in January 2007, near Les Escoumins (J.-P.L.S., pers. obs.) also suggests that a certain number of White-winged Scoters overwinter in Quebec.

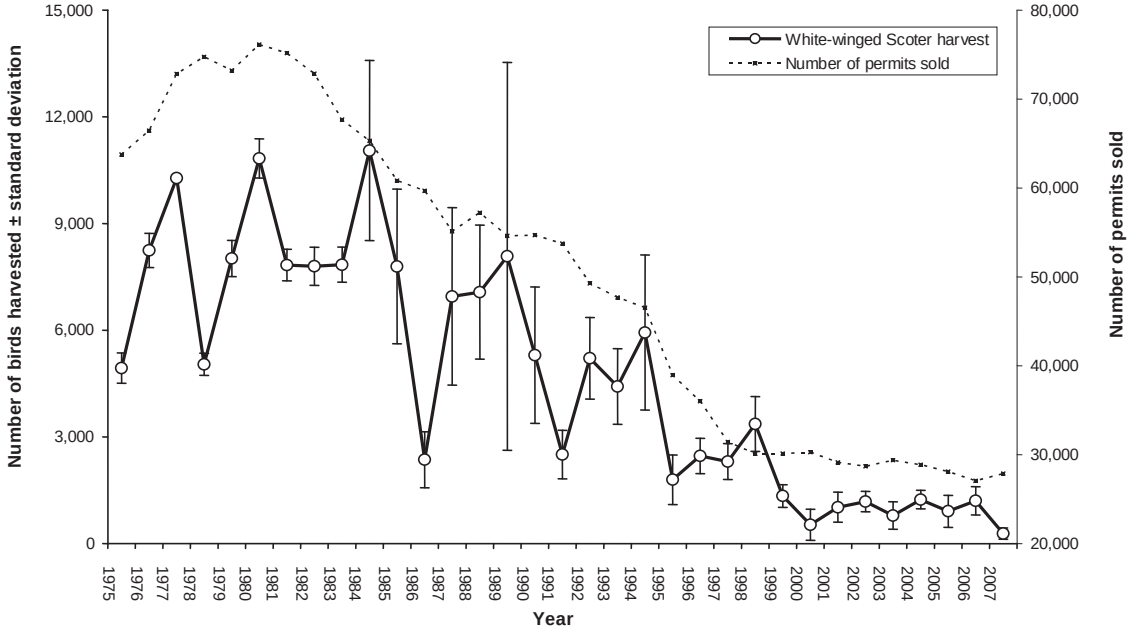
Conservation

The North American population of White-winged Scoters is estimated at 600,000 individuals (Table 2), with a downward trend in numbers observed between 1970 and 2003 (North American Waterfowl Management Plan 2004). However, since the data supporting this decline comes from winter surveys in which it was not possible to differentiate among the three scoter species, this trend must be viewed with caution. No trends have been discerned in Quebec populations of the species.

Some aspects of marine resource development may have negative impacts on the White-winged Scoter. Aquaculture, among others, may limit birds' access to their foraging areas. The establishment of protected marine areas in key coastal habitats could be an option to consider to offset this potential problem. Spills of hydrocarbons or other toxic substances in the estuary or Gulf could also have harmful effects on the White-winged Scoter, particularly if they occur in the species' moulting or wintering areas. Another point to consider in the conservation of the species is that the White-winged Scoter is a sea duck that may accumulate a number of contaminants in its flesh (e.g., lead, cadmium, mercury, PCBs) (Brown and Fredrickson 1997), making it potentially vulnerable to poisoning.

In the Atlantic Flyway, U.S. hunters killed an average of 5,600 White-winged Scoters annually during the 2000–2007 period (Padding and Klimstra 2008). In Quebec, slightly under 900 birds were harvested on average per year from 2003 to 2007 (Table 3; Figure 74). Like the Surf Scoter, the White-winged Scoter accounts for less than 1% of the total waterfowl sport harvest in Quebec, making the harvest a marginal one (Table 3). However, the Cree subsistence hunt must also be included, estimated at 1,300 White-winged Scoters in 2006 (Cree Regional Authority and Cree Trappers Association 2008). CWS needs better data on scoter harvests, including the total First Nations harvest; these data are all the more important since the population of White-winged Scoters breeding in eastern North America may be more at risk because of its small size.

Figure 74. Estimated White-winged Scoter sport harvest in Quebec and number of Migratory Game Bird Hunting Permits sold, 1975–2007 (data taken from Gendron and Collins 2007)



Quebec plays a less important role in the conservation of the White-winged Scoter than for the other two scoter species, since the White-winged Scoter is less abundant in the province than its congeners in all seasons except winter. However, accurately determining the species' breeding range in Quebec as well as obtaining more information about the location of its moulting areas would be advisable and should be sufficient to meet the species' conservation requirements in the province.

4.5.6 Black Scoter *Melanitta americana* (Mr, Br, We) (by Christine Lepage and Jean-Pierre L. Savard)

The Black Scoter, a New World species, has recently been recognized as a species in its own right according to genetic studies (Chesser et al. 2010) and is now considered a separate species from the Common Scoter (*Melanitta nigra*), an Old World species. There are two distinct populations of Black Scoters in North America (Bordage and Savard 1995; Sea Duck Joint Venture 2003a, Wetlands International 2006). The Pacific (or Western) population breeds mainly in Alaska—and probably also in northern Yukon and the northwestern Northwest Territories—and winters along the Pacific Coast from the Aleutian Islands to Baja California (Bordage and Savard 1995). The Atlantic (or Eastern) population breeds in the northern half of Quebec, the Hudson Bay lowlands of Ontario, and Newfoundland and Labrador (Bordage and Savard 1995; Morrier 1996; Perry et al. 2004; Gilliland et al. 2009). The division of the North American Black Scoter population into two distinct populations (Atlantic and Pacific) was not taken into account in the North American Waterfowl Management Plan (North American Waterfowl Management Plan 2004). The Atlantic population winters along the Atlantic Coast, from New Brunswick and Nova Scotia to Florida, as well as along the northern shore of the Gulf of Mexico and in the Great Lakes (Bordage and Savard 1995; Petrie et al. 2006;

American Ornithologists' Union 1998). Up to 10,000 Black Scoters have been counted in winter in northwestern Lake Ontario (Petrie et al. 2006).

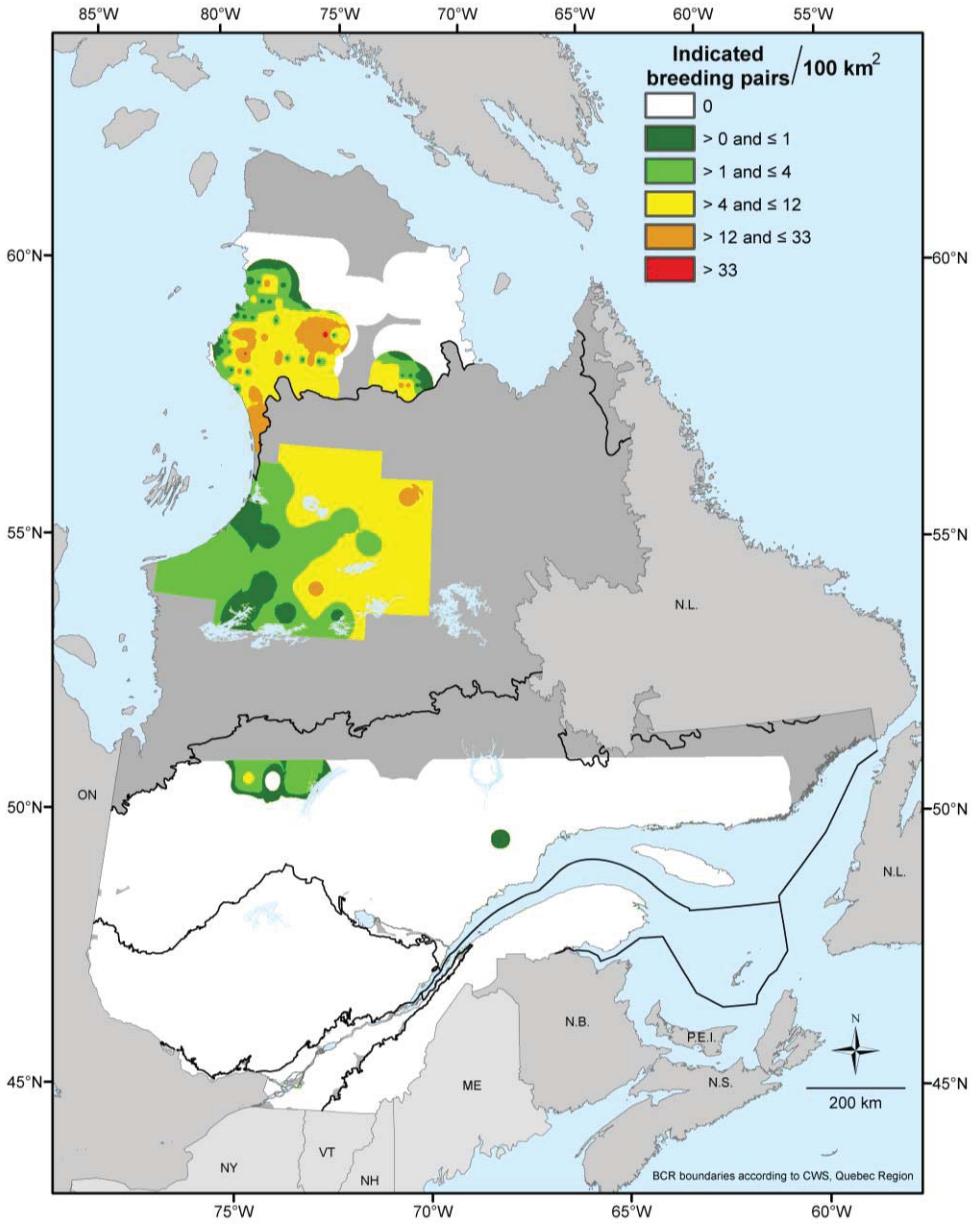
Breeding

In Quebec, the Black Scoter breeds in the boreal forest and taiga, mainly north of the 53rd parallel. Like the Surf Scoter, it nests around shallow lakes and ponds 20 to 30 ha in size (Consortium Gauthier & Guillemette – G.R.E.B.E. 1990b; 1993c). Breeding in the province has been confirmed as far north as Lake Minto, as far west as, but not including, the coast of Hudson Bay (Consortium Gauthier & Guillemette – G.R.E.B.E. 1992a), as far east as Rivière à la Baleine (brood observed 70 km southeast of Kuujjuaq; P. May, Makivik Corporation, pers. comm.), and as far south as the Vincelotte River and Laforge 1 Reservoir (Dryade 1994; 1996). During a Canada Goose breeding ground study, one or two breeding pairs of Black Scoters were observed in June 1996, 1997 and 2001 in the Polemond and Sorehead river area (BCR 3), roughly 120 km and 235 km north of Inukjuak, respectively (R. Cotter, CWS, unpubl. data). Lastly, during the WNOR surveys (see Figure 5a), many Black Scoter breeding pairs were observed every year in suitable breeding habitat (CWS, unpubl. data).

Surveys carried out in 1976 and 1989 in Northern Quebec yielded estimated breeding densities of 1.7–1.8 broods/100 km² in the coastal strip between Grande rivière de la Baleine (Great Whale River) and Petite rivière de la Baleine (Little Whale River); 3.0–7.3 broods/100 km² around Lake Bienville, and 11.2 broods/100 km² further inland near the Caniapiscau River (Consortium Gauthier & Guillemette – G.R.E.B.E. 1990a; Savard and Lamothe 1991). In the Laforge 1 Reservoir area in the centre of the province, estimated brood densities were 1.5 broods/100 km² in 1993, 1.8 broods/100 km² in 1994 and 2.2 broods/100 km² in 1995 (Dryade 1994; 1995; 1996). South of the species' confirmed breeding range, breeding pairs have been occasionally reported between the La Grande River area (BCR 7) and the southern part of Lake Mistassini (BCR 8), although breeding has never been confirmed in these sectors (WUPL; Consortium Gauthier & Guillemette – G.R.E.B.E. 1992b).

Figure 75 shows the distribution of Black Scoters in Quebec based exclusively on various surveys and inventories carried out primarily by CWS (see Chapter 3).

Figure 75. Breeding distribution of the Black Scoter in Quebec (by indicated breeding pair density); please read the explanatory note at the last paragraph of Section 2.4



Spring migration

In spring, Black Scoters travel up the Atlantic Coast to Chaleur Bay and the estuary and Gulf of St. Lawrence, where they stop over for three to five weeks, from late April to early June, before heading to their breeding grounds (Falardeau and Savard 2003; Rail and Savard 2003; McAloney et al. 2005). In 1996, the peak of migration in the species occurred in the first week of May in Chaleur Bay (BCR 14), the second week of May in the Baie-Comeau area (lower estuary; BCR 8), and the third week of May in the Sept-Îles area (Gulf; BCR 8) (Falardeau and Savard 2003). According to surveys conducted during the period of May 3–30, 2005, in Chaleur Bay, 95% of scoters present were Black Scoters (McAloney et al. 2005). This number is greater than the 61% obtained for the species in this location during WSHO surveys (2004–2008 average) and the 67%

observed in 1996 (Falardeau and Savard 2003). According to the results of the 2005 surveys, an estimated 52,200 Black Scoters were staging in Chaleur Bay (McAloney et al. 2005). In comparison, an estimated 88,000 individuals of the species (annual average for 1996–2004) staged in the Bay of Fundy in New Brunswick during spring migration (Bond et al. 2007).

Along the north shore of the estuary and Gulf of St. Lawrence, aerial surveys in May 1998 reported over 220,000 scoters (mainly Black Scoters) (Rail and Savard 2003). More recently, aerial surveys in 2005 along the north shore of the lower estuary provided estimates of 36,300 Black Scoters in this part of the St. Lawrence (McAloney et al. 2005). An estimated 40% of the scoters migrating along the North Shore are probably Black Scoters (WSHO, 2004–2008 average).

Moulting

Small numbers of non-breeding Black Scoters (first and second year birds) spend the summer in the waters of the estuary and Gulf (Bordage and Savard 1995; Gosselin 1995c). The species is not reported in large numbers in the St. Lawrence during the moulting period (Bordage and Savard 1995; Rail and Savard 2003). Small groups of individuals were observed west and south of Anticosti Island (BCR 8) from early July to late August 2005, including as many as 220 individuals between July 10 and 20 around Pointe Sud-Ouest (Southwest Point) (CWS, unpubl. data). The species moults in large numbers along the entire coastline of James Bay (BCR 7) (Perry et al. 2004; Perry and McAloney 2003; Ross and Abraham 2009), particularly the northeast coast (Benoit et al. 1991; Benoit et al. 1993). In August 1993, roughly 35,000 scoters of all three species moulted in an area stretching from the Bay of Many Islands to Pointe Louis-XIV (Benoit et al. 1994). In August 1995, new surveys showed 4,200 scoters moulting in this sector, 76% of which were Black Scoters (Benoit et al. 1995).

In the western half of James Bay, recent surveys carried out between July 30 to August 2, 2006, to develop an aerial survey methodology for regularly monitoring the population revealed roughly 140,000 Black Scoters, 99% of which were adult males (Ross and Abraham 2009). In 1983, about 90,000 individuals of the species were found along the west coast of James Bay and Hudson Bay (Ross 1983). It is thought that moulting Black Scoters in this location are birds breeding in northern Ontario and northern Quebec (Ross and Abraham 2009). Black Scoters also use moulting areas on the east coast of Hudson Bay (Savard and Lamothe 1991); Manitounuk Sound (BCR 7), among other locations, probably attracts the species from early summer to early fall (Consortium Gauthier & Guillemette – G.R.E.B.E. 1990b). A portion of the birds breeding in the centre of the province moult along the Labrador coast (Perry et al. 2004).

Fall migration and wintering

The Black Scoter flight in fall extends from mid-September to late November, with peak abundance occurring in October in the St. Lawrence (Lehoux et al. 1985). The flight is smaller in fall than in spring, whether in the St. Lawrence or on inland freshwater bodies of water (Lehoux et al. 1985; Gosselin 1995c). The species appears to take a direct overland route from its moulting areas in James Bay to its wintering grounds (ÉPOQ); it is much less abundant in fall in the estuary and Gulf of St. Lawrence than it is in spring, although small groups can indeed be found (in Sainte-Flavie [BCR 14] and Forestville [BCR 8], among other locations) (ÉPOQ).

The Black Scoter is reported only occasionally in Quebec in winter (Gosselin 1995c) and there are no records of successful overwintering to date (Gosselin 1995c; David 1996).

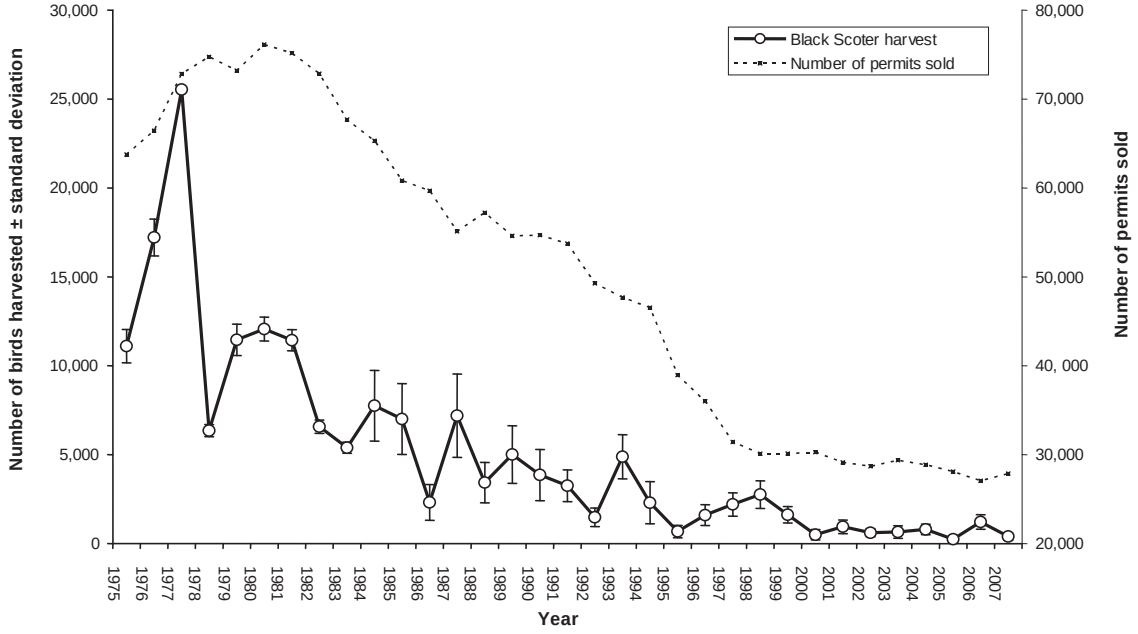
Conservation

The estimated North American population of Black Scoters is approximately 400,000 individuals (Atlantic and Pacific populations combined) (Table 2). The total Atlantic population has been estimated at 88,550 individuals, according to aerial surveys of Chaleur Bay and the north shore of the estuary carried out in May 2005 for this purpose (McAloney et al. 2005). Other estimates put the Atlantic population at between 130,000 and 200,000 individuals (Wetlands International 2006). These estimates are no doubt conservative. The Quebec population is estimated to be 112,000 individuals (Table 2). The continental population is thought to be declining over the long term according to surveys on the species' wintering grounds (North American Waterfowl Management Plan 2004). However, the methodology used in these surveys is not adequate for counting this sea duck. Recent surveys on the west coast of James Bay have provided substantially higher numbers than obtained previously, suggesting an increase in the population (Ross and Abraham 2009). However, new sectors were surveyed that were not covered in previous efforts, which could explain the much higher count obtained.

The fact that this species congregates in rafts during moulting and in winter makes it highly vulnerable to spills of hydrocarbons and other toxic substances. Furthermore, like the Surf and White-winged scoters, the Black Scoter faces potential threats from aquaculture, as well as the future development of offshore wind energy, which has already occurred in Europe on the wintering grounds (Fox and Pihl 2005). In the face of these potential threats, establishing protected marine areas could provide protection for the species. The development of new hydroelectric projects and construction of transmission lines in northern Quebec could also result in anthropogenic modifications to the landscape that could conflict in the future with the breeding of the species.

In 2000–2007, hunters in the Atlantic Flyway bagged 9,500 Black Scoters annually on average (Padding and Klimstra 2008), accounting for less than 1% of the total waterfowl harvest in this flyway. In Quebec, roughly 700 birds were shot annually in the sport hunt during the 2003–2007 period (Table 3; Figure 76). The Cree subsistence harvest was an estimated 8,400 birds in 2006 (Cree Regional Authority and Cree Trappers Association 2008).

Figure 76. Estimated Black Scoter sport harvest in Quebec and number of Migratory Game Bird Hunting Permits sold, 1975–2007 (data taken from Gendron and Collins 2007)



Quebec plays a major role in the conservation of the Black Scoter during the breeding season (28% of the North American population [Table 2]; over 50% of the Atlantic population), spring and fall migration, and the moulting period. Therefore, continuing the efforts undertaken by the SDJV (see Gilliland and McAloney 2009) to learn more about the distribution of the Atlantic population seems essential.

4.5.7 Long-tailed Duck *Clangula hyemalis* (Mr, Br, Wr) (by Christine Lepage and Richard Cotter)

The Long-tailed Duck nests in the Arctic and sub-Arctic tundra in North America and Eurasia. In North America, it breeds mainly in Alaska, the northern portions of the Northwest Territories and Yukon, throughout Nunavut, and in northern Manitoba, Ontario, Quebec (Nunavik), and Labrador (Robertson and Savard 2002). This sea duck winters primarily off the east and west coasts of North America (White et al. 2009), as well as in the Great Lakes (50,200 birds in 2002–2006 on average) (Petrie et al. 2006) and the estuary and Gulf of St. Lawrence (Lamothe 1996; Lehoux et al. 1996). The species also winters in ice-free areas along the northwest coast of Hudson Bay and around the Belcher Islands (Gilchrist and Robertson 2000) and, in smaller numbers, around Resolution and Edgell islands (Nunavut) and off Cape Chidley on the northern tip of Labrador (Prach et al. 1981). In addition, the species winters along the coast of Greenland (Merkel et al. 2002; Boertmann et al. 2004), and some of these birds may be breeding in Canada (Boertmann et al. 2004).

Breeding

The Long-tailed Duck breeds on the edges of freshwater wetlands such as lakes and ponds, along the coast and on islands as well as in inland tundra. The nest is a simple

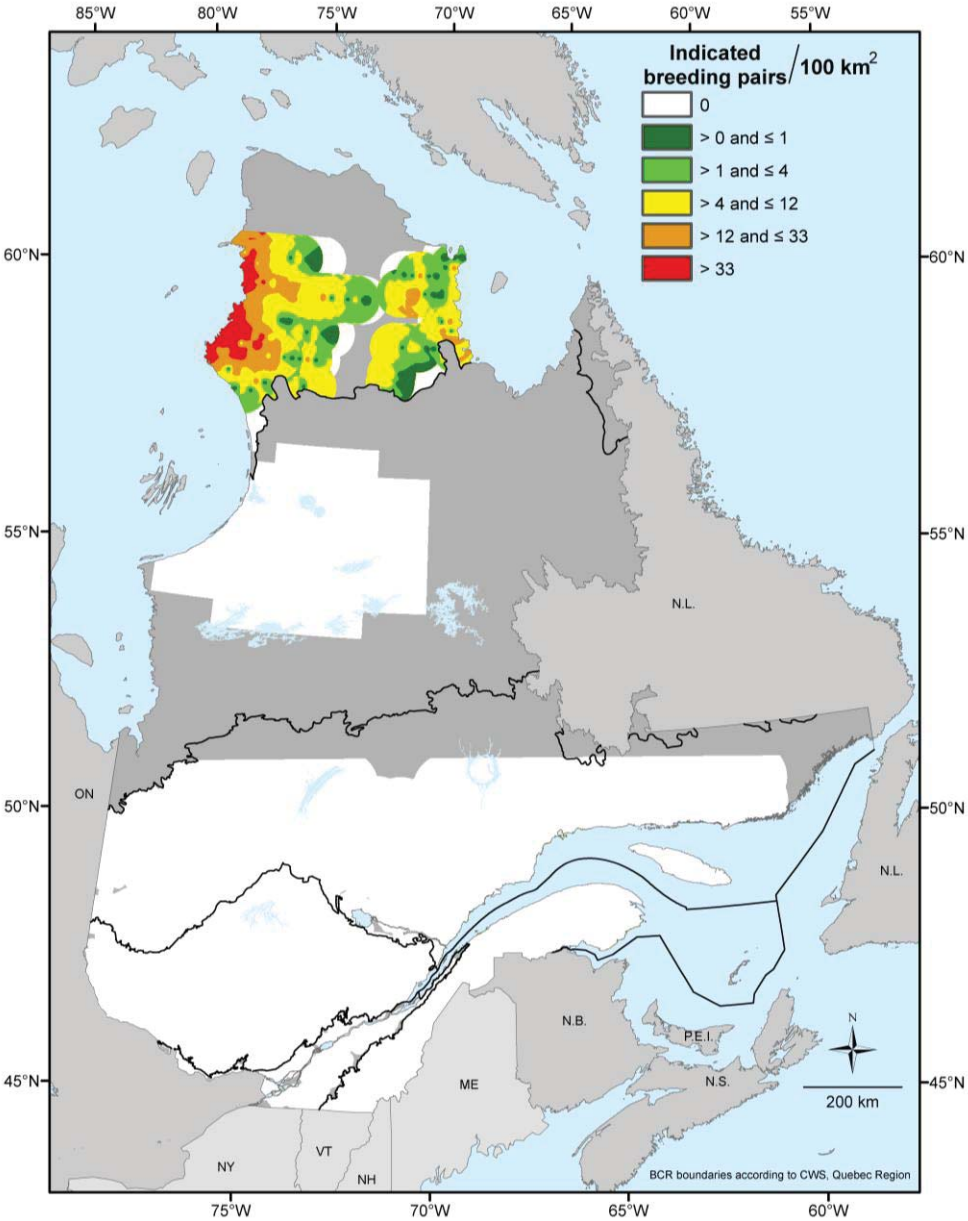
natural depression in the ground built in an open area; the hen's cryptic plumage allows her to blend in with the surroundings, thus camouflaging the nest (Lamothe 1996; Robertson and Savard 2002). In Quebec, the Long-tailed Duck breeds on the Ungava Peninsula and along the coast of Hudson Bay and James Bay (BCR 3 and 7) (Lamothe 1996). Nests and broods (up to 13 nests and broods in 2001 and up to 12 in 2002) were found near the Mariet and Polemond rivers, roughly 100 km north of Inukjuak, during a 1996–2003 Canada Goose breeding ground study, as well as near the Sorehead River, north of Puvirnituq (BCR 3) (R. Cotter, CWS, unpubl. data). The species is common in Parc National des Pingualuit (Pingualuit provincial park) (BCR 3), roughly 100 km southwest of the village of Kangiqsujuaq; in 2007, a number of breeding pairs were observed in late June as well as broods in late July (Robert 2007). The Long-tailed Duck ranks third in abundance (in indicated breeding pairs) among waterfowl species surveyed in BCR 3, behind the Canada Goose and Red-breasted Merganser (WNOR; CWS, unpubl. data).

Breeding has also been confirmed on the Hudson Bay coast between the Grande rivière de la Baleine (Great Whale River) and the Nastapoka River, by the sighting of a single brood, the only such record to date (BCR 7) (Consortium Gauthier & Guillemette – G.R.E.B.E. 1990a). Along the northeast coast of James Bay, a few nests have been found on the islands north of Attikuan Point (BCR 7) (Benoit et al. 1992; Benoit et al. 1993; Reed et al. 1996), and broods were also observed on barrens on the mainland (Benoit et al. 1994). Estimated breeding density was 12 IBP/100 km^2 in the coastal strip near Pointe Louis-XIV, at the extreme northern end of the east coast of James Bay (Benoit et al. 1993). Lastly, there are reports of indicated breeding pairs as far south as Rupert River (BCR 7) (Tecsult Inc. 2006).

Even farther south, the species probably nests on the Lower North Shore (BCR 8), where the tundra habitat scattered with ponds resembles the Arctic tundra. Breeding individuals have been reported around Brador (north of Lourdes-de-Blanc-Sablon) and Kegaska (Gosselin 1995e). More recent data is required to determine with certainty whether the species is still breeding in these areas.

Figure 77 shows the distribution of indicated breeding pairs of Long-tailed Ducks in Quebec according to data from various surveys and inventories carried out primarily by CWS.

Figure 77. Breeding distribution of the Long-tailed Duck in Quebec (by indicated breeding pair density); please read the explanatory note at the last paragraph of Section 2.4



Migration and moulting

In spring, in the southern half of Quebec, Long-tailed Ducks are concentrated more in the upper and lower estuary and Gulf of St. Lawrence, including the Middle and Upper North Shore, the area southeast of Anticosti Island and the Gaspé region (BCR 8 and 14) (Gosselin 1995e; ÉPOQ and WSHO). Five Long-tailed Ducks, which were fitted with satellite transmitters and tracked from their wintering grounds along the coast of New York State to their breeding grounds in Nunavut, migrated along the lower estuary in the spring of 2008 (Allison et al. 2008), four of them stopping over first in Chaleur Bay. In spring, the species is also found in large numbers around the Magdalen Islands (BCR 14), with some rafts consisting of up to 1,000 individuals (Fradette 1992). Some

birds also stage in the riverine lakes in southwestern Quebec (Lamothe 1996). After their stopover in the St. Lawrence system, the birds move gradually northward; the species is known to be harvested by the Mistissini Crees (BCR 8) (J. Rodrigue, CWS, pers. comm.). In the northern half of Quebec, groups of roughly 300 and 200 individuals were seen in May 2002 on the Rupert River and Némiscau River respectively (BCR 7) (Tecsult Environnement Inc. 2004). A little farther north, the Opinaca Reservoir and Boyd and Sakami lakes also host groups of Long-tailed Ducks in spring (BCR 7) (Tecsult Environnement Inc. 2004). There is a report of nearly 2,200 individuals at the outlet of Lake Bienville (BCR 7) in May 1977 (Éco-recherches Ltée 1982 in Consortium Gauthier & Guillemette – G.R.E.B.E. 1990a).

The species' distribution during fall migration is fairly similar to that in spring, with slightly greater numbers in the riverine lakes in the southwest of the province, although the majority of individuals are still in the estuary and Gulf (Gosselin 1995e; Lamothe 1996). In the Magdalen Islands, regular reports are received of 500–850 birds from mid-October to late November along the coast (BCR 14) (Fradette 1992).

There is little information on moulting in the species. Drakes probably abandon the hens during the incubation period and congregate in flocks of up to 200 individuals along the coasts of James Bay, Hudson Bay and Ungava Bay to moult (BCR 3 and 7) (Lamothe 1996). The species has been observed along the northeast coast of James Bay during the moulting period, but in small numbers (Benoit et al. 1994). It is not known where the females moult.

Wintering

In Quebec, according to winter records in the ÉPOQ database, flocks of over 10,000 Long-tailed Ducks have been reported at two locations: the north shore of the estuary between Baie-Sainte-Catherine and Les Bergeronnes (BCR 8; maximum group observed = 25,000 in January 1978) and off Cap-d'Espoir in the Gaspé region (BCR 14; maximum group observed = 60,000 in January 1992). Despite these observations, three quarters of the winter records submitted to ÉPOQ consist of 100 individuals or less.

It is difficult to estimate how many Long-tailed Ducks actually overwinter in the St. Lawrence. The winter population has been estimated at 66,500 individuals based on data from 1974–1980 (Lehoux et al. 1985). According to recent aerial surveys conducted in winter by CWS on other waterfowl species, Long-tailed Ducks could occur anywhere in the lower estuary and Gulf, on both the north and south shores. At this time of the year, the birds feed mainly on amphipods (Robertson and Savard 2002; White et al. 2009) and therefore are not limited to a fixed food resource like eiders are. During the 2002 BAGOS surveys, roughly 4,000 Long-tailed Ducks were found around the Alouettes flats, 1,000 near the shoreline between Tadoussac and Pointe-des-Monts, 7,600 along the shoreline from Pointe-des-Monts to the Mingan Islands, 2,200 around Anticosti Island and 3,000 close to Plate Island in the Gaspé region (BCR 8 and 14) (Robert et al. 2003); in 2005, 1,100 individuals were found between Tadoussac and Pointe-des-Monts, 7,800 along the coast between Sept-Îles and the Mingan Islands and 1,100 around Anticosti Island (BCR 8) (CWS, unpubl. data). Common Eider surveys (COEIS) in 2003 provided estimates of roughly 2,000 Long-tailed Ducks from the Mingan Islands to Blanc-Sablon (CWS, unpubl. data) and allowed the presence of the species to be confirmed in winter offshore from the Magdalen Islands (BCR 14) (Fradette 1992). These aerial surveys during the first decade of the

21st century revealed the presence of roughly 10,000 individuals in total in winter in the Gulf and the estuary. Although these surveys did not specifically target the Long-tailed Duck, and the numbers obtained probably represent only a portion of the numbers actually present in the St. Lawrence at this time of year—the species very likely remains further offshore than the narrow area along the coast surveyed—they do allow the vast area potentially occupied by the species in winter to be appreciated. To obtain better estimates of the number of overwintering birds, CWS began a pilot project to design an offshore survey adapted to the species' widespread distribution. Preliminary results indicate that, in February 2009 and 2010, the greatest concentrations of individuals occurred along the Middle North Shore and the area south of Anticosti Island (F. Bolduc, CWS, pers. comm.).

Recent increases in populations of Long-tailed Ducks wintering on the Great Lakes (Petrie et al. 2006) and along the U.S. East Coast (White et al. 2009), combined with the decline in numbers observed in the Tadoussac CBC since 1995 (Savard 2009a), as well as the decline observed between surveys in the 1970s and in the first decade of the 21st century in the Gulf, suggest that a majority of individuals do not stop in the province to overwinter but instead continue south and overwinter there. This is just a supposition, however, and it is crucial to test this hypothesis in order to properly direct conservation efforts for the species.

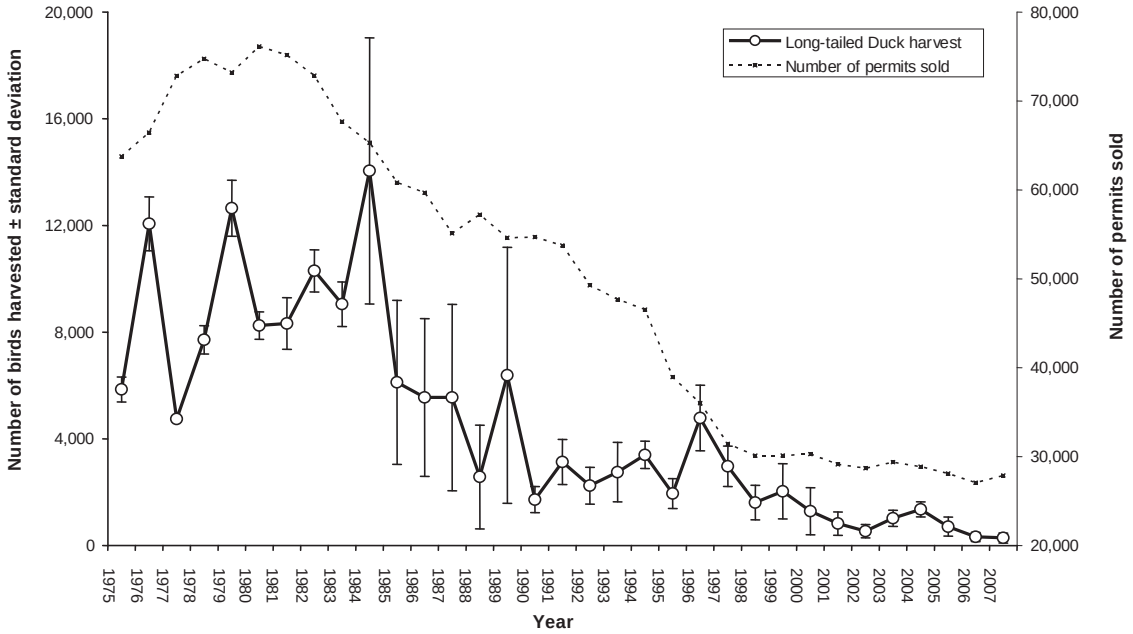
Conservation

Long-tailed Ducks in North America are considered to be a single population (Sea Duck Joint Venture 2003d), consisting of roughly 1 million birds (Table 2). According to WNOR data, there are probably around 47,000 IBP in northern Quebec (BCR 3) (CWS, unpubl. data). Of the 400,000 breeding pairs in North America (estimated based on a population of 1 million individuals), nearly 12% breed in Quebec. There is no annual survey in North America covering the entire Long-tailed Duck breeding distribution. According to the results of the Atlantic Coast Sea Duck Survey, the numbers of Long-tailed Ducks wintering along the U.S. East Coast increased during the 1991–2002 period (Canadian Wildlife Service Waterfowl Committee 2005). However, the Waterfowl Breeding Population and Habitat Survey shows an annual rate of decline of 2.7% from 1961 to 2005 ($P < 0.05$) in the population in Alaska and western boreal Canada (Canadian Wildlife Service Waterfowl Committee 2005). Furthermore, in the Rasmussen Lowlands in Nunavut, a decrease of 77% in the number of Long-tailed Ducks was observed between the 1975–1976 and 1994–1995 periods (Johnston et al. 2000).

Most Long-tailed Ducks harvested in Canada are shot by hunters in Eastern Canada. Hunters in four provinces were responsible for 95% of the 1974–2004 harvest: Quebec (47%), Ontario (19%), Nova Scotia (18%), and Newfoundland and Labrador (12%). Since the 1970s, there has been a significant decline in Long-tailed Duck harvests in the country. The average annual harvest in Canada in the three last decades was as follows: 18,473 birds in 1975–1984, 9,234 birds in 1985–1994 and 4,635 birds in 1995–2004 (Gendron and Collins 2007). The situation in Quebec (Figure 78) reflects the situation in Canada in general, with an average of 9,300 birds harvested annually in 1975–1984, 3,900 in 1985–1994 and 1,800 in 1995–2004 (Table 3); however, the parallel decrease in the number of hunters during these same decades must also be taken into account (Figure 78: see right axis). According to the most recent data, an average of 700 birds were harvested annually in 2003–2007 (Table 3). Although Quebec is the province with the greatest annual harvest of the species, Long-tailed Ducks account for less than 1% of the annual Quebec waterfowl harvest. The species

ranks 22nd among waterfowl harvested (Table 3). Lastly, U.S. hunters along the Atlantic Flyway shot an average of 17,900 Long-tailed Ducks annually during the period 2000–2007 (Padding and Klimstra 2008). The size of the First Nations harvest in Nunavik is not known.

Figure 78. Estimated Long-tailed Duck sport harvest in Quebec and number of Migratory Game Bird Hunting Permits sold, 1975–2007 (data taken from Gendron and Collins 2007)



According to the Sea Duck Joint Venture's Technical Team (Sea Duck Joint Venture 2003d), the main management and conservation concerns pertaining to the Long-tailed Duck are: (1) the lack of an adequate annual survey on the breeding grounds or wintering grounds; and (2) the risk of heavy metal contamination, either through the diet or oil spills, particularly on the wintering grounds (including Greenland; Merkel et al. 2002) and staging areas where the birds are concentrated.

Quebec plays a medium role in the conservation of the Long-tailed Duck, during the breeding season (12% of the North American population; Table 2), spring and fall migration, and in winter. Given the gaps in knowledge on a number of characteristics of the Long-tailed Duck in the province (e.g., ecology, seasonal distribution, numbers, population trends), special attention should be paid to the species in the future.

4.5.8 Bufflehead *Bucephala albeola* (Mr, Br, Wr)
(by Pierre Brousseau and Christine Lepage)

The core breeding range of the Bufflehead, an exclusively North American species, lies basically in Canada, although it also stretches to Alaska. This small duck breeds from Alaska, through the Prairie provinces, to Ontario and western Quebec, but is absent from the Maritimes. The highest breeding densities have been observed in central British Columbia, northern and central Alberta, northwest Saskatchewan, and

southwest Northwest Territories (Gauthier 1993; Erskine 2005). The species breeds mainly in the boreal forest and aspen parkland of these regions. There are also small isolated populations in the United States, mainly in Washington State, Oregon, California, Idaho, Montana and Wyoming (Gauthier 1993). The species winters primarily along the Pacific Coast, particularly California and Washington, and on the Atlantic Coast, mainly from New Jersey to North Carolina (Gauthier 1993).

Breeding

The Bufflehead breeds near ponds and small lakes often with sparse floating and emergent vegetation, and containing little or no fish, but with a thriving invertebrate community (Savard 1982). This cavity-nesting species uses the holes of Pileated Woodpeckers or Northern Flickers, or artificial nest boxes (Mallory 2007). Its distribution in Quebec is fairly limited; it breeds in the Abitibi-Témiscamingue (BCR 8 and 12) and James Bay (from Rupert River to Kuujjuarapik; BCR 7) regions and north and west of Lac Saint-Jean (BCR 8) (Aubry 1996). Breeding records are rare and fairly recent in origin. The first evidence of breeding in the province was obtained in 1982 in the James Bay region south of Radisson (Bordage 1984). The many aerial surveys carried out in the region as part of hydroelectric development projects provided good coverage of the territory and allowed the species' distribution to be described in greater detail. During these surveys, broods were observed near Rupert Bay, east of Nemiscau near the Rupert River, in Cawachagamite Lake south of the Eastmain River, on inland lakes along the coast of James Bay between Rivière au Castor and Attikuan Point, in the Roggan River area and near Kuujjuarapik (Benoit et al. 1991; Benoit et al. 1992; Benoit et al. 1993; Aubry 1996).

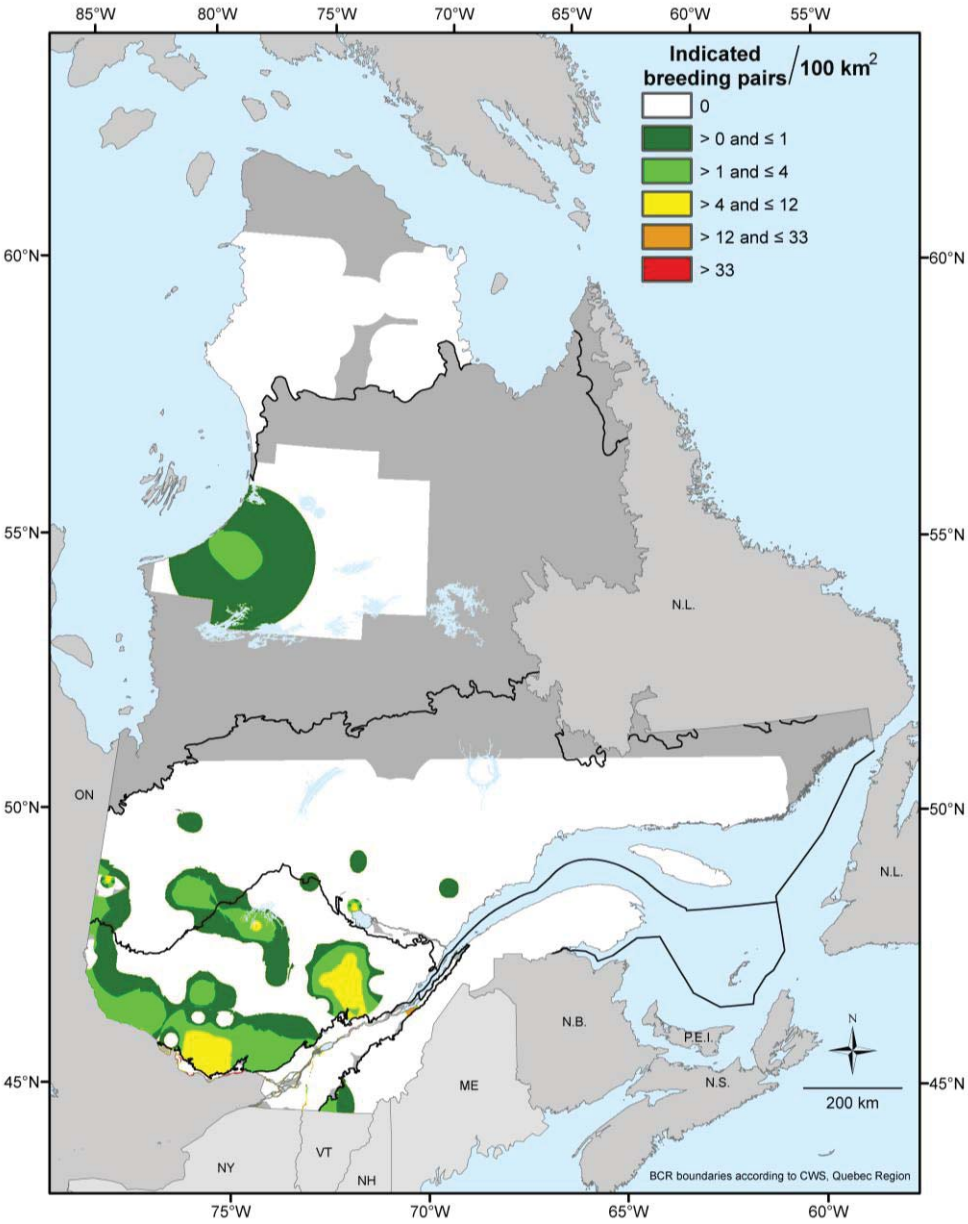
In the Abitibi-Témiscamingue region, possible, probable and confirmed breeding records were obtained for the species during the 1984–1989 period (which corresponds to the field campaign for the first Quebec breeding bird atlas) (Aubry 1996). The number of breeding Buffleheads in this region, which is huge and difficult to access, is very likely greater than the number of records suggests.

Breeding densities (by IBP) obtained during WUPL surveys in 1990–2007 were highly variable (Figure 79). Owing to the species' low densities in the boreal forest and the number of plots sampled, it is impossible to get an accurate estimate of the population. In addition, the survey period used was not suitable for the species since most Buffleheads, like other sea ducks, were still migrating when the survey was carried out. In any event, according to the WUPL data, the highest breeding densities of the species occur in the Abitibi-Témiscamingue (up to 12 IBP/100 km²), Outaouais (up to 4 IBP/100 km²) and Laurentides (up to 7 IBP/100 km²) regions (Lemelin et al. 2004; CWS, unpubl. data).

Recent possible and confirmed breeding records are extending the Bufflehead's known breeding range (Aubry 1996; Gauthier 1993) farther east in Quebec: a hen and three ducklings were observed in Lac de la Grosse Roche, in the Martin-Valin ZEC in the Saguenay region in August 2001 (Bannon et al. 2002a); a hen and four ducklings were seen on a pond near Schefferville in August 2009 (S. Richer and V. Deschamps, AECOM, pers. comm.); and a male was observed in Labrador, near the Quebec border, on June 16, 2008 (Gilliland et al. 2009). The species is timid and retiring, which could be an additional reason for our lack of knowledge of its distribution in the province.

Figure 79 shows the distribution of indicated breeding pairs of Buffleheads in Quebec according to various surveys and inventories carried out primarily by CWS (see Chapter 3).

Figure 79. Breeding distribution of the Bufflehead in Quebec (by indicated breeding pair density); please read the explanatory note at the last paragraph of Section 2.4



Spring and fall migration

Buffleheads travel up the Atlantic Coast in spring, but it is not known which areas are used by birds breeding in Quebec owing to a lack of band recoveries. Only three Buffleheads have been captured in Quebec since the waterfowl banding program began in 1948 (CWS, unpubl. data).

In spring, the species is present in good numbers throughout southern Quebec. It does not migrate in huge numbers like some other species of waterfowl, and flocks are generally no greater than 200, or more often, 100 birds. The largest flocks can be seen in the Lake Saint-Pierre region (BCR 13). Elsewhere, numbers are smaller, as shown by the maximum records obtained in other regions: 35 birds in the Gaspésie region (BCR14), 60 in the Côte-Nord region (BCR 8), and 100 in the La Tuque region (BCR 12) (ÉPOQ).

In fall, the Bufflehead is seen in the greatest numbers from late October to mid-November and can be considered a late fall migrant. No particular region has been identified as a stopover area in fall, and it is found almost everywhere at this time. The Ottawa River, greater Montréal area (Lac des Deux-Montagnes and Lake Saint-Louis) and the Richelieu River comprise the areas where the average number of individuals per record is highest. The maximum number of birds observed in fall is 200 in BCR 14, 100 in BCR 8, 100 in BCR 13 and 40 in BCR 12 (ÉPOQ).

Moulting

We have almost no knowledge of where Buffleheads moult in Quebec. The only record of moulting birds comes from a coastal habitat in the northeast part of James Bay (BCR 7) (Benoit et al. 1992).

Wintering

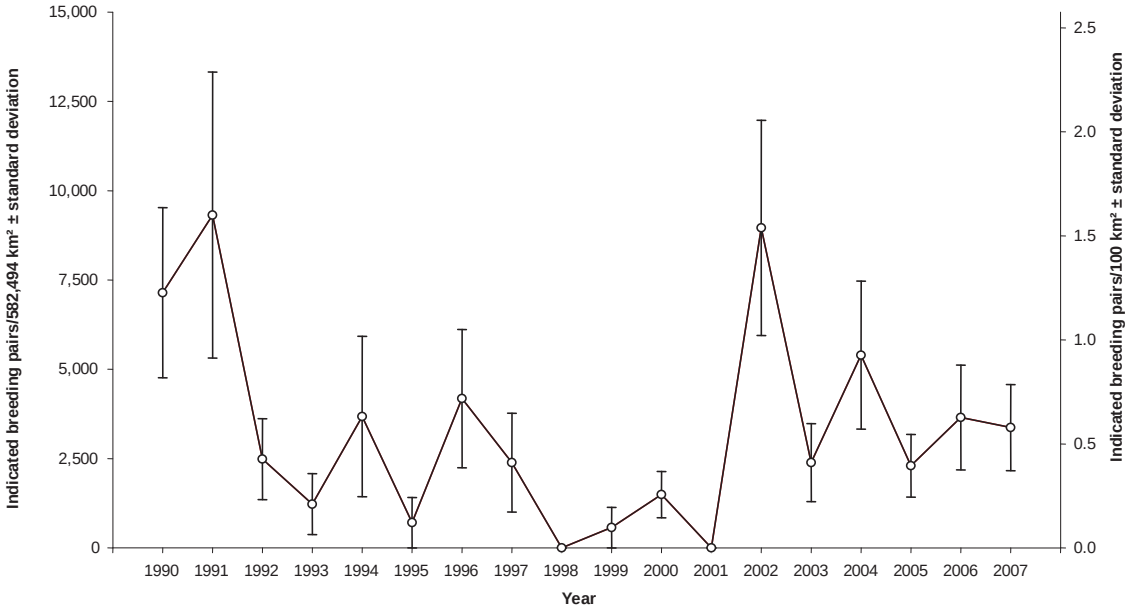
A few Buffleheads overwinter every year in Quebec, in both saltwater and freshwater habitats. During BAGOS surveys (1999, 2002, 2005 and 2009), a group of 15–45 Buffleheads was found on a regular basis on the Alouettes flats in the upper estuary, opposite Baie-Sainte-Catherine (BCR 8) (Robert et al. 2003; CWS, unpubl. data). ÉPOQ data confirm the use of this site by the species year after year, and it is probably present in winter in the area between Baie-Sainte-Catherine and Les Escoumins (ÉPOQ). In addition, small numbers of birds overwinter in the Outaouais (BCR 13) (Gosselin 1995h; ÉPOQ), Montréal (BCR 13) (Gosselin 1995h; Bannon 2008; ÉPOQ), Middle North Shore (Baie-Comeau–Franquelin sector, BCR 8) (Gosselin 1995h; CWS, unpubl. data) and Gaspésie (BCR 14) (Bannon et al. 2006c; ÉPOQ) regions in certain years.

Conservation

The species is much more common in the western part of the continent than in the eastern part. The North American population has been estimated at roughly 1,400,000 individuals (Table 2) and, according to NAWMP, is probably increasing (North American Waterfowl Management Plan 2004). According to surveys carried out under the BDJV in eastern Canada (Ontario, Quebec and the Atlantic provinces), the average breeding population in the East in 1990–2003 was 6,000 breeding pairs, including roughly 3,600 pairs in Quebec (CWS, unpubl. data). However, most Buffleheads breed north of the area covered annually in this survey (now the BWPSEC and WUPL). The Quebec population is estimated at 11,000 birds (Table 2). In the WUPL survey area, a downward trend in the breeding population was found (6% per year, almost statistically significant [$0.10 \geq P \geq 0.05$]; Figure 80), during the same period (1990–2003) (CWS, unpubl. data). At an even more regional scale, a significant annual decline of 5.7% was calculated for the 1990–2007 period in BCR 8 (Lepage et al., in prep.). However, it must be remembered that this is not a province-wide trend, but rather one in the southern part of the species' breeding range. In addition, the

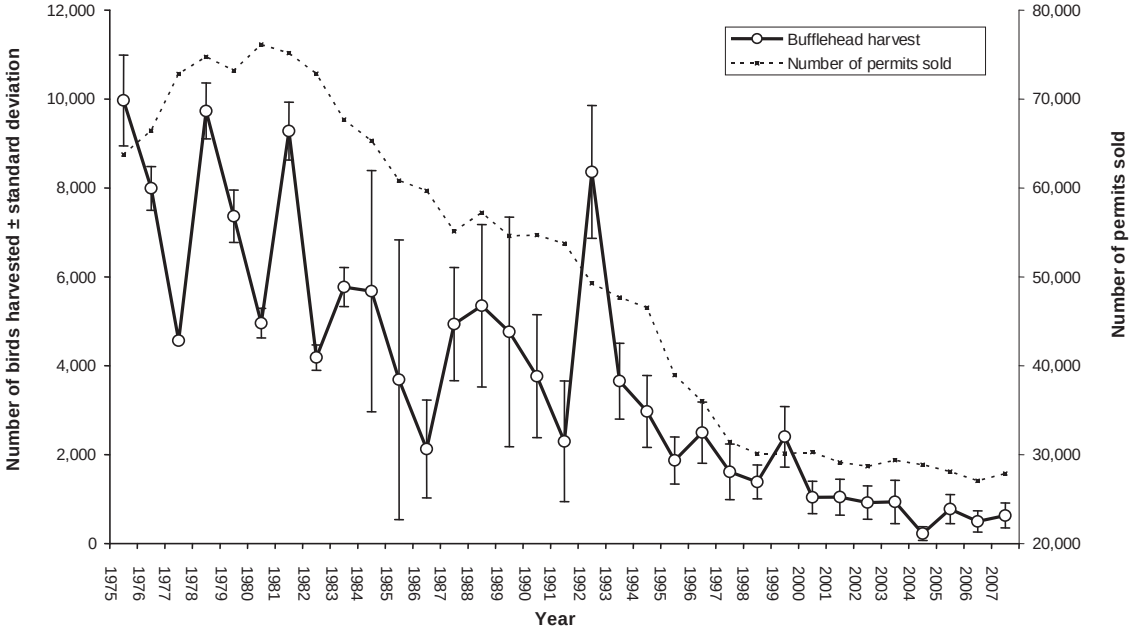
Bufflehead population increased considerably between the periods of 1981–1985 and 2001–2005 in Ontario (Mallory 2007).

Figure 80. Trends in the Bufflehead breeding population in southern Quebec uplands, 1990–2007 (WUPL data); total number of indicated breeding pairs (left axis) and density per 100 km² (right axis)



During the 2005 and 2006 hunting seasons, the total U.S. harvest was 140,000 and 191,000 Buffleheads respectively. Out of this total harvest, 40% and 32% of birds were bagged in the Atlantic Flyway in these two years respectively (U.S. Fish and Wildlife Service 2007). In 2000–2007, the average annual harvest of the species in the Atlantic Flyway was 57,100 birds (Padding and Klimstra 2008). Canadian harvests of the species are much more modest; in 2005 and 2006, an estimated 14,000 Bufflehead were taken by hunters annually (Gendron and Collins 2007). This estimate represents a sharp decline from the 1975 number, when over 75,000 birds were harvested. Since then, the harvest has declined steadily in all provinces, most likely echoing the decrease in the number of hunters. In Quebec, the average annual harvest in 1995–2004 was only 1,400 birds, compared with 7,000 in 1975–1984 and 4,200 in 1985–1994 (Table 3). The estimated 1975 harvest was close to 10,000 birds, compared with slightly over 600 in 2007 (Figure 81). The decline in harvests in Quebec has been much more pronounced than in Canada overall. The percentage represented by the Quebec harvest in the total Canadian harvest began to decline in 1993: in 1975–1984 and 1984–1994, the Quebec harvest made up 12% of the total Canadian harvest; in 1995–2004, 7%; and in 2007, 3%. During the same periods, the Ontario harvest made up 64%, 68%, 65% and 55% of the total Canadian harvest respectively. The reasons for this change are not known.

Figure 81. Estimated Bufflehead sport harvest in Quebec and number of Migratory Game Bird Hunting Permits sold, 1975–2007 (data taken from Gendron and Collins 2007)



Owing to the modest numbers of Buffleheads in Quebec, the establishment of specific conservation measures for the species is not warranted. However, this is a cavity-nesting species and would benefit from the recommendation that snags be left intact during logging operations; forestry activities will be subject to the provisions of upcoming regulations on the incidental take of migratory birds. Lastly, the species is surveyed periodically under the Breeding Waterfowl Plot Survey of Eastern Canada (WUPL component), although the coverage of Quebec territory is limited (see Figure 2) and the survey is probably conducted too early for the species. However, the BWPSEC contributes to our knowledge (distribution, abundance and trends) of the species.

4.5.9 Common Goldeneye *Bucephala clangula americana* (Mr, Br, Wr) (by Daniel Bordage)

The Common Goldeneye has a circumpolar breeding range. It breeds in Eurasia, from Scandinavia (south of the treeline) to Siberia, as well as locally in northern Europe, particularly Scotland, where it has bred since 1970 (Dennis and Dow 1984; American Ornithologists' Union 1998; Zicus 2005). The species' breeding range in North America extends, from the treeline southward, across western Alaska, northern Yukon, northwestern and southern Mackenzie, southwestern Keewatin, northern Manitoba, northern Ontario, northern Quebec, and the central portion of Newfoundland and Labrador, as far south as the 45th parallel (American Ornithologists' Union 1998; Zicus 2005). Some isolated breeding populations have been extirpated in Eurasia and North America owing to habitat loss (Phillips 1922–26 in Dement'ev and Gladkov 1952; Zicus 2005). In North America, the species winters from the Aleutian Islands and southeastern Alaska south to Baja California and the State of Sonora in Mexico, and from inland western Washington State and Idaho south to Utah, as well as on the Great Lakes and along the Atlantic Coast and Gulf of Mexico, from Newfoundland and

Labrador and Nova Scotia in the north to Central Florida in the south and Texas in the west (American Ornithologists' Union 1998). Along the East Coast, the species is particularly abundant in winter from northern New England to the Chesapeake Bay (Zicus 2005).

Breeding

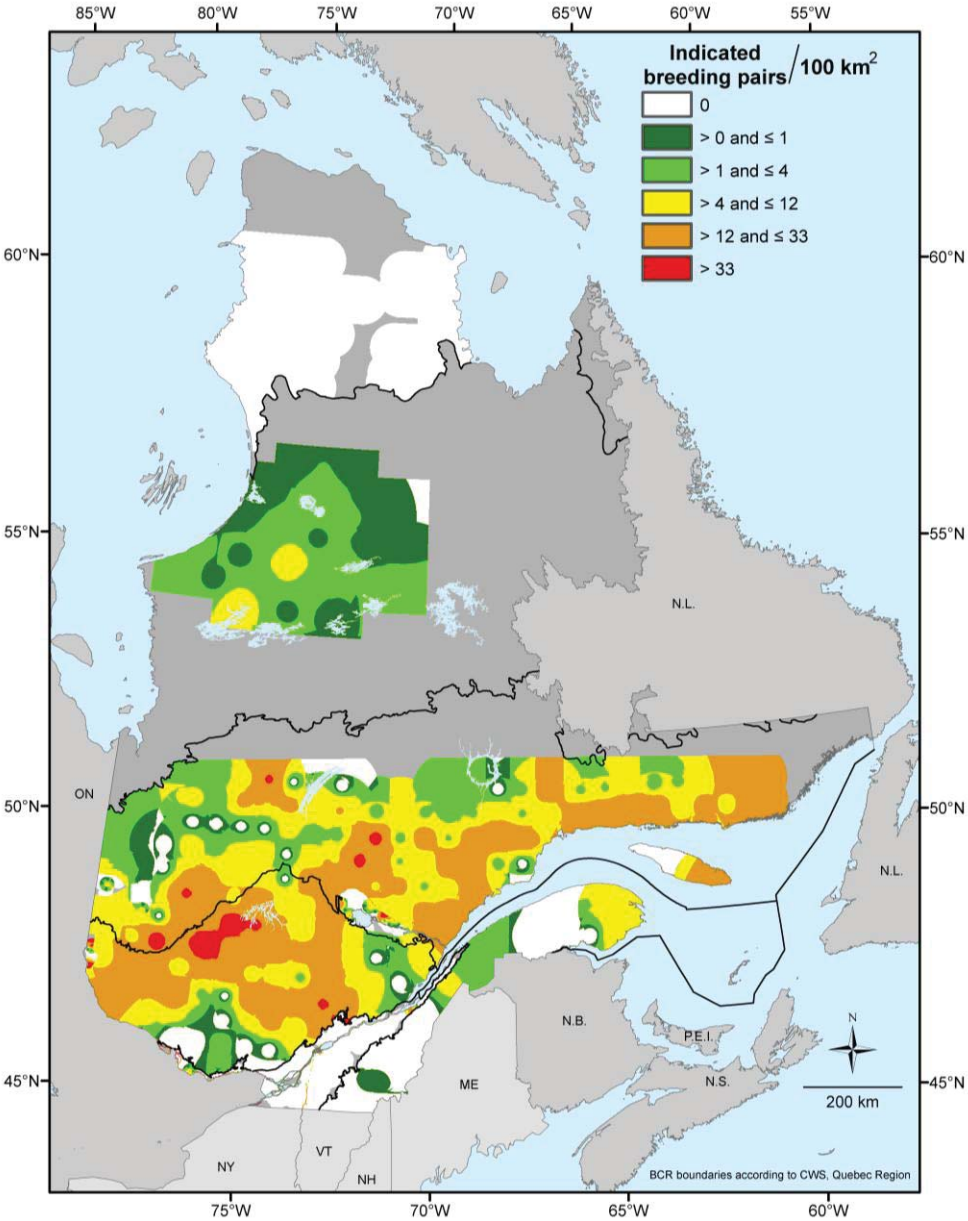
The Common Goldeneye prefers ponds, small lakes and rivers with a forested edge containing trees large enough to provide suitable nesting cavities (Eadie et al. 1995). In a study on the effects of lake acidity and morphometry on the distribution of aquatic birds during the breeding season near Québec City, the Common Goldeneye was frequently observed on the most acidic lakes (DesGranges and Darveau 1985). Furthermore, according to several studies, the species chooses, whenever possible, lakes without fish that consequently are rich in aquatic invertebrates (see Eadie et al. 1995). During the breeding season, the diet of adults and ducklings consists mainly of invertebrates, particularly dragonfly nymphs and caddisfly larvae, which they usually capture by diving in shallow water (< 4 m for adults and < 2 m for ducklings) along the shoreline (Eadie et al. 1995); the goldeneyes compete with certain fish species for this food source (see Eadie et al. 1995).

In Quebec, the species breeds almost everywhere in the province except the Ungava Peninsula (BCR 3). The northern limit of the species' range in BCR 7, at roughly 55° 50' N latitude, was confirmed by sightings of individual broods on Boutin and Coats rivers (Consortium Gauthier & Guillemette – G.R.E.B.E. 1990a). A brood was also seen south of Lake Bienville, at roughly 54° 37' N, 72° 36' W (BCR 7) (CWS, unpubl. data). Surprisingly, the species nests in the taiga (BCR 7), where the population is estimated to be close to 9,000 IBP (CWS, unpubl. data), but where trees of sufficient diameter are probably fairly scarce (Bordage 1996). The Common Goldeneye does not breed along the northeast coast of James Bay, no doubt due to the lack of suitable nesting cavities (Benoit et al. 1992).

The Common Goldeneye ranks third in abundance among waterfowl species breeding in Quebec's mixed and boreal forests (south of 51° 15' N, WUPL survey area), behind only the American Black Duck and Ring-necked Duck (CWS, unpubl. data). Over 85% of the Common Goldeneye breeding population in Quebec nests in the Boreal Softwood Shield (BCR 8; 51,000 IBP) and the Boreal Hardwood Transition (BCR 12; 25,000 IBP) regions (Lepage et al., in prep.). Roughly 2,500 IBP breed in the Atlantic Northern Forest (BCR 14) (WUPL), while fewer than 500 pairs breed in the St. Lawrence Plain (BCR 13) (WLOW and WSHO). Breeding pair density in the St. Lawrence lowlands is very low—0.1 IBP/100 km² (WLOW)—which is not surprising given the lack of forest cover in the region's agriculture-dominated landscape. However, the Abitibi and Saguenay–Lac-Saint-Jean lowlands had densities a bit higher, 2.4 and 3.4 IBP/100 km² respectively, probably due to the more extensive forest cover in these regions. In 2000–2007, the average breeding density observed in forested habitats in southern Quebec uplands was 11.5 IBP/100 km², although some of the plots had average densities above 30 IBP/100 km² (WUPL). The Common Goldeneye is probably a common breeder in the Robertson Reservoir area on the Lower North Shore (BCR 8), where the estimated brood density is 2.3 broods/25 km², the highest among the waterfowl species present in the sector (Morneau 1998). Lastly, a sighting of a brood on Fatima Barachois in 1995 (ÉPOQ) seems to be the first confirmed nesting record for the species on the Magdalen Islands (Fradette 1992; Bordage 1996).

Figure 82 shows the distribution of indicated breeding pairs of the Common Goldeneye in Quebec according to various surveys and inventories carried out primarily by CWS (see Chapter 3).

Figure 82. Breeding distribution of the Common Goldeneye in Quebec (by indicated breeding pair density); please read the explanatory note at the last paragraph of Section 2.4



Spring migration

Although the earliest migrants arrive in mid-March in Quebec, the Common Goldeneye spring flight peaks during the second and third week of April (ÉPOQ; David 1996). At this time, rafts of 1,000–2,000 birds can be observed, particularly in the Sainte-Catherine area in the Montérégie region and around Île Perrot and Île-des-Sœurs

(Nuns' Island) in the Montréal region (BCR 13); in addition, up to 1,000 individuals can be found off Rimouski in BCR 14 and as many as 900 individuals off Les Bergeronnes (Côte-Nord) in BCR 8 (ÉPOQ).

Moulting

Along the northeast coast of James Bay, the disappearance of the species from saltwater habitats in August and the record of 150 moulting individuals on a coastal lake during the same period suggests that the species congregates on the seacoast before going inland to moult (Benoit et al. 1992). The sighting of a few individuals as far north as Puvirnituk (60° 02' N, 77° 17' W; BCR 3) on June 5 and 6, 2006 (ÉPOQ) suggests that some Common Goldeneyes may moult in northern Quebec, in areas also frequented by moulting Barrow's Goldeneye at this time of year (see *Migration and moulting* and *Wintering* in section 4.5.10*).*

Fall migration

According to constancy data gleaned from ÉPOQ checklists, there are two peaks in the species' fall flight: one in late August and early September and another, more pronounced, in the first two weeks of November (ÉPOQ; David 1996). The first peak may correspond to the arrival in the St. Lawrence of females and their young from their inland nesting and brood-rearing sites (J.-P.L. Savard, S & T, pers. comm.). In BCR 13, a number of sites support thousands of staging goldeneyes in fall, notably the centre of Lake Saint-Pierre in early December, where large flocks of Common Goldeneyes have been regularly sighted (F. St-Pierre, pers. comm.) and Oka (Laurentians) and Sainte-Pétronille (Île d'Orleans), where as many as 3,000 individuals are estimated to stop over (ÉPOQ). In BCR 8, observers have regularly reported over 2,000 individuals around Tadoussac and Les Bergeronnes (Côte-Nord) (ÉPOQ).

Wintering

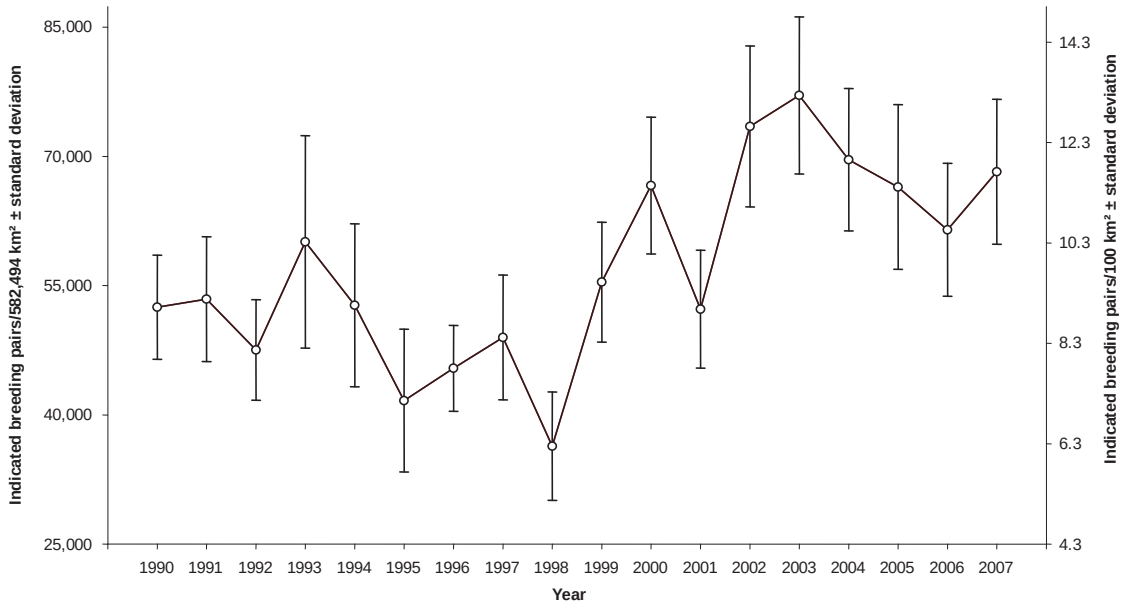
The Common Goldeneye's main wintering grounds in the upper and lower estuary are around the mouth of the Saguenay (BCR 8), from the Alouettes flats to Bon-Désir (Robert et al. 2003; Robert and Savard 2006). The section of the estuary from Baie-Comeau to Godbout (BCR 8) also contains good numbers of wintering goldeneyes (Robert et al. 2003). Mid-winter surveys carried out by CWS between 1999 and 2005 reported 2,500 individuals on average in the upper and lower estuary (Robert and Savard 2006). In the Gulf, surveys in 2002 and 2005 revealed the following maximum numbers of the species, respectively: 500 and 600 birds from Pointe-des-Monts to the Mingan Islands on the north shore; 1,300 and 250 individuals around Anticosti Island; and 400 and 300 individuals from Rivière-au-Renard to Barachois on the eastern part of the Gaspé Peninsula (BAGOS; CWS, unpubl. data). In the greater Montréal region (BCR 13), roughly 1,600 goldeneyes have been overwintering every year since 2003, with peaks of 2,500 individuals (in 2002 and 2004) observed (Bannon 2008). More specifically, Île des Sœurs (Nuns' Island) (Montréal) and the Sainte-Catherine area (Montérégie) often host a thousand or so individuals in winter (ÉPOQ).

Conservation

No long-term (1970–2003) discernable trends have been found in the North American population of the Common Goldeneye, estimated at 1,345,000 individuals (Table 2) (North American Waterfowl Management Plan 2004). However, according to the Breeding Waterfowl Plot Survey of Eastern Canada (helicopter plots), there has been a significant increase in the number of breeding pairs from 1991 to 2003, corresponding

to an estimated average annual increase of 3.0% (CWS, unpubl. data). In Quebec, surveys in the WUPL survey area show significant fluctuations, with an average of 46,140 IBP in 1990–1999 compared with 66,900 IBP in 2000–2007 (Figure 83). At the BCR level, an analysis of the data reveals no significant long-term trends (1990–2007) in numbers in BCR 8, but a significant increase ($P < 0.05$) of 4.6% annually in BCR 12 (Lepage et al., in prep.). The total Quebec population of Common Goldeneye is estimated at 222,000 individuals (Table 2).

Figure 83. Trends in the Common Goldeneye breeding population in southern Quebec uplands, 1990–2007 (WUPL data); total number of indicated breeding pairs (left axis) and density per 100 km² (right axis)

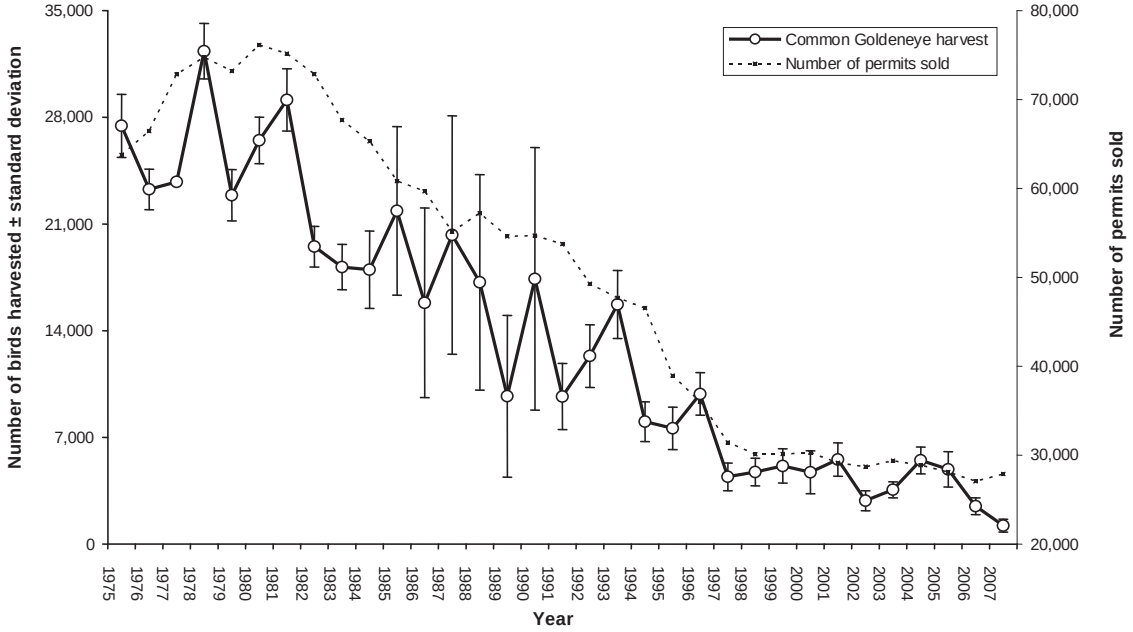


Although Common Goldeneyes may breed for the first time at the age of two, many do not reproduce until they are three years or older (Eadie et al. 1995). According to a study carried out northwest of Québec City (Portneuf Wildlife Reserve and Batiscan-Neilson ZEC), nesting trees used by the species (all hardwoods) had a median diameter at breast height of 49 cm (36–69 cm) and a median distance from the closest water body of 300 m (82–1,750 m) (Maisonneuve et al. 2002; Maisonneuve 2004). The study's key recommendations were: (1) a minimum number of snags or large trees should be maintained, with the number to vary depending on the bioclimatic domain; (2) tree species that deteriorate quickly such as white birch should not be maintained; (3) certain forestry or silvicultural practices such as the girdling of dying yellow birch to hasten their fall harms the conservation of trees likely to contain or form cavities; and (4) cavities created by Pileated Woodpeckers are particularly important for cavity-nesting ducks, and this species' requirements should be integrated into forest management practices (Maisonneuve 2004).

Trends in the Quebec Common Goldeneye harvest over the years closely parallel trends in the number of hunters (Figure 84). During the most recent period (2003–2007), the annual harvest was 3,500 individuals on average, with the species accounting for 1% of the total Quebec waterfowl hunt (Table 3). In the United States, 12,400 Common Goldeneyes were harvested annually on average in the Atlantic

Flyway in 2000–2007 (Padding and Klimstra 2008). The Common Goldeneye is not a commonly harvested duck.

Figure 84. Estimated Common Goldeneye sport harvest in Quebec and number of Migratory Game Bird Hunting Permits sold, 1975–2007 (data taken from Gendron and Collins 2007)



Quebec's responsibility for the Common Goldeneye is fairly great from the quantitative point of view, with the province hosting roughly 17% of the population of the *americana* subspecies and 6% of the world population of the species overall (Table 2). In addition, the Common Goldeneye is an important indicator species for the integrity of the Eastern boreal forest on several levels: logging industry (logging and loss of natural cavities), lake acidification (acid rain), fish abundance (stocking and pollution), abundance of aquatic invertebrates (stocking, pollution and climate change) and abundance of small lakes (beaver ponds, reservoir creation, etc.). Consequently, for all these reasons, the conservation of the species in Quebec is clearly important.

4.5.10 Barrow's Goldeneye *Bucephala islandica* (Mr, Br, Wr) (by Michel Robert)

There are three populations of Barrow's Goldeneye: the Eastern North American population, Western North American population and Icelandic population. The estimated world population of the species is roughly 258,000 individuals (Table 2), over 90% of which breed and winter in western North America, particularly Canada and Alaska, west of the Rocky Mountains (Eadie et al. 2000). The Eastern North American population of Barrow's Goldeneye (referred to here simply as the Eastern population) has been on the list of species at risk in Canada since 2000, currently designated of special concern (Committee on the Status of Endangered Wildlife in Canada 2009). The Eastern population consists of over 6,000 individuals (the equivalent of roughly 2,000 breeding pairs), found mainly in Quebec during the breeding season and in winter (Robert et al. 2000b; Robert et al. 2002; Robert and Savard 2006). The

sedentary Icelandic population is concentrated in the Lake Myvatn and Laxa River areas of northeastern Iceland and consists of roughly 2,000 individuals (Einarsson 2005).

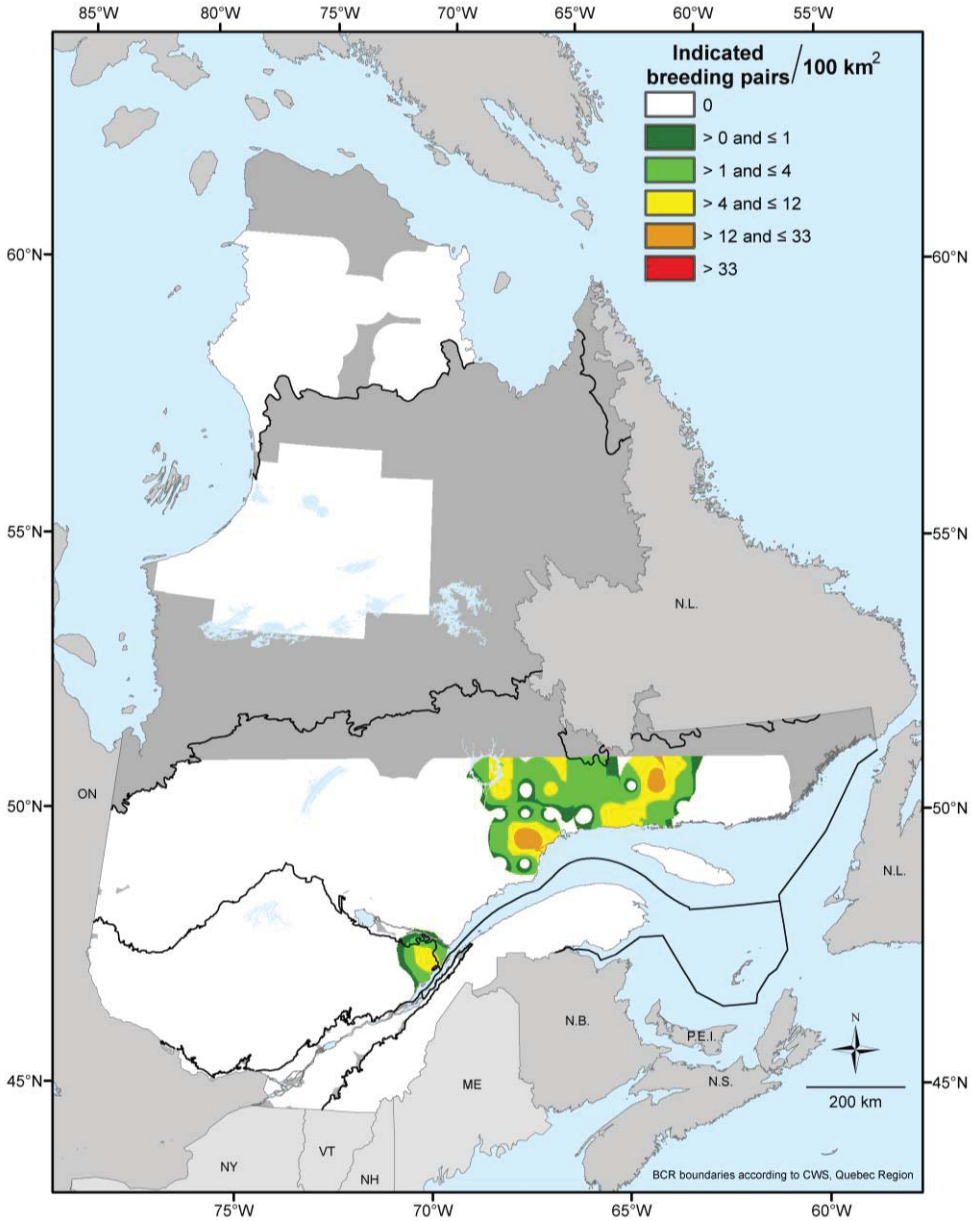
Breeding

Eastern population Barrow's Goldeneyes do not breed in the far north as previously thought (Godfrey 1986; American Ornithologists' Union 1998), but instead nest near boreal forest lakes north of the estuary and Gulf of St. Lawrence, in the balsam fir–white birch and black spruce–moss forest regions (Robert et al. 2000b; Robert et al. 2002). Research to date shows that this species prefers small (< 15 ha), high-elevation (> 500 m) lakes in rugged mountainous terrain. There is a positive correlation between the presence of Barrow's Goldeneyes and lakes without fish. The birds prefer this type of lake because of the thriving invertebrate community they support, made possible by the absence of fish, which also feed on invertebrates (Robert et al. 2000b; Robert et al. 2008a).

Quebec makes up a very large portion of the breeding range of the Eastern population, which breeds at higher elevations in the Côte-Nord (BCR 8), Saguenay (BCR 8) and Charlevoix (BCR 12) regions. From west to east, breeding evidence for the species has been obtained in the Laurentide Wildlife Reserve (where the species is rare) to north of Blanc-Sablon; however, most of the lakes where breeding pairs have been observed to date are located in difficult-to-access backcountry north of Baie-Comeau and Sept-Îles (SOS-POP 2008). The information available indicates that in Quebec, the Barrow's Goldeneye does not breed south of the St. Lawrence or in western Quebec (e.g., Mauricie, Abitibi-Témiscamingue and James Bay regions). Outside the province, it probably breeds in southern Labrador and northern Newfoundland (Robert and Savard 2008), although evidence of this has yet to be obtained.

Figure 85 shows the distribution of indicated breeding pairs of the Barrow's Goldeneye in Quebec, based on various surveys and inventories carried out primarily by CWS (see Chapter 3).

Figure 85. Breeding distribution of the Barrow's Goldeneye in Quebec (by indicated breeding pair density); please read the explanatory note at the last paragraph of Section 2.4



Migration and moulting

During migration, Barrow's Goldeneyes frequent mainly the estuary and Gulf of St. Lawrence (BCR 8, 12 and 14). On the North Shore, between Saint-Irénée (BCR 12) and Pointe-des-Monts (BCR 8), the birds are present fairly continuously from December to April (Robert et al. 2003). Areas most commonly used on the North Shore during migration include Cap-à-l'Aigle, Baie-des-Rochers, Baie-Comeau and Franquelin (Robert et al. 2003). Outside the estuary and Gulf, the species also occasionally frequents the fluvial section of the St. Lawrence and some of its tributaries.

Eastern population males moult quite far north, particularly along the coast of Hudson Bay (BCR 7 and 3) and Ungava Bay (BCR 7 and 3), where they go after the females begin incubation in June. They remain in these areas in summer and early autumn, before heading back to the St. Lawrence to spend the winter (Benoit et al. 2001; Robert et al. 2002). A 2009 study showed that, out of five females fitted with a satellite transmitter at their nesting area in the Chauvin ZEC, two went to Nunavik to moult (one near Kuujjuaq and the other on a lake about 200 km north of the Caniapiscau Reservoir), one went to a coastal lake on James Bay (near Point Kakassituq) and two moulted in the lower estuary (one at Ragueneau, offshore from the mouth of the Rivière aux Outardes, and the other at an unknown location) (Savard 2009b).

In fall, the males return to the St. Lawrence in October or November, and remain there until spring, when they migrate back to the breeding grounds (Robert et al. 2002). Rafts of Barrow's Goldeneyes are common along the south shore of the lower estuary (BCR 14) in both fall (e.g., Anse à Mercier and Baie du Ha! Ha!) and spring (Mitis Bay and Rocher-Blanc), but disappear from the area when winter comes and the coast freezes up. The Barrow's Goldeneyes are absent from the south shore of the estuary during the coldest part of the winter, but are abundant there in spring and fall. Conversely, the north shore of the estuary has very large numbers of goldeneye in January and February (Robert and Savard 2006).

Wintering

The wintering grounds for almost the entire (> 90%) Eastern population of Barrow's Goldeneyes are in the St. Lawrence. Mid-winter surveys (BAGOS) show that the birds are concentrated along the wide tidal flats on the north shore of the estuary (BCR 12 and 8) as well as in certain locations in the Gulf (BCR 8), such as Chaleur Bay (BCR 14) and the south side of Anticosti Island (BCR 8). Over 1,000 Barrow's Goldeneyes were counted off Baie-Comeau and Baie-Sainte-Catherine, and several hundred concentrate at times off Baie-des-Rochers and around La Malbaie (Robert et al. 2003; Robert and Savard 2006; BAGOS). The rest of the Eastern population (< 1,000 individuals) winters in the Atlantic provinces and Maine (Daury and Bateman 1996), most around Dalhousie, on the New Brunswick side of Chaleur Bay very close to the Quebec border, where up to 750 individuals have been counted (Robert and Savard 2006; BAGOS).

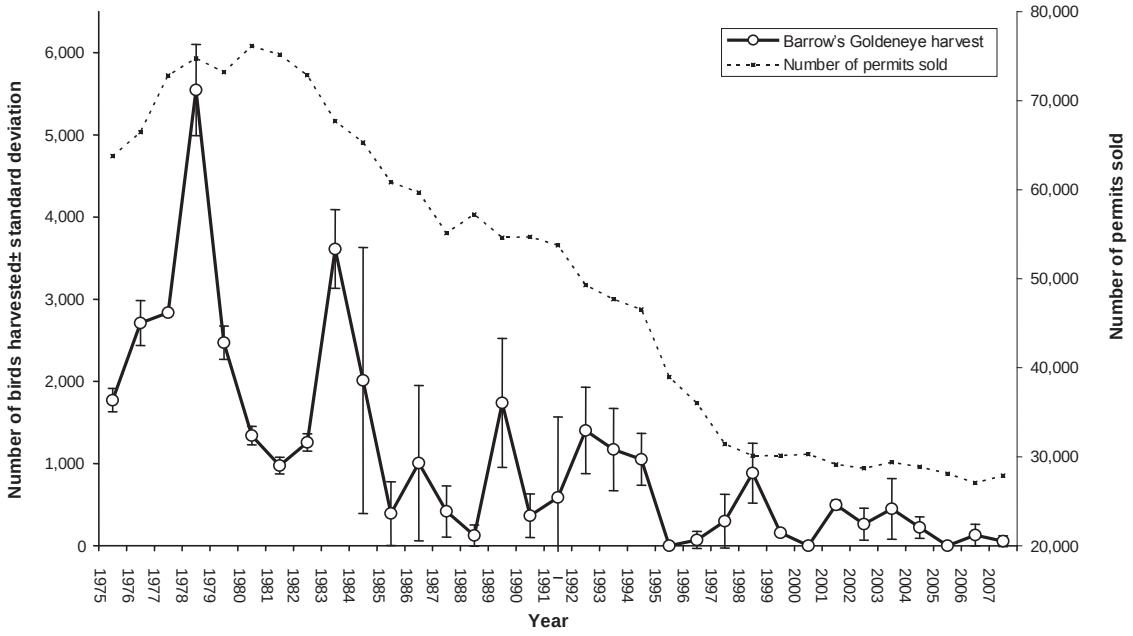
Conservation

The Eastern population of the Barrow's Goldeneye is estimated at roughly 6,800 individuals (Table 2; 2009 BAGOS survey), or the equivalent of around 2,100 breeding pairs (Environment Canada 2010). This population could be affected by a number of limiting factors, on both their wintering and breeding grounds (Robert et al. 2000a; Environment Canada 2009; Environment Canada 2010). On the wintering grounds, accidental hydrocarbon spills pose the greatest threat, since a single oil spill in the St. Lawrence estuary could result in the death of a good portion of the Eastern population. On the breeding grounds, the activities of the logging industry are a concern since the Barrow's Goldeneye is a cavity-nesting duck that lays its eggs in natural cavities in very large dead or living trees (diameter at breast height ≥ 35 cm) (Evans et al. 2002; CWS, unpubl. data). The main negative effects of logging activities are probably the reduction in the availability of potential snags and trees for nesting, increased predation on hens and their ducklings caused by forcing them to nest at a greater distance from brood-rearing lakes, and the opening up of access to anglers and hunters of innumerable lakes, previously inaccessible by land, which may increase

disturbance of the species and allow previously fishless lakes to be stocked with fish (Robert et al. 2000a). According to recent research carried out in the province on the species' breeding grounds (Vaillancourt et al. 2008; Vaillancourt et al. 2009), current logging practices result in a reduction in the number of large trees with cavities, which is unquestionably harmful to the species.

Poaching is also a threat to the Eastern population, since the birds are concentrated along the estuary and Gulf of St. Lawrence from October on (Robert et al. 2003; Robert and Savard 2006). It is for this reason that special hunting regulations, specifically targeting this species at risk, were implemented beginning in 1995 (see estimated Quebec harvests in Figure 86). Since 2008, hunters have not been allowed to take more than one Barrow's Goldeneye per day, and the possession limit for the species is also one. In addition, since 2002, the season for both Barrow's Goldeneye and Common Goldeneye has closed on October 21 in the aquatic portion of federal District E and along a portion of the north shore of the St. Lawrence in District F, between Jureux Point (Saint-Irénée) and Gros Cap à l'Aigle (Saint-Fidèle). Special regulations are also in effect in the rest of Eastern Canada.

Figure 86. Estimated Barrow's Goldeneye sport harvest in Quebec and number of Migratory Game Bird Hunting Permits sold, 1975–2007 (data taken from Gendron and Collins 2007)



Quebec appears to play a crucial role in the conservation of the Eastern North America population of the Barrow's Goldeneye, seeing that the species is at risk and it is concentrated mainly in the province, both during the breeding season (when over 90% of numbers are found here; Table 2) as well as in migration and in winter.

4.5.11 Hooded Merganser *Lophodytes cucullatus* (Mr, Br, Wr) (by Christine Lepage)

The Hooded Merganser, a North American native, has a patchy distribution in the western and eastern parts of the continent (Dugger et al. 1994; Titman 2005b). Consequently, it is thought that the species is better managed as two distinct populations (Sea Duck Joint Venture 2005). In the Eastern population, the greatest breeding densities occur in the Northeast, particularly Ontario, Quebec and the U.S. Great Lakes States (Titman 2005b). These birds winter mainly in freshwater environments along the Atlantic and Mississippi flyways (Dugger et al. 1994). The separation of the continental population into two distinct populations is not followed in NAWMP (North American Waterfowl Management Plan 2004) or *Waterbird Population Estimates* (Wetlands International 2006).

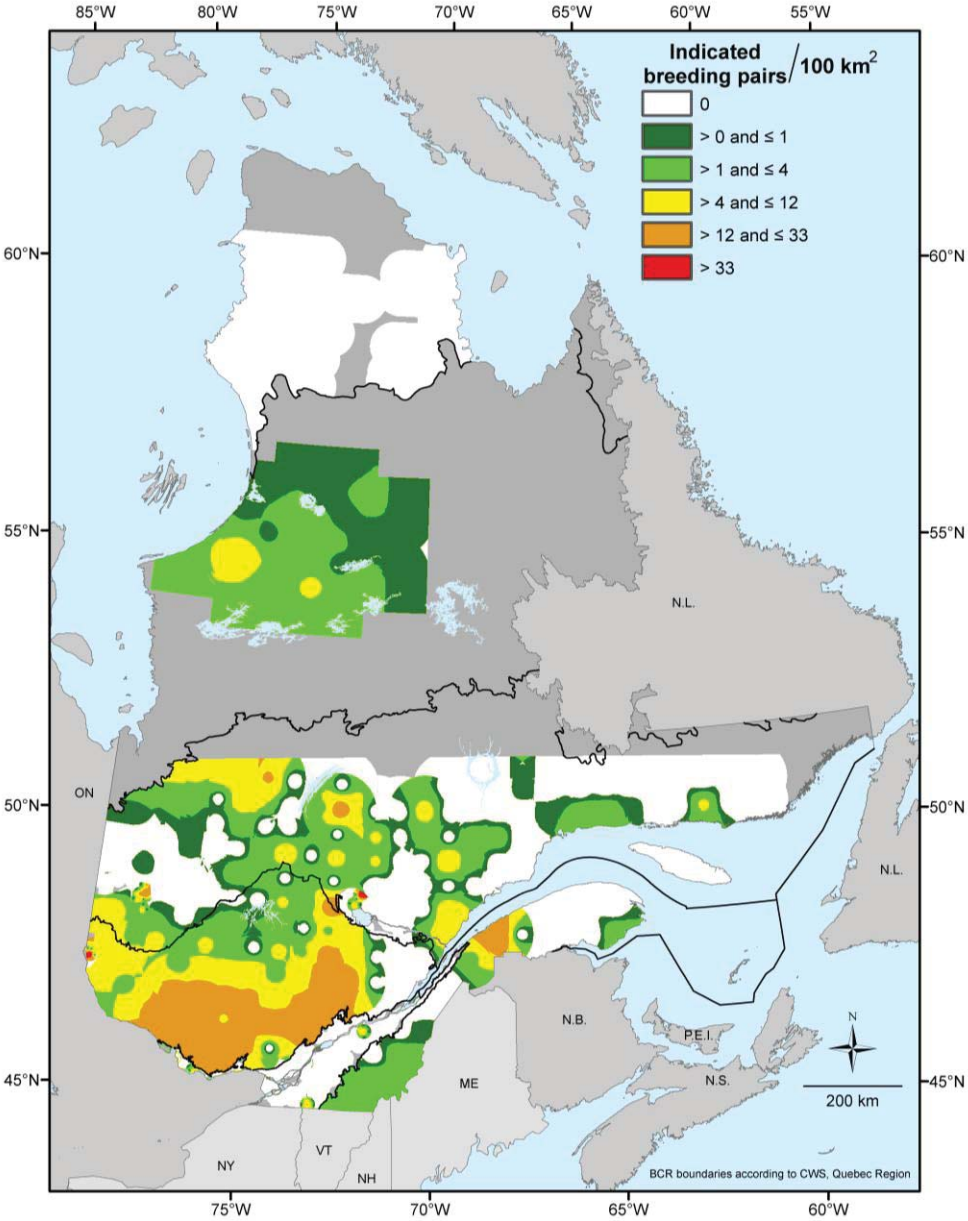
Breeding

In Quebec, the Hooded Merganser is a secretive nester, using a cavity in a tree on the edge of a beaver pond, swamp, small lake or other isolated wooded wetland. Although it is fairly widely distributed in the southern part of the province, the greatest concentrations are found in forested habitats in southwestern Quebec (Outaouais, Laurentides, Lanaudière and Mauricie regions; BCR 12), with breeding densities in the range of 8.0–28.0 IBP/100 km^2. Although densities decrease gradually further east and north according to WUPL data, the Hooded Merganser is still a regular breeder in isolated bodies of water in forest environments in the Abitibi-Témiscamingue (BCR 12), Saguenay–Lac-Saint-Jean (BCR 8) and Bas-Saint-Laurent regions (BCR 8) (CWS, unpubl. data). While it is considered rare east of the Saguenay River by Bouvier and Barrette (1996) and Gosselin (1995f), surveys in the WUPL study area show that it is now a little more common on the Upper and Middle North Shore (BCR 8) as far as Havre-Saint-Pierre (see Figure 87; CWS, unpubl. data). When the species occurs in non-forested habitats, densities are low; examples include the shoreline of the fluvial section of the St. Lawrence (BCR 13; 2.5 IBP/100 km^2) (WSHO) and the Abitibi-Témiscamingue and Saguenay–Lac-Saint-Jean lowlands (4.3 IBP/100 km^2 and 1.9 IBP/100 km^2 respectively) (WLOW).

Farther north, although the diameter of trees decreases progressively, breeding densities in the range of 5.0–7.5 IBP/100 km^2 have been reported south of the Rupert River and around Lake Mistassini (BCR 8) (WUPL); breeding has been confirmed in the James Bay region by the observation of broods on the Eastmain River (BCR 7) (Tecsult Inc. 2006). The species also frequents fen-pool systems along the northeast coast of James Bay (Benoit et al. 1995). In the Caniapiscau Reservoir area (BCR 7), the observation of two Hooded Merganser broods in June 1999 allowed breeding to be confirmed in the centre of the province (Morneau 1999b). In the Laforge 1 Reservoir area, west of Caniapiscau Reservoir, estimated densities are around 2.0 breeding pairs/25 km^2 (Morneau 1998), although they were estimated at 10.0–17.5 pairs/100 km^2 based on previous data (Dryade 1992). Broods have also been observed around the Grande rivière de la Baleine (Great Whale River) and Petite rivière de la Baleine (Little Whale River) (Consortium Gauthier & Guillemette – G.R.E.B.E. 1990a), although it is not known if these sightings (54° N latitude; BCR 7) represent the northern limit of this cavity nester's breeding range in the province. Lastly, the first confirmed breeding records in the Gaspé region were obtained in 1999 (BCR 14) (David et al. 1999), and on the Magdalen Islands the Hooded Merganser is considered an irregular breeder (Fradette 1992).

Figure 87 shows the distribution of indicated breeding pairs of Hooded Mergansers in Quebec, based solely on observations obtained in the various surveys and inventories carried out primarily by CWS (see Chapter 3).

Figure 87. Breeding distribution of the Hooded Merganser in Quebec (by indicated breeding pair density); please read the explanatory note at the last paragraph of Section 2.4



Migration, moulting and wintering

Information on spring and fall migration and moulting in this species tends to be fragmented and anecdotal. The Hooded Merganser frequents more or less the same regions during both spring and fall migration as it does during the breeding season

(Gosselin 1995f), but spends more time on large bodies of water. Consequently, it is reported in the largest numbers in the Outaouais region (Aylmer, Masson, Plaisance; BCR 13), the Lake Saint-Pierre area (Berthierville, Saint-Barthélemy, Baie-du-Febvre; BCR 13) and in the stretch of the St. Lawrence between Portneuf and Rimouski (BCR 13) (ÉPOQ). There are no known major stopover areas in Quebec for the species. During migration as well as the moulting period, the species is the least gregarious of the three species of mergansers in Quebec (Gosselin 1995f; Heusmann et al. 2000).

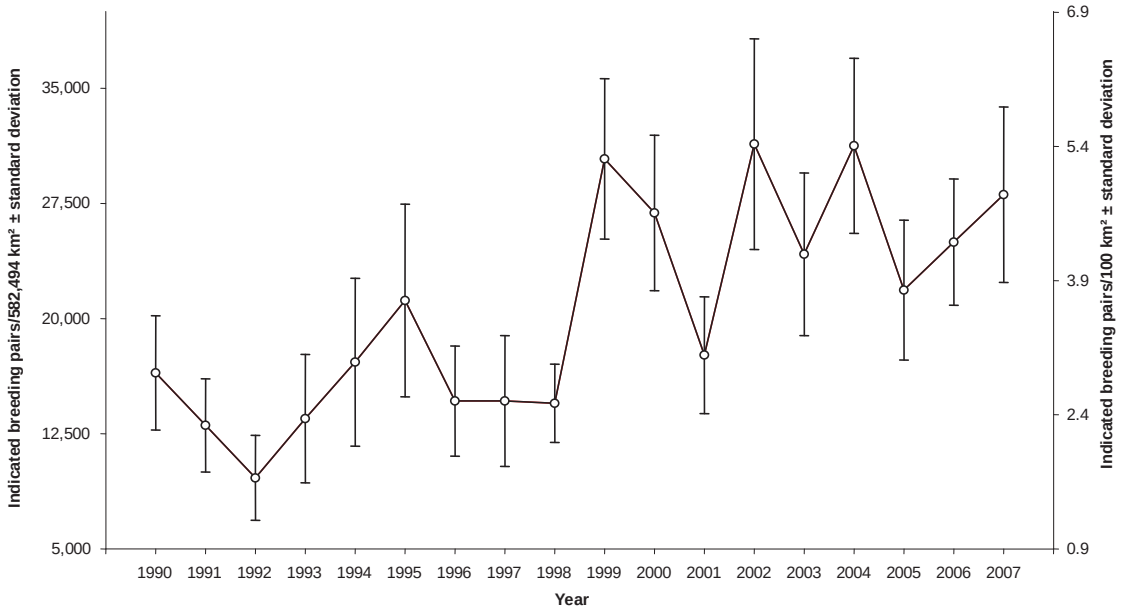
During the moulting period, “hoodies” disperse in small groups to moult on isolated lakes in scattered locations. In southern Quebec, there are no known sites with large moulting concentrations. Instead, individuals undertake a moult migration towards the north, moulting in terrestrial coastal habitats along the northeast coast of James Bay (BCR 7) (Benoit et al. 1992; Bouvier and Barrette 1996) and Hudson Bay (BCR 7) (Consortium Gauthier & Guillemette – G.R.E.B.E. 1990a). A survey in August 1989 in the Grande rivière de la Baleine (Great Whale River) and Petite rivière de la Baleine (Little Whale River) sectors (Hudson Bay; BCR 7) found roughly 14,300 individuals in small groups on both the inland plateau and the coastal strip (Consortium Gauthier & Guillemette – G.R.E.B.E. 1990a). In the same area, groups of 5–10 moulting individuals were observed on small lakes almost everywhere (Savard 1977). Males are thought to moult in groups north of the breeding grounds, while females moult individually on the breeding grounds in scattered locations (Sea Duck Joint Venture 2003b). There are also reports of moulting individuals on Sainte-Marguerite 3 Reservoir, northwest of Sept-Îles (BCR 8) (Morneau 2003).

A few Hooded Mergansers overwinter locally in the Montréal region (BCR 13) (Bannon 2008) and near the U.S. border (west and south; BCR 13 and 14) (Gosselin 1995f).

Conservation

With an estimated world (North American) population of only 350,000 individuals (Table 2), the Hooded Merganser is one of the least abundant waterfowl species on the continent. The continental population is probably increasing (North American Waterfowl Management Plan 2004), although this conclusion is based on winter surveys that do not differentiate between the three species of mergansers. Biologists in the northeastern states have also observed an increase in the population (Heusmann et al. 2000). Data from the Breeding Waterfowl Plot Survey of Eastern Canada (helicopter plots) indicates a significant annual increase of 4.3%, with the population increasing from 49,600 breeding pairs in 1990 to 75,700 in 2003 (Figure 88) (CWS, unpubl. data). This significant increase has been observed both in Ontario (roughly 3.0% per year) and Quebec (5.4% per year) (CWS, unpubl. data). On a regional scale, during the 1990–2007 period, significant annual increases were found in BCR 12 (7.2%) and BCR 14 (12.6%), but not in BCR 8 (Lepage et al., in prep.).

Figure 88. Trends in the Hooded Merganser breeding population in southern Quebec uplands, 1990–2007 (WUPL data); total number of indicated breeding pairs (left axis) and density per 100 km² (right axis)



The Hooded Merganser's distribution and ecological niche resemble those of the Wood Duck, and in fact the conservation concerns pertaining to the two species are fairly similar. They are both cavity nesting ducks with their core breeding range in southwestern Quebec. Since ensuring the availability of trees large enough to provide suitable nesting cavities for the species is a particularly crucial issue, logging and forest management practices can have a negative impact on the species if they do not take account of its ecological requirements.

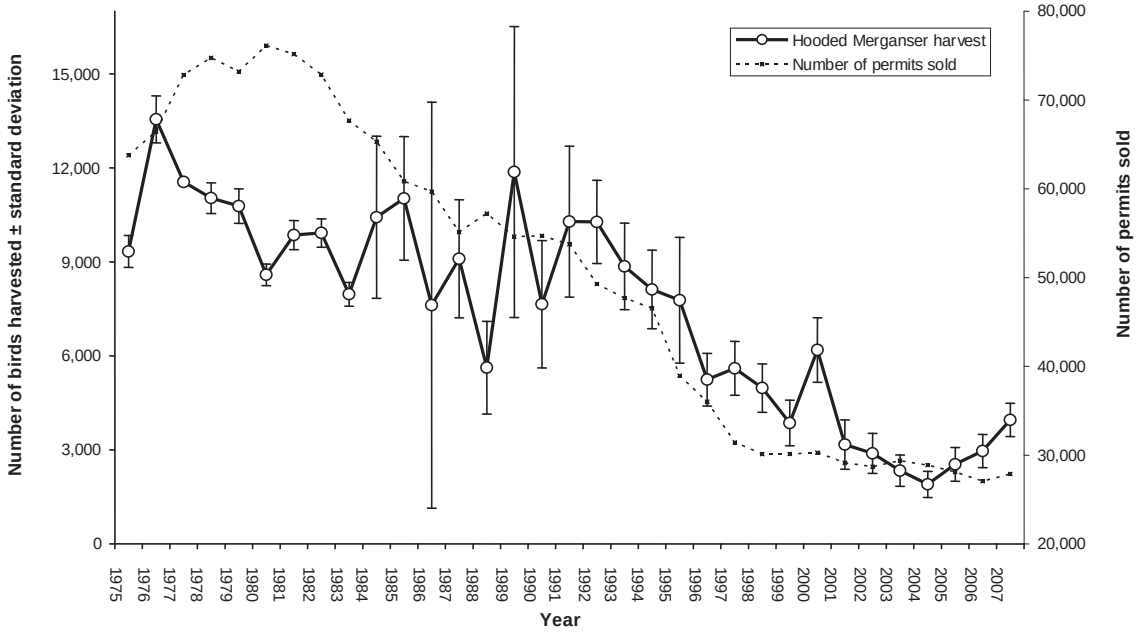
The Hooded Merganser readily uses artificial nest boxes, even though they are usually installed for Wood Ducks. In the province's network of artificial nest boxes, Hooded Mergansers were found to occupy 11% of nest boxes and account for 30% of occupied nest boxes in 2005, with a gross productivity of 514 ducklings (Société d'aménagement de la baie Lavallière 2006). The species is reported to have a strong tendency to lay its eggs in the nests of its congeners or other cavity nesting species (Mallory et al. 1993; Dugger et al. 1994; Mallory et al. 2002).

Wetland degradation and loss are always a concern in the case of this species, but the commitment to protecting wetlands shown in recent years (e.g., regional wetland conservation plans by Ducks Unlimited Canada [Ducks Unlimited Canada 2007] and 2007–2012 Action Plan by the Quebec Liberal Party stating that it intends to halt the filling in of wetlands [Parti libéral du Québec 2007]) suggests that the alteration of these habitats may be slowing down somewhat. The current increase in beaver populations in northeastern North America (Heusmann et al. 2000; Mallory et al. 2002; Lafond and Pilon 2004) is also resulting in an increased number of wetlands, used extensively by Hooded Mergansers (Heusmann et al. 2000; CWS, unpubl. data). In a different vein, water turbidity is probably also a limiting factor on the species since the Hooded Merganser forages in clear water (Dugger et al. 1994). Lastly, on the species' wintering

grounds in the United States, river channelization, deforestation and agricultural practices reduce available habitat for the species (Dugger et al. 1994).

Although the Hooded Merganser was hunted in large numbers in the past (Dugger et al. 1994; Bouvier and Barrette 1996; Titman 2005b), current harvests are moderate. The average annual harvest in the U.S. Atlantic Flyway in 2000–2007 was 32,200 birds, representing 2% of the total duck harvest there (Padding and Klimstra 2008), but nearly 10% of the total North American population of the species. As can be seen in Figure 89, the number of active waterfowl hunters has been declining in Quebec since the 1980s and Hooded Merganser harvests have similarly decreased. The mean annual harvest in the province was 2,700 birds during the 2003–2007 period, representing less than 1% of the total waterfowl harvest by hunters (Table 3). Estimates of sea duck harvests are always less reliable than those for other duck species owing to the smaller sample size. While the Common Merganser was the most commonly harvested merganser until 1990 (annual average of 12,300 birds versus 9,800 for the Hooded Merganser; Gendron and Collins 2007), the Hooded Merganser has become the most popular merganser among hunters since the first decade of the 21st century, ranking 11th among all duck and goose species hunted (Table 3).

Figure 89. Estimated Hooded Merganser sport harvest in Quebec and number of Migratory Game Bird Hunting Permits sold, 1975–2007 (data taken from Gendron and Collins 2007)



The conservation of the Hooded Merganser does not appear to raise any particular concerns or require any special measures in Quebec, aside from maintaining the availability of natural nesting cavities. The current increase in the Quebec population of the species suggests that it is doing well in the province. Nearly 30% of the North American population (and therefore, the world population; Table 2) breeds in Quebec, giving the province major responsibility in the conservation of the species, particularly since the world population (350,000 individuals) makes the Hooded Merganser one of the least abundant waterfowl species in North America, ranking just ahead of Barrow's

Goldeneye (258,000 individuals), Tundra Swan (299,000 individuals) and Harlequin Duck (336,000 individuals; Table 2).

4.5.12 Common Merganser *Mergus merganser americanus* (Mr, Br, Wr) (by Christine Lepage)

The Holarctic Common Merganser occurs in Asia and Europe as well as in North America. Three subspecies are recognized based on distribution: *Mergus merganser americanus* (North America), *M. m. merganser* (Palearctic distribution from Iceland to northeast China and northern Japan) and *M. m. comatus* (central Asia, from Afghanistan to western China) (Titman 2005a). In North America, the species breeds below the treeline, in the 10 provinces and southern portions of the 3 territories in Canada, as well as in Alaska, the U.S. Pacific Northwest and New England (Mallory and Metz 1999). It does not breed on the Canadian Prairies or U.S. Great Plains. The Common Merganser is one of North America's most northernmost wintering waterfowl species, wintering mainly along the coast of Alaska as far south as California, throughout the western, central and northeastern states and in southern Ontario and Quebec and the Atlantic provinces (Mallory and Metz 1999).

Breeding

Although the Common Merganser is primarily a fish eater—with its favourite prey measuring from 10 to 30 cm long (Mallory and Metz 1999)—it also feeds on insects, crustaceans, molluscs and amphibians (Alvo 1996b). It nests near medium or large lakes, and along rivers with clear water and fairly high fish productivity, bordered by mature forests with large enough trees to provide suitable nesting cavities (Mallory and Metz 1999). The Common Merganser is a facultative, rather than an obligate, cavity nester (Mallory and Metz 1999; Sea Duck Joint Venture Management Board 2008) and can build its nest in various type of natural cavities, holes excavated by large woodpeckers or nest boxes (Gosselin 1995d; Champoux 1996; Titman 2005a), or even hide it on the ground in rock crevices, root tangles or holes in banks (Mallory and Metz 1999).

The Common Merganser has a very wide distribution in Quebec. In the northern part of its breeding range, in the James Bay territory (Broadback, Rupert, Eastmain, Opinaca and Petite Opinaca rivers; BCR 7), numbers increased greatly between 1991 and 2005 (Tecsult Inc. 2006). Breeding densities are estimated to be around 0.85 IBP/10 km of shoreline along the Broadback River and 1.0 IBP/10 km of shoreline along the Rupert River (Tecsult Inc. 2006); the Common Merganser is one of the most abundant waterfowl species in the region (Tecsult Inc. 2006). Along the northeast coast of James Bay, broods have been reported inland from the Bay of Many Islands (Benoit et al. 1991). Farther north, large number of broods have been observed throughout the vast Great Whale and Little Whale river region (Grande rivière de la Baleine and Petite rivière de la Baleine; Hudson Bay) as far north as the Nastapoka River (BCR 7) (Consortium Gauthier & Guillemette – G.R.E.B.E. 1990a). Above this latitude (57° N), trees and shrubs make way to tundra, which appears to provide less suitable breeding habitat for the species. Furthermore, since 1998, Common Merganser breeding pairs have been observed every year during the WNOR surveys, with an estimated density of 1.94 IBP/100 km^2 (CWS, unpubl. data). A drake was observed on Puvirnituq River on June 23, 2007, inside Parc National des Pingualuit (Pingualuit provincial park) (BCR 3) (Robert 2007); although this male could have been undertaking a postnuptial migration, the sighting constitutes a possible breeding record at a location, which is, to say the

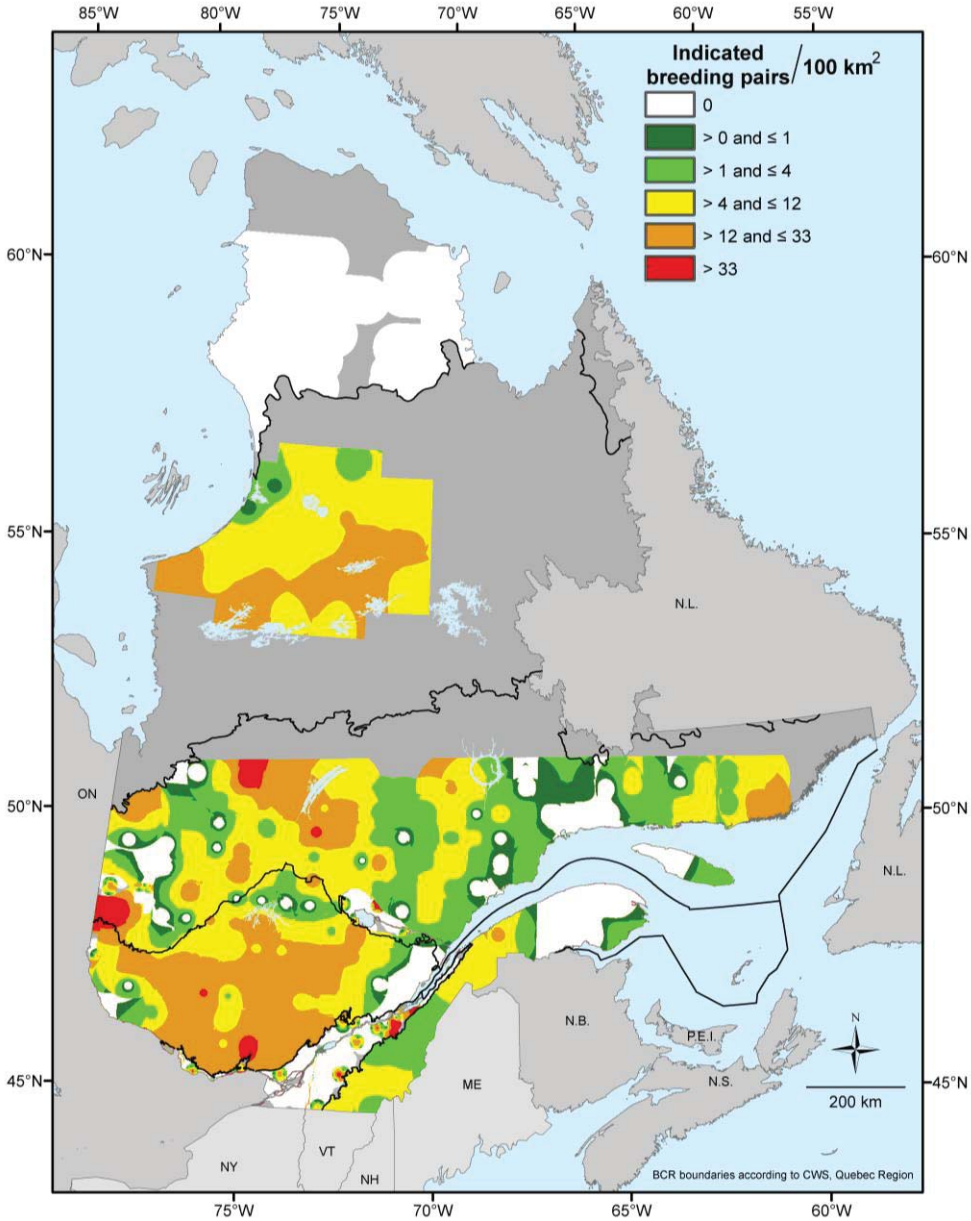
least, very far north for the species. Breeding evidence (nests or broods) has yet to be obtained at these latitudes. In 1999, sightings of three broods on the Vincelotte River (near Laforge 1 Reservoir) confirmed breeding in the centre of the province (BCR 7) (Morneau 1999a), while, a little farther east, the observation of breeding pairs (2.1 breeding pairs/25 km²) in the Caniapiscau Reservoir region resulted in a status of probable breeder only (Morneau 1999b).

In the southern half of its breeding range in Quebec, the Common Merganser is present almost everywhere in forested habitats and along the St. Lawrence shoreline (WUPL and WSHO); it is also found, to a lesser extent, in the Abitibi (BCR 8 and 12), the Saguenay–Lac-Saint-Jean (BCR 8) and the St. Lawrence (BCR 13) lowlands (WLOW). In the uplands of southern Quebec, the average density observed in the WUPL study area as a whole was 9.2 IBP/100 km² for the 2000–2007 period (CWS, unpubl. data). Higher densities were obtained, however, in the Outaouais (BCR 12; 19–31 IBP/100 km²), Laurentides (BCR 12; 16–21 IBP/100 km²), Lanaudière (BCR 12; 15–32 IBP/100 km²) and Mauricie (BCR 12; 22–33 IBP/100 km²) regions, as well as the region extending from Matagami to Lake Mistassini (BCR 8; 17–34 IBP/100 km²) (Lemelin et al. 2004; CWS, unpubl. data). Among the lowlands of southern Quebec, the Saguenay–Lac-Saint-Jean (BCR 8) lowlands had the greatest number of Common Merganser breeding pairs, with average densities of 6.0 IBP/100 km² in 1998–2007; densities in the Abitibi (BCR 8 and 12) and St. Lawrence (BCR 13) lowlands were quite a bit lower at around 2.7–3.5 IBP/100 km² (WLOW). Lastly, along the shoreline of the St. Lawrence and its main tributaries, densities were high, with an average of 37.7 IBP/100 km² for the entire region during the 2004–2007 period (WSHO). However, it is probable that these high densities include a certain number of pairs still migrating. Densities were particularly high along the Ottawa River and in the fluvial section upstream from Montréal (average for fluvial section: 41.9 IBP/100 km²), in the Québec City region and on the north shore of Lac Saint-Jean (average for estuary: 22.9 IBP/100 km²) and, lastly, along the shoreline of the Gulf from Pointe-des-Monts to the Mingan Islands, the north coast of the Gaspé Peninsula, and from Gaspé Bay to Chaleur Bay (average for Gulf: 48.4 IBP/100 km²). In general, along the St. Lawrence, the mouths of tributaries provide especially suitable breeding habitat for the species, particularly in the Gulf, whether on the North Shore, around the coast of Anticosti Island or on the Gaspé Peninsula (CWS, unpubl. data).

In extreme eastern Quebec, two broods were spotted on Robertson Reservoir, north of La Tabatière on the Lower North Shore (BCR 8) (Morneau 1998). Although the Common Merganser was only considered a possible breeder on the Magdalen Islands (BCR 14) (presence of species during the breeding season) before 1992 (Fradette 1992), breeding has been confirmed since then (Alvo 1996b), but is not a regular occurrence (ÉPOQ).

Figure 90 shows the distribution of indicated breeding pairs of Common Mergansers in Quebec, based on various surveys and inventories carried out primarily by CWS (see Chapter 3).

Figure 90. Breeding distribution of the Common Merganser in Quebec (by indicated breeding pair density); please read the explanatory note at the last paragraph of Section 2.4



Migration

Given the vast size of the species' breeding range in the province, the Common Merganser can be observed almost anywhere in Quebec during spring and fall migration (Gosselin 1995d; ÉPOQ). Although large flocks are generally rare along the St. Lawrence—the species tends to migrate in groups of a few pairs in spring—concentrations of these mergansers can be found in the Richelieu (Saint-Paul-de-l'Île-aux-Noix; BCR 14) and Saguenay (Saint-Fulgence; BCR 8) rivers while, in fall, the Ottawa River (Plaisance; BCR 13) and Beauharnois Canal (BCR 13) host good-sized flocks (ÉPOQ). In the eastern James Bay region (BCR 7), the sectors of the Opinaca Reservoir, Boyd and Sakami lakes and Rupert and Némiscau rivers each host from 100

to 400 migrants in spring and fall (Tecsult Environnement Inc. 2004). Since part of the population breeds and winters in Quebec, the Common Merganser can be described as more of a short- or intermediate-distance migrant than a long-distance one (Sea Duck Joint Venture 2003a).

Moulting

Little is known about moulting in the species. Numerous Common Mergansers are found along the northeast coast of James Bay (BCR 7) during the moulting period (Benoit et al. 1994; Reed et al. 1996). The watersheds of the Petite rivière de la Baleine and Grande rivière de la Baleine (Little and Great Whale rivers) likely host good numbers of moulting drakes, particularly on the large lakes; the density of moulting individuals was calculated at 32.4 birds/100 km of transect in the Lenormand Lake (formerly Vaujours Lake) area (Savard 1977). In general, it is thought that birds congregate on large northern lakes to moult (Sea Duck Joint Venture 2003a). There is no information on moulting in the southern half of Quebec.

Wintering

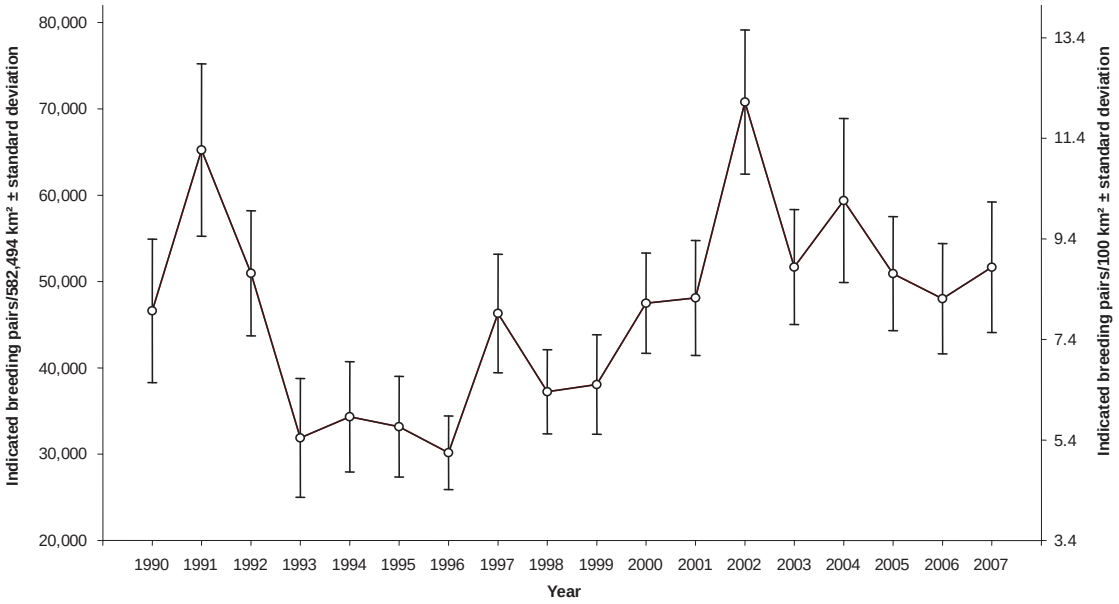
In winter, the Common Merganser usually prefers freshwater to saltwater (with roughly 58% of wintering birds found in inland U.S. states) (Bellrose in Titman 2005a). Wintering Common Mergansers are found in large lakes, reservoirs and rivers as well as in estuaries and bays along the Pacific and Atlantic coasts (Mallory et Metz 1999). In Quebec, the species overwinters in bodies of water that remain free of ice. The Common Merganser occurs regularly in winter in southern Quebec and groups of 20 to 500 birds are not rare, with sometimes up to 3,000 individuals observed, particularly in the Montréal (between Valleyfield and Verdun, and including the Beauharnois Canal and Lachine Rapids; BCR 13), Outaouais (Ottawa River; BCR 13), Montérégie (Richelieu River; BCR 13 and 14), Centre-du-Québec (Saint-François River; BCR 13 and 14) and Québec City (Portneuf and Deschambault-Grondines; BCR 13) regions (Alvo 1996b; Gosselin 1995d; Bannon 2008; ÉPOQ). The species also winters in fewer numbers farther east, in the Saguenay–Lac-Saint-Jean region, upper and lower estuary and the Gaspésie region (Gosselin 1995d; Robert et al. 2003; ÉPOQ). In 1982, an estimated 1,000 birds were wintering in Quebec (Gosselin 1982); however, this number should now be higher since the Montréal region alone has hosted at least 1,600 wintering birds annually since 2003 (Bannon 2008; ÉPOQ).

Conservation

The North American population of Common Mergansers is estimated at 1 million birds, including roughly 302,000 in Quebec (Table 2). According to NAWMP, the population is increasing in North America overall (North American Waterfowl Management Plan 2004), but not in the northeast. From 1990 to 2003, no trends could be discerned in the population in Eastern Canada (Ontario, Quebec and the Atlantic provinces), according to data from BDJV surveys and the Breeding Waterfowl Plot Survey of Eastern Canada (CWS, unpubl. data). In Quebec, after a decline in the early 1990s, numbers gradually increased and then stabilized in 2003–2007 (Figure 91). In the WUPL survey area as a whole, average density increased from 7.2 IBP/100 km² in 1990–1999 to 9.2 IBP/100 km² in 2000–2007 (Figure 91), although the increase was not statistically significant (CWS, unpubl. data). At the BCR level, during the same period (1990–2007), no significant trend was found in Common Merganser numbers in BCR 8, while a significant mean annual increase ($P < 0.5$) of 2.3% was found in BCR 12 (Lepage et al., in prep.). Among the 20 or so species of waterfowl that breed in mixed and conifer

forests in Quebec (south of 51° 15' N latitude, WUPL survey), the Common Merganser ranks fourth in abundance, behind the American Black Duck, Ring-necked Duck and Common Goldeneye (CWS, unpubl. data).

Figure 91. Trends in the Common Merganser breeding population in southern Quebec uplands, 1990–2007 (WUPL data); total number of indicated breeding pairs (left axis) and density per 100 km² (right axis)



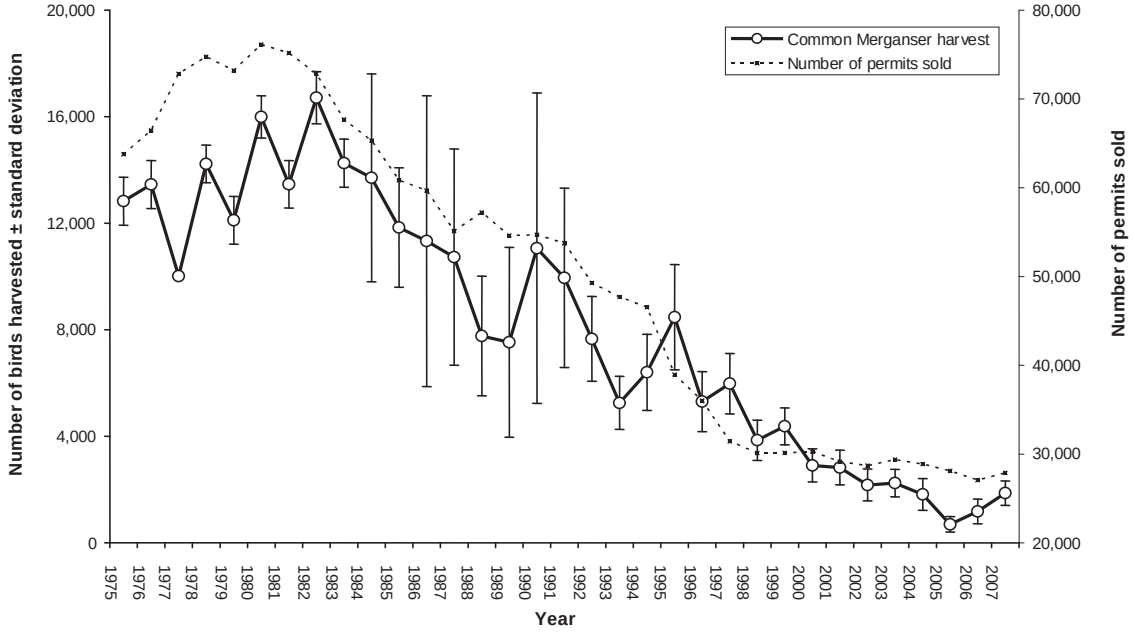
Conservation issues involving the Common Merganser include poaching and eradication efforts targeting the species (Sea Duck Joint Venture 2003a; Erskine 1992). Given the species' propensity to eat large quantities of fish (20–40% of its weight daily) (Mallory and Metz 1999), the Common Merganser is often viewed as a nuisance species. Some outfitters and aquaculture operators look unfavourably on the predation that may occur on young trout or salmon and hold permits to eliminate the birds (Mallory and Metz 1999; Sea Duck Joint Venture 2003c) or demand that the authorities institute eradication programs (New Brunswick Wildlife Federation 2004). In Nova Scotia and New Brunswick, intensive hunting programs were carried out on some salmon rivers from the 1930s to the late 1960s (Erskine 1972). In Quebec, this does not seem to have occurred and no kill permits for mergansers have been issued, although a few scare permits were granted to specific aquaculture operations (A. Boudreau, CWS, pers. comm.).

Levels of contaminants are fairly high in this species, which is at the top of the food chain. In a study analyzing chemical residues in waterfowl and game birds taken from all over the country between 1987 and 1995, the highest concentrations of polychlorinated biphenyls (PCBs) were found in a Common Merganser in northern Ontario (Braune et al. 1999). High levels of dioxins, furans and PCBs were found in Common Merganser eggs collected in 1991 along the Saint-Maurice River near La Tuque (Champoux 1996).

The Common Merganser is not considered a trophy species, due to its fishy-tasting flesh, and is not heavily hunted. In Canada, hunters killed 7,000 birds on average

annually between 2000 and 2007 (Gendron and Collins 2007), 1,900 of which were in Quebec (Table 3). The Common Merganser ranks 17th among waterfowl species harvested in the province, making up less than 1% of the total waterfowl harvest (Table 3). The declining harvests of the species (see average harvests by decade in Table 3) closely parallel the drop in the number of hunters over the years in Quebec (Figure 92). U.S. hunters along the Atlantic Flyway bagged 8,300 Common Mergansers per year on average during the 2000–2007 period (Padding and Klimstra 2008).

Figure 92. Estimated Common Merganser sport harvest in Quebec and number of Migratory Game Bird Hunting Permits sold, 1975–2007 (data taken from Gendron and Collins 2007)



Since the species has a widespread and fairly uniform distribution in Quebec, occurs in large numbers (ranking as fourth most abundant waterfowl species in the province; Table 2), uses relatively unaltered foraging and brood-rearing areas (rivers) and has low harvest rates, the Common Merganser does not appear to face any imminent threats. The fact that the Common Merganser is a cavity nester—a potential limiting factor for the species—may mean that monitoring is required, but otherwise the population is in relatively good health and there is no reason for serious concern in the province. However, it must be kept in mind that 30% of the North American population would breed in Quebec (Table 2), a high percentage that implies the province bears a strong responsibility for the conservation of the species.

4.5.13 Red-breasted Merganser *Mergus serrator* (Mr, Br, Wr) (by Christine Lepage)

The Red-breasted Merganser has a widespread distribution in the Northern Hemisphere, occurring in North America as well as Europe and Asia (Titman 2005c). Despite this, no subspecies have been officially recognized (American Ornithologists' Union 1998; Titman 1999; Titman 2005c). In North America, this merganser breeds mainly in Alaska, Yukon, Northwest Territories, mainland Nunavut (as well as on Baffin

Island and Victoria Island), northern Alberta and Saskatchewan, Manitoba, Ontario, Quebec and the Atlantic provinces (Titman 1999). It also breeds, but much more locally, in parts of the U.S. northeast (Titman 1999). The species has a more northerly distribution than the Common Merganser, although their breeding ranges overlap in the southern part of the Red-breasted's range. Individuals winter mainly along the Pacific Coast (from the Aleutian Islands to Baja California), on the Great Lakes and on the Atlantic Coast (from Quebec and the Atlantic provinces to the Gulf of Mexico) (American Ornithologists' Union 1998; Titman 1999; Petrie et al. 2006).

Breeding

The Red-breasted Merganser is the most northerly of the three species of mergansers that occur in Quebec and also the one that spends the most time in marine habitats. The species breeds on islands and in coastal habitats in the boreal forest and tundra. Preferred nest sites may include the wooded banks of a river, marsh or lake, the shoreline of a sheltered bay, lagoon or estuary, or a rocky islet or coastal island; the nest is most often close to saltwater, but brackish or freshwater environments may also be used (Alvo and Bourget 1996; Titman 1999). The Red-breasted Merganser generally builds its nest near water (< 100 m), in a sheltered spot on the ground (at the base of a stump, under a fallen log or pile of driftwood, or in dense vegetation), but may also use a cavity (rocky crevice, shallow hole, etc.) (Titman 1999). For this reason, it is considered a facultative cavity nester (Sea Duck Joint Venture Management Board 2008). A study in Kouchibouguac National Park, New Brunswick, found that Red-breasted Merganser nest sites had more significant lateral or overhead concealment, or taller or denser vegetation, than did random locations (Craik and Titman 2009). The nest is generally a shallow scrape in the ground, which the female lines with plant materials and her own down as laying and incubation progress (Titman 1999). The Red-breasted Merganser may breed in small loose colonies, often on islands containing colonies of terns, gulls and eiders (Young and Titman 1986; Alvo and Bourget 1996; Titman 1999; Sea Duck Joint Venture 2004; Titman et al. 2006; Craik and Titman 2009). The species' diet consists mainly of small fish (10–15 cm) (salmon fry and parr, minnows, stickleback, chub, etc.) and crustaceans, but may also include worms, insects and amphibians (Titman 1999).

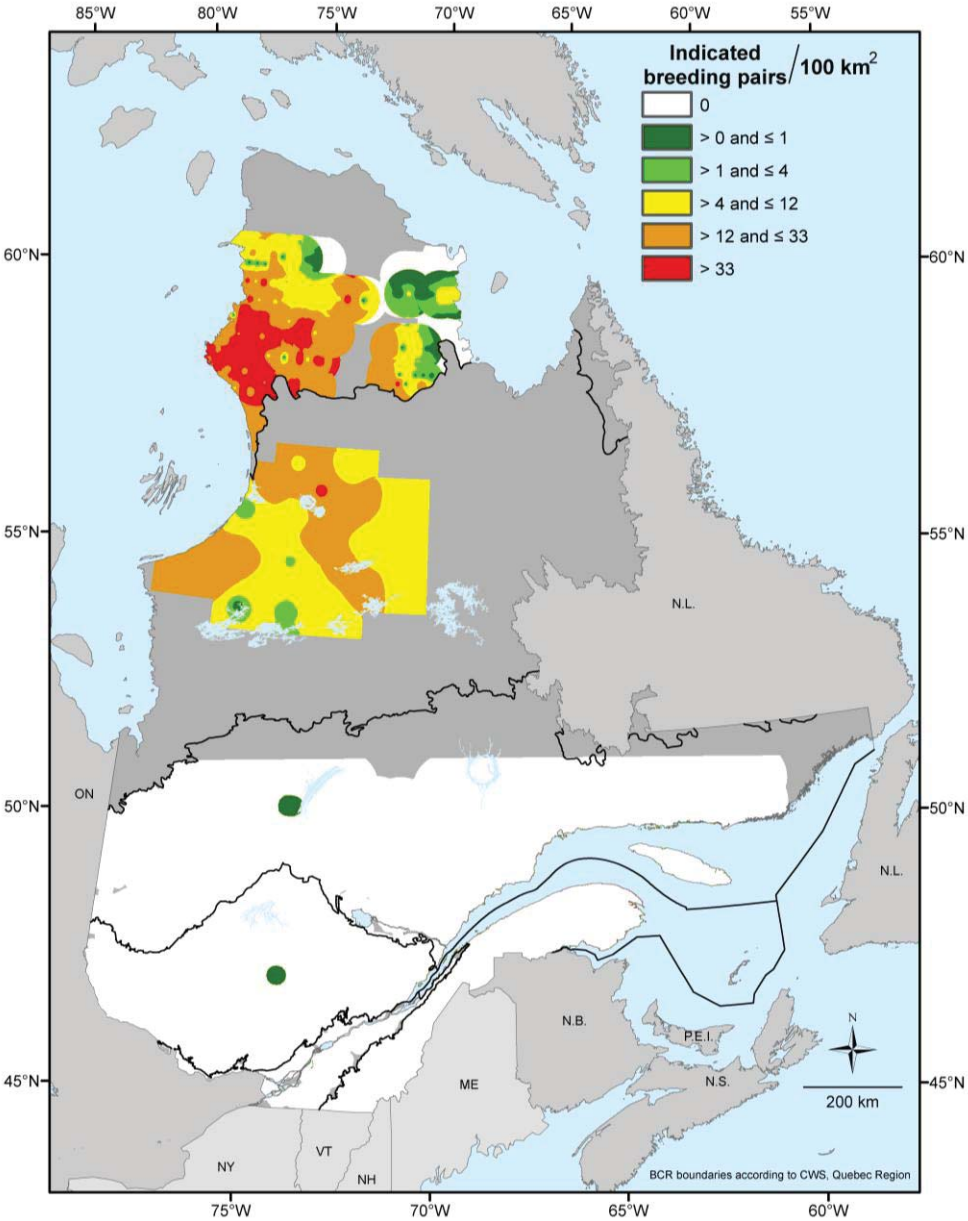
In northern Quebec, the Red-breasted Merganser breeds almost everywhere, along the coastline as well as on inland bodies of water (freshwater). Although the northern limit of the Common Merganser's range does not extend much beyond the taiga, that of the Red-breasted Merganser extends much further north, into the shrub tundra and beyond in Nunavik. The species' vast breeding range in northern Quebec has been confirmed by a number of breeding records. Two broods were observed in 2005 on the Rupert River near the southeast coast of James Bay (BCR 7) (Tecsult Inc. 2006). Breeding has also been confirmed along the northeast coast of James Bay (from Rivière au Castor to Pointe Louis-XIV) (Benoit et al. 1992; Benoit et al. 1993; Benoit et al. 1994; 1995; Reed et al. 1996). In the Hudson Bay region, many pairs raise their broods on rivers, from the Grande rivière de la Baleine (Great Whale River) north to the Nastapoka River (BCR 7) (Consortium Gauthier & Guillemette – G.R.E.B.E. 1990a). In the western Ungava Peninsula, a nest with eight eggs was found on June 25, 2003, near the Polemond River, 120 km north of Inukjuak (BCR 3) (R. Cotter, CWS, unpubl. data). In the summer of 1999, sightings of broods on the Vincelotte River and Caniapiscau Reservoir allowed breeding to be confirmed in the centre of the province (BCR 7) (Morneau 1999b; a). Lastly, even further north, on the eastern Ungava Peninsula, several breeding pairs were observed in late June 2007 in Parc National des

Pingualuit (Pingualuit provincial park), at the same latitude as Kangiqsujuaq (BCR 3) (Robert 2007). According to WNOR surveys, the Red-breasted Merganser is found almost everywhere on the Ungava Peninsula (Figure 93) (CWS, unpubl. data).

Although the species is more closely associated with coastal habitats than the Common Merganser, confirmed breeding records for the Red-breasted Merganser were obtained well inland in the southern part of the province (Alvo and Bourget 1996). While the species is significantly more abundant in coastal areas in eastern Quebec, including the Gaspé Peninsula, Magdalen Islands (BCR 14), Anticosti Island, the Saguenay region and the North Shore (BCR 8), it also breeds, but much less often, in the Outaouais, Abitibi, Laurentides, Mauricie and Chaudière-Appalaches regions (BCR 12 and 14) (Alvo and Bourget 1996; WSHO and WUPL). According to WSHO surveys, in 2004–2007, estimated average breeding density was 12.9 IBP/100 km² along the shoreline of the Gulf and 4.9 IBP/100 km² along the shoreline of the estuary (including the Saguenay–Lac-Saint-Jean region). According to WUPL data, mean breeding pair density was only 0.1 IBP/100 km² in the entire WUPL study area (582,494 km²), corresponding to estimates of only around 600 breeding pairs in the conifer and mixed forests south of 51° 15' N latitude (1990–2007 average). In extreme eastern Quebec, breeding was confirmed by sightings of broods on Robertson Reservoir, north of La Tabatière on the Lower North Shore (BCR 8) (Morneau 1998). The Red-breasted Merganser is the only merganser regularly breeding on the Magdalen Islands (BCR 14) (Fradette 1992). In southwestern Quebec, hens with broods or young have been observed around the Lachine Rapids and Île aux Hérons Migratory Bird Sanctuary (across from Lasalle, BCR 13), including four females in 2004 (Bannon et al. 2004a) and at least five females in 2005 (Bannon et al. 2005b). These sightings confirm breeding in the Montréal region, which represents a southern expansion of the species' breeding range compared with the range described in the 1996 Quebec atlas (Alvo and Bourget 1996; Gosselin 1995g).

Figure 93 shows the distribution of indicated breeding pairs of Red-breasted Mergansers in Quebec, according to various surveys and inventories carried out primarily by CWS.

Figure 93. Breeding distribution of the Red-breasted Merganser in Quebec (by indicated breeding pair density); please read the explanatory note at the last paragraph of Section 2.4



Migration

The Red-breasted Merganser is a late spring migrant. In spring, it occurs mainly in eastern Quebec—the estuary and Gulf of St. Lawrence and Chaleur Bay (Gosselin 1995g; WSHO)—migrating in small groups of 5–15 individuals on average (Titman 1999; ÉPOQ). It is also seen in the southwestern part of the province (St. Lawrence River and other freshwater bodies of water), but in smaller numbers. The fall flight is also centred in eastern Quebec (Gosselin 1995g).

Moulting

Like most other sea ducks, the males leave the females at the beginning of the incubation period and congregate on large bodies of water to moult, while females moult in or near the same area where they nested (Titman 1999). In southern Quebec, Anticosti Island (BCR 8) is one area hosting moulting aggregations of males (Titman et al. 2006). Moulting individuals are present around the island from early July (maximum group: 790 individuals at Southwest Point on July 8, 2005) to late August (736 individuals between Southwest Point and the mouth of the Brick River on August 26, 2005) (S. Craik, unpubl. data). An estimated 3,000 adult males at least are present in early July along the western coastline of Anticosti Island (S. Craik, pers. comm.). In northern Quebec, the Red-breasted Merganser, like the Common Merganser, moults in large numbers along the northeast coast of James Bay (BCR 7) (Benoit et al. 1994; Reed et al. 1996).

Wintering

The Red-breasted Merganser prefers to overwinter in salt water, unlike the Common Merganser (Mallory and Metz 1999). In Quebec, the lower estuary and Gulf (BCR 8 and 14) are known wintering areas for the species (Alvo and Bourget 1996; David 1996), although this depends on ice conditions, which vary from year to year. According to data from BAGOS aerial surveys in 2002, an estimated 3,300 Red-breasted Mergansers were found between Tadoussac and Pointe-des-Monts (including 1,000 in the Godbout area and 1,200 between Pointe aux Outardes and Lebel Point), 300 between Pointe-des-Monts and Havre-Saint-Pierre, 100 around Anticosti Island and 1,100 between Carleton and Cap-des-Rosiers (Robert and Savard 2006; CWS, unpubl. data). Therefore, a total of roughly 5,000 Red-breasted Mergansers overwinter in the northern part of the lower estuary and in the Gulf (Côte-Nord region and south shore of the Gaspé Peninsula). However, these estimates are believed to be far too low (M. Robert, CWS, pers. comm.) since there are no winter surveys directly targeting the species. A small number of Red-breasted Mergansers also winter around the Magdalen Islands (BCR 14) when there is enough open water; individuals observed here are mainly adult males (Fradette 1992).

Not far from Quebec, aerial surveys covering the western part of Lake Ontario revealed the presence of over 6,000 Red-breasted Mergansers in January 2006; sea duck numbers in winter on the Great Lakes have greatly increased since the late 1980s (Petrie et al. 2006). Lastly, some Red-breasted Mergansers winter in Greenland (Boertmann et al. 2004) and it is possible, as is the case with the Harlequin Duck and Common Eider and is suspected in the King Eider and Long-tailed Duck, that some of these wintering birds breed in Nunavik (Sea Duck Joint Venture Management Board 2008); this possibility remains to be confirmed, however.

Conservation

The Red-breasted Merganser population in North America is estimated at 700,000 individuals (Table 2). Estimates of the continental population of the species provided by NAWMP (250,000 individuals) are clearly too low (North American Waterfowl Management Plan 2004). NAWMP estimates, based on USFWS aerial surveys, are not as reliable because Red-breasted Mergansers and Common Mergansers are not identified to species and are combined in the surveys. In addition, a large percentage of the species' breeding range (northern portion) is not covered and since the Red-breasted Merganser is a late breeder, in the parts of its range where it is

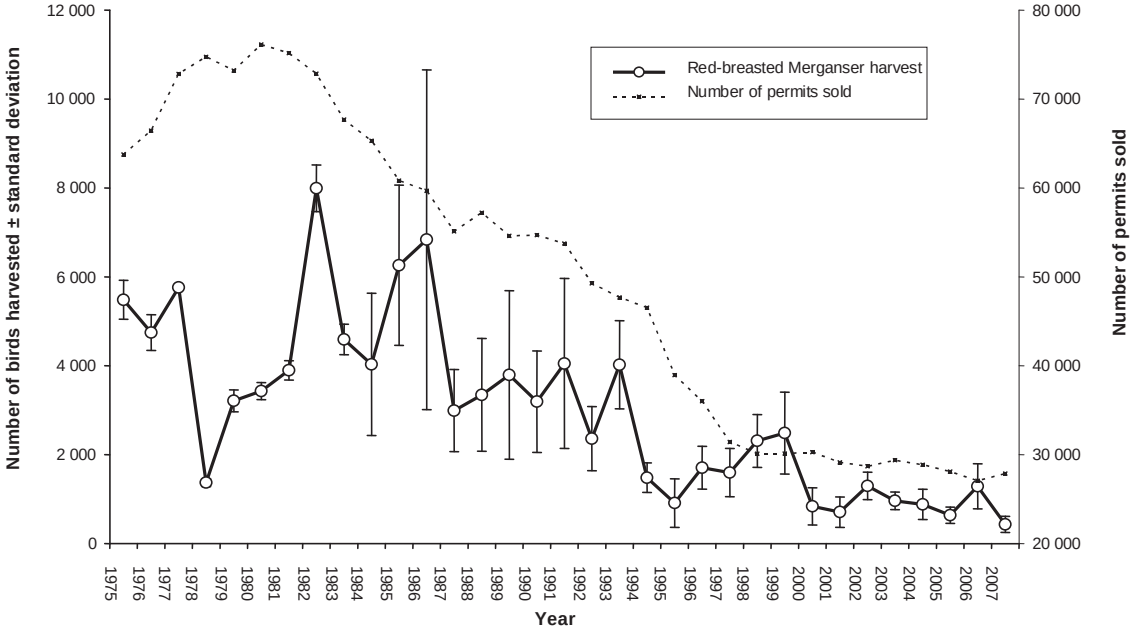
surveyed, it is too early for the species (Sea Duck Joint Venture Management Board 2008). In the light of these shortcomings, the Sea Duck Joint Venture Technical Team has estimated the North American population at more likely between 300,000 and 400,000 individuals (Sea Duck Joint Venture Management Board 2008). This estimate is also probably too low since Quebec's population of the species is roughly 390,000 individuals (Table 2). The continental population showed an upward trend during the 1970–2003 period (North American Waterfowl Management Plan 2004), but this again is based on winter surveys that do not distinguish between the species. CWS has no recent data concerning long-term trends in the Quebec population overall, but it was thought to be increasing during the period from 1970 to 1989, according to ÉPOQ data (Gosselin 1995g). WNOR data, which gives a fairly accurate picture of population trends on the Ungava Peninsula (BCR 3), shows an increase in numbers (Lepage et al., in prep.).

In the past, the Red-breasted Merganser was the target of eradication campaigns, both legal and illegal, because of its taste for salmon fry and parr (Erskine 1972; Titman 1999). However, it may have been wrongly accused of having a negative impact on the commercial fishery since it is often confused with the Common Merganser, a much more abundant species (Titman 1999; Titman et al. 2006). No concerns of this type have been reported in Quebec, however.

Intraspecific parasitism has been documented in the species. According to one study, 64% of nests had been parasitized by one or more conspecifics in colony-nesting birds (Young and Titman 1986; 1988). Although hatching success was greater in nests that were not parasitized, the number of ducklings produced was the same in both parasitized and non-parasitized nests (Young and Titman 1988).

The Red-breasted Merganser is not harvested in large numbers in North America. In Canada, average annual harvests are around 5,100 individuals (2000–2007) (Gendron and Collins 2007), including 900 individuals in Quebec (Table 3). The Red-breasted Merganser ranks 20th on the list of waterfowl species harvested in the province (Table 3; Figure 94), making the sport harvest a very minor issue for the species in Quebec. In the Atlantic Flyway, U.S. hunters shot 9,300 Red-breasted Mergansers annually between 2000 and 2007 on average (Padding and Klimstra 2008). The size of the Aboriginal harvest is not known, either in Nunavik or southern Quebec.

Figure 94. Estimated Red-breasted Merganser sport harvest in Quebec and number of Migratory Game Bird Hunting Permits sold, 1975–2007 (data taken from Gendron and Collins 2007)



Little is known about the ecology of this species, either in its overall North American breeding range or in Quebec specifically. Of a hundred or so research projects funded by the Sea Duck Joint Venture in 2000–2007 (Sea Duck Joint Venture 2007), only two focused on the Red-breasted Merganser (Pearce et al. 2006; Titman et al. 2006), and this species indeed seems to get little attention. Links between the breeding and wintering grounds are poorly understood, and have not been examined up to now except for one telemetry study in Alaska (Sea Duck Joint Venture 2004). In the area of genetic studies, no studies have been undertaken to date to determine whether the species should be managed by subspecies or population (North American and Eurasian, wintering on the West Coast versus on the East Coast of North America, etc.).

For a species that occurs year-round in the province, it has not been given much attention. For one, the regular surveys conducted in the province by CWS do not provide an adequate picture of the species, particularly since the majority of the breeding population is in northern Quebec. This is particularly true for the Taiga Shield and Hudson Plains (BCR 7), which represents 37% of Quebec's land mass but is not covered in any annual waterfowl survey. The Red-breasted Merganser is the most abundant waterfowl species in this BCR (Lepage et al., in prep.). A portion of this territory has been covered by USFWS for several years in the Breeding Waterfowl Plot Survey of Eastern Canada (fixed wing plots) but, as previously noted, Red-breasted and Common mergansers cannot be differentiated in this type of survey. Therefore, the emphasis must be placed on determining the size of the population in Quebec, discerning long-term trends (difficult in the case of breeding birds, which are highly dispersed, but perhaps possible for wintering birds concentrated in the estuary and Gulf), locating moulting areas and identifying factors affecting reproductive success and survival in the species. To sum up, in view of the scanty knowledge we have on the

Red-breasted Merganser in Quebec (numbers, distribution, population trends, ecology, etc.) and the fact that Quebec probably hosts over 50% of the North American breeding population of the species (Table 2), as well as good numbers of wintering birds, the province bears a high degree of responsibility towards this species. Finally, the Red-breasted Merganser is the third most abundant species of waterfowl in Quebec during the breeding season, behind Canada Goose and American Black Duck (Table 2).

4.6 Stiff-tailed ducks (Oxyurini)
(by Christine Lepage)

The representatives of this tribe are extremely well adapted to aquatic life (i.e., very broad feet and legs set far back on the body), take advantage of a wide range of freshwater wetlands and, last but not least, have stiff, upright tails. The tribe Oxyurini is represented by only one species in Quebec, the Ruddy Duck, which also breeds in the province (Table 2).

4.6.1 Ruddy Duck *Oxyura jamaicensis rubida* (Mr, Br)
(by Pierre Brousseau and Christine Lepage)

The species' breeding range is restricted to the Americas, although there is an introduced population in the United Kingdom that has now become established elsewhere in Europe (Hughes 2005). There is a fair amount of controversy over species and subspecies in the genus *Oxyura* (Brua 2002; Hughes 2005). Under North American nomenclature, there are two subspecies of *Oxyura jamaicensis: Oxyura jamaicensis rubida,* which breeds in Canada, the United States and Mexico, and *O. j. jamaicensis,* which breeds in the Bahamas and Greater Antilles (Brua 2002; American Ornithologists' Union 1998). The range of *O. j. rubida* covers the Prairie provinces, British Columbia and the northern central and western United States (Brua 2002). In Canada, the Ruddy Duck breeds mainly in the West, but its breeding range also extends to southern Ontario and Quebec. In Quebec, the species is a recent addition to the province's list of breeding anatids. The *rubida* subspecies winters throughout the United States, except the northern central states, and in Mexico (Brua 2002).

Breeding

In Quebec, the Ruddy Duck prefers to nest on the edges of shallow bodies of water with relatively stable water levels (Jauvin 1996). This duck frequents sewage lagoons, as well as small ponds and marshes bordered with dense emergent vegetations. Such habitats contain large numbers of aquatic invertebrates, which are the species' primary food during the breeding season (Jauvin 1996).

Although the first breeding record dates back to 1951 in the province, the species did not become regularly established in Quebec until the 1980s (Jauvin 1996; ÉPOQ). The Lake Saint-Pierre region, including Baie-du-Febvre where the first nest was found in July 1996 (ÉPOQ), remains the species' preferred breeding area in the province, although breeding is increasingly frequent elsewhere in Quebec (Jauvin 1996; ÉPOQ). The Ruddy Duck has bred in a number of other regions, including Montérégie (Saint-Étienne-de-Beauharnois, Lac Saint-François NWA and Lake Saint-Louis, BCR 13) (Jauvin 1996; Cyr 1995a), Québec City (Léon-Provancher Marsh, BCR 13) (Bannon et al. 2002b), Chaudière-Appalaches (Saint-Pamphile, BCR 13) (Bannon et al. 2002b), Abitibi (Rouyn-Noranda, BCR 8) (Cyr 1995a; Jauvin 1996) and Saguenay–Lac-Saint-Jean (Saint-Fulgence, BCR 8) (Bannon et al. 2001a); the species does not breed every

year in each of these regions, however. In summer, the species has also been observed in the Bas-Saint-Laurent region, as well as on the tip of the Gaspé Peninsula and in the Eastern Townships (Cyr 1995a; Jauvin 1996; ÉPOQ). The Ruddy Duck continues to expand its range in the province, but at a relatively slow rate when compared with the Gadwall in southwestern Quebec in the 1970s (Cantin et al. 1976).

Migration

The species is fairly shy and is only seen rarely in groups, whether in spring or in fall. In spring, records have come from as far east as the Gaspésie region (Amqui and Barachois, BCR 14) (Bannon and David 1999) and the Middle North Shore (a hen 65 km east of Sept-Îles, BCR 8) (Bannon and David 1999), and as far north as the Abitibi region (BCR 12) (Cyr 1995a). In fall, the species is less widely dispersed and is observed mainly in the Montréal and Québec City regions, as well as along the Richelieu River (Cyr 1995a).

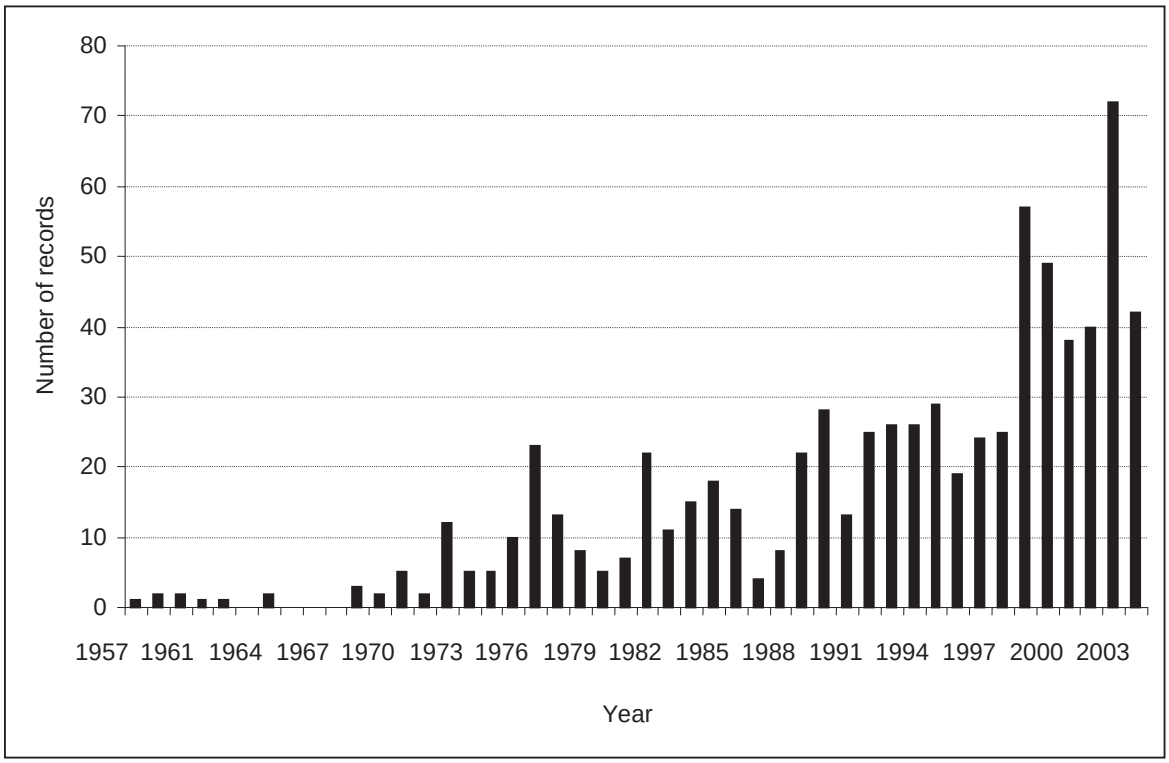
Wintering

There are no winter records of the species in Quebec. The few sightings in December in southern Quebec no doubt involve late fall migrants (Cyr 1995a). Approximately one quarter of the North American population overwinters along the Atlantic Coast and the Quebec and Ontario breeding birds are probably found there, too (Bellrose 1976).

Conservation

The estimated North American Ruddy Duck population is 1.1 million birds (Table 2). The data from 1970 to 2003 show a long-term upward trend in the continental population (North American Waterfowl Management Plan 2004). The presence of sewage lagoons has probably helped the species expand to Quebec, among other places, due to the similarity in size and shape between the lagoons and the species' typical Prairie breeding habitat farther west (Jauvin 1996). However, the Quebec Ruddy Duck population remains small. An analysis of ÉPOQ data shows that the average number of individuals per record is 2.5 and the largest group observed was 22 individuals in Baie-du-Febvre in September. Figure 95 shows the number of distinct records for the species (different birds and locations) in the ÉPOQ database from 1957 to 2003.

Figure 95. Distinct Ruddy Duck records (different birds and locations) in the ÉPOQ database, 1957–2003



Regulatory restrictions were instituted in Quebec in 1991 to support the establishment of the species, but were revoked in 1997 due to the expansion of the population.

The Ruddy Duck harvest in Quebec is fairly low (Table 3), as would be expected of such an uncommon species in the province. Although the National Harvest Survey of waterfowl hunters is an effective tool for estimating the size of harvests and species composition in the case of the most abundant species (see Section 3.8), it is less able to provide statistically reliable estimates in species with low populations, such as the Ruddy Duck; therefore, caution must be used in interpreting the harvest data table (Table 3).

Since the Ruddy Duck is first and foremost a Prairie species and its presence in Quebec represents an expansion of its traditional breeding range, the province plays a very modest role in its conservation. Ruddy Duck populations are increasing almost everywhere in North America and there are few conservation issues affecting the species—except perhaps habitat loss and degradation in its breeding range in the Prairies and on its wintering grounds (Jauvin 1996; Brua 2002). The species' status in Quebec, therefore, raises no serious concerns, and in fact the species may expand more in the province in the future, both in breeding range and numbers (Cyr 1995a; ÉPOQ).

5. Conclusion

The *Status of Quebec Waterfowl Populations, 2009* has amply illustrated the richness, diversity and abundance of Quebec's waterfowl populations. This document contains a huge amount of information and is the result of the hard work and enthusiasm of a number of people. The information presented demonstrates that a large part of Quebec's territory is covered by annual waterfowl surveys that do a good job of documenting most priority species. However, information on moulting and, to a lesser extent, migration and wintering, is often incomplete. In addition, there is an urgent need for data on certain regions of the province (e.g., BCR 7), both during the breeding season and at other times of the year. A number of species do not benefit from a targeted survey program allowing changes in their populations to be monitored over the longer term, particularly the sea ducks (Mergini), the vast majority of which are not adequately covered by actual surveys. Even in the case of species with satisfactory coverage, information on demographic parameters such as productivity is scant (the majority of the members of the Anserini tribe are an exception to this). Despite these shortcomings, this document represents a major step towards a better understanding of Quebec's precious waterfowl resources. The wealth of information presented in this document demonstrates the amount of effort devoted to managing this group of migratory birds, which are of unequivocal value and interest.

The information compiled in *Status of Quebec Waterfowl Populations, 2009* has been presented from the perspective of population-scale management, in accordance with the North American Waterfowl Management Plan. At the BCR scale—the Bird Conservation Regions defined under the North American Bird Conservation Initiative (NABCI)—information has purposely been kept general since this document will serve as a cornerstone of the *Quebec Waterfowl Management Plan, 2011* (Lepage et al., in prep.), which will contain much more detailed information, particularly at the BCR scale. The 2010 management plan, which is the next logical step in ensuring the sustainability of Quebec's waterfowl populations, will identify conservation issues and concerns at a scale that will enable more targeted measures to be taken in the six bird conservation regions in Quebec.

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7. References

Abraham, K.F. and G.H. Finney. 1986. Eiders of the eastern Canadian Arctic, pp. 55-73 in A. Reed, ed. Eider ducks in Canada/Les eiders au Canada. Canadian Wildlife Service/Canadian Wildlife Service, Ottawa, Ontario. 177 pp.

Abraham, K.F. and R.L. Jefferies. 1997. High goose populations: causes, impacts and implications, pp. 7-72 in B.D.J. Batt, ed. Arctic ecosystems in peril: Report of the Arctic Goose Habitat Working Group. Arctic Goose Joint Venture Special Publication. U.S. Fish and Wildlife Service, Washington, D.C. and Canadian Wildlife Service, Ottawa (Ontario).

Addy, E.C. 1964. Down the Flyways - Atlantic Flyway, pp. 167-184 in J.P. Linduska, ed. Waterfowl Tomorrow. The United States Department of the Interior, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Washington D.C. 770 pp.

Afton, A.D. and M.G. Anderson. 2001. Declining Scaup Populations: a Retrospective Analysis of Long-term Population and Harvest Survey Data. Journal of Wildlife Management 65(4): 781-796.

Allin, C.C. and T.P. Husband. 2003. Mute Swan (*Cygnus olor*) impact on submerged aquatic vegetation and macroinvertebrates in a Rhode Island coastal pond. Northeastern Naturalist 10(30): 305-318.

Allison, T.D., S. Perkins, M.C. Perry and M. Sorenson. 2008. Delineating Breeding Populations and Tracking Night-time Movements of Long-tailed Ducks Wintering in Nantucket Sound (SDJV FY09 PROPOSAL #13). Site: www.seaduckjv.org/sdjvwork/proposals11-16.pdf.

Alliston, W.G. 1979. The population ecology of an isolated nesting population of Redheads (*Aythya americana*). Ph.D. Dissertation, Cornell University, Ithaca, NY, USA. 211 pp.

Alvo, R. 1996a. Tundra Swan, pp. 1098-1099 in J. Gauthier and Y. Aubry, eds. The Breeding Birds of Québec: Atlas of the Breeding Birds of Southern Québec. Association québécoise des groupes d'ornithologues, Province of Quebec Society for the Protection of Birds, Canadian Wildlife Service, Environment Canada, Quebec Region, Montréal, Quebec, xviii + 1302 pp.

_____. 1996b. Common Merganser, pp. 344-347 in J. Gauthier and Y. Aubry, eds. The Breeding Birds of Québec: Atlas of the Breeding Birds of Southern Québec. Association québécoise des groupes d'ornithologues, Province of Quebec Society for the Protection of Birds, Canadian Wildlife Service, Environment Canada, Quebec Region, Montréal, Quebec, xviii + 1302 pp.

Alvo, R. and A. Bourget. 1996. Red-breasted Merganser, pp. 348-351 in J. Gauthier and Y. Aubry, eds. The Breeding Birds of Québec: Atlas of the Breeding Birds of Southern Québec. Association québécoise des groupes d'ornithologues, Province of Quebec Society for the Protection of Birds, Canadian Wildlife Service, Environment Canada, Quebec Region, Montréal, Quebec, xviii + 1302 pp.

American Ornithologists' Union. 1998. Check-list of North American Birds. 7th edition. American Ornithologists' Union, Washington, D.C. 829 pp.

_____. 2003. Forty-fourth supplement to the American Ornithologists' Union *Check-list of North American Birds*. Auk 120(3): 923-931.

_____. 2004. Forty-fifth supplement to the American Ornithologists' Union *Check-list of North American Birds*. Auk 121(3): 985-995.

Anderson, M., J. Austin, A. Afton, J. Barclay, R. Clark, M. Koneff and S. Slattery. 2006. Lesser Scaup and Greater Scaup. Prospectus for an Action Team. 11 pp.

Angers, R., P. Messier, R. Page, R. Shooner and P. Dupuis. 1996. Canard branchu, guide de terrain. Société d'aménagement de la baie Lavallière Inc., Édition S.A.B.L., II. 38 pp.

Anteau, M.J. 2006. Ecology of Lesser Scaup and amphipods in the upper-Midwest: scope and mechanisms of the Spring condition hypothesis and implications for migration habitat conservation. Ph.D. Dissertation, Louisiana State University and Agricultural and Mechanical College, Baton Rouge, LA, USA. 213 pp.

Aubry, Y. 1996. Bufflehead, pp. 336-339 in J. Gauthier and Y. Aubry, eds. The Breeding Birds of Québec: Atlas of the Breeding Birds of Southern Québec. Association québécoise des groupes d'ornithologues, Province of Quebec Society for the Protection of Birds, Canadian Wildlife Service, Environment Canada, Quebec Region, Montréal, Quebec, xviii + 1302 pp.

Aubry, Y. and P. Bannon. 1995. Les observations saisonnières : l'été 1995 (juin et juillet). QuébecOiseaux 7(3): 25.

Aubry, Y., N. David and P. Bannon. 1999. Quebec Regional report: Winter season. North American Birds 53(2): 141-143.

Austin, J.E., A.D. Afton, M.G. Anderson, R.G. Clark, C.M. Custer, J.S. Lawrence, J.B. Pollard and J.K. Ringelman. 2000. Declining Scaup Populations: Issues, Hypotheses, and Research Needs. Wildlife Society Bulletin 28(1): 254-263.

Austin, J.E., C.M. Custer and A.D. Afton. 1998. Lesser Scaup (*Aythya affinis*), in A. Poole and F. Gill, eds. The Birds of North America, no. 338. The Birds of North America, Inc., Philadelphia, PA, 32 pp.

_____. 2005. Lesser Scaup *Aythya affinis*, pp. 679-685 in J. Kear, ed. Ducks, geese and swans. Volume 1: General chapters, and Species accounts (*Anhima* to *Salvadorina*). Volume 2: Species accounts (*Cairina* to *Mergus*). Oxford University Press, New York, NY. 908 pp.

Austin, J.E. and M.R. Miller. 1995. Northern Pintail (*Anas acuta*), in A. Poole and F. Gill, eds. The Birds of North America, no. 163. The Birds of North America, Inc., Philadelphia, PA, 32 pp.

Badzinski, S.S. 2007. Mute Swan, pp. 64-65 in M.D. Cadman, D.A. Sutherland, G.G. Beck, D. Lepage and A.R. Couturier, eds. Atlas of the Breeding Birds of Ontario, 2001-2005. Birds Studies Canada, Environment Canada, Ontario Field Ornithologists, Ontario Ministry of Natural Resources, and Ontario Nature, Toronto, Ontario, xxii + 706 pp.

Baillie, S.R. and H. Milne. 1982. The influence of female age on breeding in the eider *Somateria mollissima*. Bird Study 29: 55-66.

Bannon, P. 2008. Recensement des canards hivernants dans la région de Montréal (1982-2008). Site: http://pages.infinit.net/pbannon/canards19822006.htm. Consulted March 6, 2008.

Bannon, P., Y. Aubry and N. David. 1998. Quebec Regional report: Summer season. North American Birds 52(4): 432-434.

Bannon, P., Y. Aubry, S. Denault and N. David. 2002a. Quebec Regional report: Fall migration. North American Birds 56(1): 24-26.

_____. 2002b. Quebec Regional report: Summer season. North American Birds 56(4): 412-414.

Bannon, P., O. Barden, N. David, S. Denault and Y. Aubry. 2005a. Quebec Regional report: Spring migration. North American Birds 59(3): 400-402.

_____. 2005b. Quebec Regional report: Summer season. North American Birds 59(4): 566-568.

_____. 2006a. Quebec Regional report: Fall migration. North American Birds 60(1): 35-37.

_____. 2006b. Quebec Regional report: Spring migration. North American Birds 60(3): 345-347.

_____. 2006c. Quebec Regional report: Winter season. North American Birds 60(2): 202-203.

Bannon, P. and N. David. 1999. Quebec Regional report: Spring season. North American Birds 53(3): 256-258.

Bannon, P., N. David and Y. Aubry. 2000. Quebec Regional report: Fall migration. North American Birds 54(1): 23-25.

Bannon, P., S. Denault, Y. Aubry and N. David. 2001a. Quebec Regional report: Summer season. North American Birds 55(4): 410-412.

_____. 2001b. Quebec Regional report: Winter season. North American Birds 55(2): 144-146.

_____. 2002c. Quebec Regional report: Winter season. North American Birds 56(2): 151-153.

_____. 2003a. Quebec Regional report: Summer season. North American Birds 57(4): 462-464.

_____. 2003b. Quebec Regional report: Winter season. North American Birds 57(2): 175-177.

_____. 2004a. Quebec Regional report: Summer season. North American Birds 58(4): 491-492.

_____. 2004b. Quebec Regional report: Winter season. North American Birds 58(2): 198-200.

_____. 2005c. Quebec Regional report: Winter season. North American Birds 59(2): 234-236.

Barrette, S. and M. Robert. 1996. Eurasian Wigeon, p. 1106 in J. Gauthier and Y. Aubry, eds. The Breeding Birds of Québec: Atlas of the Breeding Birds of Southern Québec. Association québécoise des groupes d'ornithologues, Province of Quebec Society for the Protection of Birds, Canadian Wildlife Service, Environment Canada, Quebec Region, Montréal, Quebec, xviii + 1302 pp.

Barrette, S. and R.D. Titman. 1996. Lesser Scaup, pp. 312-315 in J. Gauthier and Y. Aubry, eds. The Breeding Birds of Québec: Atlas of the Breeding Birds of Southern Québec. Association québécoise des groupes d'ornithologues, Province of Quebec Society for the Protection of Birds, Canadian Wildlife Service, Environment Canada, Quebec Region, Montréal, Quebec, xviii + 1302 pp.

Barry, T.W. 1968. Observations on natural mortality and native use of eider ducks along the Beaufort Sea coast. Canadian Field-Naturalist 82: 140-144.

Bartonek, J.C., J.R. Serie and K.A. Converse. 1991. Mortality in Tundra Swans *Cygnus columbianus*, pp. 356-358 in J. Sears and P.J. Bacon, eds. Proceedings of the Third IWRB International Swan Symposium. Wildfowl-suppl. No. 1, Oxford, UK.

Batt, B.D.J. (editor). 1998. The Greater Snow Goose: report of the Arctic Goose Habitat Working Group. Arctic Goose Joint Venture Special Publication. U.S. Fish and Wildlife Service, Washington, D.C. and Canadian Wildlife Service, Ottawa (Ontario). 88 pp.

Béchet, A., A. Reed, N. Plante, J.-F. Giroux and G. Gauthier. 2004. Estimating the size of large bird populations: the case of the Greater Snow Goose. Journal of Wildlife Management 68: 639-649.

Bédard, J. 1988. L'Eider à duvet de l'estuaire du Saint-Laurent : un plan de gestion. Sauvagiles Ltée, submitted to Ducks Unlimited Canada, March 1988, 71 pp.

Bédard, J., J. Huot and J.-F. Giroux. 1987. Île Blanche : Programme de suivi environnemental. Rapport pour l'année 1986. Report prepared for Ducks Unlimited Canada by Sauvagiles Ltée, February 1987, 20 pp.

Bédard, J. and A. Nadeau. 1994. L'Eider à duvet dans le Saint-Laurent : un plan de gestion (revisé 1994). Report prepared by Société Duvetnor Ltée for Ducks Unlimited Canada, Quebec Region, 64 pp.

Bédard, J., A. Nadeau, J.-F. Giroux and J.-P.L. Savard. 2008. Eiderdown, Characteristics and Harvesting procedures. Société Duvetnor Ltée and Canadian Wildlife Service, Environment Canada, Quebec Region, Québec, Quebec, 48 pp.

Bédard, J., A. Nadeau and J.-P.L. Savard. 1997. Répartition et abondance de la Macreuse à front blanc (*Melanitta perspicillata*) dans le moyen estuaire du Saint-Laurent à l'automne. Environment Canada, Canadian Wildlife Service, Quebec Region. Technical Report Series No. 281, Sainte-Foy, Quebec.

Bélanger, L. 1989. Potentiel des îles du Saint-Laurent dulcicole pour la sauvagine et plan de protection. Canadian Wildlife Service, Quebec Region, Environment Canada. Unpublished report, Sainte-Foy, Quebec, 71 pp.

Bélanger, L. and J. Bédard. 1997. L'habitat de l'Eider à duvet sur l'île Bicquette : évaluation du couvert forestier et prescriptions sylvicoles. Report prepared for Environment Canada, Quebec Region, by Société Duvetnor Ltée, February 1997, 32 pp.

Bélanger, L., L. Gratton and D. Lehoux. 1994. Étude de la nidification du Canard noir dans divers habitats côtiers de l'estuaire du Saint-Laurent et perspectives de conservation. Canadian Wildlife Service, Quebec Region, Environment Canada. Technical Report Series No. 210, Sainte-Foy, Quebec, 37 pp.

Bélanger, L. and J. Lefebvre. 2006. Plan for Sustainable Integrated Management of the Greater Snow Goose in Québec: 2005-2010 Action Plan. Canadian Wildlife Service, Quebec Region, Environment Canada, Sainte-Foy, Quebec, 34 pp.

Bellrose, F.C. 1976. Ducks, geese and swans of North America. Stackpole Books, Harrisburg, PA. 544 pp.

Benoit, R. and D. Dauphin. 1996. Blue-winged Teal, pp. 286-289 in J. Gauthier and Y. Aubry, eds. The Breeding Birds of Québec: Atlas of the Breeding Birds of Southern Québec. Association québécoise des groupes d'ornithologues, Province of Quebec Society for the Protection of Birds, Canadian Wildlife Service, Environment Canada, Quebec Region, Montréal, Quebec, xviii + 1302 pp.

Benoit, R., R. Lalumière and A. Reed. 1993. Étude de la sauvagine sur la côte-est de la baie James – 1992. Société d'énergie de la Baie James, 91 pp.

_____. 1996. Étude sur la Bernache cravant et la Macreuse à ailes blanches (côte nord-est de la baie James – 1995). Report submitted to Service écologie, Société d'énergie de la Baie James, 55 pp.

Benoit, R. and J.-F. Rail. 1996. Greater Scaup, pp. 308-311 in J. Gauthier and Y. Aubry, eds. The Breeding Birds of Québec: Atlas of the Breeding Birds of Southern Québec. Association québécoise des groupes d'ornithologues, Province of Quebec Society for the Protection of Birds, Canadian Wildlife Service, Environment Canada, Quebec Region, Montréal, Quebec, xviii + 1302 pp.

Benoit, R., A. Reed and R. Lalumière. 1992. Utilisation par la sauvagine des habitats côtiers de la côte nord-est de la baie James, été 1991. Report submitted to Service écologie, Direction Ingénierie et Environnement, Société d'énergie de la Baie James, 62 pp.

_____. 1994. Étude de la sauvagine sur la côte nord-est de la baie James – 1993. Report submitted to Service écologie, Direction Ingénierie et Environnement, Société d'énergie de la Baie James, 113 pp.

_____. 1995. Étude de la sauvagine sur la côte-est de la baie James – 1994. Report submitted to Service écologie, Société d'énergie de la Baie James, 62 pp.

Benoit, R., A. Reed, R. Lalumière and G. Morissette. 1991. Utilisation par la sauvagine des habitats côtiers de la baie of Many Islands, baie James. Report submitted to Service écologique, Direction Ingénierie et Environnement, Société d'énergie de la Baie James, 62 pp.

Benoit, R., M. Robert, C. Marcotte, G. Fitzgerald and J.-P.L. Savard. 2001. Étude des déplacements du Garrot d'Islande dans l'est du Canada à l'aide de la télémétrie satellitaire. Canadian Wildlife

Service, Quebec Region, Environment Canada. Technical Report Series No. 360, Sainte-Foy, Québec, 71 pp.
Black Duck Adaptive Harvest Management Working Group. 2004. Development of an Integrated, Adaptive Management Protocol for American Black Ducks. Site: http://coopunit.forestry.uga.edu/blackduck/. Georgia Cooperative Fish & Wildlife Research Unit, D. B. Warnell School of Forest Resources, University of Georgia.
Blanchard, K.A. 2004. Mobiliser les communautés de la Moyenne et de la Basse Côte Nord du Québec pour la conservation des oiseaux migrateurs : stratégie 2005-2007. Internal report prepared for Environment Canada, Canadian Wildlife Service, Quebec Region, by Les associés de la conservation et du patrimoine Intervalle, Lasalle, Quebec, 90 pp.
Boertman, D. 2008. Harlequin Ducks in Greenland. Waterbirds 31(Special Publication 2): 4-7.
Boertmann, D., P. Lyngs, F.R. Merkel and A. Mosbech. 2004. The significance of Southwest Greenland as winter quarters for seabirds. Bird Conservation International 14(2): 87-112.
Boertmann, D. and A. Mosbech. 2002. Molting Harlequin Ducks in Greenland. Waterbirds 25(3): 326-332.
Bolduc, F. and M. Guillemette. 2003a. Human disturbance and nesting success of Common Eiders: interaction between visitors and gulls. Biological Conservation 110: 77-83.
_____. 2003b. Incubation constancy and mass loss in the common eider *Somateria mollissima*. Ibis 145: 329-332.
Bolduc, F., M. Guillemette and R.D. Titman. 2005. Nesting success of Common Eider *Somateria mollissima* as influenced by nest-site and female characteristics in the Gulf of the St. Lawrence. Wildlife Biology 11(4): 273-279.
Bond, A.L., P.W. Hicklin and M. Evans. 2007. Daytime spring migration of scoters (*Melanitta* spp.) in the Bay of Fundy. Waterbirds 30(4): 566-572.
Bordage, D. 1984. Distribution et abondance des Anatidés le long des rivières Eastmain, Opinaca et Petite rivière Opinaca en aval des ouvrages de dérivation. Report for Direction de l'Environnement, Société d'énergie de la Baie James, Canadian Wildlife Service, Quebec Region, Progress Report No. 3, 1983, Sainte-Foy, Quebec, 46 pp.
_____. 1985. Bilan de surveillance des populations de sauvagine des régions sud-ouest et est du Nouveau-Québec (1981–84). Report for Société d'énergie de la Baie James, Canadian Wildlife Service, Sainte-Foy, Quebec, 92 pp.
_____. 1987. Suivi des couples nicheurs de Canard noir en forêt boréale – 1985. Canadian Wildlife Service, Quebec Region. Technical Report Series No. 18, Sainte-Foy, Quebec, 29 p.
_____. 1996. Common Goldeneye, pp. 328-331 in J. Gauthier and Y. Aubry, eds. The Breeding Birds of Québec: Atlas of the Breeding Birds of Southern Québec. Association québécoise des groupes d'ornithologues, Province of Quebec Society for the Protection of Birds, Canadian Wildlife Service, Environment Canada, Quebec Region, Montréal, Quebec, xviii + 1302 pp.
Bordage, D. and C. Lepage. 2002. Trends in Waterfowl Breeding Populations along the Shores of the St. Lawrence River and Its Main Tributaries, 1990-1992. Canadian Wildlife Service, Quebec Region, Environment Canada. Technical Report Series No. 382, Sainte-Foy, Quebec, 84 pp.
Bordage, D., C. Lepage and S. Orichefsky. 2003. Black Duck Joint Venture Helicopter Survey – Quebec (Annual Report, Spring 2003). Canadian Wildlife Service report, Quebec Region, Environment Canada, Sainte-Foy, Québec, 26 pp.
Bordage, D. and N. Plante. 1993. A breeding ground survey of Canada Geese in Northern Quebec—1993. Unpubl. report, Canadian Wildlife Service, Quebec Region for the Engineering and Environment Division of the James Bay Energy Corporation, Sainte-Foy, Quebec, 17 pp.
_____. 1994. A breeding ground survey of Atlantic Flyway Canada Geese in Northern Quebec—Costs estimates. Unpubl. report, Canadian Wildlife Service, Quebec Region, Sainte-Foy, Quebec, 9 pp.
_____. 1997. Tendance des effectifs nicheurs de Canard noir et de Canard colvert au Québec méridional 1985-1995. Canadian Wildlife Service, Quebec Region, Environment Canada. Technical Report Series No. 300, Sainte-Foy, Quebec, 46 pp.
Bordage, D., N. Plante, A. Bourget and S. Paradis. 1998. Use of ratio estimators to estimate the size of Common Eider populations in winter. Journal of Wildlife Management 62(1): 185-192.
Bordage, D., N. Plante and M. Grenier. 1992. Milieux propices à la reproduction de la Bernache du Canada, de la Macreuse à bec jaune et de la Macreuse à front blanc : projet pilote – Complexe Grande Baleine. Report by the Canadian Wildlife Service, Quebec Region, for the Vice-Présidence Environnement, Hydro-Québec, Sainte-Foy, Quebec, 78 pp.
Bordage, D. and J.-P.L. Savard. 1995. Black Scoter (*Melanitta nigra*), in A. Poole and F. Gill, eds. The Birds of North America, no. 177. The Birds of North America, Inc., Philadelphia, PA, 20 pp.
Bourget, A., P. Dupuis and W.R. Whitman. 1986. Les eiders hivernant dans le golfe du Saint-Laurent: effectifs et distribution, pp. 94-99 in A. Reed, ed. Eider ducks in Canada/Les eiders au Canada. Canadian Wildlife Service/Canadian Wildlife Service, Ottawa, Ontario. 177 pp.

Bouvier, J. and S. Barrette. 1996. Hooded Merganser, pp. 340-343 in J. Gauthier and Y. Aubry, eds. The Breeding Birds of Québec: Atlas of the Breeding Birds of Southern Québec. Association québécoise des groupes d'ornithologues, Province of Quebec Society for the Protection of Birds, Canadian Wildlife Service, Environment Canada, Quebec Region, Montréal, Quebec, xviii + 1302 pp.

Bowler, J. 2005a. Bewick's Swan *Cygnus columbianus bewickii*, pp. 243-248 in J. Kear, ed. Ducks, geese and swans. Volume 1: General chapters, and Species accounts (*Anhima* to *Salvadorina*). Volume 2: Species accounts (*Cairina* to *Mergus*). Oxford University Press, New York, 908 pp.

_____. 2005b. Whistling Swan *Cygnus columbianus columbianus*, pp. 238-243 in J. Kear, ed. Ducks, geese and swans. Volume 1: General chapters, and Species accounts (*Anhima* to *Salvadorina*). Volume 2: Species accounts (*Cairina* to *Mergus*). Oxford University Press, New York, 908 pp.

Boyd, H. 2005a. American Wigeon *Anas americana*, pp. 503-506 in J. Kear, ed. Ducks, geese and swans. Volume 1: General chapters, and Species accounts (*Anhima* to *Salvadorina*). Volume 2: Species accounts (*Cairina* to *Mergus*). Oxford University Press, New York, NY. 908 pp.

_____. 2005b. Brent Goose (Brant) *Branta bernicla*, pp. 321-329 in J. Kear, ed. Ducks, geese and swans. Volume 1: General chapters, and Species accounts (*Anhima* to *Salvadorina*). Volume 2: Species accounts (*Cairina* to *Mergus*). Oxford University Press, New York, NY. 908 pp.

Boyd, H. and K. Dickson. 2005. Canada Goose *Branta canadensis*, pp. 306-316 in J. Kear, ed. Ducks, geese and swans. Volume 1: General chapters, and Species accounts (*Anhima* to *Salvadorina*). Volume 2: Species accounts (*Cairina* to *Mergus*). Oxford University Press, New York, NY. 908 pp.

Braune, B.M., B. Malone, N.M. Burgess, J.E. Elliot, N. Garrity, J. Hawkings, J. Hines, H. Marshall, W.K. Marshall, J. Rodrigue, B. Wakeford, M. Wayland, D.V. Weseloh and P.E. Whitehead. 1999. Chemical residues in game birds harvested in Canada, 1987-1995. Canadian Wildlife Service, Quebec Region, Environment Canada. Technical Report Series No. 326, Sainte-Foy, Quebec.

Brodeur, S., J.-P.L. Savard, M. Robert, A. Bourget, G. Fitzgerald and R.D. Titman. 2008. Abundance and movements of Harlequin Ducks breeding on rivers of the Gaspé Peninsula, Québec. Waterbirds 31(Special Publication 2): 122-129.

Brodeur, S., J.-P.L. Savard, M. Robert, P. Laporte, P. Lamothe, R.D. Titman, S. Marchand, S. Gilliland and G. Fitzgerald. 2002. Harlequin Duck *Histrionicus histrionicus* population structure in eastern Nearctic. Journal of Avian Biology 33: 127-137.

Brousseau, P. et B. Gagnon. 2004. Baguage de Bernache du Canada au réservoir Opinaca en 2003. Hydro-Québec, Unité Environnement – Division Équipement and Environment Canada, Canadian Wildlife Service, Montréal, Quebec, 9 pp.

Brousseau, P. and J. Rodrigue. 2001. Inventaire de la sauvagine dans les refuges d'oiseaux migrateurs de la région Côte-du-Sud, Automne 1999. Environment Canada, Canadian Wildlife Service, Quebec Region, Québec, Quebec, 41 pp.

Brown, P.W. and L.H. Fredrickson. 1997. White-winged Scoter (*Melanitta fusca*), in A. Poole and F. Gill, eds. The Birds of North America, no. 274. The Birds of North America, Inc., Philadelphia, PA, 28 pp.

Brua, R.B. 2002. Ruddy Duck (*Oxyura jamaicensis*), in A. Poole and F. Gill, eds. The Birds of North America, no. 696. The Birds of North America, Inc., Philadelphia, PA, 32 pp.

Burnett, J.A., W. Lidster, P. Ryan and C. Baldwin. 1994. Saving cultured mussels and waterfowl in Newfoundland. Canadian Wildlife Service, Environmental Conservation Branch, Environment Canada, Atlantic Region, St. John, Newfoundland, 34 pp.

Callaghan, D. and J. Harshman. 2005. Taxonomy and systematics, pp. 14-26 in J. Kear, ed. Ducks, geese and swans. Volume 1: General chapters, and Species accounts (*Anhima* to *Salvadorina*). Volume 2: Species accounts (*Cairina* to *Mergus*). Oxford University Press, New York, NY. 908 pp.

Calvert, A.M., G. Gauthier, E.T. Reed, L. Bélanger, J.-F. Giroux, J.-F. Gobeil, M. Huang, J. Lefebvre and A. Reed. 2007a. Abundance and distribution, pp. 6-19 in E.T. Reed and A.M. Calvert, eds. Evaluation of the special conservation measures for Greater Snow Geese: Report of the Greater Snow Goose Working Group, Canadian Wildlife Service, Sainte-Foy, Quebec. 85 pp.

_____. 2007b. Impacts of Snow Geese on natural habitats and farmlands, pp. 52-64 in E.T. Reed and A.M. Calvert, eds. Evaluation of the special conservation measures for Greater Snow Geese: Report of the Greater Snow Goose Working Group, Canadian Wildlife Service, Sainte-Foy, Quebec. 85 pp.

_____. 2007c. Breeding and productivity, pp. 20-29 in E.T. Reed and A.M. Calvert, eds. Evaluation of the special conservation measures for Greater Snow Geese: Report of the Greater Snow Goose Working Group, Canadian Wildlife Service, Sainte-Foy, Quebec. 85 pp.

_____. 2007d. Temporal changes in harvest, pp. 5-7 in E.T. Reed and A.M. Calvert, eds. Evaluation of the special conservation measures for Greater Snow Geese: Report of the Greater Snow Goose Working Group, Canadian Wildlife Service, Sainte-Foy, Quebec. 85 pp.

Camphuysen, C.J., C.M. Berrevoets, H.J.W.M. Cremers, A. Dekinga, R. Dekker, B.J. Ens, T.M. van der Have, R.K.H. Kats, T. Kuiken, M.F. Leopold, J. van der Meer and T. Piersma. 2002. Mass

mortality of common eiders (Somateria mollissima) in the Dutch Wadden Sea, winter 1999–2000: starvation in a commercially exploited wetland of international importance. Biological Conservation 106(3): 303-317.

Canada Goose Committee - Atlantic Flyway Technical Section. 1999. Atlantic Flyway Resident Canada Goose Management Plan. Atlantic Flyway Council, 42 pp.

Canadian Wildlife Service and Ministère du Loisir de la Chasse et de la Pêche. 1986. Quebec Waterbird Management Plan. Environment Canada, Canadian Wildlife Service, Quebec Region and Ministère du Loisir, de la Chasse et de la Pêche, Québec, Québec, 108 pp.

Canadian Wildlife Service Waterfowl Committee. 2005. Population Status of Migratory Game Birds in Canada: November 2005. CWS Migratory Birds Regulatory Report Number 16, Sainte-Foy, Quebec, 102 pp.

_____. 2007. Population Status of Migratory Game Birds in Canada: November 2007. CWS Migratory Birds Regulatory Report Number 22, Sainte-Foy, Quebec, 100 pp.

Cantin, M., J. Bédard and H. Milne. 1974. The food and feeding of Common Eiders in the St. Lawrence estuary. Canadian Journal of Zoology 52: 319-334.

Cantin, M., A. Bourget, G. Chapdelaine and W.G. Alliston. 1976. Distribution et écologie de la reproduction du Canard chipeau (*Anas strepera*) au Québec. Naturaliste canadien 103(5): 469-481.

Champoux, L. 1996. PCBs, dioxins and furans in Hooded Merganser (*Lophodytes cucullatus*), Common Merganser (*Mergus merganser*) and mink (*Mustela vison*) collected along the St. Maurice River near La Tuque, Quebec. Environmental Pollution 92(2): 147-153.

Chapdelaine, G. 1974. Aménagement du Canard huppé sur la Réserve de Dundee (saison 1974). Unpublished report, Canadian Wildlife Service, Environment Canada, 20 pp.

_____. 1979. Situation du Canard huppé (*Aix sponsa*) au Québec. Unpublished report, Canadian Wildlife Service, Environment Canada, 20 pp.

Chapdelaine, G., A. Bourget, W.B. Kemp, D.J. Nakashima and D.J. Murray. 1986a. Population d'eider à duvet près des côtes du Québec septentrional, p. 39-50 in A. Reed, ed. Eider ducks in Canada/Les eiders au Canada. Canadian Wildlife Service, Ottawa, Ontario. 177 pp.

Chapdelaine, G., P. Dupuis and A. Reed. 1986b. Distribution, abondance et fluctuations des populations d'eider à duvet dans l'estuaire et le golfe du Saint-Laurent, pp. 6-19 in A. Reed, ed. Eider ducks in Canada/Les eiders au Canada. Canadian Wildlife Service, Ottawa, Ontario. 177 pp.

Chesser, R.T., R.C. Banks, F.K. Barker, C. Cicero, J.L. Dunn, A.W. Kratter, I.J. Lovette, P.C. Rasmussen, J.V.J. Remsen, J.D. Rising, D.F. Stotz and K. Winker. 2010. Fifty-First Supplement to the American Ornithologists' Union Check-List of North American Birds. Auk 127(3): 726-744.

Ciaranca, M.A., C.C. Allin and G.S. Jones. 1997. Mute Swan (*Cygnus olor*), in A. Poole and F. Gill, eds. The Birds of North America, no. 273. The Birds of North America, Inc., Philadelphia, PA.

Club des ornithologues du Québec. 1978. Observations ornithologiques : juin et juillet 1978. Bulletin ornithologique 23(3): 82-83.

Cochran, W.G. 1977. Sampling techniques. Third edition. John Wiley & Sons, New York, New York. 428 pp.

Commission internationale des noms français des oiseaux. 1993. Noms français des oiseaux du Monde. 1ère édition. Éditions MultiMondes Inc., Sainte-Foy, Quebec, Canada & Éd. Chabaud, Bayonne, France. 452 pp.

Committee on the Status of Endangered Wildlife in Canada. 2009. Canadian Wildlife Species at Risk. Committee on the Status of Endangered Wildlife in Canada, 101 pp.

Conroy, M.J., M.W. Miller and J.E. Hines. 2002. Identification and synthetic modeling of factors affecting American black duck populations. Wildlife Monographs 150: 64 pp.

Consortium Gauthier & Guillemette – G.R.E.B.E. 1990a. Complexe Grande-Baleine. Avant-projet Phase II. Étude de l'avifaune et du castor : écologie de la sauvagine (été 1989). Final report submitted to Hydro-Québec, vice-présidence Environnement, Montréal, Quebec, 214 pp.

_____. 1990b. Complexe Grande-Baleine. Avant-projet Phase II. Étude de l'avifaune et du castor : utilisation estivale et automnale du détroit de Manitounuk par la sauvagine (1989). Final report submitted to Hydro-Québec, vice-présidence Environnement, Saint-Romuald, Quebec, 47 pp.

_____. 1992a. Complexe Grande-Baleine. Avant-projet Phase II. Étude de l'avifaune et du castor : aire de reproduction des macreuses dans la péninsule Québec-Labrador. Report submitted to Hydro-Québec, vice-présidence Environnement, Montréal, Quebec, 35 pp.

_____. 1992b. Complexe Nottaway-Broadback-Rupert. La sauvagine. Volume 1 : Densité, abondance et habitat de la sauvagine. Report submitted to Hydro-Québec, vice-présidence Environnement, Montréal, Quebec, 238 pp.

_____. 1993a. Complexe Grande-Baleine. Avant-projet Phase II. Étude de l'avifaune et du castor : acquisition de connaissances sur l'écologie du Canard arlequin. Report submitted to Hydro-Québec, vice-présidence Environnement, Montréal, Quebec, 38 pp.

_____. 1993b. Complexe Grande-Baleine. Avant-projet Phase II. Étude de l'avifaune et du castor : dénombrement de l'effectif reproducteur du Canard arlequin, 1992. Report submitted to Hydro-Québec, vice-présidence Environnement, Montréal, Quebec, 22 pp.

_____. 1993c. Complexe Grande-Baleine. Avant-projet Phase II. Étude de l'avifaune et du castor : description et utilisation de l'habitat d'élevage des macreuses à l'été 1990. Report submitted to Hydro-Québec, vice-présidence Environnement, Saint-Romuald, Québec, 54 pp.

Cooch, E.G., D.B. Lank, R.F. Rockwell and F. Cooke. 1991. Long-term decline in body size in a Snow Goose population: evidence of environmental degradation? Journal of Animal Ecology 60: 483-496.

Cooch, F.G. 1965. Breeding biology and management of the Northern Eider (*Somateria mollissima borealis*) in the Cape Dorset area, Northwest Territories. Canadian Wildlife Service Wildlife Management Bulletin Series 2. No. 10, 68 pp.

_____. 1986. The numbers of nesting Northern Eiders on the West Foxe Islands, NWT, in 1956 and 1976, pp. 114-118 in A. Reed, ed. Eider ducks in Canada/Les eiders au Canada. Canadian Wildlife Service, Ottawa, Ontario. 177 pp.

Cotter, R.C., P. Dupuis and D. Henderson. 1996a. Mallard, pp. 278-281 in J. Gauthier and Y. Aubry, eds. The Breeding Birds of Québec: Atlas of the Breeding Birds of Southern Québec. Association québécoise des groupes d'ornithologues, Province of Quebec Society for the Protection of Birds, Canadian Wildlife Service, Environment Canada, Quebec Region, Montréal, Quebec, xviii + 1302 pp.

Cotter, R.C., P. Dupuis, J. Tardif and A. Reed. 1996b. Canada Goose, pp. 262-265 in J. Gauthier and Y. Aubry, eds. The Breeding Birds of Québec: Atlas of the Breeding Birds of Southern Québec. Association québécoise des groupes d'ornithologues, Province of Quebec Society for the Protection of Birds, Canadian Wildlife Service, Environment Canada, Quebec Region, Montréal, Quebec, xviii + 1302 pp.

Craik, S.R. and R.D. Titman. 2009. Nesting Ecology of Red-breasted Mergansers in a Common Tern Colony in Eastern New Brunswick. Waterbirds 32(2): 282-292.

Cramp, S. and K.E.L. Simmons (eds.). 1977. Handbook of the Birds of Europe, the Middle East, and North Africa: The Birds of the Western Palearctic (Volume 1: Ostrich to Ducks). Oxford University Press, Oxford. 722 pp.

Cree Regional Authority and Cree Trappers Association. 2008. Migratory Bird Data Collection and Information Sharing in Northern Cree Communities. Report of the Cree Regional Authority, Montréal (Quebec), Canada, 32 pp.

Curtis, S. and L. Allen. 1976. The Waterfowl ecology of the Quebec coast of James Bay. Internal report, Canadian Wildlife Service, Ottawa, Ontario,

Cyr, A. 1995a. Répartition saisonnière et spatio-temporelle de l'Érismature rousse (*Oxyura jamaicensis*) pour le Québec méridional de 1969 à 1989, pp. 170-171 in A. Cyr and J. Larivée, eds. Atlas saisonnier des oiseaux du Québec. Presses de l'Université de Sherbrooke and Société de Loisir Ornithologique de l'Estrie, Sherbrooke, Quebec, 711 pp.

_____. 1995b. Répartition saisonnière et spatio-temporelle de l'Oie de Ross (*Anser rossii*) pour le Québec méridional de 1969 à 1989, pp. 108-109 in A. Cyr and J. Larivée, eds. Atlas saisonnier des oiseaux du Québec. Presses de l'Université de Sherbrooke and Société de Loisir Ornithologique de l'Estrie, Sherbrooke, Quebec, 711 pp.

_____. 1995c. Répartition saisonnière et spatio-temporelle de l'Oie rieuse (*Anser albifrons*) pour le Québec méridional de 1969 à 1989, pp. 104-105 in A. Cyr and J. Larivée, eds. Atlas saisonnier des oiseaux du Québec. Presses de l'Université de Sherbrooke and Société de Loisir Ornithologique de l'Estrie, Sherbrooke, Quebec, 711 pp.

_____. 1995d. Répartition saisonnière et spatio-temporelle de la Bernache cravant (*Branta bernicla*) pour le Québec méridional de 1969 à 1989, pp. 110-111 in A. Cyr and J. Larivée, eds. Atlas saisonnier des oiseaux du Québec. Presses de l'Université de Sherbrooke and Société de Loisir Ornithologique de l'Estrie, Sherbrooke, Quebec, 711 pp.

_____. 1995e. Répartition saisonnière et spatio-temporelle de la Sarcelle à ailes bleues (*Anas discors*) pour le Québec méridional de 1969 à 1989, pp. 124-125 in A. Cyr and J. Larivée, eds. Atlas saisonnier des oiseaux du Québec. Presses de l'Université de Sherbrooke and Société de Loisir Ornithologique de l'Estrie, Sherbrooke, Quebec, 711 pp.

_____. 1995f. Répartition saisonnière et spatio-temporelle de la Sarcelle d'hiver (*Anas crecca carolinensis*) pour le Québec méridional de 1969 à 1989, pp. 116-117 in A. Cyr and J. Larivée, eds. Atlas saisonnier des oiseaux du Québec. Presses de l'Université de Sherbrooke and Société de Loisir Ornithologique de l'Estrie, Sherbrooke, Quebec, 711 pp.

_____. 1995g. Répartition saisonnière et spatio-temporelle du Canard branchu (*Aix sponsa*) pour le Québec méridional de 1969 à 1989, pp. 114-115 in A. Cyr and J. Larivée, eds. Atlas saisonnier

des oiseaux du Québec. Presses de l'Université de Sherbrooke and Société de Loisir Ornithologique de l'Estrie, Sherbrooke, Quebec, 711 pp.
_____. 1995h. Répartition saisonnière et spatio-temporelle du Canard chipeau (*Anas strepera*) pour le Québec méridional de 1969 à 1989, pp. 128-129 in A. Cyr and J. Larivée, eds. Atlas saisonnier des oiseaux du Québec. Presses de l'Université de Sherbrooke and Société de Loisir Ornithologique de l'Estrie, Sherbrooke, Quebec, 711 pp.
_____. 1995i. Répartition saisonnière et spatio-temporelle du Canard colvert (*Anas platyrhynchos*) pour le Québec méridional de 1969 à 1989, pp. 120-121 in A. Cyr and J. Larivée, eds. Atlas saisonnier des oiseaux du Québec. Presses de l'Université de Sherbrooke and Société de Loisir Ornithologique de l'Estrie, Sherbrooke, Quebec, 711 pp.
_____. 1995j. Répartition saisonnière et spatio-temporelle du Canard d'Amérique (*Anas americana*) pour le Québec méridional de 1969 à 1989, pp. 132-133 in A. Cyr and J. Larivée, eds. Atlas saisonnier des oiseaux du Québec. Presses de l'Université de Sherbrooke and Société de Loisir Ornithologique de l'Estrie, Sherbrooke, Quebec, 711 pp.
_____. 1995k. Répartition saisonnière et spatio-temporelle du Canard souchet (*Anas clypeata*) pour le Québec méridional de 1969 à 1989, pp. 126-127 in A. Cyr and J. Larivée, eds. Atlas saisonnier des oiseaux du Québec. Presses de l'Université de Sherbrooke and Société de Loisir Ornithologique de l'Estrie, Sherbrooke, Quebec, 711 pp.
_____. 1995l. Répartition saisonnière et spatio-temporelle du Fuligule à dos blanc (*Aythya valisineria*) pour le Québec méridional de 1969 à 1989, pp. 134-135 in A. Cyr and J. Larivée, eds. Atlas saisonnier des oiseaux du Québec. Presses de l'Université de Sherbrooke and Société de Loisir Ornithologique de l'Estrie, Sherbrooke, Quebec, 711 pp.
_____. 1995m. Répartition saisonnière et spatio-temporelle du Fuligule à tête rouge (*Aythya americana*) pour le Québec méridional de 1969 à 1989, pp. 136-137 in A. Cyr and J. Larivée, eds. Atlas saisonnier des oiseaux du Québec. Presses de l'Université de Sherbrooke and Société de Loisir Ornithologique de l'Estrie, Sherbrooke, Quebec, 711 pp.
_____. 1995n. Répartition saisonnière et spatio-temporelle du Fuligule milouinan (*Aythya marila*) pour le Québec méridional de 1969 à 1989, pp. 140-141 in A. Cyr and J. Larivée, eds. Atlas saisonnier des oiseaux du Québec. Presses de l'Université de Sherbrooke and Société de Loisir Ornithologique de l'Estrie, Sherbrooke, Quebec, 711 pp.
_____. 1995o. Répartition saisonnière et spatio-temporelle du Petit Fuligule (*Aythya affinis*) pour le Québec méridional de 1969 à 1989, pp. 142-143 in A. Cyr and J. Larivée, eds. Atlas saisonnier des oiseaux du Québec. Presses de l'Université de Sherbrooke and Société de Loisir Ornithologique de l'Estrie, Sherbrooke, Quebec, 711 pp.
Cyr, A. and J. Larivée. 1995. Atlas saisonnier des oiseaux du Québec. Presses de l'Université de Sherbrooke and Société de Loisir Ornithologique de l'Estrie, Sherbrooke, Quebec. 711 p.
Daigle, S. and M. Darveau. 1995. Indice de priorisation de nettoyage d'oiseaux aquatiques lors de déversements d'hydrocarbures dans le Saint-Laurent. Canadian Wildlife Service, Quebec Region. Technical Report Series No. 231, Sainte-Foy, Quebec, 33 pp.
Daury, R.W. and M.C. Bateman. 1996. The Barrow's Goldeneye (*Bucephala islandica*) in the Atlantic Provinces and Maine. Regional report, Canadian Wildlife Service, Atlantic Region, Sackville, New Brunswick, 47 pp.
David, N. 1996. Liste commentée des oiseaux du Québec. Association Québécoise des Groupes d'Ornithologues, Montréal, Quebec. 169 pp
David, N., Y. Aubry and P. Bannon. 1999. Quebec Regional report: Summer season. North American Birds 53(4): 361-362.
David, N., S. Denault and P. Bannon. 2000. Quebec Regional report: Spring season. North American Birds 54(3): 257-259.
David, N. and M. Gosselin. 1983. The autumn migration: August 1 - November 30 1982. Quebec region. American Birds 37(2): 158-160.
Décarie, R., F. Morneau, D. Lambert, S. Carrière and J.-P.L. Savard. 1995. Habitat use by brood-rearing waterfowl in subarctic Québec. Arctic 48: 383-390.
del Hoyo, J., A. Elliott et J. Sargatal (editors). 1992. Handbook of the Birds of the World. Volume 1. Lynx Edicions, Barcelona, Spain. 696 pp.
Delany, S. 2005. Mute Swan *Cygnus olor*, pp. 231-234 in J. Kear, ed. Ducks, geese and swans. Volume 1: General chapters, and Species accounts (*Anhima* to *Salvadorina*). Volume 2: Species accounts (*Cairina* to *Mergus*). Oxford University Press, New York, 908 pp.
Dement'ev, G.P. and N.A. Gladkov (editors). 1952. Birds of the Soviet Union. Volume IV. English translation from Russian, Israel Program for Scientific Translations, Jerusalem 1967. 683 pp.
Dennis, D.G., N.R. North and H.G. Lumsden. 2000. Range expansion and population growth of giant Canada Geese in Southern Ontario: benefits, drawbacks, and management techniques,

pp. 159-168 in K.M. Dickson, ed. Towards conservation of the diversity of Canada geese (*Branta canadensis*). Occasional Paper No. 103, Canadian Wildlife Service, Ottawa, Ontario. 168 pp.

DesGranges, J.-L. and M. Darveau. 1985. Effect of lake acidity and morphometry on the distribution of aquatic birds in southern Quebec. Holarctic Ecology 8(3): 181-190.

Dickson, D.L. 2005. Distribution and abundance of King Eiders, Long-tailed Ducks, and Canada Geese on western Victoria Island. Progress report submitted to the Sea Duck Joint Venture, Project No. 39 (available at: www.seaduckjv.org/ssna.html)), 6 pp.

Dickson, D.L., R.C. Cotter, J.E. Hines and M.F. Kay. 1997. Distribution and abundance of King Eiders in the western Canadian Arctic, pp. 29-39 in D.L. Dickson, ed. King and Common eiders of the western Canadian Arctic. Canadian Wildlife Service, Occasional Paper No. 94, Ottawa, Ontario. 73 pp.

Dickson, K.M. 2000. The diversity of Canada Geese, pp. 11-24 in K.M. Dickson, ed. Towards conservation of the diversity of Canada Geese (*Branta canadensis*). Occasional Paper No. 103, Canadian Wildlife Service, Ottawa, Ontario. 168 pp.

Diéval, H. 2006. Répartition de l'Eider à duvet pendant les périodes d'élevage des jeunes et de mue des adultes le long du fleuve Saint-Laurent. Biology master's thesis, Université du Québec à Montréal, Montréal, Quebec, Canada. 79 pp.

Dill, H.H. and F.B. Lee. 1970. Home grown honkers. Int. Wild. Waterfowl Ass., U.S. Fish and Wildlife Service. 154 pp.

Dionne, M. 2004. Relationship between diving ducks and mussel aquaculture in Prince Edward Island, Canada. M.Sc. Thesis, University of New Brunswick, Fredericton, New Brunswick, Canada. 154 pp.

Dionne, M., J.-S. Lauzon-Guay, D.J. Hamilton and M.A. Barbeau. 2006. Protective socking material for cultivated mussels: a potential non-disruptive deterrent to reduce losses to diving ducks. Aquaculture International 14(6): 595-613.

Drilling, N., R.D. Titman and F. McKinney. 2002. Mallard (*Anas platyrhynchos*), in A. Poole and F. Gill, eds. The Birds of North America, no. 658. The Birds of North America, Inc., Philadelphia, PA, 44 pp.

Driver, P.M. 1958. Biological studies in Ungava during 1958. Arctic 11(3): 191-193.

Drolet, C.A. 1989. Eider management workshop held in Québec City on January 12 and 13, 1988. Canadian Wildlife Service, Quebec Region. Technical Report Series No. 64, 68 pp.

Ducks Unlimited Canada. 2007. Plans régionaux de conservation. Site: www.ducks.ca/fr/province/qc/plansreg/index.html. Ducks Unlimited Canada. Consulted July 4, 2008.

Dryade. 1992. Projet de Laforge-1 : Caractérisation de la sauvagine et de son utilisation des milieux humides. Report submitted to direction Ingénierie et Environnement, Société d'Énergie de la Baie James, Québec, Quebec, 49 pp.

_____. 1994. Projet de Laforge-1 : Étude de la sauvagine et caractérisation de ses habitats - Été 1993. Report submitted to direction Ingénierie et Environnement, Société d'Énergie de la Baie James, Québec, Quebec, 115 pp.

_____. 1995. Projet de Laforge-1 : Étude de la sauvagine et caractérisation de ses habitats - Été 1994. Report submitted to direction Ingénierie et Environnement, a Société d'Énergie de la Baie James, Québec, Quebec, 127 pp.

_____. 1996. Projet de Laforge-1. Étude de la sauvagine et caractérisation de ses habitats - Été 1995. Report submitted to direction Ingénierie et Environnement, Société d'Énergie de la Baie James, Québec, Quebec, 139 pp.

DuBowy, P.J. 1996. Northern Shoveler (*Anas clypeata*), in A. Poole and F. Gill, eds. The Birds of North America, no. 217. The Birds of North America, Inc., Philadelphia, PA, 24 pp.

Dugger, B.D., K.M. Dugger and L.H. Fredrickson. 1994. Hooded Merganser (*Lophodytes cucullatus*), in A. Poole and F. Gill, eds. The Birds of North America, no. 98. The Birds of North America, Inc., Philadelphia, PA, 24 pp.

Dugger, K.M. and L.H. Fredrickson. 1992. Life history and habitat needs of the Wood Duck. Waterfowl management handbook. U.S. Fish and Wildlife Service. Fish and Wildlife Leaflet 13.1.6., Washington, D.C., 8 pp.

Dupuis, P., A. Bourget and H. Lévesque. 1996. Quebec migratory game bird harvest estimates, 1973–92, pp. 1236-1237 in J. Gauthier and Y. Aubry, eds. The Breeding Birds of Québec: Atlas of the Breeding Birds of Southern Québec. Association québécoise des groupes d'ornithologues, Province of Quebec Society for the Protection of Birds, Canadian Wildlife Service, Environment Canada, Quebec Region, Montréal, Québec, xviii + 1302 pp.

Durinck, J. and K. Falk. 1996. The distribution and abundance of seabirds off southwestern Greenland in autumn and winter 1988-1989. Polar Research 15(1): 23-42.

Eadie, J.M., M.L. Mallory and H.G. Lumsden. 1995. Common Goldeneye (*Bucephala clangula*), in A. Poole and F. Gill, eds. The Birds of North America, no. 170. The Birds of North America, Inc., Philadelphia, PA, 32 pp.

Eadie, J.M., J.-P.L. Savard and M.L. Mallory. 2000. Barrow's Goldeneye (*Bucephala islandica*), in A. Poole and F. Gill, eds. The Birds of North America, no. 548. The Birds of North America, Inc., Philadelphia, PA, 32 pp.

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, Map at 1:7,500,000 scale. Department of Supply and Services Canada 1996. Cat. No. A42-65/1996E. 0-662-24107-X, Ottawa/Hull, Canada, 125 pp.

Einarsson, A. 2005. Barrow's Goldeneye *Bucephala islandica*, pp. 735-739 in J. Kear, ed. Ducks, geese and swans. Volume 1: General chapters, and Species accounts (*Anhima* to *Salvadorina*). Volume 2: Species accounts (*Cairina* to *Mergus*). Oxford University Press, New York, NY. 908 pp.

Ely, C.R. and A.X. Dzubin. 1994. Greater White-fronted Goose (*Anser albifrons*), in A. Poole and F. Gill, eds. The Birds of North America, no. 131. The Birds of North America, Inc., Philadelphia, PA. 31 pp.

Environment Canada. 2009. Management Plan for the Barrow's Goldeneye (*Bucephala islandica*), Eastern Population, in Canada [Proposed]. *Species at Risk Act* Management Plan Series. Environment Canada, Ottawa. iv + 15 pp.

_____. 2010. Management Plan for the Barrow's Goldeneye (*Bucephala islandica*), Eastern Population, in Canada [Proposed]. *Species at Risk Act* Management Plan Series, Environment Canada, Ottawa, 25 pp.

Erskine, A.J. 1972. Populations, movements and seasonal distribution of mergansers in northern Cape Breton Island. Canadian Wildlife Service, Environment Canada. Canadian Wildlife Service Report Series No. 17, Ottawa, Ontario, 36 pp.

_____. 1992. Atlas of breeding birds of the Maritime Provinces. Nimbus Publishing Limited and Nova Scotia Museum, Halifax, Nova Scotia, 270 pp.

_____. 1997. Canada goose studies in the Maritime Provinces 1950-1992. Environment Canada - Atlantic Region, Occasional Report. No. 7. 179 pp.

_____. 2005. Bufflehead *Bucephala albeola*, pp. 726-730 in J. Kear, ed. Ducks, geese and swans. Volume 1: General chapters, and Species accounts (*Anhima* to *Salvadorina*). Volume 2: Species accounts (*Cairina* to *Mergus*). Oxford University Press, New York, NY. 908 pp.

Evans, M.R., D.B. Lank, W.S. Boyd and F. Cooke. 2002. A comparison of the characteristics and fate of Barrow's Goldeneye and Bufflehead nests in nest boxes and natural cavities. Condor 104: 610-619.

Evarts, S. 2005. Blue-winged Teal *Anas discor*, pp. 545-549 in J. Kear, ed. Ducks, geese and swans. Volume 1: General chapters, and Species accounts (*Anhima* to *Salvadorina*). Volume 2: Species accounts (*Cairina* to *Mergus*). Oxford University Press, New York, NY. 908 pp.

Fabijan, M., R. Brook, D. Kuptana and J.E. Hines. 1997. The subsistence harvest of King and Common eiders in the Inuvialuit Settlement region, 1988-1994, pp. 67-73 in D.L. Dickson, ed. King and Common eiders of the western Canadian Arctic. Canadian Wildlife Service, Occasional Paper No. 94, Ottawa, Ontario. 73 pp.

Falardeau, G., J.-F. Rail, S. Gilliland and J.-P.L. Savard. 2003. Breeding survey of Common Eiders along the west coast of Ungava Bay, in summer 2000, and a supplement on other nesting aquatic birds. Environment Canada, Canadian Wildlife Service, Quebec Region. Technical Report Series No. 405, Sainte-Foy, Quebec, 67 pp.

Falardeau, G. and J.-P.L. Savard. 2003. Migration printanière des macreuses sur la Côte-Nord et dans la baie des Chaleurs. Environment Canada, Canadian Wildlife Service, Quebec Region. Technical Report Series No. 406, Sainte-Foy, Quebec, 47 pp.

Falardeau, G., J.-P.L. Savard, J. Bédard, A. Nadeau and M.C.S. Kingsley. 2000. Tendances temporelles et répartitions des oiseaux aquatiques et des mammifères marins dans la passe de l'île aux Lièvres, à l'été 1997. Environment Canada, Canadian Wildlife Service, Quebec Region. Technical Report Series No. 351, Sainte-Foy, Quebec, 90 pp.

Filion, B. and J. Bédard. 1989. Aménagement de l'habitat de l'île Blanche pour contrer l'action sporadique d'épidémie de choléra aviaire, pp. 24-27 in C.A. Drolet, ed. Eider management workshop held in Québec City on January 12 and 13, 1988. Canadian Wildlife Service, Quebec Region. Technical Report Series No. 64, 68 pp.

Fortin, C., M. Laliberté and J. Ouzilleau. 2001. Guide d'aménagement et de gestion du territoire utilisé par le castor au Québec. Fondation de la faune du Québec, Sainte-Foy, Quebec. 112 pp.

Fournier, M.-H. and F. Montminy-Munyan. 2003. L'état de la mariculture au Québec. Bureau du coordonnateur à l'aquaculture, CSMOPM, RMQ, SODIM, Emploi Québec, 39 pp.

Fox, A.D., C. Glahder, C.R. Mitchell, D.A. Stroud, H. Boyd and J. Frikke. 1996. North American Canada geese (*Branta canadendis*) in west Greenland. Auk 113: 231-233.

Fox, T. 2005. Northern Pintail *Anas acuta*, pp. 595-599 in J. Kear, ed. Ducks, geese and swans. Volume 1: General chapters, and Species accounts (*Anhima* to *Salvadorina*). Volume 2: Species accounts (*Cairina* to *Mergus*). Oxford University Press, New York, NY. 908 pp.

Fox, T. and M. Owen. 2005. White-fronted Goose *Anser albifrons*, pp. 281-285 in J. Kear, ed. Ducks, geese and swans. Volume 1: General chapters, and Species accounts (*Anhima* to *Salvadorina*). Volume 2: Species accounts (*Cairina* to *Mergus*). Oxford University Press, New York, NY. 908 pp.

Fox, T. and S. Pihl. 2005. Common Scoter *Melanitta nigra*, pp. 719-723 in J. Kear, ed. Ducks, geese and swans. Volume 1: General chapters, and Species accounts (*Anhima* to *Salvadorina*). Volume 2: Species accounts (*Cairina* to *Mergus*). Oxford University Press, New York, NY. 908 pp.

Fradette, P. 1992. Les oiseaux des Îles-de-la-Madeleine : populations et sites d'observations. Attention Frag'Îles, Mouvement pour la valorisation du patrimoine naturel des îles, L'Étang-du-Nord, Québec. 292 pp.

Freeman, M.M.R. 1970. Observations on the seasonal behaviour of the Hudson Bay Eider (*Somateria mollissima sedentaria*). Canadian Field-Naturalist 71: 145-153.

Freemark, K.E. 1977. Nest site selection by the Hudson Bay Eider *Somateria mollissima sedentaria*. Honours Bachelor thesis, Department of Biology, Queen's University, Kingston, Ontario, Canada. 64 pp.

Galbraith, C. 1992. Mussel Farms: Their management alongside Eider Ducks. Nature Conservancy Council for Scotland. 27 pp.

Gaston, A.J. 2004. Report on surveys and research at Digges Island and vicinity, 27 July-9 August 2004. National Wildlife Research Centre, Carleton University, Ottawa, Ontario.

Gauthier, G. 1993. Bufflehead (*Bucephala albeola*), in A. Poole and F. Gill, eds. The Birds of North America, no. 67. The Birds of North America, Inc., Philadelphia, PA, 24 pp.

Gauthier, G., J.-F. Giroux, A. Reed, A. Béchet and L. Bélanger. 2005. Interactions between land use, habitat use and population increase in Greater snow geese: what are the consequences for natural wetlands? Global Change Biology 11: 856-868.

Gauthier, J. and Y. Aubry (editors). 1996. The Breeding Birds of Québec: Atlas of the Breeding Birds of Southern Québec. Association québécoise des groupes d'ornithologues, Province of Quebec Society for the Protection of Birds, Canadian Wildlife Service, Environment Canada, Quebec Region, Montréal, Quebec. xviii + 1302 pp.

Gauthier, J. and J. Bédard. 1976. Les déplacements de l'eider commun (*Somateria mollissima*) dans l'estuaire du Saint-Laurent. Naturaliste canadien 103: 261-283.

Gauthier, J., J. Bédard and A. Reed. 1976. Overland migration by Common Eiders of the St. Lawrence estuary. Wilson Bulletin 88(2): 333-344.

Gauthier, J., D. Lehoux and J. Rosa. 1980. Les marécages intertidaux dans l'estuaire du Saint-Laurent. Internal report, Canadian Wildlife Service, Quebec Region, Sainte-Foy, Quebec, 91 pp.

Gendron, M. 2007. American Wigeon, pp. 74-75 in M.D. Cadman, D.A. Sutherland, G.G. Beck, D. Lepage and A.R. Couturier, eds. Atlas of the Breeding Birds of Ontario, 2001-2005. Birds Studies Canada, Environment Canada, Ontario Field Ornithologists, Ontario Ministry of Natural Resources, and Ontario Nature, Toronto, Ontario, xxii + 706 pp.

Gendron, M.H. and B.T. Collins. 2007. National Harvest Survey website, Version 1.2. Site: www.cws-scf.ec.gc.ca/harvest/default_f.cfm. Migratory Bird Populations Division, National Wildlife Research Centre, Canadian Wildlife Service, Ottawa (Ontario). Consulted March 6, 2008.

Gilbert, G., R.G. Helie and J.M. Mondoux. 1985. Ecosystem sensitivity to acid precipitation for Québec. Part a: ecoregions and ecodistricts of Québec. Environment Canada. Ecological Land Classification Series No. 20. , 87 pp.

Gilchrist, G. and G.J. Robertson. 2000. Observations of marine birds and mammals wintering at polynyas and ice edges in the Belcher Islands, Nunavut, Canada. Arctic 53(1): 61-68.

Gilchrist, H.G., F.R. Merkel, S. Gilliland and J.-P.L. Savard. 1999. Identifying research priorities of King and common eider duck populations shared by Canada and Greenland (Results from a strategic planning meeting). Unpublished Report, Canadian Wildlife Service and Greenland Institute of Natural Resources, Available from the National Wildlife Research Centre, Carleton University, 1125 Colonel By Drive, Ottawa, Ontario, K1A 0H3, Canada, 20 pp.

Gilchrist, H.G., G.M. Robertson, A. Dallaire, T. Gaston and I. Butler. 2006. Avian Cholera confirmed among Northern Common Eider ducks nesting in northern Hudson Bay, Nunavut 2004-2005. Special Publication, Canadian Wildlife Service, Western and Northern region, Yellowknife, Northwest Territories, 4 pp.

Gilliland, S., H.G. Gilchrist, R.F. Rockwell, G.J. Robertson, J.-P.L. Savard, F. Merkel and A. Mosbech. 2007a. Evaluating the sustainability of fixed-number harvest of Northern Common Eiders in

Greenland and Canada. Unpublished manuscript, Canadian Wildlife Service, St. John's, Newfoundland.
Gilliland, S. and K. McAloney. 2009. Population delineation, migratory connectivity and habitat use of Atlantic Scoters: Black scoters (SDJV #117). Site: http://seaduckjv.org/studies/pro3/pr117.pdf. Sea Duck Joint Venture.
Gilliland, S., K. McAloney, R.D. Titman, E. Reed, J.-P.L. Savard, N. Burgess, S. Bin Muzaffar and M. O'Conner. 2007b. Demography and moult ecology of Surf Scoters in Eastern North America (SDJV#49). Site: http://seaduckjv.org/studies/pro3/pr49.pdf. Sea Duck Joint Venture.
Gilliland, S., G.J. Robertson, M. Robert, J.-P.L. Savard, D. Amirault, P. Laporte and P. Lamothe. 2002. Abundance and distribution of Harlequin Ducks molting in eastern Canada. Waterbirds 25: 333-339.
Gilliland, S.G., H.G. Gilchrist, D. Bordage, C. Lepage, F.R. Merkel, A. Mosbech, B. Letournel and J.-P.L. Savard. 2008. Winter distribution and abundance of Common Eiders in the Northwest Atlantic and Hudson Bay. Pages 95 in Proceedings of the Third North American Sea Duck Conference, November 10-14, 2008.
Gilliland, S.G., C. Lepage, J.-P.L. Savard, D. Bordage and G.J. Robertson. 2009. An assessment of distribution and abundance of Surf and Black scoters breeding within the eastern section of Labrador Low-level Flight Training Area 732. Final report submitted to the Institute for Environmental Monitoring and Research, Labrador, Newfoundland, 53 pp.
Giroux, J.-F. 2007. Nidification des canards aux îles de Varennes en 2007. Département des sciences biologiques, Groupe de recherche en écologie comportementale et animale, Université du Québec à Montréal, Montréal, Quebec, 11 pp.
Giroux, J.-F., G. Gauthier, G. Costanzo and A. Reed. 1998. Impact of geese on natural habitats, pp. 32-57 in B.D.J. Batt, ed. The Greater Snow Goose: report of the Arctic Goose Habitat Working Group. Arctic Goose Joint Venture Special Publication. U.S. Fish and Wildlife Service, Washington, D.C. and Canadian Wildlife Service, Ottawa (Ontario).
Giroux, J.-F., J. Lefebvre, L. Bélanger, J. Rodrigue and S. Lapointe. 2001. Establishment of a breeding population of Canada Geese in southern Quebec. Canadian Field-Naturalist 115(1): 75-81.
Giroux, J.-F. and J.-F. Rail. 1996. Gadwall, pp. 294-297 in J. Gauthier and Y. Aubry, eds. The Breeding Birds of Québec: Atlas of the Breeding Birds of Southern Québec. Association québécoise des groupes d'ornithologues, Province of Quebec Society for the Protection of Birds, Canadian Wildlife Service, Environment Canada, Quebec Region, Montréal, Quebec, xviii + 1302 pp.
Giroux, J.-F., F. St-Pierre, J. Lefebvre and S. Lapointe. 1995. Contrôle des prédateurs et nidification des canards à la Réserve nationale de faune des îles de Contrecœur en 1994. Département des sciences biologiques, Université du Québec à Montréal, Montréal, Quebec, 21 pp.
Godfrey, W.E. 1986. The birds of Canada. National Museum of Natural Sciences, Ottawa, Ontario. 595 pp.
Gosselin, M. 1982. Recensements de canards. Bulletin ornithologique 27(1): 33-34.
_____. 1995a. Répartition saisonnière et spatio-temporelle de la Macreuse à front blanc (*Melanitta perspicillata*) pour le Québec méridional de 1969 à 1989, pp. 154-155 in A. Cyr and J. Larivée, eds. Atlas saisonnier des oiseaux du Québec. Presses de l'Université de Sherbrooke and Société de Loisir Ornithologique de l'Estrie, Sherbrooke, Quebec, 711 pp.
_____. 1995b. Répartition saisonnière et spatio-temporelle de la Macreuse brune (*Melanitta fusca*) pour le Québec méridional de 1969 à 1989, pp. 156-157 in A. Cyr and J. Larivée, eds. Atlas saisonnier des oiseaux du Québec. Presses de l'Université de Sherbrooke and Société de Loisir Ornithologique de l'Estrie, Sherbrooke, Quebec, 711 pp.
_____. 1995c. Répartition saisonnière et spatio-temporelle de la Macreuse noire (*Melanitta nigra*) pour le Québec méridional de 1969 à 1989, pp. 152-153 in A. Cyr and J. Larivée, eds. Atlas saisonnier des oiseaux du Québec. Presses de l'Université de Sherbrooke and Société de Loisir Ornithologique de l'Estrie, Sherbrooke, Quebec, 711 pp.
_____. 1995d. Répartition saisonnière et spatio-temporelle du Grand Harle (*Mergus merganser*) pour le Québec méridional de 1969 à 1989, pp. 166-167 in A. Cyr and J. Larivée, eds. Atlas saisonnier des oiseaux du Québec. Presses de l'Université de Sherbrooke and Société de Loisir Ornithologique de l'Estrie, Sherbrooke, Quebec, 711 pp.
_____. 1995e. Répartition saisonnière et spatio-temporelle du Harelde kakawi (*Clangula hyemalis*) pour le Québec méridional de 1969 à 1989, pp. 150-151 in A. Cyr and J. Larivée, eds. Atlas saisonnier des oiseaux du Québec. Presses de l'Université de Sherbrooke and Société de Loisir Ornithologique de l'Estrie, Sherbrooke, Quebec, 711 pp.
_____. 1995f. Répartition saisonnière et spatio-temporelle du Harle couronné (*Lophodytes cucullatus*) pour le Québec méridional de 1969 à 1989, pp. 164-165 in A. Cyr and J. Larivée, eds. Atlas saisonnier des oiseaux du Québec. Presses de l'Université de Sherbrooke and Société de Loisir Ornithologique de l'Estrie, Sherbrooke, Quebec, 711 pp.

_____. 1995g. Répartition saisonnière et spatio-temporelle du Harle huppé (*Mergus serrator*) pour le Québec méridional de 1969 à 1989, pp. 168-169 in A. Cyr and J. Larivée, eds. Atlas saisonnier des oiseaux du Québec. Presses de l'Université de Sherbrooke and Société de Loisir Ornithologique de l'Estrie, Sherbrooke, Quebec, 711 pp.

_____. 1995h. Répartition saisonnière et spatio-temporelle du Petit Garrot (*Bucephala albeola*) pour le Québec méridional de 1969 à 1989, pp. 162-163 in A. Cyr and J. Larivée, eds. Atlas saisonnier des oiseaux du Québec. Presses de l'Université de Sherbrooke and Société de Loisir Ornithologique de l'Estrie, Sherbrooke, Quebec, 711 pp.

Gosselin, M., R. Yank and Y. Aubry. 1988. Quebec Regional report. American Birds 42(5): 1270-1272.

Goudie, R.I., S. Brault, B. Conant, A.V. Kondratyev, M.R. Petersen and K. Vermeer. 1994. The status of sea ducks in the north Pacific rim: toward their conservation and management, pp. 27-49 in Transactions of the 59th North American Wildlife and Natural Resources Conference.

Goudie, R.I., G.J. Robertson and A. Reed. 2000. Common Eider (*Somateria mollissima*), in A. Poole and F. Gill, eds. The Birds of North America, no. 546. The Birds of North America, Inc., Philadelphia, PA, 32 pp.

Guérette-Montminy, A., É. Berthiaume, M. Darveau, S. Cumming, D. Bordage, S. Lapointe and L.-V. Lemelin. 2009. Répartition de la sauvagine en période de nidification entre les 51º et 58º de latitude nord dans la province de Québec. Ducks Unlimited Canada. Technical report no. Q14, Québec, Quebec, 43 pp.

Guild, B.L. 1974. The breeding biology of the Hudson Bay Eider at La Perouse Bay, Manitoba. M.Sc. Thesis, Wright State University, Dayton, OH, USA.

Guillemette, M., J.H. Himmelman, C. Barette and A. Reed. 1993. Habitat selection by common eiders in winter and its interaction with flock size. Canadian Journal of Zoology 71: 1259-1266.

Guillemette, M., R.C. Ydenberg and J.H. Himmelman. 1992. The role of energy intake rate in prey and habitat selection of common eiders in winter: a risk-sensitive interpretation. Journal of Animal Ecology 61: 599-610.

Hamilton, D.J. 2000. Direct and indirect effects of predation by Common Eiders and abiotic disturbance in an intertidal community. Ecological Monograph 70: 21-41.

_____. 2001. Feeding behavior of Common Eider ducklings in relation to availability of rockweed habitat and duckling age. Waterbirds 24: 233-241.

Hansen, K. 2002. A farewell to Greenland's wildlife. Gads Forlag and Narayana Press, Gylling, Copenhagen, Denmark. 154 pp.

Harvey, W.F. and J. Rodrigue. 2002. A breeding pair survey of Canada Geese in Northern Québec - 2002. Unpublished report by the Maryland Department of Natural Resources and Canadian Wildlife Service, Quebec Region.

_____. 2005. A breeding pair survey of Canada Geese in northern Quebec - 2005. Maryland Department of Natural Resources and Canadian Wildlife Service, Quebec Region.

_____. 2009. A breeding pair survey of Canada Geese in Northern Québec - 2009. Unpublished report by the Maryland Department of Natural Resources and Canadian Wildlife Service, Quebec Region, 12 pp.

Hepp, G.R. and F.C. Bellrose. 1995. Wood Duck (*Aix sponsa*), in A. Poole and F. Gill, eds. The Birds of North America, no. 169. The Birds of North America, Inc., Philadelphia, PA, 24 pp.

Hestbeck, J.B. and M.C. Bateman. 2000. Breeding, migration, and wintering affinities of Canada Geese marked in the Atlantic provinces, pp. 73-84 in K.M. Dickson, ed. Towards conservation of the diversity of Canada Geese (*Branta canadensis*). Occasional Paper No. 103, Canadian Wildlife Service, Ottawa, Ontario. 168 pp.

Heusmann, H.W., T.J. Early and B.J. Nikula. 2000. Evidence of an Increasing Hooded Merganser Population in Massachusetts. Wilson Bulletin 112(3): 413-415.

Hicklin, P. and K. Bunker-Popma. 2001. The spring and fall migrations of scoters, *Melanitta* spp., at Confederation Bridge in the Northumberland Strait between New Brunswick and Prince Edward Island. Canadian Field-Naturalist 115(3): 436-445.

Hicklin, P.W. 1989. Eiders and gull predation in New Brunswick, pp. 21-22 in C.A. Drolet, ed. Eider management workshop held in Québec City on January 12 and 13, 1988. Canadian Wildlife Service, Quebec Region. Technical Report Series No. 64, 68 pp.

Hicklin, P.W. and W.R. Barrow. 2004. The incidence of embedded shot in waterfowl in Atlantic Canada and Hudson Strait. Waterbirds 27(1): 41-45.

Hindman, L.J., K.M. Dickson, W.F. Harvey and J.R. Serie. 2004. Atlantic Flyway Canada Geese: new perspectives in goose management, pp. 12-21 in T.J. Moser, R.D. Lien, K.C. VerCauteren, K.F. Abraham, D.E. Andersen, J.G. Bruggink, J.M. Coluccy, D.A. Graber, J.O. Leafloor, D.R. Luukkonen and R.E. Trost, eds. Proceedings of the International Canada Goose Symposium. Madison, Wisconsin.

Hines, J.E. 2006. Concluding discussion: status of geese and swans in the Inuvialuit Settlement Region, pp. 67-73 in J.E. Hines and M.O. Wiebe Robertson, eds. Surveys of geese and swans in the Inuvialuit Settlement Region, western Canadian Arctic, 1989-2001. Occasional Paper No. 112. Canadian Wildlife Service, Ottawa, Ontario.

Hines, J.E., M.O. Wiebe Robertson, M.F. Kay and S.E. Westover. 2006. Aerial surveys of Greater White-fronted Geese, Canada Geese and Tundra Swans of the mainland of the Inuvialuit Settlement Region, western Canadian Arctic, 1989-1993, pp. 27-43 in J.E. Hines and M.O. Wiebe Robertson, eds. Surveys of geese and swans in the Inuvialuit Settlement Region, western Canadian Arctic, 1989-2001. Occasional Paper No. 112. Canadian Wildlife Service, Ottawa, Ontario.

Hohman, W.L. 2005a. Canvasback *Aythya valisineria*, pp. 639-643 in J. Kear, ed. Ducks, geese and swans. Volume 1: General chapters, and Species accounts (*Anhima* to *Salvadorina*). Volume 2: Species accounts (*Cairina* to *Mergus*). Oxford University Press, New York, NY. 908 pp.

_____. 2005b. Ring-necked Duck *Aythya collaris*, pp. 667-671 in J. Kear, ed. Ducks, geese and swans. Volume 1: General chapters, and Species accounts (*Anhima* to *Salvadorina*). Volume 2: Species accounts (*Cairina* to *Mergus*). Oxford University Press, New York, NY. 908 pp.

Hohman, W.L. and R.T. Eberhardt. 1998. Ring-necked Duck (*Aythya collaris*), in A. Poole and F. Gill, eds. The Birds of North America, no. 329. The Birds of North America, Inc., Philadelphia, PA, 32 pp.

Hughes, B. 2005. Ruddy Duck *Oxyura jamaicensis*, pp. 351-355 in J. Kear, ed. Ducks, geese and swans. Volume 1: General chapters, and Species accounts (*Anhima* to *Salvadorina*). Volume 2: Species accounts (*Cairina* to *Mergus*). Oxford University Press, New York, NY. 908 pp.

Huot, J. 1999. Île Bicquette : problématique de la regénération du couvert forestier. Report prepared for Ducks Unlimited Canada, Québec, Quebec, 4 pp.

Huot, J. and J.-F. Giroux. 1985. Aménagement de l'Île Blanche. Phase I : dégagement de l'île, Phase II : Revégétation de l'île et distribution des nichoirs d'eiders. Report prepared for Ducks Unlimited Canada in three separate reports, Québec, Quebec, 4 pp.

Institut de la statistique du Québec. 2009. Québec Handy Numbers, 2009 Edition. Site: www.stat.gouv.qc.ca. Document compiled and published by the Institut de la statistique du Québec (ISQ). Consulted December 17, 2009.

Jauvin, D. 1996. Ruddy Duck, pp. 352-355 in J. Gauthier and Y. Aubry, eds. The Breeding Birds of Québec: Atlas of the Breeding Birds of Southern Québec. Association québécoise des groupes d'ornithologues, Province of Quebec Society for the Protection of Birds, Canadian Wildlife Service, Environment Canada, Quebec Region, Montréal, Quebec, xviii + 1302 pp.

Jobin, B., J. Beaulieu, M. Grenier, L. Bélanger, C. Maisonneuve, D. Bordage and B. Fillion. 2003. Landscape changes and ecological studies in agricultural regions, Québec, Canada. Landscape Ecology 18(6): 575-590.

_____. 2004. Les paysages agricoles du Québec méridional. Le Naturaliste Canadien 128(2): 92-98.

Joint Working Group on the Management of the Common Eider. 2004. Québec Management Plan for the Common Eider *Somateria mollissima dresseri*. A special publication of the Joint Working Group on the Management of the Common Eider, Québec, 44 pp.

Johnson, K. 1995. Green-winged Teal (*Anas crecca*), in A. Poole and F. Gill, eds. The Birds of North America, no. 193. The Birds of North America, Inc., Philadelphia, PA, 20 pp.

Johnston, V.H., C.L. Gratto-Trevor and S.T. Pepper. 2000. Assessment of bird populations in the Rasmussen Lowlands, Nunavut. Canadian Wildlife Service, Environment Canada, Ottawa, Ontario, 56 pp.

Kaczynski, C.F. and E.B. Chamberlain. 1968. Aerial surveys of Canada geese and black ducks in eastern Canada. United States Department of the Interior, Migratory Bird Populations Station, Division of Wildlife Research. Special Scientific Report—Wildlife No. 118, Washington, D.C., 29 pp.

Kaiser, M.J., M. Galanidi, D.A. Showler, A.J. Elliott, R.W.G. Caldow, E.I.S. Rees, R.A. Stillman and W.J. Sutherland. 2006. Distribution and behaviour of Common Scoter *Melanitta nigra* relative to prey resources and environmental parameters Ibis 148: 110-128.

Kear, J. 2005a. American Wood Duck *Aix sponsa*, p. 461-465 in J. Kear, ed. Ducks, geese and swans. Volume 1: General chapters, and Species accounts (*Anhima to Salvadorina*). Volume 2: Species accounts (*Cairina to Mergus*). Illustrated by Mark Hulme. Oxford University Press, New York, NY. 908 pp.

_____ (editor). 2005b. Ducks, geese and swans. Volume 1: General chapters, and Species accounts (*Anhima to Salvadorina*). Volume 2: Species accounts (*Cairina to Mergus*). Illustrated by Mark Hulme. Oxford University Press, New York, NY. 908 pp.

Kessel, B., D.A. Rocque and J.S. Barclay. 2002. Greater Scaup (*Aythya marila*), in A. Poole and F. Gill, eds. The Birds of North America, no. 650. The Birds of North America, Inc., Philadelphia, PA, 32 pp.

Kolenosky, G.B. and S.M. Strathearn. 1987. Black Bear, p. 444-454 in M. Novak, J.A. Baker, M.E. Obbard and B. Malloch, eds. Wild Furbearer Management and Conservation in North America. Ministry of Natural Resources, Ontario. 1150 pp.

Korschgen, C.E., H.C. Gibbs and H.L. Mendall. 1978. Avian cholera in eider ducks in Maine. Journal of Wildlife Diseases 14(2): 254-258.

Krohn, W.B., P.O. Corr and A.E. Hutchinson. 1992. Status of the American Eider with special reference to Northern New England. United States Department of the Interior Fish and Wildlife Service, Washington, D.C., 12 pp.

Kuujjuaq Research Center. 1986. MITIQ: The ecology, use and management of the Common Eider in Northern Quebec. Kuujjuaq Research Center special publication, Kuujjuaq, Quebec, 60 pp.

Lacroix, D.L. 2001. Foraging impacts and patterns of wintering Surf Scoters feeding on Bay mussels in coastal Strait of Georgia, British Columbia. M.Sc. Thesis, Department of Biological Sciences, Simon Fraser University, Burnaby, British Columbia, Canada. 124 pp.

Lafond, R. and C. Pilon. 2004. Abondance du castor (*Castor canadensis*) au Québec. Bilan d'un programme d'inventaire aérien. Naturaliste canadien 128(1): 43-51.

Lalumière, R. and C. Lemieux. 2002. Suivi environnemental des projets La Grande-2-A et La Grande-1. La zostère marine de la côte nord-est de la baie James. Rapport synthèse pour la période 1999-2000. Report prepared for Hydro-Québec by Genivar inc., Québec City, Quebec.

Lamothe, P. 1996. Oldsquaw, pp. 1112-1114 in J. Gauthier and Y. Aubry, eds. The Breeding Birds of Québec: Atlas of the Breeding Birds of Southern Québec. Association québécoise des groupes d'ornithologues, Province of Quebec Society for the Protection of Birds, Canadian Wildlife Service, Environment Canada, Quebec Region, Montréal, Quebec, xviii + 1302 pp.

Lamothe, P. and L. Choinière. 1996. King Eider, pp. 1108-1110 in J. Gauthier and Y. Aubry, eds. The Breeding Birds of Québec: Atlas of the Breeding Birds of Southern Québec. Association québécoise des groupes d'ornithologues, Province of Quebec Society for the Protection of Birds, Canadian Wildlife Service, Environment Canada, Quebec Region, Montréal, Quebec, xviii + 1302 pp.

Langlois, A. 2005. Écologie de la mue et de la migration automnale chez l'Arlequin plongeur (*Histrionicus histrionicus*). Thèse de maîtrise, Faculté des sciences, Université Laval, Québec City, Quebec, Canada.

Larivée, J. 1993. Chronobiologie des oiseaux du Bas-Saint-Laurent. Migration et reproduction. Club des ornithologues du Bas-Saint-Laurent, Pointe-au-Père, Quebec.

_____. 2007. Étude des populations d'oiseaux du Québec (ÉPOQ). Site: www.quebecoiseaux.org/index.php?option=com_content&view=article&id=196:etude-des-populations-doiseaux-du-quebec-epoq&Itemid=103. Ornithological database, Regroupement QuébecOiseaux (RQO).

Leckie, S. 2007. Ring-necked Duck, pp. 92-93 in M.D. Cadman, D.A. Sutherland, G.G. Beck, D. Lepage and A.R. Couturier, eds. Atlas of the Breeding Birds of Ontario, 2001-2005. Birds Studies Canada, Environment Canada, Ontario Field Ornithologists, Ontario Ministry of Natural Resources, and Ontario Nature, Toronto, Ontario, xxii + 706 pp.

Lehoux, D., L. Bélanger, L.-G. de Repentigny and J.-C. Bourgeois. 1996. Waterfowl and Shorebirds of the St. Lawrence, pp. 1207-1213 in J. Gauthier and Y. Aubry, eds. The Breeding Birds of Québec: Atlas of the Breeding Birds of Southern Québec. Association québécoise des groupes d'ornithologues, Province of Quebec Society for the Protection of Birds, Canadian Wildlife Service, Environment Canada, Quebec Region, Montréal, Quebec, xviii + 1302 pp.

Lehoux, D. and D. Bordage. 1999. Bilan des activités réalisées sur la faune ailée suite au déversement d'hydrocarbures survenu à Havre-Saint-Pierre en mars 1999. Internal report, Canadian Wildlife Service, Quebec Region, Sainte-Foy, Quebec, 14 pp.

Lehoux, D., A. Bourget, P. Dupuis and J. Rosa. 1985. La sauvagine dans le système du Saint-Laurent (fleuve, estuaire, golfe). Environment Canada, Canadian Wildlife Service, Quebec Region, Sainte-Foy, Quebec. Vol. 1, 76 pp.; Vol. 2 (appendix), 72 pp.

Lehoux, D., D. Dauphin, O. Champoux, J. Morin and G. Létourneau. 2003. Impact des fluctuations des niveaux d'eau sur les canards barboteurs en reproduction dans le tronçon lac Saint-Louis/lac Saint-Pierre (utilisation des données d'habitats). Final internal report, Environment Canada, Quebec Region, Canadian Wildlife Service, Meteorological Service of Canada and St. Lawrence Centre, Sainte-Foy, Quebec, 65 p.

Lemelin, L.-V., D. Bordage, M. Darveau and C. Lepage. 2004. Répartition de la sauvagine et d'autres oiseaux utilisant les milieux aquatiques en période de nidification dans le Québec forestier. Canadian Wildlife Service, Quebec Region, Environment Canada. Technical Report Series No. 422, Sainte-Foy, Quebec, 70 pp.

Lepage, C., D. Bordage, D. Dauphin, B. Audet and F. Bolduc. In prep. Quebec Waterfowl Conservation Plan, 2010. Environment Canada, Canadian Wildlife Service, Quebec Region, Québec, Quebec, XXX p.

Lepage, C. and J.-P.L. Savard. 2007. Molt ecology of White-winged Scoters (*Melanitta fusca*) in the St. Lawrence estuary (SDJV Project # 87). Site: http://seaduckjv.org/studies/pro3/pr87.pdf. Sea Duck Joint Venture.

Lepage, D. 2008. Les oiseaux du Québec : Liste des oiseaux observés au Québec. Site: www.oiseauxqc.org/listeannotee.jsp. Consulted March 6, 2008.

Lepage, M. and M.-R. Doyon. 1996. Ring-necked Duck, pp. 304-307 in J. Gauthier and Y. Aubry, eds. The Breeding Birds of Québec: Atlas of the Breeding Birds of Southern Québec. Association québécoise des groupes d'ornithologues, Province of Quebec Society for the Protection of Birds, Canadian Wildlife Service, Environment Canada, Quebec Region, Montréal, Quebec, xviii + 1302 pp.

LeSchack, C.R., S.K. McKnight and G.R. Hepp. 1997. Gadwall (*Anas strepera*), in A. Poole and F. Gill, eds. The Birds of North America, no. 283. The Birds of North America, Inc., Philadelphia, PA, 28 pp.

Lewis, H.F. 1937. Migrations of the American Brant (*Branta bernicla hrota*). Auk 54: 73-95.

Lewis, T. 2005. Foraging behaviors and prey depletion by wintering scoters in Baynes Sound, British Columbia: inferring food availability and habitat quality. M.Sc. Thesis, Department of Biological Sciences, Simon Fraser University, Burnaby, British Columbia, Canada. 114 pp.

Limpert, R.J. and S.L. Earnst. 1994. Tundra Swan (*Cygnus comlumbianus*), in A. Poole and F. Gill, eds. The Birds of North America, no. 89. The Birds of North America, Inc., Philadelphia, PA, 20 pp.

Livezey, B.C. 1986. A phylogenetic analysis of recent Anseriform genera using morphological characters. Auk 103(4): 737-754.

Long Point Waterfowl and Wetlands Research Fund. 2007a. Lower Great Lakes January Survey, pp. 5-6 in Annual Newsletter. Fall 2007. Number 2. 24 pp.

_____. 2007b. Satellite Tracking Lesser Scaup and Greater Scaup from the Lower Great Lakes, pp. 8-10 in Annual Newsletter. Fall 2007. Number 2. 24 pp.

Longcore, J.R., D.G. McAuley, G.R. Hepp and J.M. Rhymer. 2000. American Black Duck (*Anas rubripes*), in A. Poole and F. Gill, eds. The Birds of North America, no. 481. The Birds of North America, Inc., Philadelphia, PA, 36 pp.

Lumsden, H.G. 1984. The pre-settlement breeding distribution of Trumpeter, *Cygnus buccinator*, and Tundra swan *C. columbianus*, in Eastern Canada. Canadian Field-Naturalist 98(4): 415-424.

Lyngs, P. 2003. Migration and winter ranges of birds in Greenland, an analysis of ringing recoveries. Dansk Ornithologisk Forenings Tidsskrift 97. Argang 2003 Nr 1, 167 pp.

Madge, S. and H. Burn. 1988. Waterfowl: An identification guide to the ducks, geese and swans of the world. Houghton Mifflin Company, Boston, MA. 298 pp.

Maisonneuve, C. 2004. Gros chicots et canards arboricoles : importance pour la nidification. Naturaliste canadien 128(2): 51-57.

Maisonneuve, C., L. Bélanger, D. Bordage, B. Jobin, M. Grenier, J. Beaulieu, S. Gabor and B. Fillion. 2006. American Black Duck and Mallard breeding distribution and habitat relationships along a forest-agriculture gradient in southern Québec. Journal of Wildlife Management 70(2): 450-459.

Maisonneuve, C., R. Mc Nicoll, A. Desrosiers and G. Lupien. 2002. Caractérisation de l'habitat de reproduction des canards aboricoles. Société de la faune et des parcs du Québec, Direction de la recherche sur la faune et Direction de l'aménagement de la faune du Saguenay-Lac-Saint-Jean, Québec, 52 pp.

Malecki, R., B. Batt and S. Shaffer. 2001a. Temporal and geographic distribution of North Atlantic Population (NAP) Canada Geese.

Malecki, R., S. Sheaffer, D. Howell and T. Strange. 2006. Northern Pintails in Eastern North America: Their seasonal distribution, movement patterns, and habitat affiliations. Atlantic Flyway Council and Technical Section, Final Report, 67 pp.

Malecki, R.A., B. Batt and S. Shaffer. 2001b. Spatial and temporal distribution of Atlantic Population Canada Geese. Journal of Wildlife Management 65(2): 242-247.

Malecki, R.A. and R.E. Trost. 1990. A breeding ground survey of Atlantic Flyway Canada Geese, *Branta canadensis*, in northern Quebec. Canadian Field-Naturalist 104: 575-578.

Mallory, M. 2007. Bufflehead, pp. 108-109 in M.D. Cadman, D.A. Sutherland, G.G. Beck, D. Lepage and A.R. Couturier, eds. Atlas of the Breeding Birds of Ontario, 2001-2005. Birds Studies Canada, Environment Canada, Ontario Field Ornithologists, Ontario Ministry of Natural Resources, and Ontario Nature, Toronto, Ontario, xxii + 706 pp.

Mallory, M.L., H.G. Lumsden and R.A. Walton. 1993. Nesting habits of Hooded Mergansers *Mergus cucullatus* in northeastern Ontario. Wildfowl 44: 101-107.

Mallory, M.L. and K. Metz. 1999. Common Merganser (*Mergus merganser*), in A. Poole and F. Gill, eds. The Birds of North America, no. 441. The Birds of North America, Inc., Philadelphia, PA, 28 pp.

Mallory, M.L., A. Taverner, B. Bower and D. Crook. 2002. Wood duck and hooded merganser breeding success in nest boxes in Ontario. Wildlife Society Bulletin 30(2): 310-316.

Manning, T.H. 1976. Birds and mammals of the Belcher, Sleeper, Ottawa, and King George Islands, N.W.T. Canadian Wildlife Service. Occasional Paper No. 28, 40 pp.

Maryland Department of Natural Resources. 2003. Mute Swans in Maryland: a Statewide management plan. Wildlife and Heritage Service, 39 pp.

McAloney, K., J.-P.L. Savard and S. Gilliland. 2005. Monitoring Atlantic Flyway Black scoters (SDJV#55). Site: http://seaduckjv.org/studies/pro3/pr55.pdf. Sea Duck Joint Venture.

McDonald, M. and B. Flemming. 1990. Development of a community-based eider down industry in Sanikiluaq: Resource management and business strategies. A report prepared for the Canada-Northwest Territories economic development agreement, Project Number 561 510, Municipality of Sanikiluaq, Sanikiluaq, Northwest Territories, 60 pp.

McGill, M. 2005. Ross's Goose *Anser rossii*, pp. 303-305 in J. Kear, ed. Ducks, geese and swans. Volume 1: General chapters, and Species accounts (*Anhima* to *Salvadorina*). Volume 2: Species accounts (*Cairina* to *Mergus*). Oxford University Press, New York, NY. 908 pp.

McNicoll, R. and J. Tardif. 1996. Northern Pintail, pp. 282-285 in J. Gauthier and Y. Aubry, eds. The Breeding Birds of Québec: Atlas of the Breeding Birds of Southern Québec. Association québécoise des groupes d'ornithologues, Province of Quebec Society for the Protection of Birds, Canadian Wildlife Service, Environment Canada, Quebec Region, Montréal, Québec, xviii + 1302 pp.

Mehl, K.R., R.T. Alisauskas, K.A. Hobson and D.K. Kellett. 2004. To winter east or west? Heterogeneity in winter philopatry in a central-arctic population of King Eiders. Condor 106: 241-251.

Mendall, H.L. 1980. Intergradation of eastern American common Eiders. Canadian Field-Naturalist 94: 286-292.

Merkel, F.R. 2003. Common Eider, pp. 102-103 in D.B. Jensen and K.D. Christensen, eds. The biodiversity of Greenland-a country study. Technical report No. 55. Pinngortitaleriffik, Gronlands Naturinstitut.

_____. 2004a. Evidence of population decline in common eiders breeding in western Greenland. Arctic 57: 27-36.

_____. 2004b. Impact of hunting and gillnet fishery on wintering eiders in Nuuk, southwest Greenland. Waterbirds 27: 469-479.

Merkel, F.R., A. Mosbech, D. Boertmann and L. Grondahl. 2002. Winter seabird distribution and abundance off south-western Greenland, 1999. Polar Research 21(1): 17-36.

Michot, T.C. and M.C. Woodin. 2005. Redhead *Aythya americana*, pp. 644-651 in J. Kear, ed. Ducks, geese and swans. Volume 1: General chapters, and Species accounts (*Anhima* to *Salvadorina*). Volume 2: Species accounts (*Cairina* to *Mergus*). Oxford University Press, New York, NY. 908 pp.

Milne, H. and C. Galbraith. 1986. Predation by Eider Ducks on cultivated mussels. University of Aberdeen, Aberdeen, UK, 166 pp.

Milne, H. and A. Reed. 1974. Annual production of fledged young from the eider colonies of the St. Lawrence estuary. Canadian Field-Naturalist 88: 163-169.

Ministère de l'Agriculture des Pêcheries et de l'Alimentation du Québec. 2006. Statistiques: Pêches et aquaculture commerciales: Mariculture. Site: www.mapaq.gouv.qc.ca/Fr/Peche/md/statistiques/pecheaquaculture/mariculture/. Website of the Ministère de l'Agriculture, des Pêcheries et de l'Alimentation - Direction générale des pêches et de l'aquaculture commerciales. Consulted June 12, 2006.

Mitchell, C. 2005. Northern Shoveler *Anas clypeata*, pp. 560-564 in J. Kear, ed. Ducks, geese and swans. Volume 1: General chapters, and Species accounts (*Anhima* to *Salvadorina*). Volume 2: Species accounts (*Cairina* to *Mergus*). Oxford University Press, New York, NY. 908 pp.

Moisan, G. 1996. Green-winged Teal, pp. 270-273 in J. Gauthier and Y. Aubry, eds. The Breeding Birds of Québec: Atlas of the Breeding Birds of Southern Québec. Association québécoise des groupes d'ornithologues, Province of Quebec Society for the Protection of Birds, Canadian Wildlife Service, Environment Canada, Quebec Region, Montréal, Quebec, xviii + 1302 pp.

Morneau, F. 1998. Utilisation des réservoirs par la sauvagine pour la reproduction. Research report submitted to Hydro-Québec, Hydraulique et Environnement, Groupe Production, Montréal, Quebec, 27 pp.

_____. 1999a. Suivi environnemental du Complexe La Grande. Utilisation des aménagements correcteurs par les Anatidés et d'autres espèces aviaires sur la rivière Vincelotte et dans le secteur W-1 du réservoir Laforge 1 en 1999. Report submitted to Hydro-Québec, Hydraulique et Environnement, Groupe Production, Montréal, Quebec, 31 pp.

_____. 1999b. Utilisation des réservoirs par la sauvagine. Réservoir Caniapiscau. Report submitted to Hydro-Québec, Hydraulique et Environnement, Groupe Production, Montréal, Quebec, 51 pp.

_____. 2003. Aménagement hydroélectrique de la Sainte-Marguerite-3. Suivi de l'avifaune 1994-2002 - phase construction. Faune aviaire; summary report submitted to Hydro-Québec. Montréal, Quebec, 91 pp.

Morneau, F., M. Robert, J.-P.L. Savard, P. Lamothe, M. Laperle, N. D'Astous, S. Brodeur and R. Décarie. 2008. Abundance and distribution of Harlequin Ducks in the Hudson Bay and James Bay area, Québec. Waterbirds 31 (Special Publication 2): 110-121.

Morrier, A. 1996. Black Scoter, pp. 1115-1117 in J. Gauthier and Y. Aubry, eds. The Breeding Birds of Québec: Atlas of the Breeding Birds of Southern Québec. Association québécoise des groupes d'ornithologues, Province of Quebec Society for the Protection of Birds, Canadian Wildlife Service, Environment Canada, Quebec Region, Montréal, Quebec, xviii + 1302 pp.

Morrier, A., L. Lesage, A. Reed and J.-P.L. Savard. 2008. Étude sur l'écologie de la Macreuse à front blanc au lac Malbaie, réserve des Laurentides, 1994-1995. Environment Canada, Canadian Wildlife Service, Quebec Region, Sainte-Foy, Québec, 120 pp.

Mosbech, A. and D. Boertmann. 1999. Distribution, abundance and reaction to aerial surveys of post-breeding King Eiders (*Somateria spectabilis*) in western Greenland. Arctic 52(2): 188-203.

Mosbech, A., R.S. Dano, F. Merkel, C. Sonne, G. Gilchrist and A. Flagstad. 2006a. Use of satellite telemetry to locate key habitats for King Eiders *Somateria spectabilis* in West Greenland, pp. 769-776 in G.C. Boere, C.A. Galbraith and D.A. Stroud, eds. Waterbirds around the world. The Stationery Office, Edinburgh, UK, 940 pp.

Mosbech, A., G. Gilchrist, F. Merkel, C. Sonne, A. Flagstad and H. Nyegaard. 2006b. Year-round movements of Northern Common Eiders *Somateria mollissima borealis* breeding in Arctic Canada and West Greenland followed by satellite telemetry. Ardea 94(3): 651-665.

Mosbech, A. and S.R. Johnson. 1999. Late winter distribution and abundance of sea-associated birds in south-western Greenland, the Davis Strait and southern Baffin Bay. Polar Research 18(1): 1-17.

Mowbray, T.B. 1999. American Wigeon (*Anas americana*), in A. Poole and F. Gill, eds. The Birds of North America, no. 401. The Birds of North America, Inc., Philadelphia, PA, 32 pp.

_____. 2002. Canvasback (*Aythya valisineria*), in A. Poole and F. Gill, eds. The Birds of North America, no. 659. The Birds of North America, Inc., Philadelphia, PA, 40 pp.

Mowbray, T.B., F. Cooke and B. Ganter. 2000. Snow Goose (*Chen caerulescens*), in A. Poole and F. Gill, eds. The Birds of North America, no. 514. The Birds of North America, Inc., Philadelphia, PA, 40 pp.

Mowbray, T.B., C.R. Ely, J.S. Sedinger and R.E. Trost. 2002. Canada Goose (*Branta canadensis*), in A. Poole and F. Gill, eds. The Birds of North America, no. 682. The Birds of North America, Inc., Philadelphia, PA, 44 pp.

Munro, J. and J. Bédard. 1977a. Crèche formation in the Common Eider. Auk 94: 759-771.

_____. 1977b. Gull predation and crèching behaviour in the Common Eider. Journal of Animal Ecology 46: 799-810.

Nadeau, A. and J. Bédard. 2001. Aménagement de l'archipel de Ragueneau pour les oiseaux aquatiques. Report prepared for Ducks Unlimited Canada, 53 pp.

Nakashima, D.J. 1986. Inuit knowledge of the ecology of the Common Eider in northern Quebec, pp. 102-113 in A. Reed, ed. Eider ducks in Canada/Les eiders au Canada. Canadian Wildlife Service, Ottawa, Ontario. 177 pp.

_____. 1991. The ecological knowledge of Belcher Island Inuit: a traditional basis for contemporary wildlife comanagement. Ph.D. Dissertation, McGill University, Montréal, Québec, Canada.

Nakashima, D.J. and R. Dumas. 1984. Breeding biology and economic potential of an inland-nesting population of the Common Eider *Somateria mollissima borealis*, in Northern Québec. Research Department, Makivik Corporation, Kuujjuaq, Québec, 49 pp.

Nakashima, D.J. and D.J. Murray. 1988. The Common Eider (*Somateria mollissima sedentaria*) of eastern Hudson Bay: a survey of nest colonies and Inuit ecological knowledge. Environmental Studies Revolving Funds Report. no. 102, Ottawa, xxiv + 174 pp.

New Brunswick Wildlife Federation. 2004. New Brunswick Wildlife Federation 2004 resolutions. Fisheries: Merganser and Cormorant Cull. Site: http://nbwildlifefederation.org/resolutions2004.html. Consulted March 6, 2008.

New Jersey Division of Fish and Wildlife. 2003. Ecology of the Atlantic Brant. Site: www.state.nj.us/dep/fgw/brant03/main.htm. New Jersey Division of Fish and Wildlife. Consulted January 20, 2009.

North American Waterfowl Management Plan. 1986. North American Waterfowl Management Plan. Environment Canada, Canadian Wildlife Service and U.S. Department of the Interior, Fish and Wildlife Service, 21 pp.

_____. 1994. The 1994 Update to the North American Waterfowl Management Plan: Expanding the Commitment. Environment Canada, Canadian Wildlife Service, Secretaria de Desarrollo Social du Mexique and U.S. Department of the Interior, Fish and Wildlife Service, 30 pp.

_____. 1998. The 1998 Update to the North American Waterfowl Management Plan: Expanding the Vision. Environment Canada, Canadian Wildlife Service, Instituto Nacional de Ecología - SEMARNAP du Mexique and U.S. Department of the Interior, Fish and Wildlife Service, 32 pp.

_____. 2004. North American Waterfowl Management Plan 2004. Implementation Framework: Strengthening the Biological Foundation. Canadian Wildlife Service, U.S. Fish and Wildlife Service, Secretaria de Medio Ambiente y Recursos Naturales (SEMARNAP) of Mexico, 106 pp.

Oakes, J. 1999. Coats of Eider. Aboriginal Issues Press.

Ogilvie, M. 2005. Common Eider *Somateria mollissima*, pp. 701-705 in J. Kear, ed. Ducks, geese and swans. Volume 1: General chapters, and Species accounts (*Anhima* to *Salvadorina*). Volume 2: Species accounts (*Cairina* to *Mergus*). Oxford University Press, New York, 908 pp.

Ouellet, H. 1969. Les oiseaux de l'île d'Anticosti, province de Québec, Canada. National Museums of Canada, National Museum of Natural Sciences, Publications in Zoology no. 1, Ottawa, Ontario. xx + 79 pp.

Padding, P. and J.D. Klimstra. 2008. Atlantic Flyway - Waterfowl Harvest and Population Survey Data, July 2008. U.S. Fish and Wildlife Service, Division of Migratory Bird Management, Laurel, Maryland, USA, 101 pp.

Palmer, R.S. 1976. Handbook of North American Birds: waterfowl (part 1 and 2). Yale University Press, New Haven. Vol. 2, 521 pp.; Vol. 3, 560 pp.

Paris, B. 1985. Utilisation du lac Saint-Louis et de la partie est du lac des Deux-Montagnes par le Grand Morillon (*Aythya marila*) et le Petit Morillon (*Aythya affinis*) lors de la migration d'automne 1984. Université du Québec à Montréal, Montréal, Québec, 38 pp.

Parti libéral du Québec. 2007. S'unir pour réussir le Québec de demain. Plan d'action 2007-2012 : Deuxième mandat du gouvernement du Parti libéral du Québec. Engagement n° 23 : mieux protéger le territoire et les écosystèmes. Site: www.plq.org/pdf/Plateforme_PLQ_2007_FR.pdf. Parti libéral du Québec. Consulted July 24, 2008.

Pearce, J., P. Flint, S. Talbot and D. Derksen. 2006. Factors involved in population dynamics and delineation of North American mergansers (SDJV #43). Site: www.seaduckjv.org/studies/pro3/pr51.pdf. Sea Duck Joint Venture.

Pearce, J.M., S.L. Talbot, B.J. Pierson, M.R. Petersen, K.T. Scribner, D.L. Dickson and A. Mosbech. 2004. Lack of spatial genetic structure among nesting and wintering King Eiders. Condor 106: 229-240.

Peck, G.K. et R.D. James. 1983. Breeding birds of Ontario: nidiology and distribution. Volume 1: Nonpasserines. Royal Ontario Museum. Alger Press, Toronto, Ontario. 321 p.

Perry, M.C., E.J.R. Lohnes, A.M. Wells, P.C. Osenton and D.M. Kidwell. 2004. Atlantic Seaduck Project. Site: www.pwrc.usgs.gov/resshow/perry/scoters/default.htm. USGS Patuxent Wildlife Research Center, Laurel, MD.

Perry, M.C. and K. McAloney. 2003. On the trail of Black scoters. Birdscapes (Winter): 14.

Petrie, S.A., S.S. Badzinski and K.G. Drouillard. 2007. Contaminants in Lesser and Greater Scaup Staging on the Lower Great Lakes. Archives of Environmental Contamination and Toxicology 52: 580-589.

Petrie, S.A., S.S. Badzinski, K.R. Ross and N.R. North. 2006. Great Lakes winter sea duck survey (SDJV #83). Site: http://seaduckjv.org/studies/pro3/pr83.pdf. Sea Duck Joint Venture.

Petrie, S.A. and C.M. Francis. 2003. Rapid increase in the lower Great Lakes population of feral mute swans: a review and recommendation. Wildlife Society Bulletin 31(2): 407-416.

Petrie, S.A. and K.L. Wilcox. 2003. Migration chronology of Eastern-population Tundra Swans. Canadian Journal of Zoology 81: 861-870.

Pihl, S. and T. Fox. 2005. Velvet Scoter *Melanitta fusca*, pp. 715-719 in J. Kear, ed. Ducks, geese and swans. Volume 1: General chapters, and Species accounts (*Anhima* to *Salvadorina*). Volume 2: Species accounts (*Cairina* to *Mergus*). Oxford University Press, New York, 908 pp.

Poulin, J.-F. and Y. Plourde. 2010. Nidification du canard pilet, du plongeon du Pacifique et du cygne siffleur à la baie Déception, Nunavik, Québec. Naturaliste canadien 134(1): 70-72.

Prach, R.W., H. Boyd and F.G. Cooch. 1981. Polynyas and seaducks, pp. 67-70 in Polynyas in the Canadian Arctic. Canadian Wildlife Service. Occasional Paper No. 45. Canadian Wildlife Service, Ottawa.

Quinn, J.L. 2005. Greater Scaup *Aythya marila*, pp. 675-679 in J. Kear, ed. Ducks, geese and swans. Volume 1: General chapters, and Species accounts (*Anhima* to *Salvadorina*). Volume 2: Species accounts (*Cairina* to *Mergus*). Oxford University Press, New York, 908 pp.

Rail, J.-F. and G. Chapdelaine. 2002. Fifteenth Census of Seabird Populations in the Sanctuaries of the North Shore of the Gulf of St. Lawrence, 1998-1999, Canadian Field-Naturalist 118(2): 256-263.

Rail, J.-F. and R.C. Cotter. 2007. Sixteenth Census of Seabird Populations in the Sanctuaries of the North Shore of the Gulf of St. Lawrence, 2005. Canadian Field-Naturalist 121(3): 287-294.

Rail, J.-F. and J.-P.L. Savard. 2003. Identification des aires de mue et de repos au printemps des macreuses (*Melanitta sp.*) et de l'Eider à duvet (*Somateria mollissima)* dans l'estuaire et le golfe

du Saint-Laurent. Série de rapports techniques n° 408. Environment Canada, Canadian Wildlife Service, Quebec Region, Sainte-Foy, Québec, 54 pp.
Reed, A. 1969. Waterfowl breeding reconnaissance 1968. Québec Wildlife Service, unpublished report, 9 pp.
_____. 1975. Migration, homing, and mortality of breeding females eiders *Somateria mollissima dresseri* of the St. Lawrence estuary, Québec. Ornis Scandinavica 6: 41-47.
_____. 1978. Canadian Waterfowl Management Plan—Quebec. Unpubl. report, Canadian Wildlife Service, Quebec Region, Sainte-Foy, Quebec, 18 pp.
_____ (editor). 1986a. Eider ducks in Canada/Les eiders au Canada. Report Series No. 47. Canadian Wildlife Service, Ottawa, Ontario. 177 p.
_____. 1986b. Eiderdown harvesting and other uses of Common Eiders in spring and summer, pp. 138-146 in A. Reed, ed. Eider ducks in Canada/Les eiders au Canada. Canadian Wildlife Service, Ottawa, Ontario. 177 pp.
_____. 1991. Subsistence harvesting of waterfowl in northern Quebec: goose hunting and the James Bay Cree. Transactions of the North American Wildlife and Natural Resources Conference 56: 344-349.
_____. 1996a. Brant, pp. 258-261 in J. Gauthier and Y. Aubry, eds. The Breeding Birds of Québec: Atlas of the Breeding Birds of Southern Québec. Association québécoise des groupes d'ornithologues, Province of Quebec Society for the Protection of Birds, Canadian Wildlife Service, Environment Canada, Quebec Region, Montréal, Quebec, xviii + 1302 pp.
_____. 1996b. Snow Goose, pp. 1102-1105 in J. Gauthier and Y. Aubry, eds. The Breeding Birds of Québec: Atlas of the Breeding Birds of Southern Québec. Association québécoise des groupes d'ornithologues, Province of Quebec Society for the Protection of Birds, Canadian Wildlife Service, Environment Canada, Quebec Region, Montréal, Quebec, xviii + 1302 pp.
_____. 2005. Surf Scoter *Melanitta perspicillata*, pp. 712-714 in J. Kear, ed. Ducks, geese and swans. Volume 1: General chapters, and Species accounts (*Anhima* to *Salvadorina*). Volume 2: Species accounts (*Cairina* to *Mergus*). Oxford University Press, New York, 908 pp.
Reed, A., Y. Aubry and E. Reed. 1994. Surf Scoter, *Melanitta perspicillata*, nesting in southern Québec. Canadian Field-Naturalist 108(3): 364-365.
Reed, A., R. Benoit, R. Lalumière and M. Julien. 1996. Duck use of the coastal habitats of northeastern James Bay. Occasional Paper No. 90, Canadian Wildlife Service, Environment Canada, Sainte-Foy, Québec, 49 pp.
Reed, A. and J.G. Cousineau. 1967. Epidemics involving the Common Eider (*Somateria mollissima*) at Île Blanche, Québec. Naturaliste canadien 94: 327-334.
Reed, A., P. Dupuis, A. Bourget and H.L. Mendall. 1986. Sous-espèces d'Eider à duvet hivernant dans le golfe du Saint-Laurent, pp. 89-91 in A. Reed, ed. Eider ducks in Canada/Les eiders au Canada. Canadian Wildlife Service, Ottawa, Ontario. 177 pp.
Reed, A. and A.J. Erskine. 1986. Populations of the Common Eider in eastern North America: their size and status, pp. 156-162 in A. Reed, ed. Eider ducks in Canada/Les eiders au Canada. Canadian Wildlife Service, Ottawa, Ontario. 177 pp.
Reed, A., J.-F. Giroux and G. Gauthier. 1998a. Population size, productivity, harvest and distribution, pp. 5-31 in B.D.J. Batt, ed. The Greater Snow Goose: report of the Arctic Goose Habitat Working Group, special publication of the Arctic Goose Joint Venture. U.S. Fish and Wildlife Service and Canadian Wildlife Service, Washington D.C. and Ottawa (Ontario).
Reed, A., D.H. Ward, D.V. Derksen and J.S. Sedinger. 1998b. Brant (*Branta bernicla*), in A. Poole and F. Gill, eds. The Birds of North America, no. 337. The Birds of North America, Inc., Philadelphia, PA, 32 pp.
Regroupement QuébecOiseaux. 2007. Liste des oiseaux du Québec. Version 1.1. 2007-08-28. Site: www.quebecoiseaux.org/files/RQOlisteOiseaux(1).pdf.
Richkus, K.D., K.A. Wilkins, R.V. Raftovich, S.S. Williams and H.L. Spriggs. 2008. Migratory bird hunting activity and harvest during the 2006 and 2007 hunting seasons: Preliminary estimates. U.S. Fish and Wildlife Service, Laurel, Maryland, USA, 65 pp.
Roberge, B. 2002. Situation de la population nicheuse d'Eiders à duvet de la Réserve de parc national du Canada de l'Archipel-de-Mingan 1998. Parks Canada, Natural Resources Conservation Service, Mingan field unit, Québec, 40 pp.
Roberge, B. and G. Chapdelaine. 2000. Suivi des impacts du déversement de pétrole du Gordon C. Leitch sur les populations d'oiseaux nicheurs de la Réserve de parc national de l'Archipel-de-Mingan (QC), Canada. Canadian Wildlife Service, Quebec Region, Environment Canada. Technical Report Series No. 359, Sainte-Foy, Quebec, 21 pp.
Robert, M. 2007. Bilan des observations réalisées dans le Parc national des Pingualuit et ses environs en juin et juillet 2007. Canadian Wildlife Service, Quebec Region, Sainte-Foy, Québec, 7 pp.

Robert, M., R. Benoit, C. Marcotte, J.-P.L. Savard, D. Bordage and D. Bourget. 2003. Le Garrot d'Islande dans l'estuaire du Saint-Laurent : calendrier de présence annuelle, répartition, abondance, âge-ratio et sex-ratio. Canadian Wildlife Service, Quebec Region, Environment Canada. Technical Report Series No. 398, Sainte-Foy, Québec, 129 p.

Robert, M., R. Benoit and J.-P.L. Savard. 2000a. Status report on the eastern population of the Barrow's Goldeneye (*Bucephala islandica*) in Canada. Committee on the Status of Endangered Wildlife in Canada (COSEWIC), Ottawa, Ontario.

_____. 2002. Relationship among breeding, molting, and wintering areas of male Barrow's Goldeneye in eastern North America. Auk 119: 676-684.

Robert, M., D. Bordage, J.-P.L. Savard, G. Fitzgerald and F. Morneau. 2000b. The breeding range of the Barrow's Goldeneye in eastern North America. Wilson Bulletin 112(1): 1-7.

Robert, M. and L. Cloutier. 2001. Summer food habits of Harlequin Ducks in eastern North America. Wilson Bulletin 113: 78-84.

Robert, M., B. Drolet and J.-P.L. Savard. 2008a. Habitat features associated with Barrow's Goldeneye breeding in eastern Canada. Wilson Journal of Ornithology 120: 320-330.

Robert, M., G.H. Mittelhauser, B. Jobin, G. Fitzgerald and P. Lamothe. 2008b. New insights on Harlequin Duck population structure in eastern North America as revealed by satellite telemetry. Waterbirds 31(Special Publication 2): 159-172.

Robert, M., F. Morneau, C. Marcotte and P. Lamothe. 2001. Inventaires héliportés de l'Arlequin plongeur sur des rivières du Québec et du Labrador aux printemps de 1999 et 2000. Canadian Wildlife Service, Quebec Region, Environment Canada. Technical Report Series No. 375, Sainte-Foy, Quebec, 33 pp.

Robert, M. and J.-P.L. Savard. 2006. The St. Lawrence River Estuary and Gulf: a stronghold for Barrow's Goldeneyes wintering in eastern North America. Waterbirds 29(4): 437-450.

_____. 2008. Survey of Barrow's Goldeneyes in Southern Labrador and on the Québec North Shore (Spring 2008). Final report presented to Institute for Environmental Monitoring and Research. Environment Canada, Québec, Quebec.

Robertson, G.J. and H.G. Gilchrist. 1998. Evidence of population declines among common eiders breeding in the Belcher Islands, Northwest Territories. Arctic 51(4): 378-385.

Robertson, G.J. and J.-P.L. Savard. 2002. Long-tailed Duck (*Clangula hyemalis*), in A. Poole and F. Gill, eds. The Birds of North America, no. 651. The Birds of North America, Inc., Philadelphia, PA, 28 pp.

Rohwer, F.C., W.P. Johnson and E.R. Loos. 2002. Blue-winged Teal (*Anas discors*), in A. Poole and F. Gill, eds. The Birds of North America, no. 625. The Birds of North America, Inc., Philadelphia, PA, 36 pp.

Ross, K. 2007a. Blue-winged Teal, pp. 80-81 in M.D. Cadman, D.A. Sutherland, G.G. Beck, D. Lepage and A.R. Couturier, eds. Atlas of the Breeding Birds of Ontario, 2001-2005. Birds Studies Canada, Environment Canada, Ontario Field Ornithologists, Ontario Ministry of Natural Resources, and Ontario Nature, Toronto, Ontario, xxii + 706 pp.

_____. 2007b. Surf Scoter, pp. 100-101 in M.D. Cadman, D.A. Sutherland, G.G. Beck, D. Lepage and A.R. Couturier, eds. Atlas of the Breeding Birds of Ontario, 2001-2005. Birds Studies Canada, Environment Canada, Ontario Field Ornithologists, Ontario Ministry of Natural Resources, and Ontario Nature, Toronto, Ontario, xxii + 706 pp.

Ross, K.R. 1983. An estimate of the Black Scoter (*Melanitta nigra*) population molting in James and Hudson Bays. Canadian Field-Naturalist 97: 147-150.

Ross, K.R. and K.F. Abraham. 2009. Annual Survey of Moulting Black scoters in James Bay (SDJV Project # 82). Site: http://seaduckjv.org/studies/pro3/pr82.pdf. Sea Duck Joint Venture.

Ryder, J.P. and R.T. Alisauskas. 1995. Ross's Goose (*Chen rossii*), in A. Poole and F. Gill, eds. The Birds of North America, no. 162. The Birds of North America, Inc., Philadelphia, PA.

Sandilands, A.P. 2005. The birds of Ontario: habitat requirements, limiting factors, and status. Volume 1: Nonpasserines: waterfowl through cranes. UBC Press, Vancouver, British Columbia. 365 pp.

Savard, J.-P.L. 1977. Étude de la faune avienne dans les bassins de la Grande rivière de la Baleine et de la Petite rivière de la Baleine (été 1976). Report for Hydro-Québec, Direction de l'Environnement. GB-BIOP-ECO-77-3. Éco-Recherches Ltée, Pointe-Claire, Quebec, 132 pp.

_____. 1982. Intra and inter-specific competition between Barrow's Goldeneye (*Bucephala islandica*) and Bufflehead (*Bucephala albeola*). Canadian Journal of Zoology 60(12): 3439-3446.

_____. 2009a. Diversité, abondance et répartition des oiseaux aquatiques hivernant dans les eaux côtières et pélagiques du Parc marin Saguenay–Saint-Laurent. Revue des sciences de l'eau 22(2): 353-371.

Savard, J.-P.L., D. Bordage and A. Reed. 1998. Surf Scoter (*Melanitta perspicillata*), in A. Poole and F. Gill, eds. The Birds of North America, no. 363. The Birds of North America, Inc., Philadelphia, PA, 28 pp.

Savard, J.-P.L. and G. Falardeau. 1997. Inventaires aériens hivernaux, printaniers et estivaux dans les estuaires moyen et marin du Saint-Laurent (hiver 1994, été 1994, printemps 1995). Environment Canada, Canadian Wildlife Service, Quebec Region. Technical Report Series No. 282, Sainte-Foy, Québec, 42 pp.

Savard, J.-P.L. and P. Lamothe. 1991. Distribution, abundance, and aspect of breeding ecology of Black scoters, *Melanitta nigra*, and Surf Scoters, *M. perspicillata*, in northern Québec. Canadian Field-Naturalist 105(4): 488-496.

Savard, J.-P.L., L. Lesage, S. Gilliland, G. Gilchrist and J.-F. Giroux. In preparation. Molting, staging and wintering locations of Common Eiders breeding in the Gyrfalcon Archipelago, Ungava Bay. Environment Canada, Canadian Wildlife Service, Quebec Region. Technical Report Series No.XXX, Sainte-Foy, Quebec, 42 pp.

Savard, J.-P.L., A. Reed and L. Lesage. 2007. Chronology of breeding and molt migration in Surf Scoters (*Melanitta perspicillata*). Waterbirds 30(2): 223-229.

Savard, J.-P.L., M. Robert and S. Brodeur. 2008. Harlequin Ducks in Québec. Waterbirds 31(Special Publication 2): 19-31.

Savard, J.P.-L. 2009b. Identification of molting locations of adult female Barrow's Goldeneye in Eastern North America (SDJV Project # 119). Site: http://seaduckjv.org/studies/pro3/pr119.pdf. Sea Duck Joint Venture.

Schmutz, J.K. 1981. Coloniality of the Hudson Bay Eider duck. Ph.D. Dissertation, Queen's University, Kingston, Ontario, Canada. 90 p.

Schmutz, J.K., R.J. Robertson and F. Cooke. 1983. Colonial nesting of the Hudson Bay Eider duck. Canadian Journal of Zoology 61: 2424-2433.

Sea Duck Joint Venture. 2003a. Common Merganser (*Mergus merganser*), pp. 76-79 in Species Status Reports. Sea Duck Joint Venture Continental Technical Team. Site: www.seaduckjv.org/meetseaduck/species_status_summary.pdf.

_____. 2003b. Hooded Merganser (*Lophodytes cucullatus*), pp. 83-85 in Species Status Reports. Sea Duck Joint Venture Continental Technical Team. Site: www.seaduckjv.org/meetseaduck/species_status_summary.pdf.

_____. 2003c. King Eider (*Somateria spectabilis*), pp. 24-28 in Species Status Reports. Sea Duck Joint Venture Continental Technical Team. Site: www.seaduckjv.org/meetseaduck/species_status_summary.pdf.

_____. 2003d. Long-tailed Duck (*Clangula hyemalis*), pp. 49-52 in Species Status Reports. Sea Duck Joint Venture Continental Technical Team. Site: www.seaduckjv.org/meetseaduck/species_status_summary.pdf.

_____. 2003e. Surf Scoter (*Melanitta perspicillata*), pp. 53-55 in Species Status Reports. Sea Duck Joint Venture Continental Technical Team. Site: www.seaduckjv.org/meetseaduck/species_status_summary.pdf.

_____. 2003f. White-winged Scoter (*Melanitta fusca deglandi*), pp. 59-61 in Species Status Reports. Sea Duck Joint Venture Continental Technical Team. Site: www.seaduckjv.org/meetseaduck/species_status_summary.pdf.

_____. 2004. Red-breasted Merganser (*Mergus serrator*). Sea Duck Information Series. Sea Duck Joint Venture Continental Technical Team, http://seaduckjv.org/infoseries/rbme_sppfactsheet.pdf.

_____. 2005. Hooded Merganser (*Lophodytes cucullatus*). Sea Duck Information Series. Sea Duck Joint Venture Continental Technical Team, http://seaduckjv.org/infoseries/home_sppfactsheet.pdf.

_____. 2007. Recommendations for monitoring distribution, abundance, and trends for North American sea ducks. September 2007. Available at www.seaduckjv.org. U.S. Fish and Wildlife Service, Anchorage, Alaska and Canadian Wildlife Service, Sackville, New Brunswick, 18 pp.

Sea Duck Joint Venture Management Board. 2008. Sea Duck Joint Venture Strategic Plan 2008-2012. USFWS, Anchorage, Alaska and CWS, Sackville, New Brunswick, 95 pp.

Semenchuk, G.P. (editor). 1992. The atlas of breeding birds of Alberta. The Federation of Alberta Naturalists, Edmonton, Alberta. 390 pp.

Serie, J.R. and B. Raftovich. 2005. Atlantic Flyway - Waterfowl Harvest and Population Survey Data, July 2005. U.S. Fish and Wildlife Service, Division of Migratory Bird Management, Laurel, Maryland, 75 pp.

Shaffer, F. and J.-F. Rail. 1996. Redhead, pp. 300-303 in J. Gauthier and Y. Aubry, eds. The Breeding Birds of Québec: Atlas of the Breeding Birds of Southern Québec. Association québécoise des groupes d'ornithologues, Province of Quebec Society for the Protection of Birds, Canadian Wildlife Service, Environment Canada, Quebec Region, Montréal, Quebec, xviii + 1302 pp.

Sibley, C.G. and B.L. Monroe Jr. 1990. Distribution and Taxonomy of Birds of the World. Yale University Press, New Haven & London. 1111 pp.

Sibley, D.A. 2004. Identification of Canada and Cackling Goose. Site: www.sibleyguides.com/canada_cackling.htm. Sibley Guides. Consulted on February 5, 2005.

Smith, A.E., S.R. Craven and P.D. Curtis. 1999. Managing Canada Geese in urban environments. A technical guide. Jack Berryman Institute Publication 16, and Cornell University Cooperative Ithaca, N.Y., 42 pp.

Snyder, L.L. 1941. On the Hudson Bay Eider. Royal Ontario Museum Zoology Occasional Paper 6: 1-7.

Société d'aménagement de la baie Lavallière. 2006. Bilan des occupants des nichoirs pour 2005. Bande à Branchus (décembre 2006): 3.

SOS-POP. 2008. Banque de données sur les oiseaux en péril du Québec. Site: www.quebecoiseaux.org/index.php?option=com_content&task=blogcategory&id=38&Itemid=207. Regroupement QuébecOiseaux and Canadian Wildlife Service, Environment Canada, Quebec Region.

Soulliere, G.J. 1990. Review of Wood Duck nest-cavity characteristics. Pages 153-162 in L.H. Fredrickson, G.V. Burger, S.P. Havera, D.A. Graber, R.E. Kirby and T.S. Taylor, eds. Proceedings of 1998 North American Wood Duck Symposium. St. Louis, Missouri, USA.

Spurr, E.B. and H. Milne. 1976. Factors affecting laying date in the Common Eider. Wildfowl 27: 107-109.

St-Hilaire, D. and A. Morrier. 1996. Wood Duck, pp. 266-269 in J. Gauthier and Y. Aubry, eds. The Breeding Birds of Québec: Atlas of the Breeding Birds of Southern Québec. Association québécoise des groupes d'ornithologues, Province of Quebec Society for the Protection of Birds, Canadian Wildlife Service, Environment Canada, Quebec Region, Montréal, Quebec, xviii + 1302 pp.

Suydam, R.S. 2000. King Eider (*Somateria spectabilis*), in A. Poole and F. Gill, eds. The Birds of North America, no. 491. The Birds of North America, Inc., Philadelphia, PA, 28 pp.

Suydam, R.S., D.L. Dickson, J.B. Fadely and L.T. Quakenbush. 2000. Population declines of King and Common eiders of the Beaufort Sea. Condor 102: 219-222.

Tardif, J. and N. Gagnon. 1996. Canvasback, pp. 1107 in J. Gauthier and Y. Aubry, eds. The Breeding Birds of Québec: Atlas of the Breeding Birds of Southern Québec. Association québécoise des groupes d'ornithologues, Province of Quebec Society for the Protection of Birds, Canadian Wildlife Service, Environment Canada, Quebec Region, Montréal, Quebec, xviii + 1302 pp.

Tecsult Environnement Inc. 2004. Centrale de l'Eastmain-1-A et dérivation Rupert – Avifaune – Sauvagine et autres oiseaux aquatiques. Report prepared for Société d'énergie de la Baie James. FORAMEC Inc., Québec, Quebec, 157 pp.

Tecsult Inc. 2006. Centrale de l'Eastmain-1-A et dérivation Rupert – Inventaires de la sauvagine sur les rivières Broadback, Rupert, Eastmain, Opinaca et Petite rivière Opinaca. Report prepared for Hydro-Québec Équipement, Québec, Québec, 151 pp.

Therres, G.D. and D.F. Brinkler. 2004. Mute Swan interactions with other birds in Chesapeake Bay. Pages 43-46 in M.C. Perry, ed. Mute Swans and their Chesapeake Bay habitats: Proceedings of a symposium. U.S. Geological Survey, Information and Technology Report USGS/BRD/ITR-2004-0005, Wye Mills, Maryland, USA.

Thomas, P. and M. Robert. 2001. Updated COSEWIC status report of the eastern Canada Harlequin Duck (*Histrionicus histrionicus*). Committee on the Status of Endangered Wildlife in Canada (COSEWIC), Ottawa, Ontario.

Thomas, P.W. 2008. Harlequin Ducks in Newfoundland. Waterbirds 31(Special Publication 2): 44-49.

Titman, R.D. 1999. Red-breasted Merganser (*Mergus serrator*), in A. Poole and F. Gill, eds. The Birds of North America, no. 443. The Birds of North America, Inc., Philadelphia, PA, 24 pp.

_____. 2005a. Common Merganser (Goosander) *Mergus merganser*, pp. 752-755 in J. Kear, ed. Ducks, geese and swans. Volume 1: General chapters, and Species accounts (*Anhima* to *Salvadorina*). Volume 2: Species accounts (*Cairina* to *Mergus*). Oxford University Press, New York, 908 pp.

_____. 2005b. Hooded Merganser *Lophodytes cucullatus*, pp. 744-746 in J. Kear, ed. Ducks, geese and swans. Volume 1: General chapters, and Species accounts (*Anhima* to *Salvadorina*). Volume 2: Species accounts (*Cairina* to *Mergus*). Oxford University Press, New York, 908 pp.

_____. 2005c. Red-breasted Merganser *Mergus serrator*, pp. 755-758 in J. Kear, ed. Ducks, geese and swans. Volume 1: General chapters, and Species accounts (*Anhima* to *Salvadorina*). Volume 2: Species accounts (*Cairina* to *Mergus*). Oxford University Press, New York, 908 pp.

Titman, R.D. and S. Barrette. 1996a. American Wigeon, pp. 298-299 in J. Gauthier and Y. Aubry, eds. The Breeding Birds of Québec: Atlas of the Breeding Birds of Southern Québec. Association québécoise des groupes d'ornithologues, Province of Quebec Society for the Protection of Birds, Canadian Wildlife Service, Environment Canada, Quebec Region, Montréal, Quebec, xviii + 1302 pp.

_____. 1996b. Northern Shoveler, pp. 290-293 in J. Gauthier and Y. Aubry, eds. The Breeding Birds of Québec: Atlas of the Breeding Birds of Southern Québec. Association québécoise des groupes d'ornithologues, Province of Quebec Society for the Protection of Birds, Canadian Wildlife Service, Environment Canada, Quebec Region, Montréal, Quebec, xviii + 1302 pp.

Titman, R.D., J.-P.L. Savard and S.R. Craik. 2006. Habitat use by breeding and post-breeding Red-breasted Merganser in the Gulf of St. Lawrence (SDJV #51). Site: http://seaduckjv.org/studies/pro3/pr51.pdf. Sea Duck Joint Venture.

Traylor, J.J., R.T. Alisauskas and F.P. Kehoe. 2004. Nesting ecology of white-winged Scoters (*Melanitta fusca deglandi*) at Redberry Lake Saskatchewan. Auk 121(3): 952-960.

Trimper, P.G., P.W. Thomas and T.E. Chubbs. 2008. Harlequin Ducks in Labrador. Waterbirds 31(Special Publication 2): 32-43.

U.S. Fish and Wildlife Service. 2007. Migratory bird hunting activity and harvest during the 2005 and 2006 hunting seasons: Preliminary estimates. U.S. Department of the Interior, Washington, D.C., U.S.A.

_____. 2008. Waterfowl Population Status, 2008. U.S. Department of the Interior, Washington, D.C., U.S.A., 65 pp.

Vaillancourt, M.-A., P. Drapeau, S. Gauthier and M. Robert. 2008. Availability of standing trees for large cavity-nesting birds in the eastern boreal forest of Québec, Canada. Forest Ecology and Management 255: 2272–2285.

Vaillancourt, M.-A., P. Drapeau, M. Robert and S. Gauthier. 2009. Origin and availability of large cavities for Barrow's Goldeneye, a species at risk inhabiting the eastern Canadian boreal forest. Avian Conservation and Ecology - Écologie et conservation des oiseaux 4(1): 6. [Online]: www.ace-eco.org/vol4/iss1/art6/.

Wadden Sea Newsletter. 2001. Special Issue: Eider mortality in the Wadden Sea in the winter 1999/2000. Common Wadden Sea Secretariat, Virchowstr. 1, D-26382 Wilhelmshaven. Newsletter 2001 - No. 1., 48 pp.

Ward, D.H., A. Reed, J.S. Sedinger, J.M. Black, D.V. Derksen and P.M. Castelli. 2005. North American Brant: effects of changes in habitat and climate on population dynamics. Global Change Biology 11: 869-880.

Wendt, J.S. and E. Silieff. 1986. The kill of eiders and other sea ducks by hunters in eastern Canada, pp. 147-154 in A. Reed, ed. Eider ducks in Canada/Les eiders au Canada. Canadian Wildlife Service, Ottawa, Ontario. 177 pp.

Wetlands International. 2006. Waterbird Population Estimates - Fourth Edition. Wetlands International, Wageningen, The Netherlands. 239 pp.

White, T.P., R.R. Veit and M.C. Perry. 2009. Feeding ecology of Long-tailed Ducks *Clangula hyemalis* wintering on the Nantucket shoals. Waterbirds 32(2): 293-299.

Williams, T.D., E.G. Cooch, R.L. Jefferies and F. Cooke. 1993. Environmental degradation, food limitation and reproductive output: juvenile survival in Lesser Snow Geese. Journal of Animal Ecology 62: 766-777.

Woodby, D.A. and G.J. Divoky. 1982. Spring migration of eiders and other waterbirds at Point Barrow, Alaska. Arctic 35: 403-410.

Woodin, M.C. and T.C. Michot. 2002. Redhead (*Aythya americana*), in A. Poole and F. Gill, eds. The Birds of North America, no. 695. The Birds of North America, Inc., Philadelphia, PA, 40 pp.

Yank, R., Y. Aubry and M. Gosselin. 1991. Les observations saisonnières : l'été 1990 (juin et juillet). QuébecOiseaux 2(3): 28.

Young, A.D. and R.D. Titman. 1986. Costs and benefits to Red-breasted Mergansers nesting in tern and gull colonies. Canadian Journal of Zoology 64: 2339-2343.

_____. 1988. Intraspecific nest parasitism in Red-breasted Mergansers. Canadian Journal of Zoology 66: 2454-2458.

Young, G. 2005. Northern Mallard *Anas platyrhynchos*, pp. 513-517 in J. Kear, ed. Ducks, geese and swans. Volume 1: General chapters, and Species accounts (*Anhima* to *Salvadorina*). Volume 2: Species accounts (*Cairina* to *Mergus*). Oxford University Press, New York, 908 pp.

Zicus, M. 2005. Common Goldeneye *Bucephala clangula*, pp. 730-735 in J. Kear, ed. Ducks, geese and swans. Volume 1: General chapters, and Species accounts (*Anhima* to *Salvadorina*). Volume 2: Species accounts (*Cairina* to *Mergus*). Oxford University Press, New York, NY. 908 pp.

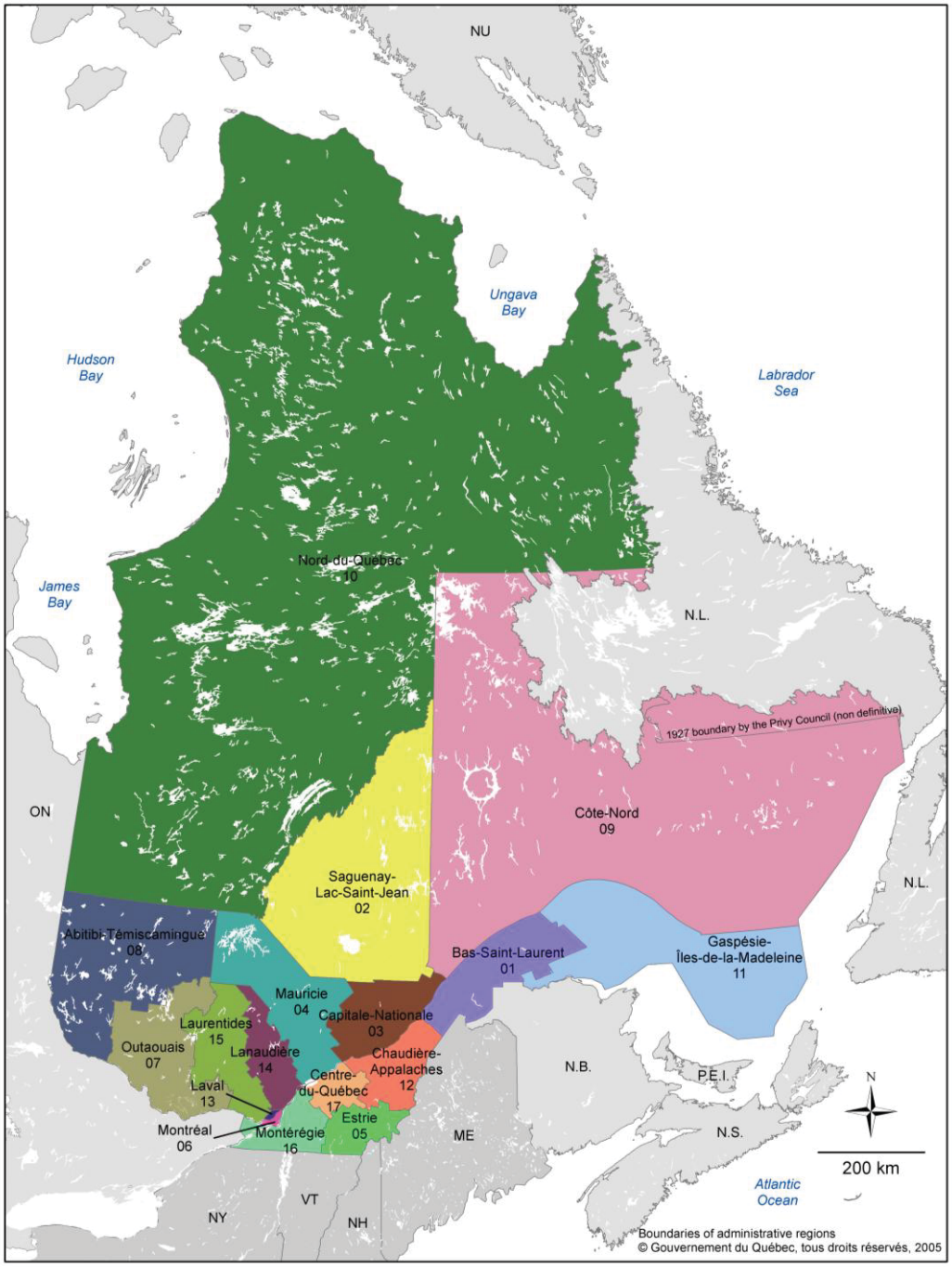
Zimmerling, J.R. 2007. Wood Duck, pp. 70-71 in M.D. Cadman, D.A. Sutherland, G.G. Beck, D. Lepage and A.R. Couturier, eds. Atlas of the Breeding Birds of Ontario, 2001-2005. Birds Studies Canada, Environment Canada, Ontario Field Ornithologists, Ontario Ministry of Natural Resources, and Ontario Nature, Toronto, Ontario, xxii + 706 pp.

8. Appendices

8.1 Bird Conservation Regions (BCRs) in Quebec

BCR 3	*Arctic Plains and Mountains*
BCR 7	*Taiga Shield and Hudson Plains*
BCR 8	*Boreal Softwood Shield*
BCR 12	*Boreal Hardwood Transition*
BCR 13	*Lower Great Lakes/St. Lawrence Plain*
BCR 14	*Atlantic Northern Forest*

8.2 Administrative regions of Quebec



8.3 List of acronyms

AOU	American Ornithologists' Union
BAGOS	Barrow's Goldeneye Winter Survey (see Section 3.6)
BBS	Breeding Bird Survey
BCR	Bird Conservation Region
BDJV	Black Duck Joint Venture
BDTQ	Base de données topographiques du Québec (Quebec topographic database)
BIOMQ	Banque informatisé des colonies d'oiseaux de mer du Québec (Quebec Seabird Database)
BWPSEC	Breeding Waterfowl Plot Survey of Eastern Canada
CBC	Christmas Bird Count (see Section 3.11)
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
COEIS	Common Eider Winter Survey (see Section 3.7)
CWS	Canadian Wildlife Service, Environment Canada
EC	Environment Canada
EHJV	Eastern Habitat Joint Venture
ÉPOQ	Études des populations d'oiseaux du Québec (Study of Bird Populations in Quebec) (see Section 3.10)
GSGOS	Greater Snow Goose Spring Survey (see Section 3.5)
IBP	Indicated breeding pairs
MAPAQ	Ministère de l'Agriculture, des Pêcheries et de l'Alimentation du Québec (Quebec Department of Agriculture, Fisheries and Food)
MBS	Migratory Bird Sanctuary
NAWMP	North American Waterfowl Management Plan
NJDFW	New Jersey Division of Fish and Wildlife
NWA	National Wildlife Area
ONCFS	Office national de la chasse et de la faune sauvage (National Hunting and Wildlife Agency) (France)
RQO	Regroupement Québec Oiseaux
S & T	Science and Technology, Environment Canada
SARA	Species at Risk Act
SDJV	Sea Duck Joint Venture
SOS-POP	Suivi de l'occupation des stations de nidification - Populations d'oiseaux en péril du Québec (Monitoring Nest Sites of Species at Risk)
WLOW	Waterfowl Survey of Southern Quebec Lowlands (see Section 3.2)
WNOR	Waterfowl Survey of Northern Quebec (see Section 3.4)
WSHO	Waterfowl Survey of the St. Lawrence Shoreline (see Section 3.3)
WUPL	Waterfowl Survey of Southern Quebec Uplands (see Section 3.1)
USFWS	United States Fish and Wildlife Service
ZEC	Zone d'exploitation contrôlée (controlled harvesting zone)

8.4 Conversion factors used to estimate total populations (numbers) from the estimated number of indicated breeding pairs

Tribe	Conversion factor	Indicated breeding pairs	Adult females	Adult males	Immatures	Total population (numbers)	Sex ratio (M:F)	Percentage of immatures (%)
Geese and swans (Anserini)	2.67	100	100	100	67	267	1.0	25
Dabbling ducks (Anatini)	2.10	100	100	100	10	210	1.0	5
Diving ducks (Aythyini)	2.63	100	100	150	13	263	1.5	5
Sea ducks (Mergini)	2.56	100	100	130	26	256	1.3	10

www.**ec.gc.ca**

Additional information can be obtained at:

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