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Population Status of Migratory Game Birds in Canada

November 2012

Canadian Wildlife Service
Waterfowl Committee

CWS Migratory Birds Regulatory Report Number 37

Canada

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Comments:

Comments regarding this report, the regulation-setting process or other concerns relating to national migratory game birds should be sent to the Director of the Population Conservation and Management Division at the national office of the Canadian Wildlife Service of Environment Canada, at the following address:

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Region-specific comments should be sent to the appropriate Regional Director, Canadian Wildlife Service, Environmental Stewardship Branch, at the following addresses:

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Background

Canadian hunting regulations for migratory game birds are reviewed annually by Environment Canada, with input from the provinces and territories and a range of other stakeholders. As part of this process, the Canadian Wildlife Service (CWS) of Environment Canada produces three reports each year. The first report, *Population Status of Migratory Game Birds in Canada* (commonly called the November report), contains population and other biological information on migratory game birds, and thus provides the scientific basis for management. The second report, *Proposals to Amend the Canadian Migratory Birds Regulations* (the December report), outlines the proposed changes to the annual hunting regulations, as well as proposals to amend the overabundant species regulations and other proposed amendments to the *Migratory Birds Regulations*. Proposals for hunting regulations are developed in accordance with the Objectives and Guidelines for the Establishment of National Regulations for Migratory Game Bird Hunting (www.ec.gc.ca/rcom-mbhr/default.asp?lang=En&n=6DE5A330-1).
The third report, *Migratory Birds Regulations in Canada*, summarizes the hunting regulations for the upcoming hunting season. The three reports are distributed to organizations and individuals with an interest in migratory game bird conservation, to provide an opportunity for input on the development of hunting regulations in Canada.

Data presented in the *Population Status of Migratory Game Birds in Canada* report come from a variety of sources. Breeding population estimates and trends for inland ducks are derived from large-scale systematic aerial surveys conducted annually in eastern and western Canada and parts of the United States. Additional small-scale, usually annual, breeding waterfowl surveys are also conducted in other parts of this country. Information on sea duck populations comes mainly from surveys limited to a few key locations or a small portion of the species' range, and the surveys are conducted during the breeding, moulting or overwintering period. Goose population estimates and trends are derived mainly from specific annual or occasional surveys carried out during the breeding season or, in some cases, during migration. Additional information on waterfowl populations is also provided by mid-winter surveys on the wintering grounds conducted annually in the four U.S. flyways. Population information on swans and other migratory game birds is derived from specific breeding or wintering surveys or countrywide breeding bird surveys. Harvest levels of migratory game birds in Canada and the United States are estimated through national harvest surveys and, in some cases, through species-specific surveys. From 1961 through 2001, estimates of waterfowl harvest in the U.S. were derived from the U.S. Fish and Wildlife Service's (USFWS) Waterfowl Questionnaire Survey. However, a new survey, the Harvest Information Program, was fully implemented in 1999. In addition to waterfowl, it gathers information on species and groups of migratory game birds such as woodcock, doves and snipe. Harvest estimates yielded by the two surveys cannot be directly compared.

Population Status of Inland Ducks

Eastern Canada

In Eastern Canada, breeding waterfowl populations are monitored annually through the Eastern Waterfowl Breeding Ground Survey (hereafter referred to as the Eastern Waterfowl Survey). The CWS carries out a systematic helicopter survey over the Boreal Shield region from northeastern Ontario to Newfoundland and Labrador, and the Atlantic Highlands region from the Gaspé Peninsula in Quebec to Nova Scotia. The USFWS conducts a fixed-wing aerial survey in parts of eastern Canada and the northeastern U.S. (Figure 1). This work has been evolving since 1990, originating as part of the Black Duck Joint Venture of the North American Waterfowl Management Plan (NAWMP). The surveys are designed and timed primarily to provide reliable breeding population estimates and trends for the American Black Duck, an early nesting species.

Historically, the data from these surveys (CWS and USFWS) have been analyzed separately, despite some overlap in geographic coverage. In 2004, the CWS and the USFWS agreed to integrate the two surveys to reduce the extent of overlap and expand the geographic region covered. The data presented in this report represent an integration of the results of the two survey platforms. In time, all survey results will be integrated for reporting on a regional basis.

Additional breeding population surveys are also conducted in some parts of eastern Canada, although they are presently not included in the integrated Eastern Waterfowl Survey.

In southern Ontario, a breeding waterfowl survey of ground plots was conducted by the CWS at three- to five-year intervals from 1971 to 2004. In 2005 it was changed to an annual survey employing a rotating sample of the original plots.

In southern Quebec, beginning in 2004, helicopter surveys along the St. Lawrence River shoreline (106 10 km × 1 km transects randomly

distributed in the fluvial, the estuary and the gulf sections) and in the lowlands (100 2 km × 2 km plots systematically distributed in the Abitibi, the Lake St. Jean and the St. Lawrence plain regions) were added to assess the value of these areas to breeding waterfowl on a regular basis. Due to budget constraints, the St. Lawrence shoreline survey was discontinued in 2010. A statistical analysis of the lowlands survey in 2011 revealed that the level of precision was insufficient. Therefore, in 2012, the Abitibi and Lake St. Jean survey areas were dropped and sampling effort was increased in the St. Lawrence lowlands to increase precision. The St. Lawrence lowlands is the region of Quebec facing the greatest pressures on habitats and waterfowl populations, so trends of Black Ducks and Mallards need to be closely monitored.

An aerial survey program to assess waterfowl breeding in agricultural landscapes in New Brunswick and Nova Scotia was initiated in 2008. This program is supported by the Eastern Habitat Joint Venture and was expanded from 2009 to 2012 to include agricultural land on Prince Edward Island in addition to the areas in Nova Scotia and New Brunswick surveyed since program inception. Although not fully integrated into the Eastern Waterfowl Survey analysis, data from these surveys are providing resource managers with insight on the relative value of these areas to breeding waterfowl in the region.

In this section, we summarize information on inland duck populations in Eastern Canada.

American Black Duck

There has been some concern over American Black Duck (*Anas rubripes*) population in North America over recent decades, but now the population has stabilized.

Mid-winter inventories in the Atlantic and Mississippi flyways showed a decline in the continental population between 1955 and the early 1980s, when numbers stabilized at a low level (Figure 2). The total number of Black Ducks counted in both flyways combined in winter 2012 (246 334) was 32% higher than the 2011 count (187 198) and is 8% above the 2002–2011 average (228 688). In 2012, the estimated population of Black Ducks in the Atlantic Flyway was 223 551, while in the Mississippi Flyway it was 22 783 (Klimstra and Padding 2012). Surveys of American Black Ducks in their wintering areas are useful for studying overall population trends, but they are not effective for evaluating the status of breeding populations, because of the mixing of birds from diverse breeding areas. In the area covered by the Eastern Waterfowl Survey, the integrated index of the number of indicated breeding American Black Ducks is shown in Figure 3.

The 2012 Eastern Waterfowl Survey estimate was 603 100 Black Ducks, which was 11% higher than the 2011 estimate (544 200) and 5% lower than the 10-year (2002–2011) average of 634 570. Trends appear to be relatively stable for most survey strata, except for the Western Boreal Shield, where the trend is declining.

The decline of American Black Ducks on their wintering grounds prompted the United States to initiate a program to reduce the harvest of the species in 1983; Canada joined the initiative in 1984. Between 1984 and 1988, the harvest in the U.S. gradually decreased, while it remained relatively the same in Canada (Table 2). In 1989 and 1990, however, Canada successfully implemented more restrictive Black Duck hunting regulations to protect local breeding populations.

In 2011, for the first time since harvest data have been recorded, the number of Black Ducks harvested in Canada increased (91 862) while the number in the United States decreased (88 351) (Table 2). Mild winter conditions in Canada may have caused more Black Ducks than usual to stay longer into the season. In the U.S., the mild winter may have meant that Black Ducks limited their movements to forage, compared to a normal winter, and may have made them less vulnerable to hunting (Paul Padding, pers. comm.).

Other Inland Duck Species

Eastern Waterfowl Survey

The Eastern Waterfowl Survey of Eastern Canada (Figure 1), though originally designed to survey Black Ducks, provides quantitative information on other inland duck species that can be used to evaluate the status of their breeding populations. The range-wide integrated indices for the number of indicated breeding birds of the most abundant eastern dabbling and diving duck species are plotted in Figures 4a to 4c.

Mallard

The estimated abundance of Mallards (*Anas platyrhynchos*) in the Eastern Survey Area decreased by 4% in 2012 compared to the 2011 estimate (Figure 4a). Overall, Mallards continue to exhibit increasing trends in all the regions covered by the Eastern Waterfowl Survey, with the highest rate of increase in the Atlantic Highlands.

American Green-winged Teal

The estimated abundance of Green-winged Teal (*Anas crecca*) in the Eastern Survey Area increased by 1% in 2012 compared to the 2011 estimate

(Figure 4b). American Green-winged Teal showed an increase in 2012 in the Atlantic Highlands and Central Boreal Shield, but a decrease in Eastern and Western Boreal Shields. Overall, Green-winged Teal continues to exhibit stable trends, but with the Atlantic Highlands showing an increasing trend.

Ring-necked Duck

The estimated abundance of Ring-necked Duck (*Aythya collaris*) in the Eastern Waterfowl Survey Area decreased by 1% in 2012 compared to the 2011 estimate (Figure 4c). Overall, Ring-necked Duck continues to do well in the four regions covered by the survey.

Southern Quebec Waterfowl Surveys

From 2004 to 2011, an annual survey of the Southern Quebec Lowlands (Abitibi, Lake Saint-Jean and St. Lawrence plain regions) was conducted by helicopter, following a rotational sampling scheme where half of the 200 plots were surveyed each year. To improve precision of the St. Lawrence lowlands survey, the other two survey areas were dropped in 2012 and sampling effort was re-allocated. Results for the most abundant species are shown in Table 1b. The Mallard is by far the most abundant species in the St. Lawrence lowlands, with the 2012 estimate reaching 13 200 indicated breeding pairs. The species has experienced a stable long-term trend since 2004 with a 0.6% increase per year. The 2012 American Black Duck estimate reached 3800 pairs, with the species showing a decline of -3.6% per year since 2004. Green-winged Teals, Wood Ducks and temperate-breeding Canada Geese continue to do well in this part of the province, with increasing trends of 5%, 10% and 8%, respectively (Table 1b). In contrast, the Ring-necked Duck has shown a positive trend of 1.5% annually from 2004 to 2012.

Southern Ontario Waterfowl Plot Survey

Since 2005, the Southern Ontario Waterfowl Plot Survey has been conducted annually using a rotational sampling scheme where half of the 349 plots are surveyed each year. Prior to 2005, surveys were conducted sporadically (roughly every 3 years), and all plots were surveyed in a given year. In 1981 and 1982, survey effort was split and the survey was completed over a 2-year period (1981 – High Strata; 1982 – Low Strata). As a result, the population estimate for 1981 is determined using the combined data from 1981 and 1982 (Figures 5a, 5b, 34).

Results of the breeding waterfowl plot survey in southern Ontario are shown graphically in Figures 5a and 5b for the more common duck species encountered. Trend estimates are presented for both the 1971–2012 and 2000–2012 periods (Table 1a). Among the dabbling ducks, only Blue-winged Teal has exhibited a long-term declining trend (-5.7% annually); however, recently the population appears to be improving (increasing short-term trend). Similarly, the population of American Black Duck shows a slight decreasing long-term trend and a slight increasing trend since 2000 (Table 1a; Figure 5a). The breeding population of Mallard, the most abundant duck species in southern Ontario, has increased slightly since 1984; in 2012, there were just over 165 000 pairs of Mallards in southern Ontario. Wood Ducks have demonstrated a steady increase since 1971 (4.0% annually; Table 1a) and are the second-most-abundant duck species in this area. For diving ducks, all species demonstrate long-term increases in their breeding population (Figure 5b). Results for Common and Hooded Mergansers show that the breeding populations have increased substantially since 2000 (Table 1a). Population estimates for Ring-necked Duck also show a positive trend over the long and short term (Table 1a). Annual population estimates for some species, such as Blue-winged Teal, Green-winged Teal and Ring-necked Duck, can be highly variable. For Teal, this is related mainly to their general low abundance within the survey area. For Ring-necked Ducks, a later-nesting species, annual estimates may be influenced by the presence of large numbers of migrating birds in some years.

Canadian Prairies and Western Boreal Canada

Breeding waterfowl populations are monitored annually through the Waterfowl Breeding Population and Habitat Survey of Western Canada (U.S. Department of the Interior and Environment Canada 1987). The traditional survey area encompasses the Canadian Prairies and Western Boreal Canada (northwestern Ontario to Old Crow Flats in the Yukon), as well as the north-central United States (U.S. Prairies) and parts of Alaska (Figure 6). The USFWS and CWS have been conducting this survey, using fixed-wing aircraft in combination with ground counts, since 1955. Breeding population estimates have been corrected for visibility bias since 1961.

In this section, we summarize information on inland duck populations in the Canadian Prairies and Western Boreal Canada. Summaries of the results by province and territory can be found in Schuster and Ingram (2012).

Breeding Habitat Conditions in the Prairie Pothole Region

In the Prairie Pothole Region (Canadian and U.S. prairies), weather has a strong influence on waterfowl breeding habitat conditions and, consequently, on the abundance of waterfowl populations. Droughts create difficult breeding conditions for ducks. Since 1961, spring habitat conditions have been measured by the number of ponds in May (Figure 7). In 2012, the total pond estimate (prairie Canada and U.S. combined) was 5.5 ± 0.2 million ponds. This was 32% below the 2011 estimate, and 9% above the long-term average of 5.1 ± 0.03 million ponds (USFWS 2012). The 2012 estimate of ponds in the Canadian Prairies was 3.9 ± 0.1 million ponds. This was a 21% decrease from last year's estimate (4.9 ± 0.2 million) (Figure 7). An analysis of trends showed significant increases ($P < 0.05$) in the number of ponds in the Canadian Prairie Pothole Region during the last 10 years (2003–2012) (Table 3).

Mallard

The Mallard (*Anas platyrhynchos*) breeding population in the traditional survey area had recovered from the decline seen in the 1980s, but in 2001 it dropped below the NAWMP goal of 8.2 million (Figure 8), and remained there until 2006. Between 2007 and 2009, the Mallard breeding population index in the traditional survey area oscillated around the NAWMP goal. In 2012, the Mallard breeding population index was 10.60 ± 0.32 million birds, 29% above the NAWMP goal. There are significant positive 5-year and 10-year trends in the traditional survey area (Table 3).

The 2012 Canadian Prairie breeding population index (4.16 ± 0.17 million) was 17% higher than in 2011 (3.55 million), and slightly below the NAWMP goal of 4.37 million birds for the region (Figure 8). In Western Boreal Canada, the Mallard breeding population index was 44% higher compared to the previous year, with an estimated 2.60 ± 0.21 million birds (Figure 8). There are no significant trends in Western Boreal Canada, but there are significant increasing 5-year and 10-year trends in the Canadian Prairies (Table 3).

The continental harvest of Mallards during the last several years increased considerably compared to the late 1980s and early 1990s (Table 4), reflecting the large growth in this population. This increase in harvest has occurred entirely in the U.S., whereas harvest levels have stabilized in Canada. In 2011, it was estimated that 4.41 million Mallards were killed in the U.S., similar to the harvest of the previous year (4.17 million). In 2011 in Canada, the estimated harvest was 509 889 birds killed, an increase of 14% compared to 2010 estimate (446 319). Overall, when compared to 2010, the continental harvest of Mallards in 2011 increased by 7% to 4.92 million birds (Table 4).

Northern Pintail

Following the dramatic decline in abundance in the 1980s and early 1990s, the breeding population of Northern Pintail (*Anas acuta*) in the traditional survey area showed signs of recovery in the late 1990s, increasing to 3.6 million birds by 1997 (Figure 9). Thereafter, pintail numbers again declined, reaching an historic low in 2002. Since 2003, the population has increased, reaching 4.43 million in 2011. In 2012, the population estimate was 3.47 ± 0.19 million birds. However, the population remains below the NAWMP goal of 5.56 million (Figure 9). Table 3 shows that the population is experiencing a significant short-term increase in the traditional area survey; however the population shows a significant long-term decline.

The 2012 breeding population in the Canadian Prairies was estimated at 984 233 ± 81 711 birds, about half that of the 2011 estimate of 1.80 million. The habitat conditions were particularly good in 2011 with a very high number of ponds. The Canadian Prairies population still remains below the NAWMP population goal of 3.30 million. In the Western Boreal Region, Northern Pintail numbers decreased by 25% in 2012 to 112 593 ± 16 625 birds (Figure 9). This population remains below the NAWMP goal of 407 000 pintails. In the Western Boreal Region, the population shows significant short- and long-term declines while the U.S. and Canadian Prairies show a short term increase.

The total annual harvest of Northern Pintails dropped with the population decline that began in the 1980s. The continental harvest gradually rose during the mid-1990s (Table 5), reflecting the increase in estimated pintail numbers during the same period. Between 2002 and 2004, both the estimated breeding population and harvest dropped again. Since then, continental harvest numbers have been increasing every year, driven by increases in U.S. harvest. The estimated continental harvest increased by 15% in 2011 (851 413 birds killed), with an increase noted in both Canada (49 313) and the U.S. (802 100; Table 5).

Other Dabbling Ducks

Other dabbling duck species monitored under the Waterfowl Breeding Population and Habitat Survey are Blue-winged Teal (*Anas discors*), Gadwall (*A. strepera*), Green-winged Teal (*A. crecca*), American Wigeon (*A. americana*), and Northern Shoveler (*A. clypeata*). The continental

abundance increased in 2012 relative to 2011 for all these species (Figures 10 through 14). All species but the American Wigeon show significant positive 10-year and long-term trends (Table 3); the long-term trend for the American Wigeon is declining, but not significantly. For all species there were increases in the 2012 population estimates for the Canadian Prairies (including American Wigeon; Figures 10 through 14).

These five species are currently above their NAWMP population goal in the traditional survey area (Figures 10 to 14). Since the 1980s, the continental population of American Wigeon has stayed mostly under the NAWMP goal of 2.97 million birds, but in 2012 the population reached 3.47 million birds, well above the population objective (Figure 13).

Scaup

Lesser Scaup (*Aythya affinis*) and Greater Scaup (*A. marila*) are not treated separately in the Waterfowl Breeding Population and Habitat Survey because it is difficult to differentiate among them from fixed-winged aircraft. Nonetheless, Lesser Scaup is the much more abundant species (Austin *et al.* 1999). After several years of decline, Scaup populations in the traditional survey area have increased to pre-2000s levels (5.24 ± 0.30 million birds in 2012) approaching the NAWMP goal of 6.3 million.

The scaup population size in Western Boreal Canada accounts for nearly two-thirds of the continental total. At 3.26 ± 0.26 million birds estimated in 2012, the number of scaup in Western Boreal Canada remains well below the NAWMP population goal of 4.3 million birds (Table 3). The Western Boreal breeding population showed significant 10- and 5-year increasing trends, but a significant long-term decline. In 2012, the Canadian Prairie breeding population was estimated at 917 791 ± 97 875 birds, a 39% increase compared to the 2011 estimate. Although this regional population shows a significant 10- and 5-year increasing trends (Table 3), it remains well below the NAWMP goal of 1.05 million.

The harvest of Lesser and Greater Scaup has declined considerably in Canada over time (Tables 6 and 7). In 2011, the Canadian harvest of Lesser and Greater Scaup was estimated at 21 066 and 5532 birds, respectively, which in both cases represents a decrease over 2010 (40% and 20%, respectively).

The scaup harvest has been quite variable in the U.S. (Tables 6 and 7). In 2011, the Lesser Scaup harvest in the U.S. was 227 426 birds, which represented a decrease of 21% compared to 2010. The Greater Scaup harvest has also been variable over the years in the U.S. The estimated harvest was 59 424 birds in 2011 (15% lower than in 2010).

The continental harvest of Lesser Scaup decreased by 23% to 248 492 birds in 2011. Similarly, the continental harvest of Greater Scaup was down by 15% to 64 956 birds in 2011.

Other Diving Ducks

The other diving duck species monitored as part of the Waterfowl Breeding Population and Habitat Survey are the Canvasback (*Aythya valisineria*), Redhead (*A. americana*), Ring-necked Duck (*A. collaris*) and Ruddy Duck (*Oxyura jamaicensis*).

The breeding population of Canvasbacks in the Canadian Prairies has recovered somewhat from the population decline seen during the 1980s and early 1990s. The population has fluctuated widely in recent years (Figure 16). Overall in 2012, within the entire traditional survey area, Canvasback shows significant increasing trends over the long and short terms; however, in Alaska and the Western Boreal, Canvasbacks are experiencing significant 10-year declines, while in both the Canadian Prairies and U.S. Prairies the 5- and 10-year terms show significant increasing trends (Table 3). At 759 937 ± 68 516 Canvasbacks in 2012, the continental population is above the NAWMP goal of 541 868 (Figure 16).

The Canadian harvest of Canvasback fluctuates from year to year. In 2011, the estimated harvest was 12 998, double the 2010 estimate (Table 8). The harvest in the U.S. also fluctuates widely from year to year; the 2011 U.S. harvest was, estimated at 140 862 birds, 3% below the 2010 estimate (Table 9).

Like the Canvasback, Redhead numbers are highly variable from year to year (Figure 17). The 2012 continental count of 1.27 ± 0.10 million birds is comparable to the estimates of the past five years, but higher than numbers estimated prior to 2006 (below 1 million), and lower than last year's estimate which was an all-time high (Figure 17). The population remains well above the NAWMP goal. Redheads show a significant increasing trend over the 10-year and long terms in the traditional survey area.

The Ring-necked Duck population shows an increasing trend of 2.5% per year over the long term for the Western Boreal and Canadian Prairies regions as well as the entire survey area (Table 3). Ruddy Ducks have also done well, with a significant increasing trend of 1.8% per year over the long term in the traditional survey area (Table 3; Figure 19).

Southern Yukon

This was the 21st year of the Cooperative Yukon

Roadside Waterfowl Breeding Population Survey. This is a ground survey aimed at waterfowl as well as other waterbirds and shorebirds. It is intended to track trends only–there are no associated population estimates. The survey consists of counts on a sample of wetlands, conducted five times between early May and mid-June. The 2012 survey sample consisted of approximately 285 wetlands along the southern Yukon road system. To minimize missing data issues, a sample of 169 wetlands was chosen from the 285 to examine trends over the past 5, 10, and 15 years, as well as the entire 21-year period. For each survey, indicated pairs were calculated using standard operating procedures. The numbers presented in Figures 20 and 24 are the total number of indicated pairs on these 169 wetlands from all five surveys each year.

Spring 2012 (March through May) was slightly warmer and much wetter than normal in the Yukon/Northern B.C. Mountains Climate Region. Summer (June through August) temperatures and precipitation were well above normal. These conditions, combined with above-average winter precipitation and snowpacks, resulted in many breeding wetlands in southern Yukon having much higher than normal water levels during May and early June.

Spring migration of dabbling ducks (as measured by counts at Marsh Lake near Whitehorse) was slightly ahead of normal. Mallard migration peaked around April 24.

Total duck numbers were up 17% from last year. Dabbling duck numbers (Figure 20) were all up, while diving duck and seaduck numbers were all down (Figure 24). The most dramatic changes from last year were Northern Shoveler (+164%), Northern Pintail (+63%) and Green-winged Teal (+56%). Long-term trends (5, 10, 15 and 21 years) were examined for the 10 major duck species counted on the Yukon survey. The only significant trends were: (1) a continued decline in scaup spp. (primarily Lesser Scaup) over the past 10, 15 and 20 years, although the 5-year trend is stable; (2) a modest long-term (15 and 21 years) decline in American Wigeon; and (3) 15- and 21-year increases in Gadwall. A cursory examination of the increasing Gadwall trend shows that it reflects increasing populations of this species in the vicinity of Whitehorse, likely related to a large sewage lagoon complex constructed there in 1996. Although the sample size is small, Trumpeter Swans continue to show highly significant increases over all periods except the last five years. (J. Hawkings, pers. comm.).

Interior British Columbia

The La Niña weather pattern experienced in British Columbia during the 2011-2012 winter resulted in a late and cool spring. In early May 2012, snowpack conditions were above average to well above average in all Interior B.C. regions. The onset of the surveys was delayed to May 7, 2012 to allow some melt and opening up of wetlands at mid- and high altitude. As in previous years, some high-altitude wetlands (>4500 feet) remained completely frozen during the entire survey period, but water levels at mid-altitude (3500 to 4500 feet) were higher than last year and generally good. Water levels for low-elevation wetlands (below 3500 feet) were marginally better than last year but still below long-term levels (1980–2010). Overall, breeding habitat conditions were marginally to substantially better than in May 2011. Conditions were average to good in the northern portion of the survey area and for higher-altitude wetlands but below average in the southern portion, which contains the highest number and most productive wetlands in the province.

Aerial surveys of breeding waterfowl have been conducted in the Central Interior Plateau of B.C. annually since 2006, over an area in excess of 10 million hectares. The survey used a strip-transect total count method similar to the one used for the mid-continent breeding waterfowl survey, although all waterfowl sightings are geo-referenced and associated with a unique habitat type (i.e., stream, wetland, river, lake, agricultural field) and ecological unit (ecosection) to allow for the subsequent determination of ecosystem-specific, habitat-to-species relationships and the development of landscape use models. Using the USFWS formula to estimate breeding waterfowl abundance, the duck population of the Central Plateau was estimated at 297 716 birds (SE 15 023) in May 2012, with Mallard being the most abundant species (26% of the total). The overall estimate is 14% higher than the 260 578 total duck estimate for 2011 (A. Breault, pers. comm.).

Population Status of Sea Ducks

There is concern about the population status of most of the sea duck species (tribe *Mergini*) that breed in North America. There are 15 species on the continent. Because many breed at low densities in remote parts of the continent and cover a broad geographic area, it is difficult to gather adequate information on their ecology and population dynamics. Consequently, sea ducks are poorly understood and few reliable population indices or estimates of annual productivity exist for any of the

species. Much of our knowledge is based on a very few, localized studies. Harvest levels are also poorly understood. In comparison to other waterfowl, sea ducks have low reproductive rates, which means that population maintenance is highly sensitive to adult mortality. There is therefore limited potential for quick population recovery. Because of increasing concern about the status of sea ducks, the NAWMP Committee created the Sea Duck Joint Venture (SDJV) in 1998 (see www.seaduckjv.org). The goals of the SDJV can be grouped under four broad categories: knowledge, communication, partnerships and conservation actions. A SDJV Strategic Plan was developed for 2008–2012. This plan identifies information needs for sea ducks and describes general strategies to address those needs. The SDJV also developed the 2012–2015 Implementation Plan, which defines current SDJV priorities and identifies specific tasks, timelines and responsibilities for addressing priority needs. Harvest information is estimated through the national harvest survey programs in Canada and the U.S. However, harvest estimates are imprecise for some sea duck species due to small sample sizes.

Eiders

Common and King Eiders inhabit arctic and subarctic coastal marine habitats and have a circumpolar distribution. Their breeding ranges in Canada are extensive, and cover most coastlines from the Beaufort Sea east into Coronation and Queen Maud gulfs, and north into the High Arctic islands, as well as throughout the eastern Canadian Arctic, including Hudson and James bays, and from the coast of Labrador south into New Brunswick. Eiders that breed in Canada, and that winter as far north as open water persists, form large aggregations in coastal areas. In the Pacific, they winter as far north as the polynyas adjacent to the Chukotka Peninsula in Russia, while in the northwest Atlantic they winter in Hudson's Bay, southwest Greenland, and from the Labrador coast south to New York. Throughout their range, there are four subspecies of Common Eiders and two populations of King Eiders. These populations are thought to be demographically distinctive, as they experience different climatic conditions and local threats.

Eiders have long been exploited for food and eiderdown, and more recently they have become the focus of outfitted hunts along the eastern seaboard of the U.S. Market hunting almost extirpated them from eastern North America by the end of the 19th century. The Migratory Birds Convention designated special protection to eiders and largely eliminated commercial hunting in North America. More recently, commercial exploitation of eiders in Greenland has led to concern for the sustainability of eiders wintering there (Hansen 2002; Gilliland *et al.* 2009). Unlike any other species of migratory birds in North America, Common Eiders in some areas of eastern Canada support large commercial and subsistence harvests of eiderdown, where it provides a cash crop in areas with low employment or is used locally for insulation in Inuit parkas and supports local economies.

Industrial activity in Canada's north is likely to increase in the next decades. There is renewed interest in offshore oil and gas development in the Beaufort Sea, as well as some areas in the eastern Arctic. Marine shipping is likely to increase in the Arctic, especially in Hudson Strait. Both the Beaufort Sea and Hudson Strait have important marine resting and feeding areas used by thousands of eiders at certain times of the year. Increased human activity in these areas could negatively affect eiders through disturbance and pollution from accidental spills or chronic discharge.

The remoteness of much of their breeding and wintering ranges, the existence of several distinctive populations, and the fact that eiders do not use recognized North American flyways all have been factors that have led to inconsistent or non-existent management and monitoring programs across Canada. Clearly, Canada has a core responsibility for their management, but cooperation is needed with northern wildlife management boards, Russia, Greenland, France and the U.S.

King Eider

Western Arctic Population

The population estimates and trends for the Western Arctic King Eider are currently based on a count obtained about every 10 years during spring migration at Point Barrow, Alaska (Suydam *et al.* 2000, 2008). These counts indicated a 56% decline in numbers over a 20-year period, from 800 000 in 1976 to about 350 000 in 1996. Counts in 2003 and 2004 suggest the population may have stabilized, or possibly increased, since the mid-1990s (304 000 ± 76 254 and 592 000 ± 172 011 in 2003 and 2004, respectively). Aerial transect surveys on western Victoria Island suggest that the King Eider population breeding on western Victoria Island declined by 54% between the early 1990s and 2004–2005 (Raven and Dickson 2006). The greatest decline occurred around Holman, the only community in the survey area.

Movement between nesting, moulting and wintering areas has been documented for King Eiders tagged with satellite transmitters on Victoria Island and Banks Island, Northwest Territories, and

Prudhoe Bay, Alaska. The results show the majority of western King Eiders moult and winter off the east coast of Russia or off the coast of Alaska (Dickson 2012a). The west coast of Banks Island is a primary staging area during moult migration for King Eiders that were implanted with satellite transmitters on Banks Island, Northwest Territories (Dickson 2012b). The most heavily used staging area during the spring was the southeast Beaufort Sea (Dickson 2012a). King Eiders banded in the central Arctic, in the Queen Maud Gulf, have been recovered near Alaska as well as near Greenland (R. Alisauskas, pers. comm.).

The King Eider is harvested for subsistence use in Canada, Alaska and Russia. There is some concern that local harvest in communities such as Holman, Canada, are having an impact, yet harvest data for all three countries lack the accuracy and precision needed to model effects on adult survival. Fabijan *et al.* (1997) estimated a harvest in Alaska and Canada of 2–5% of the population from the mid-1970s to mid-1990s. The eider harvest in Canada occurs mainly in June, with most (99%) of the harvest occurring at Holman (96% are King Eiders). Harvest data for Russia are speculative (probably numbers in the low 1000s).

Eastern Arctic Population

A review of available data on the wintering grounds in Greenland has shown a substantial decrease in the numbers of wintering and moulting King Eiders and suggests that the eastern Arctic population is declining. It is not known if this apparent decline represents a shift in distribution due to human disturbance (Suydam 2000). In the Rasmussen Lowlands of Nunavut, however, a significant decline in the numbers of King Eiders was seen between 1974–1975 and 1994–1995 (Gratto-Trevor *et al.* 1998). These findings support the concerns expressed by hunters in the area that numbers are declining (Johnston *et al.* 2000). In February 2010, CWS conducted exploratory surveys in parts of Hudson's Strait and Frobisher Bay. These surveys confirmed the occurrence of large numbers of wintering King and Common Eiders at the northern tip of Labrador and southern tip of Baffin Island (S. Gilliland and C. Lepage, unpubl. data), with small numbers of birds occurring on the eastern side of Ungava Bay and in Frobisher Bay. The east coast of Baffin Island has not been explored, but anecdotal observations by helicopter pilots suggest concentrations of eiders may winter there as well (J. Innis, pers. comm.).

In the eastern Arctic, available harvest data for eiders are limited. However, the harvest of eiders (King and Common Eiders combined) in southwest Greenland is estimated at over 100 000 birds annually. A large proportion of this harvest consists of Canadian breeding birds, since the breeding population of Common Eiders in western Greenland is likely only 20 000 pairs, based upon recent surveys (G. Gilchrist, pers. comm.). The largest eider harvests in Canada occur in Newfoundland, where about 10% of the harvest may be composed of King Eiders (Gilliland and Robertson 2009).

Pacific Common Eider

Pacific Common Eider population estimates and trends for Canada are currently based on a count obtained about every 10 years during spring migration at Point Barrow Alaska (Suydam *et al*. 2000, 2008). These counts indicated a 53% decline over a 20-year period from 156 000 in 1976 to about 73 000 in 1996. More recent counts in 2003 and 2004 suggest the population has increased since the mid-1990's to over 100 000 eiders.

Surveys during spring migration in the late 1980s suggested that more than half of the Pacific Common Eiders that breed in Canada nest in Dolphin and Union Strait, Coronation Gulf, and Queen Maud Gulf. To document the size and location of nesting colonies, provide a breeding population estimate for the region, and establish a baseline for monitoring Pacific Common Eider populations in future, aerial and ground surveys were conducted over three years beginning in 1995. The breeding population for the central Arctic was estimated at about 37 000 and the primary nesting areas were identified as southeastern Dolphin and Union Strait, outer Bathurst Inlet, Melville Sound, Elu Inlet and central Queen Maud Gulf (L. Dickson, pers. comm.).

Aerial surveys in late June in the Bathurst Inlet area were conducted in 1995, then again in 2006–2008 to establish a baseline for monitoring Pacific Common Eider breeding population trends (Raven and Dickson 2008). At a subset of 24 colonies in the same area, nest success and annual survival of adult females were monitored over a 7-year period starting in 2001 (Hoover and Dickson 2007).

Satellite telemetry of eiders from a nesting colony near Bathurst Inlet, Nunavut, indicated that most of these eiders winter off the southeast coast of Chukotka Peninsula, Russia and off the coast of St. Lawrence Island, Alaska (Dickson 2012b). About one third of the males also moult off Russia. Harvest information for eastern Russia is limited, but suggests a substantial take of eiders. A rough estimate of the subsistence harvest in 2001 in Chukotka was 115 000 eiders (from four different species) (E. Syroechkovski Jr., pers. comm.). However, it is not known what percentage of this take is Pacific Common Eiders from Canadian

breeding grounds. The subsistence harvest of Pacific Common Eiders in Canada and Alaska is an estimated 2500 birds per year (Fabijan *et al.* 1997).

Northern Common Eider

The northern subspecies of the Common Eider breeds throughout the coastal areas of the eastern Canadian Arctic and Greenland, and winters along the coasts of Newfoundland and Labrador, Quebec, and southwest Greenland. This subspecies is unique in that it is intensively harvested commercially in west Greenland and is subjected to both subsistence and recreational harvest in Canada. Demographic modelling recently suggested that harvest levels were unsustainable (Gilliland *et al.* 2009). The bulk of the harvests occur in Greenland and insular Newfoundland, but harvest levels in Greenland were determined to be excessive, leading to a harvest allocation issue with Canada. More restrictive harvest regulations were put in place in Newfoundland in 1997 and Greenland in 2002–2004 (Merkel 2010), resulting in a decrease in overall harvest, but harvest levels remain high. Pressures to liberalize harvest in Greenland and Newfoundland continue, and population impacts of recent avian cholera outbreaks in the Canadian Arctic continue to be a major population threat.

Despite the harvest issue, there is no recent data on breeding areas: the very large distribution of this subspecies in the Canadian Arctic makes it very difficult to survey on a regular basis. Historical data only exist for three sites: Ungava Bay, Hells Gate (High Arctic) and Digges Sound. Recent surveys in Greenland indicate that dramatic population declines have occurred since the 1970s. However, a community-based monitoring program implemented following the 2002–2004 harvest restriction has documented a strong recovery of eiders breeding in western Greenland (Merkel pers. comm.)

A winter monitoring program was implemented in 2003 to estimate population size and trends for the component of this subspecies that overwinters in Canada. The entire wintering range of Northern Common Eiders in eastern Canada (and St. Pierre and Miquelon, France) has been surveyed every third winter since the survey was implemented in 2003. Population estimates in 2003, 2006 and 2009 were 204 000 ± 15 500, 175 800 ± 8000 and 204 800 ± 22 400, respectively, suggesting that the Canadian overwintering component has been stable over this period (Gilliland *et al.*, in prep.). The survey of the wintering range was repeated in February 2012, and the final result will not be available until January 2013.

Emerging threats for Northern Eiders include disease, disturbance of breeding colonies by polar bears, increased shipping though Hudson's Strait, oil mortality, and high harvest in Newfoundland. For example, the first recorded Arctic outbreaks of avian cholera were recorded in Common Eiders in 2004 (northern Quebec), 2005 (Southampton Island) and 2006–2007 (Southampton Island and northern Quebec). Many hundreds of Common Eider ducks died of avian cholera at nesting colonies in northern Hudson Bay and west Hudson Strait in July and August 2004–2005. This finding was first detected by local residents hunting in the area near Ivujivik, northern Quebec. In the summer of 2006, cholera was again detected at eider colonies along the northern coasts of Quebec in Nunavik, and at East Bay, Southampton Island, Nunavut. At East Bay, over 3200 eiders (i.e., more than 40% of the nesting females) were killed between late June and early August 2006 (Gilchrist, unpubl. data). Similarly, Inuit from Nunavut and Nunavik have recently reported catastrophic losses at many breeding colonies as a result of polar bear activity. Although polar bear activity has been observed intermittently, it has never been observed at the current levels, and cholera has never been observed in Arctic breeding eiders.

Harvest information is estimated through the national harvest survey programs in Canada and the U.S., and these estimates are thought to be imprecise for most sea duck species. This survey has shown that harvest of eiders has generally declined over the last 30 years; however, harvests in Newfoundland and Labrador have been increasing since 2005, and unusually high levels were recorded in 2007 and 2008. These levels have not been observed since the mid-1980s and may be unsustainable (Gilliland *et al.* 2009).

Hudson Bay Common Eider

The Hudson Bay subspecies of the Common Eider breeds within Hudson Bay and winters in open water leads near the Belcher Islands and off the western coast of Quebec. This is one of the only waterfowl species in the world that spends the entire year in Arctic waters. Mass die-offs can occur in winter when large portions of the population are concentrated in open-water leads that sometimes freeze over (Robertson and Gilchrist 1998). The frequency and magnitude of these die-offs and the impact that they have on the Hudson Bay Common Eider population is unknown.

Breeding data for this subspecies only exist for the Belcher Islands and the area of La Perouse Bay, Manitoba. The Belcher Islands, first surveyed in the 1980s, were resurveyed in 1997. The results showed that the breeding population had declined by 70% since the late 1980s, apparently due to winter weather events (e.g., freezing of polynyas) that led to high levels of mortality in 1992 (Robertson and

Gilchrist 1998). The CWS initiated research into the winter ecology of Hudson Bay Common Eiders in 1998. The three winters that followed were mild, with vast expanses of open sea available to foraging flocks. There have been no significant winter kill events since this work began, and the eider population appears to be recovering.

American Common Eider

The current American Common Eider population estimate is around 300 000 birds (Lepage and Bordage, in prep.) and is among the most commonly harvested waterfowl in several coastal regions of eastern Canada and the U.S. The sustainable harvest rate was estimated around 10% (Savard *et al.* 2004), and the current harvest estimate is about 32 000 birds, which exceeds the estimate of sustainable harvest for this subspecies. Historically, the majority of the American Common Eider harvest occurred in Canada; however, the Canadian harvest has declined, while the subspecies has become the focus of outfitted hunts along the eastern seaboard of the U.S., and the U.S. now takes about 65% of the total harvest. In addition to the recreational harvest, American Common Eiders are harvested for Aboriginal subsistence use and are locally important for some Aboriginal communities in Quebec and Atlantic Canada; no estimates of subsistence harvest are available. Eiderdown harvest also represents an important economic activity in the St. Lawrence Estuary.

Reliable data for breeding areas only exist for segments of the population that breed in the St. Lawrence Estuary and the North Shore of the Gulf of St. Lawrence. Trends were stable in the estuary and appeared to be increasing in the Gulf of St. Lawrence (Rail and Cotter 2007), but now appear to be declining at about 3% per year (J.-F. Giroux, Université du Québec à Montréal, pers. comm.). The number of eiders breeding in northern Newfoundland and southern Labrador also appear to be increasing (S. Gilliland, unpubl. data). There is little information on the status of the population segments breeding in the southern portion of their range. Preliminary analysis suggests that eiders breeding in New Brunswick may be experiencing a long-term decline of about 3% per year (K. Conner, unpubl. data), and anecdotal information for Nova Scotia and Maine suggests declines in the number and size of breeding colonies in these areas.

Diseases may play an important role in the dynamics of this population. Intermittent outbreaks of avian cholera have been reported throughout their range, with the most recent event occurring in 2002, when an estimated 6000 adult females died at breeding colonies in the St. Lawrence Estuary (The Joint Working Group on the Management of the Common Eider 2004). Beginning in 1998, 11 mystery winter mortality events involving 30 to 2800 eiders were observed along the coast of Cape Cod, Massachusetts (C. Dwyer, unpubl. report). In late 2010, diagnosticians at the Southeast Cooperative Wildlife Disease Study (SCWDS) at the University of Georgia isolated a previously undescribed orthomyxovirus, tentatively named Wellfleet Bay Virus, implicated in the die-offs (C. Dwyer, pers. comm.). The impacts of these emerging and re-emerging diseases on American Common Eiders is poorly understood; however, research programs at the Université du Québec à Montréal, led by J.-F. Giroux, are focusing on the impact of avian cholera on population dynamics of eiders breeding in the St. Lawrence Estuary, and the U.S. Geological Survey's National Wildlife Health Center has been collaborating with the SCWDS and the USFWS to further characterize the orthomyxovirus.

In addition to diseases, recent changes in predator communities have also been implicated as potential stresses on American Eiders breeding in the southern portion of their breeding range. Population recovery of river otters, Great Black-backed Gulls and Bald Eagles have all been identified as potential sources of mortality and disturbance at American Eider breeding colonies in Nova Scotia, New Brunswick and Maine.

In response to concerns for this population, resource agencies in Canada and the U.S. are currently undertaking an assessment of the status of this population and are planning to implement a regular range-wide monitoring program for American Eiders (see Gilliland *et al.* 2011 and Bordage *et al.* 2007). Accordingly, in May 2012, preliminary surveys of a few colonies in the St. Lawrence Estuary were conducted to test feasibility of counting males from the air and repeatability as a first step towards a concerted range-wide monitoring program.

Harlequin Duck

Until the 1990s, there was little knowledge of the ecology of Harlequin Ducks (*Histrionicus histrionicus*) in North America. However, research efforts have improved understanding of this species in some areas. Robertson and Goudie (1999) provide a review of available information on the Harlequin Duck.

Eastern Population

The eastern North American population of the Harlequin Duck was assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as endangered in Canada in 1990. As a

consequence, hunting of this species was shut down throughout the Atlantic Flyway. In the late 1980s, the population overwintering in eastern North America was estimated at less than 1000 individuals (Goudie 1991). Overhunting, disturbance and habitat loss are believed to have played a role in the decline of the population (Robertson and Goudie 1999). Later, new information indicating the number of harlequins breeding in Eastern Canada to be significantly larger than suspected led to the population being reassessed as a population of Special Concern (Thomas and Robert 2001).

Studies based on satellite telemetry suggested the existence of two Harlequin Duck populations: one that breeds in northern Quebec and Labrador and overwinters in southwest Greenland, and one that breeds in southern Labrador, Newfoundland, New Brunswick and the Gaspé Peninsula of Quebec, and winters mostly in the Maritimes and Maine (Brodeur *et al.* 2002). Genetic studies support the existence of two populations with minimal gene flow (Scribner *et al.* 2000). The extent to which the breeding and wintering areas of these populations overlap is unknown. The size of the harlequin population that originates in Canada and overwinters in Greenland is also not known, but 6200 moulting harlequins were estimated along the western coast of Greenland during surveys in 1999 (Boertmann and Mosbech 2002). The population of Harlequin Ducks wintering in eastern North America is estimated at about 3000 birds, with slightly more than half (~1600) wintering in Maine at a single location (Mittelhauser 2008; Robertson and Goudie 1999; Thomas and Robert 2001). Numbers of Harlequin Ducks wintering in Eastern Canada have shown increases since the mid-1980s. Winter surveys conducted in 2010 identified approximately 300 birds in the Bay of Fundy, 600 on the southern and eastern coasts of Nova Scotia, and roughly 450 wintering in Newfoundland. This was encouraging news, given the dramatic decline that occurred there through the 1980s and early 1990s.

Robertson *et al.* (2008) published a summary of the status of the eastern population of Harlequin Duck, and a document entitled *Management Plan for the Harlequin Duck (*Histrionicus histrionicus*), Eastern Population, in Atlantic Canada and Quebec* is available at www.sararegistry.gc.ca/document/dspdocument_e.cfm?documentid=1276.

Western Population

Reflecting conservation concern for Harlequin Ducks, considerable attention has focused on western populations, particularly in the Strait of Georgia, over the past 15 years (S. Boyd and D. Esler, pers. comm.). Collaborative efforts by the CWS and Simon Fraser University have revealed much about the ecology and conservation of Harlequin Ducks; in fact, Harlequin Ducks in the Strait of Georgia are frequently highlighted as one of the sea ducks about which an unprecedented understanding of ecology and demography exists. In brief, findings include: (1) the Strait of Georgia provides non-breeding habitat for >10 000 Harlequin Ducks; (2) concentrations in the Strait of Georgia during the spring herring spawn number in the thousands, which is a globally unique aggregation; (3) birds wintering in British Columbia breed across a wide range of mountain streams throughout the province and beyond; (4) they show very strong fidelity to wintering and moulting sites, which means that local aggregations are largely demographically discrete and therefore vulnerable to high harvest and/or disturbance levels as well as habitat change; (5) at least some ducklings follow their mothers to wintering areas, further contributing to the formation of distinct, independent population segments; (6) annual survival of adults appears to be high and sustainable; and (7) production of young birds appears to be sufficient to maintain stable population numbers (S. Boyd and D. Esler, pers. comm.).

Focused studies of Harlequin Ducks in the Strait of Georgia are coming to a close. The CWS is completing an analysis of leg band data to determine survival rates, and will eventually publish the results. The CWS also hopes to re-establish field surveys of productivity, based on counts of male age ratios during winter, in order to document annual variation and derive long-term means. Also, a research program was completed by the Centre for Wildlife Ecology at Simon Fraser University to evaluate the roles of habitat quality and acquisition of nutrients for clutch formation (S. Boyd and D. Esler, pers. comm.).

Scoters

The three species of scoters that breed in Canada are Black Scoters (*Melanitta americana*), Surf Scoters (*M. perspicillata*) and White-winged Scoters (*M. fusca*). Less is known about scoters than about any other group of sea ducks. Research efforts in recent years have brought us to a better understanding of the breeding, moulting and wintering ecology of this group. Bordage and Savard (1995), Brown and Fredrickson (1997), and Savard *et al.* (1998) all provide useful reviews of the information available on scoters. Several projects supported by the SDJV have also addressed research on important information gaps about scoters (www.seaduckjv.org/ssna.html).

Eastern Canada

Most Black Scoters breed in Eastern Canada, and until recently the eastern breeding ground was thought to be centred in northern Quebec. However, recent satellite telemetry studies (2002–2004; 2009–2010) of migrating birds marked in spring in the Chaleur Bay give evidence that pairs also breed west of Quebec, i.e., in northwestern Ontario, northern Manitoba, Nunavut and the Northwest Territories east of Great Slave Lake (Gilliland and McAloney 2009). Western Black Scoters have a breeding ground centred in Alaska (Bordage and Savard 1995).

Surf Scoters are counted during the Eastern Waterfowl Survey, although the area surveyed (Figure 1) only partially covers the southern extent of the Surf Scoter breeding distribution. According to the Eastern Waterfowl Survey, Surf Scoters continue to do well in the boreal forest (Figure 22).

The Chaleur Bay area (Quebec and New Brunswick) as well as the St. Lawrence Estuary and Gulf are major spring staging areas for scoters. Aerial surveys that had been photo-corrected for observer error indicated an Atlantic Flyway spring staging population of about 90 000 Black Scoters, i.e., 52 000 in the Chaleur Bay and 36 300 in the St. Lawrence Estuary (Quebec) in 2005 (K. McAloney, CWS, unpubl. data). In 1998, over 220 000 scoters (the three species) were staging in the St. Lawrence Estuary and Gulf (Rail and Savard 2003). Surf Scoters are the most numerous scoters in that region and are estimated to account for 70% of scoters.

Surveys in September and October 2006 indicated that the St. Lawrence Estuary was an important staging area for Surf Scoters in fall, since nearly 80 000 birds were counted there (J.-P. Savard, CWS, pers. comm.). Moult surveys in late July and early August of 2006 indicated that some 50 000 scoters (mostly male Surf and White-winged Scoters) moulted within the St. Lawrence Estuary (J.-P. Savard, pers. comm.). Scoters (all three species) implanted with satellite transmitters also confirmed the importance of the Chaleur Bay and St. Lawrence Estuary and Gulf during spring migration, moulting and fall migration.

Between 50 000 and 62 000 moulting scoters (mostly male Surf Scoters) were sighted along the Labrador coast in 1998 and 1999 (S. Gilliland, pers. comm.).

Photographic aerial surveys of moulting (primarily male) Black Scoters have been conducted during late July at western James Bay five times between 1977 and 2012 (Badzinski *et al.* 2012). Early surveys documented major concentrations of birds at various locales along the Ontario coastline of James Bay, where 45 000 and 53 960 birds were observed in 1977 and 1991, respectively (Ross *et al.* 2009). In 2006 CWS and the Ontario Ministry of Natural Resources, with support from the SDJV, began developing standard survey protocols, investigating various methodological improvements and technical innovations, and flying reconnaissance surveys to develop a potential operational population monitoring survey for eastern Black Scoters. During the 2006 survey, previously unknown major concentrations of birds were discovered along the southern and northeastern coastlines of Akimiski Island, Nunavut (Ross *et al.* 2009), information that resulted in expansion of the core survey area in James Bay. During the 2006, 2009 and 2012 surveys, a total of 88 460, 106 600 and 125 369 Black Scoters, respectively, were observed in the core survey area in western James Bay (Badzinski *et al.* 2012). A reconnaissance survey conducted during July 2009 documented relatively few (4331) Black Scoters using eastern Hudson Bay (south of Belcher Islands) and eastern James Bay (Cotter 2009). Recent satellite telemetry data suggests that in addition to eastern Hudson Bay and both sides of James Bay, Black Scoters also congregate to moult off the north coast of Ontario along the western Hudson Bay coastline (S. Gilliland *et al.*, unpubl. data), but to date no surveys have been conducted there to determine numbers or distribution (Badzinski *et al.* 2012).

In 2010, 19 White-winged and 48 Black Scoters were marked with satellite transmitters in the St. Lawrence Estuary and Chaleur Bay. These marked birds should provide valuable information on seasonal connectivity, timing and direction of movements, and site fidelity to wintering, breeding and moult sites. Movements of marked birds are available at www.seaturtle.org/tracking/?project_id=538 (White-winged Scoters) and www.seaturtle.org/tracking/index.shtml?project_id=499 (Black Scoters).

Marking scoters with satellite transmitters continued in the St. Lawrence Estuary in 2012, as part of the larger Atlantic and Great Lakes Sea Duck Migration Study (seaduckjv.org/atlantic_migration_study.html). An additional 20 White-winged Scoters and 26 Surf Scoters were marked in the Gulf of St. Lawrence. Movements of marked scoters are available at www.seaturtle.org/tracking/?project_id=759.

Western Canada

The traditional survey area of the Waterfowl Breeding Population and Habitat Survey in Western Canada (Figure 6) covers a large part of the breeding area of White-winged Scoters and a substantial portion of the Surf Scoter range. The three species of scoter are not differentiated during

these surveys, however, as it is difficult to distinguish among them from fixed-wing aircraft. Based on the extent of known breeding distributions, scoter populations in the Canadian Prairies should be White-winged Scoters only, while populations in Western Boreal Canada include White-winged and Surf Scoters. All three species are present in Alaska. However, these data should be interpreted with caution, as the surveys are not well designed for estimating scoter numbers (Savard *et al.* 1998).

Although found at very low densities on the Canadian Prairies, scoter numbers have declined over the long term based on the results of the Waterfowl Breeding Population and Habitat Survey (Figure 23). Surveys in 2012 indicated an estimated 1.06 million individuals in the entire survey area, which is a decrease of 29% from 2011 (Figure 23).

A more detailed examination of trends in various strata showed intriguing results. Alisauskas *et al*. (2004) showed that, contrary to the overall declining trend, scoters increased over the previous decade in northern Manitoba and Saskatchewan, but continued to decline in northern Alberta and the Northwest Territories. Their research, making use of reverse-time capture histories of White-winged Scoters at Redberry Lake, Saskatchewan, shows the long-term decline in the local population has now been arrested. Interestingly, this occurred as a result of increased recruitment through the immigration of adult females (Alisauskas *et al.* 2004).

Large concentrations of Surf Scoters and White-winged Scoters are found in coastal British Columbia, in habitats that also support shellfish aquaculture, an industry that has the potential to expand dramatically. Simon Fraser University and CWS have completed a study of the interactions between scoters and the shellfish industry, evaluating potential effects on scoter population sustainability at local and regional scales (S. Boyd and D. Esler, pers. comm.). The findings suggest that, at current levels of activity, the overall effect of the industry in one important area for both shellfish and scoters is sustainable (Baynes Sound). The project has resulted in the publication of several papers and two master's theses.

In response to the apparent decline in scoter numbers, reductions were made in 1993 to the bag limits for scoters in the U.S. and Canada. The harvest of all three scoter species in Canada and the U.S. has declined considerably since the 1970s (Tables 9 to 11), although harvest levels of Surf and Black Scoters in the Atlantic Flyway in 2011 again appeared to be near historic levels. In Canada, the harvest is estimated at a few thousand birds of each of the three species.

Barrow's Goldeneye

Eastern Population

In 2000, the small eastern population of Barrow's Goldeneye (*Bucephala islandica*) was assessed by COSEWIC as being of Special Concern. Because of the potential threat to the species, most Barrow's Goldeneye wintering and staging areas in Canada have been closed to hunting. However, because the Barrow's Goldeneye is an arboreal species, forestry operations and introduction of fish on fishless lakes on its breeding grounds are more likely to be threats (Robert *et al*. 2008).

The main breeding area of the eastern population of Barrow's Goldeneye consists of the small fishless lakes of the high plateaus north of the St. Lawrence River from the Saguenay River east to Blanc-Sablon, Quebec (Robert *et al.* 2000; Robert *et al.* 2008). In fact, high numbers of pairs and lone males detected in aerial and ground surveys indicate that this area is probably the core breeding area for the eastern population of the Barrow's Goldeneye (Robert *et al.* 2000).

In eastern North America, the only known moulting sites for adult male Barrow's Goldeneyes are located in the coastal waters of Hudson, Ungava and Frobisher (Baffin Island) bays, and in a few coastal inlets of northern Labrador (Robert *et al.* 1999; Robert *et al.* 2002). Two moulting areas (Tasiujaq and Tuttutuuq River, Ungava Bay) were identified while tracking males with satellite telemetry in July 2000. At least 200 goldeneyes (mostly Barrow's) were at the first location, while at least 3000 goldeneyes (mostly Common) were in the latter area (M. Robert, pers. comm.). Barrow's Goldeneye spent up to four months in the moulting locations, highlighting the importance of these areas in the annual cycle (Robert *et al.* 2002).

During the 2009 breeding season, five female Barrow's Goldeneyes were implanted with satellite transmitters in order to locate their moulting sites. Two females returned to moult in 2010 at the same location as in 2009 (one on a lake 100 km south of Ungava Bay and one in an inlet of Ungava Bay). One female that moulted on a small lake near James Bay in 2009 apparently moulted in the St. Lawrence River in 2010. One female may have moulted on a freshwater lake near the breeding area (J.-P. Savard, pers. comm.). Movements of implanted females can be viewed at www.seaturtle.org/tracking/?project_id=415.

Since 2005, a triennial winter survey has been conducted in Quebec and New Brunswick. The 2011 results indicated that the eastern North American wintering population of Barrow's Goldeneyes was composed of 4100 individuals (F. Bolduc, unpubl. data), compared to 6800 individuals in the 2009

survey. More than 80% winter along the St. Lawrence Estuary and Gulf (CWS, unpubl. data). About 500 individuals winter in the Atlantic provinces and 100 individuals winter in Maine (Robert and Savard 2006; CWS, unpubl. data).

Results of Christmas bird counts from Tadoussac suggest a slight increase in Barrow's Goldeneye numbers in the last decade (Savard 2008).

Western Population

The Waterfowl Breeding Population Survey of the British Columbia Central Interior Plateau has tracked the western population of Barrow's Goldeneye since 2006. CWS analyses estimated the presence of 21 800 individuals in the Central Interior Plateau in 2012, 36% less than 2011. An unknown portion of the observed decline is likely associated with the cold and late spring conditions experienced in 2012 that resulted in later surveys of lower elevation wetlands and a decrease in wetland availability (due to snow and ice) at mid- and high elevations. Some data are available for this population from the breeding waterfowl surveys of the southern Yukon (Figure 24), where there is no discernible trend in the population over the past 5, 10, 15 or 21 years.

From 2006 to 2011, W.S. Boyd (Environment Canada, Science and Technology Branch) and D. Esler (Simon Fraser University – Centre for Wildlife Ecology) have satellite-tagged all age and sex classes of Barrow's Goldeneye at a study site in the interior of B.C. (Riske Creek). All males marked in May 2006, 2007 and 2008 migrated north to northern Alberta and the Northwest Territories to moult, and many are showing high site-fidelity to both moulting and wintering sites, and an especially strong connection with a moulting/staging site at Cardinal Lake in Alberta. Some hatch-year birds marked in August 2011 are still being tracked. Maps showing movement and location data for all marked birds are available at www.sfu.ca/biology/wildberg/CWESeaducksfolder/BAGOwebpage/BAGOMigrationHome.html. These maps contain data only to August 2011; they will be updated in the near future. The satellite data will be used to determine migration routes, site fidelity and affiliations between breeding, moulting, staging and wintering sites. The data will also be used to further our understanding of the population structure for Pacific Barrow's Goldeneye.

Other Sea Ducks

Information on other sea duck species from the Waterfowl Breeding Population and Habitat Survey in Western Canada and the Eastern Waterfowl Survey is presented in Table 3 and Figure 22, respectively. Information on Bufflehead and other diving and sea ducks from the roadside surveys in the Yukon is presented in Figure 24.

The Waterfowl Breeding Population and Habitat Survey in Western Canada shows significant increases in numbers of mergansers, goldeneyes and Buffleheads over the long term, but a declining trend for Long-tailed Ducks (Table 3).

For the period 1990–2012, the Eastern Waterfowl Survey showed an increasing trend for Hooded Merganser. Population levels for Bufflehead, Common Merganser and Red-breasted Merganser have been variable. Surf Scoter and Common Goldeneye populations have shown relatively stable trends (Figure 22).

Population Status of Geese

Snow Goose

Greater Snow Goose

Greater Snow Geese (*Chen caerulescens atlanticus*) breed in the eastern Arctic around northern Foxe Basin, northern Baffin, Bylot, Axel Heiberg and Ellesmere islands, and northern Greenland. They winter along the mid-Atlantic coast from New Jersey to North Carolina. During migration, the entire population stages in southern Quebec in the marshes and agricultural lands.

The growth of the Greater Snow Goose population from a few thousand birds in the 1930s to over 500 000 in spring in the mid-1990s has been well documented (Reed *et al.* 1998a). Special conservation measures were implemented in 1999 to slow the rapid growth rate of the population of the Greater Snow Goose.

Aerial surveys of the spring staging area in the St. Lawrence River Valley in southern Quebec have been conducted annually since 1965. The survey covers a large territory extending from Lac Champlain (south) to Lac St-Jean (north), and from eastern Ontario (west) to the Chaleur Bay (east). Five aircraft are used simultaneously to ensure complete coverage during a one-day survey. In 2012, the survey was carried out on April 30. The size of the 2012 spring population during staging in southern Quebec was estimated at 1 005 000 (CI 85 000) geese, 10% more than the last year's estimate (917 000; Figure 25; Lefebvre 2012). Beginning in 2008, estimates have been calculated using a revised sampling methodology.

In Canada, the 2011 fall goose harvest was estimated at 96 996 (Table 12), above the harvest in 2010 (54 335) and well above the 5-year average

(72 620). In the U.S., the harvest was estimated at about 37 592 birds, which is 38% higher than last year's estimate.

An estimated 35 738 ± 5227 birds were harvested during the special conservation measures in spring 2012 in Quebec (Smith and Gendron 2012a). Numbers harvested were above the 2011 estimate (22 077) (Figure 26).

For the first time in spring 2012, a special conservation season was implemented in southern Ontario. An estimated 250±152 geese were harvested (Smith and Gendron 2012b).

In 2009, special conservation measures for Greater Snow Geese were put in place in several U.S. states of the Atlantic Flyway. In spring 2012, the estimated retrieved flyway harvest of Greater Snow Geese was 36 853 birds with an additional 2468 birds shot and lost (Snow Goose, Brant and Swan Committee of the Atlantic Flyway Council, 2012).

A detailed study of the reproductive ecology of Greater Snow Geese at the Bylot Island breeding colony in Nunavut has been conducted since 1988. Bylot Island is located off the northern end of Baffin Island in the eastern High Arctic; it harbours the largest breeding colony of Greater Snow Geese on its southwest plain. More information is available about this research project at: www.cen.ulaval.ca/bylot/.

Lesser Snow Goose

Lesser Snow Geese (*Chen caerulescens caerulescens*) nest in colonies in coastal and inland areas of the Canadian Arctic. These colonies can be grouped according to three regions: the eastern Arctic (Southampton and Baffin islands, and the western and southern shores of Hudson Bay), the central Arctic (mainland from Coppermine in the west to Gjoa Haven in the east, and western Victoria Island), and the western Arctic (Banks Island, and the Anderson and Mackenzie River deltas).

Breeding ground surveys have shown substantial growth of Lesser Snow Goose populations at several colonies and the establishment of new colonies in recent years (Batt 1998). The CWS is coordinating a series of photographic inventories of major Lesser Snow Goose nesting colonies, and these results are reported below.

The increasing number of Lesser Snow Geese in the eastern and central Arctic is also indexed by surveys on wintering areas throughout the late 1990s. It should be noted that these geese are also referred to as Mid-continent Lesser Snow Geese. Mid-winter counts increased from 0.78 million geese in 1970 to nearly 3.0 million in 1998 (Kruse 2007). The 2012 mid-winter count was about 4.02 million geese, 27% more than in 2011, and a record high for the second year in a row (Figure 27; USFWS 2012). These counts include some Ross's Geese and probably a small proportion of Lesser Snow Geese originating in western Arctic colonies. However, mid-winter counts underestimate actual population levels, and probably increasingly so, as populations have grown (Leafloor *et al.* 2012).

Recently, the population size of Lesser Snow Geese has been estimated using band recovery data and harvest estimates (Alisauskas *et al.* 2009; Alisauskas *et al.* 2011, 2012). Traditional survey approaches provide only indices of population size, but the estimates derived from harvest and banding data suggest numbers that are considerably higher than previously thought. The Mid-continent population of Lesser Snow Geese likely exceeded 15 million adult birds in 2010, and some estimates suggest that the population could be even larger than that (Alisauskas *et al*. 2011, 2012). Despite recent efforts to reduce numbers of Mid-continent Lesser Snow Geese, the population continues to grow (Leafloor *et al.* 2012).

Eastern Arctic Colonies

Baffin Island and Southampton Island

Between 2003 and 2005, photographic inventories of the largest Lesser Snow Goose nesting colonies in the eastern Arctic were conducted, for comparison to earlier counts in the early 1970s and 1997. When the Great Plain of the Koukdjuak (on Baffin Island) and Southampton Island were first surveyed in 1973, there were only 446 600 and 155 800 nesting birds, respectively (Kerbes 1975), and the area where nests were found was much smaller. By 1997, those colonies had grown to 1.7 and 0.7 million nesting birds, respectively (Figure 28). Estimates of nesting snow geese on Southampton Island in 2004 suggested numbers similar to 1997, whereas those estimated on Baffin Island in 2005 indicated that the population may have declined slightly (Figure 28). The most recent estimates of nesting birds from photographic surveys on Southampton Island indicate that Lesser Snow Goose numbers have in fact continued to grow and approached 1 million nesting birds in 2008 (K.M. Meeres, CWS Saskatoon, unpubl. data). A photographic survey of Baffin Island was conducted in 2011, but results are not yet available. Numbers of goslings in August 2012 were higher than those seen in 2011, and brood flocks were larger, suggesting that nesting effort in 2012 was better than last year (J.O. Leafloor, CWS Winnipeg, pers. obs.).

West Hudson Bay

At West Hudson Bay, snow goose numbers declined by about half between 1985 and 1997, when they numbered just over 200 000 geese (Figure 28). Estimates from photo surveys conducted in 2003 suggest that the nesting population increased slightly between 1997 and 2003, but that most of the increase occurred north of the traditional nesting colony centred at the McConnell River and especially to the north of Arviat, Nunavut. The most recent photographic estimates of nesting geese in this region suggest that numbers of Lesser Snow Geese remained stable at about 250 000 birds in 2008 (K.M. Meeres, unpubl. data).

Hudson Bay Lowlands (Akimiski Island, Cape Henrietta Maria and La Pérouse Bay)

In the Hudson Bay lowlands, surveys conducted between 1996 and 2003 showed the number of nesting pairs to be declining from the peak in 1997, when 430 000 birds were estimated nesting in the area between La Pérouse Bay, Manitoba, and Cape Henrietta Maria, Ontario (K. Ross and K. Abraham, pers. comm.). The 2006 survey of the La Pérouse Bay colony yielded 41 800 breeding pairs, virtually the same number as in 1997 (i.e., 41 700 pairs); the two small colonies near Thompson Point held 1700 and 5400 pairs, respectively (K. Abraham, R. Rockwell and K. Ross, pers. comm.). A new spatial-based analysis of helicopter surveys conducted on the Cape Henrietta Maria colony suggest a recent decline in the number of breeding birds from an average for the 1997 to 2007 period (1997, 1999, 2001, 2003, 2005, 2007) of 332 400 to lows of 230 556 and 202 140 in 2007 and 2012, respectively. There was an extreme low number of nesting birds observed in 2009, but a late spring characterized by spring flooding prevented many birds from attempting to nest. In 2009, only 17 944 breeding birds were estimated. These data represent a considerable increase from 1979, when the nesting population was estimated at 55 000 nesting pairs (P. Anghern, unpubl. report). There continues to be no sign of nesting in 2012 at the Shell Brook colony and minimal nesting at the Pen Islands colony.

Timing of the spring thaw was average in the Hudson Bay Lowlands in 2012. At James Bay, the small Akimiski Island colony consistently had an estimated 900 breeding pairs between 1998 and 2000, increasing to about 1500 pairs in 2001 and remaining about the same in 2003 (K. Abraham, pers. comm.). Nest initiation by Lesser Snow Geese on Akimiski Island appeared to be similar to the long-term average in 2012. Clutch size during late incubation searches was near average. At Cape Henrietta Maria, spring thaw was average for the long term. The area occupied by the colony appeared to be similar to the last decade (K. Abraham, Ontario Ministry of Natural Resources, pers. com).

Nesting studies of Lesser Snow Geese at La Pérouse Bay and the Cape Churchill region are now in their 44th year. Most snow on the land was melted by the time field operations began, but land-fast ice persisted into July. June was especially cold with temperatures barely above freezing most days. However, owing to open habitat, snow geese initiated nesting about a week ahead of the long-term average, and peak hatch occurred on June 15. Because of low cumulative degree days, most plants were delayed, and green-up did not occur until the last week of June. Despite that, those geese that did not fail immediately after the early portion of hatch were quite successful, and the juvenile-to-adult ratio of 0.98 was a return to the high reproductive success of the early years of the project (R. Rockwell, American Museum of Natural History, New York, pers. comm.).

Central Arctic Colonies

The central Arctic breeding population, concentrated in the Queen Maud Gulf, grew more slowly than the eastern population before the 1980s, but now appears to be increasing rapidly. Part of the rapid growth may be due to the immigration of eastern Arctic birds. In 1976, there were 30 colonies with nearly 56 000 nesting Lesser Snow Geese. By 1988, the number of colonies had increased to 57, with about 280 000 nesting Lesser Snow Geese (Kerbes 1996). Information from a photographic inventory conducted in 1998 indicated that the snow goose population was in excess of 700 000, scattered over 80 colonies (R. Kerbes, unpubl. data). Concurrent with special conservation measures instituted to reduce the mid-continent population of snow geese, the number of breeding snow geese in the central Arctic estimated from aerial photography increased from 657 000 in 1998 to 1 666 000 by 2006 (K. Meeres, CWS, unpubl. data). Alisauskas *et al.* (2011) calculated that this was equivalent to a growth rate of 12.3% per year.

At Karrak Lake in the Queen Maud Gulf, the area used by nesting Ross's Geese and Lesser Snow Geese has been increasing exponentially. The area of terrestrial habitat occupied by nesting geese at Karrak Lake increased from 177 km^2 to 279 km^2 in 2011. Similarly, at the East McNaughton colony of light geese, about 90 km east of Karrak Lake, the area of terrestrial habitat occupied by nesting geese increased from 214 km^2 in 2004 to 260 km^2 in 2011 (R. Alisauskas, pers. comm.). Based on general

impressions of conditions in the central Canadian Arctic, the timing of nesting took place later than average at Karrak Lake in 2011. This makes 2011 the fifth year in a row where nesting phenology was later than average (R. Alisauskas, pers. comm.), resulting in relatively low age ratios at banding in August.

Western Arctic Colonies

More than 95% of Lesser Snow Geese in the western Canadian Arctic nest on Banks Island. This population increased substantially between the 1960s and 2002. The total nesting population increased, growing from around 105 000 birds in 1960 to 165 000 in 1976, and exceeding 479 000 in 1995 (Kerbes *et al.* 1999a). Photographic inventories of the colony indicate that the number of nesting birds on Banks Island has remained high, with 570 000 nesting birds in 2002 and 427 000 birds in 2009 (CWS, unpubl. data). Some localized habitat damage has occurred on Banks Island due to foraging activities from Snow Geese (Hines et al. 2010). The remaining western Arctic Snow Geese nest mostly at small colonies in the Anderson River and Kendall Island Migratory Bird Sanctuaries, as well as in Alaska. Numbers of nesting geese at Kendall Island have fluctuated between <500 and several thousand nesters, with no obvious long-term trend (Wiebe Robertson and Hines 2006; CWS, unpubl. data). Nesting numbers at Anderson River have declined from >8000 birds in the early 1980s to 2800 birds or less in recent years (Wiebe Robertson and Hines 2006; CWS, unpubl. data).

Lesser Snow Geese nesting on Wrangel Island, Russia, are also of great interest to Canada, because this population migrates through western Canada in fall and spring, and more than half of the population winters on the Fraser Delta (B.C.) and the nearby Skagit Delta (Washington). The present colony of Lesser Snow Geese on Wrangel Island is all that remains of several colonies that existed in Siberia a century ago. Russian biologists monitoring the population have documented a decline from 120 000 nesting birds in 1970 (total population of 150 000 geese) to fewer than half that number in the 1990s (total population of 60 000–70 000 geese) (Kerbes *et al.* 1999a). The total population has increased in recent years to 150 000–160 000 birds (S. Boyd, pers. comm.). No estimates are available from Russia on the size of the Wrangel Island spring 2012 breeding population.

The Fraser-Skagit winter population in British Columbia has roughly doubled since the early 1990s, increasing to ca. 100 000 birds in 2006–2007, the highest abundance ever recorded. Increased harvest rates combined with poor breeding years caused the population to decline to ca. 75 000 birds in 2009–2010 and ca. 65 000 in 2010–2011. Based on the anticipated high recruitment rate and (long-term, average) annual survival rate, the 2012–2013 population is predicted to be ca. 70 000–75 000 birds. Once the Fraser-Skagit winter population increased above ca. 60 000 birds in the early 2000s, increased conflicts (socio-economic) occurred with local farms, schools and the Vancouver International Airport on the Fraser Delta, and increased grubbing rates resulted in a severe reduction in bulrush biomass. Data from a long-term monitoring program suggest that large parts of the tidal marsh will move to a state of "functional extinction" if the number of geese remains high (S. Boyd, pers. comm.). To help alleviate the above concerns, responsible management agencies in British Columbia and Washington implemented amendments to hunting regulations in 2003–2004 and again in 2007–2008 to reduce the number of geese. This was followed by the implementation of a harvest strategy to maintain the Fraser-Skagit winter population within 50 000–70 000 total geese so that the marsh habitat remains at a healthy, sustainable level and socio-economic concerns are minimized. The primary goal of the harvest strategy is to make hunting regulations, and hence harvest rates, responsive to goose abundance. For a variety of reasons, the large majority of this harvest will occur on the Skagit Delta in Washington State.

Harvest of Lesser Snow Geese

In the United States, Lesser Snow Geese are harvested in all four flyways, but mostly in the Mississippi and Central flyways. In 2011, the total U.S. harvest estimate was 355 833 geese, an increase of 18% compared to 2010 (Table 13). In Canada, the estimated harvest was 114 767 birds in 2011, an increase of 6% compared to 2010.

Since 1990, CWS Pacific and Yukon Region has conducted a special annual harvest survey of Lesser Snow Geese from the Wrangel Island population. Prior to 2003, harvest estimates varied from a low of 623 in 1990 to a high of 1989 in 2003 (A. Breault, unpubl. data; Figure 29). The 2011–2012 harvest was estimated at 3990 birds, nearly double the 2030 birds harvested in 2010–2011 (where atypical weather limited movements and availability of snow geese to local hunters). Harvest figures include a +20% adjustment for crippling loss (A. Breault, pers. comm.).

An estimated 615 ± 129 birds were harvested during the special conservation measures in spring 2012 in Saskatchewan (there is no harvest survey in Manitoba and Nunavut, because of very low harvest

and very few non-Aboriginal hunters, respectively) (Gendron and Smith 2012c). Numbers harvested were above the 2011 estimate (470 ± 108).

Management of Overabundant Geese

Conservation Issue

Most Snow and Ross's Goose populations are well above their population objectives (North American Waterfowl Management Plan 2012). This becomes an important conservation issue when the rapid growth and increasing abundance affect the habitats on which they, and other species, depend. This relatively new issue was first highlighted 15 years ago, through comprehensive assessments of the environmental effects of the rapidly growing populations of mid-continent Lesser Snow Geese and Greater Snow Geese. The analyses completed by Canadian and American experts are contained in the reports entitled *Arctic Ecosystems in Peril – Report of the Arctic Goose Habitat Working Group* (Batt 1997) and *The Greater Snow Goose – Report of the Arctic Goose Habitat Working Group* (Batt 1998).

These working groups concluded that the increase in Snow Goose populations was primarily human-induced. Changing farming practices began to supply a reliable, highly nutritious food source for migrating and wintering geese. Combined with the safety found in refuges, the improved nutritional status led to increased survival and higher reproductive rates for Snow Geese. These populations have become so large that they are affecting the plant communities at staging areas and breeding grounds on which they and other species rely. Grazing and grubbing by geese not only permanently removes vegetation, but also changes soil salinity, nitrogen dynamics and moisture levels. The result is the alteration or elimination of the plant communities. Although the Arctic is vast, the areas that support migrating and breeding geese and other companion species are limited in extent, and some areas are likely to become inhospitable for decades. Increasing crop damage is another undesirable consequence of the growing goose populations.

Management Response

Initial management efforts focused on mid-continent Lesser Snow Geese and Greater Snow Geese, the populations where there was strong evidence for detrimental effects on habitats. Canada, the United States and Mexico agreed that the habitat damage being caused was a significant conservation issue, and that the populations were overabundant to the detriment of the arctic and sub-arctic ecosystems. Following that declaration, several concurrent management measures were begun to curtail the rapid population growth and reduce population size to a level consistent with the carrying capacity of the habitat. Population models showed that of all the potential management techniques, the most successful approach to control population growth would be to reduce survival rates for adult geese.

Therefore, beginning in 1999, Canada amended the *Migratory Birds Regulations* and created new tools that could be invoked to help manage overabundant species. These included special conditions under which hunters were encouraged to increase their take for conservation reasons and, in some cases and subject to specific controls, to use exceptional methods and equipment such as electronic calls and bait. The special conservation measures for Snow Geese were implemented in 1999 in selected areas of Quebec and Manitoba, were expanded in 2001 to Saskatchewan and Nunavut, and in 2012 into southeastern Ontario. The dates and locations of application of these special conservation measures were determined in consultation with the provincial governments, other organizations and local communities.

Effectiveness of Special Measures

Evaluations showed that success of the special conservation measures to date has been mixed. In the case of Greater Snow Geese, the special conservation measures were successful in reducing the annual survival rate for adults from about 83% to about 72.5% (Calvert and Gauthier 2005). The growth of the population was stopped, but the special measures have not succeeded in reducing the size of the population, which appears stabilized at about 1 million birds in spring (Lefebvre 2012). Models showed that without the special take by hunters in spring, the population would begin to grow rapidly once more (Gauthier and Reed 2007).

For midcontinent Lesser Snow Geese, the evaluation concluded that the population has continued to grow, although perhaps at a reduced rate (Leafloor *et al*. 2012). It also concluded that while the annual harvest increased as a result of the conservation measures, it failed to reduce the size of the population. It was apparent that measures invoked to date have not been successful and that other measures would be required if population control were deemed essential. The report recommended that special conservation measures be maintained and that additional measures to increase harvest be sought.

The evaluation report also suggested that the conditions for overabundance designation are being met by Ross's Geese, and predicted that continued

growth and expansion of Lesser Snow Goose populations was especially likely in the central and western Arctic of Canada (Leafloor *et al.* 2012). The Canadian Wildlife Service is now considering designating the Lesser Snow Geese nesting in the western Arctic and Ross's Geese as overabundant, as outlined in the following sections of this report.

Notice of Intent to Consider Designation of Western Arctic Lesser Snow Geese as Overabundant

A notice of intent is hereby given that designating the western Arctic population of Lesser Snow Goose (*Chen caerulescens caerulescens*) as overabundant is under consideration. Should CWS decide to proceed with the designation following the initial consultation process taking place now; a proposal will be published in fall 2013 in the CWS Regulatory Reports.

An overabundant population is one for which the rate of population growth has resulted in, or will result in, a population whose abundance directly threatens the conservation of migratory birds (themselves or others) or their habitats, or is injurious to or threatens agricultural, environmental or other similar interests.

Experience has shown that serious habitat loss from the destructive foraging activities of Lesser Snow Geese and Ross's Geese occurred in parallel with very rapid population growth in the central and eastern Arctic (Batt 1997). Some localized habitat damage has already occurred on Banks Island from the foraging activities of western Arctic Snow Geese (Hines *et al.* 2010). If the western Arctic population continues to increase at the present rate, the negative impacts to habitat and other species are predicted to expand.

The western Arctic population breeds primarily on Banks Island, Northwest Territories, with smaller breeding colonies on the mainland of the Northwest Territories and Alaska. The population migrates mainly through Alberta and western Saskatchewan in spring and autumn. The majority of birds winter in the Pacific Flyway, mostly in California where they mix with the Wrangel Island population of Lesser Snow Geese and Ross's Geese. Some birds also winter in the western Central Flyway, where they mix with midcontinent Snow Geese.

Western Arctic Snow Geese are already well above the spring population objective of 200 000 birds (North American Waterfowl Management Plan 2012). Photographic surveys of the nesting colonies indicate that the number of nesting birds has grown from about 171 000 adults in 1976 to about 500 000 adults in recent years (Kerbes *et al.* 1999b; Hines *et al.* 2010; CWS, unpubl. data). The fall estimate of western Arctic/Wrangel Island Snow Geese in the Pacific Flyway was over one million birds in 2011; this has increased an average of 6% per year from 2003 to present (USFWS 2012). Increases also have been observed in the western Central Flyway population of Snow Geese (USFWS 2012).

Based on band return data, adults from the western Arctic population have an 85% chance of surviving from one year to the next (CWS, unpubl. data). This survival rate is high and similar to estimates of other increasing white goose populations. Recent recovery rates for banded adult birds were only 2–3%, suggesting that non-hunting mortality is currently more important than hunting mortality (CWS, unpubl. data). Increased survival is thought to be mainly due to increased agricultural food supplies, increased use of refuges during migration and winter, and reduced harvest rates by hunters (Abraham *et al.* 1996; Abraham and Jefferies 1997).

The western Arctic population is showing a pattern of rapid population growth that is similar to that which has been observed in other populations of Snow Geese and Ross's Geese. For this reason, it is important to consider implementation of special conservation measures, such as spring harvest, before the western Arctic population reaches a level that cannot be controlled through increased harvest by hunters. Similar efforts to stabilize Greater Snow Goose numbers in eastern North America were successful because the population was still small enough that it could be controlled through increased harvest (Reed and Calvert 2007). Based on experience with the mid-continent population of Lesser Snow Geese and Ross's Geese, it is likely easier to recover goose populations that reach low levels than to reduce them after they experience runaway growth (Leafloor *et al.* 2012). It may still be possible to stabilize the western Arctic population if liberalized harvest measures are implemented soon. Designation of the western Arctic population as overabundant would provide tools to liberalize harvest under special conservation measures such as spring harvest, use of electronic calls or baiting.

Notice of Intent to Consider Designation of Ross's Geese as Overabundant

A notice of intent is hereby given that designating the Ross's Goose (*Chen rossii*) as overabundant is under consideration. Should CWS decide to proceed with the designation following the initial consultation process taking place now; a proposal will be published in fall 2013 in the CWS Regulatory Reports.

An overabundant population is one for which the rate of population growth has resulted in, or will result in, a population whose abundance directly threatens the conservation of migratory birds (themselves or others) or their habitats, or is injurious to or threatens agricultural, environmental or other similar interests.

Following publication of the Ecosystems in Peril report (Batt 1997), unprecedented management actions were initiated in 1999 to reduce damage caused to arctic and subarctic ecosystems by the foraging activities of increasing numbers of lesser snow geese (*Chen caerulescens*) and Ross's geese (*Chen rossii*; Batt 1997; Moser 2001). Most of these actions were aimed at reducing survival of adult geese through increased harvest by hunters throughout the range of the mid-continent population, which was thought to be the most efficient means of reducing population size (Rockwell *et al.* 1997). Hunting regulations were liberalized during regular seasons, traditional hunting restrictions (e.g., prohibition on use of electronic calls, requirement for plugged shotguns, bag and possession limits) were relaxed or removed to promote increased harvest, and habitat management regimes on some refuges were altered to increase exposure of the birds to hunting outside of refuge areas. Additional amendments to the migratory bird regulations in Canada and the United States were made to allow conservation harvests of such overabundant species outside of hunting seasons.

Though most attention was focused on overabundance of Lesser Snow Geese, Ross's Geese were designated as overabundant in the United States in 1999, and have been included in regulations allowing spring conservation harvests there ever since. In Canada, a court decision in 1999 determined that overabundance regulations could not be applied to Ross's Geese because it had not been demonstrated that they were contributing to the habitat damage.

It is now clear that Ross's Geese contribute to habitat degradation on nesting and staging areas where they occur in large numbers (Alisauskas *et al.* 2006b; Abraham *et al.* 2012). Like Lesser Snow Geese, Ross's Geese grub during nest building and during spring staging, when a large portion of their diet is made up of the roots and rhizomes of sedges and grasses (Ryder and Alisauskas 1995). Alisauskas *et al.* (2006b) found that vegetative cover was removed in areas occupied by nesting Ross's Geese, resulting in exposure of mineral substrate and peat. This led to reduced vegetative species richness that worsened over time, particularly in low-lying habitats preferred by Ross's Geese for nesting. Reduced graminoid abundance caused by foraging of geese has also led to dramatic declines in small mammal abundance around dense nesting colonies (Samelius and Alisauskas 2009). Didiuk *et al.* (2001) suggested that use by Ross's Geese of nesting areas previously degraded by Lesser Snow Geese (e.g., on the west coast of Hudson Bay) may slow recovery of those areas due to the ongoing effects of foraging and nest building. The smaller bill morphology of Ross's Geese may allow them to crop vegetation more closely to the ground than do Lesser Snow Geese, adding to the intensity of grazing.

Ross's Geese are closely related to Lesser Snow Geese, and co-occur with the latter species throughout the year; their behavioural and morphological similarity has led to harvest management of the two species in aggregate since 1978 (Moser and Duncan 2001). In the mid-1960s, most Ross's Geese (>90%) nested in the central Arctic of Canada, and wintered in the Central Valley of California (Melinchuk and Ryder 1980). Though comprehensive estimates of population size were not available until recently, photographic surveys of known nesting areas indicated fewer than 100 000 nesting Ross's Geese in the mid-1960s (Kerbes 1994). The continental population objective for Ross's Geese has been 100 000 birds since the inception of the NAWMP in 1986. By the mid-2000s, Ross's Geese had expanded their range eastward on both nesting and wintering areas (Alisauskas *et al.* 2006a), and the population was estimated to number between 1.5–2.5 million adult birds (Alisauskas *et al.* 2009, 2011, 2012), despite efforts to stop the growth of the population through increased harvest by hunters.

Alisauskas *et al.* (2006a) analyzed hunter recoveries of Ross's Geese captured and marked in the Queen Maud Gulf region of the central Canadian Arctic, and found that survival of adults had declined during the period 1994–2000, reaching a low of approximately 0.80, apparently in response to concurrent increases in harvest. The authors noted, however, that during this same time period, the Ross's Goose population at one of the largest known breeding colonies in the Queen Maud Gulf region had shown sustained growth, suggesting that an adult survival rate of 0.80 was unlikely to have negative consequence for continental Ross's Goose populations. Since 2001 (the last year that Alisauskas *et al.* [2006a] considered), continental harvest of adult Ross's Geese has apparently stabilized, and harvest rates (the annual proportion of the adult population harvested by hunters) have declined to only about 2–3% (Alisauskas *et al.* 2009, 2012; Dufour *et al.* 2012). Annual survival of Ross's Geese declined from 0.897 (95% CI = 0.789–0.953) to a low of 0.827 (95% CI = 0.801–0.850) during the period 1989–1997, then increased steadily from 1998 onward, reaching a high of 0.950 (95% CI =

0.899–0.976) in 2009. Notably, this reversal of the survival trajectory occurred in the face of some of the highest annual harvest levels estimated for adult Ross's Geese since 1989 (Alisauskas *et al.* 2012).

Multiple lines of evidence indicate that Ross's Goose populations have continued to grow, both in the central Arctic and at the continental level (Alisauskas *et al.* 2009, 2012). Collectively, these observations suggest that, like Snow Geese, increases in harvest of Ross's Geese have been outpaced by concurrent increases in abundance, thereby diminishing the effects of harvest on adult survival (Dufour *et al.* 2012). In fact, Ross's Goose numbers have continued to increase at a higher rate than have Lesser Snow Geese since the start of conservation actions in 1999, and continued growth of the Ross's Goose population is predicted to occur (Alisauskas *et al.* 2006a; Alisauskas *et al.* 2012; Dufour *et al.* 2012). Thus, the environmental damage being caused, with its effects on other species and ecosystem structure and function, is expected to continue to increase.

Designation of Ross's Geese as overabundant is therefore being considered by the CWS and would provide tools to liberalize harvest under special conservation measures such as spring harvest, use of electronic calls or baiting.

Regulatory Proposal for 2013–2014

The special conservation measures to be implemented in spring 2013 are already made into law. They are posted on the CWS website, at www.ec.gc.ca/rcom-mbhr/default.asp?lang=en&n=a297b56f-1, and are showed in Appendix A of this report.

The regulations proposed to be implemented in fall 2013 and spring 2014 are under development, and will be presented in the December 2012 Regulatory Report.

Ross's Goose

About 95% of all Ross's Geese (*Chen rossii*) nest in the Queen Maud Gulf area of the central Canadian Arctic. Increasing numbers are being found along the western coast of Hudson Bay, on Baffin, Southampton and Banks islands, at La Perouse Bay, Manitoba, and Cape Henrietta Maria, Ontario (Kerbes 1994; D. Caswell, pers. comm.; K. Abraham, pers. comm.). Nesting colonies of Ross's Goose are usually interspersed with those of Lesser Snow Geese, so it can be difficult to accurately evaluate the size of Ross's Goose populations using traditional survey techniques. Ross's Geese traditionally wintered mostly in California, New Mexico, Texas and Mexico, but in the past two decades have expanded their range eastward in North America (Alisauskas *et al*. 2006a).

Ross's Goose was considered a rare species in the early 1900s. When legislation was passed to prohibit hunting in 1931, the estimated population of Ross's Goose was only 5000 to 6000 birds. By 1988, the breeding population had increased to more than 188 000 birds in the Queen Maud Gulf Migratory Bird Sanctuary (Kerbes 1994; Ryder and Alisauskas 1995) and to about 982 000 in 1998 (Alisauskas *et al.* 1998). Helicopter surveys on Baffin Island, in conjunction with the banding in August, indicated that there may be more than 10 000 Ross's Geese present in some years (D. Caswell, pers. comm.). A new colony of nesting Ross's Geese became established near the McConnell River, Nunavut, in the early 1990s, and was estimated at more than 70 000 birds in 2003. The colony continued to increase and was estimated at about 90 000 nesting birds in 2005 (J. Caswell, pers. comm.). Information gathered while banding Lesser Snow Geese near Cape Henrietta Maria, Ontario, indicated that the Ross's Goose population there may now be as large as 2250 pairs (Abraham 2002). The largest colony of Ross's Goose is found near Karrak Lake in the Queen Maud Gulf, where an estimated 479 400 birds nested in 2001 (Alisauskas 2001).

A recent analysis by Alisauskas *et al.* (2006a) described changes in the geographic distribution of Ross's Geese in winter. Over the past decade, the wintering populations and the harvest have shifted eastward, matching the eastward expansion of the breeding populations.

The most recent estimates available suggest that the Ross's Goose population likely exceeds 1.5 million adult birds and is increasing at a faster rate than are mid-continent Lesser Snow Geese in recent years (Alisauskas *et al.* 2012).

An earlier spring in much of the central Arctic region of Canada likely resulted in improved production for Ross's Geese over 2011. Average nesting conditions also appeared to exist in most of the eastern Arctic in 2012, where anecdotal evidence suggests that Ross's Goose numbers continue to grow (J.O. Leafloor, CWS PNR, pers. comm.). One exception to that may have been Southampton Island, where widespread flooding appeared to result in a low nesting effort (J. Ingram, CWS PNR, pers. obs.).

Greater White-fronted Goose

There are three populations of Greater White-fronted Geese *(Anser albifrons)*: Mid-continent, Tule and Pacific. The Pacific and Tule White-fronted

geese are the two subspecies of White-fronted geese that breed in Alaska and winter primarily in California. In Canada, the population is the Mid-continent White-fronted Goose.

In the past, Greater White-fronted Goose surveys were conducted in early spring, but these counts were problematic when geese were too widely spread along their migration route to allow for good counts. As numbers of Mid-continent Lesser Snow Geese increased in the important count areas, the surveys became even more problematic and were abandoned in 1992. However, until the early to mid-1980s, the surveys did a good job of tracking the trend in Greater White-fronted Goose numbers, indicating that the overall population grew from the late 1950s to the early 1980s (J. Hines, pers. comm.).

In 1992, a fall survey of the staging areas in Saskatchewan and Alberta was implemented with the objective of providing an annual index of the population size of Mid-continent Greater White-fronted Geese. Because it is unlikely that significant numbers of geese are present outside the survey area in most years (based on historical migration and distribution data, as well as experimental surveys), this fall inventory accounts for a consistent and significant proportion of the population (Nieman *et al.* 2001). In 2012, all areas that supported fall staging White-fronted Geese were surveyed. Preliminary results for fall 2012 indicate a total of 778 000 geese, which represents a 12% increase over 2011; the 3-year average was 724 000 geese, an increase of 9% (Figure 30; K. Warner, pers. comm.).

Banding of Mid-continent White-fronted Geese, begun in 1990 in the Queen Maud Gulf Migratory Bird Sanctuary, is providing new data about these birds and their movements. This information allows for informed decision making about population management. Annual survival declined over this period, from a maximum of 87% in 1993 to the lowest estimate of less than 70% in 2000. Mean estimated lifespan has also decreased. From a former maximum of 7.8 years, lifespan would now be closer to 3.7 years, with a survival rate equivalent to that estimated in 2000 (Alisauskas 2002).

The estimated Canadian harvest for 2011 was 81 042, a 44% increase from the 2010 estimate and above the 10-year average (67 867; Table 14). In the U.S., the 2011 harvest was 234 808 birds, about 13% lower than the previous year's take.

Canada Goose and Cackling Goose

Until recently, geese of the species *Branta canadensis* breeding in Canada were recognized as a single species, although debate around the validity of this taxonomic clustering continued (summarized in Dickson 2000). Over the years, many authors suggested that two species should be recognized: small-bodied birds with relatively short necks and bills, and larger-bodied birds with proportionately longer necks and bills (Mowbray *et al.* 2002). In 2003, after reviewing the genetic evidence, the American Ornithologists' Union identified two species of geese from the one species previously referred to as *B. canadensis* (Banks *et al.* 2003). Birds of the large-bodied or *B. canadensis* group, consisting of seven subspecies, typically nest in inland and more southerly regions, while the four subspecies of the smaller Cackling Goose (*B. hutchinsii*) more typically breed in tundra habitats (www.sibleyguides.com/?s=cackling).

The many different races of Canada Goose (*B. canadensis*) and Cackling Goose (*B. hutchinsii)* that have part of their breeding range in Canada are grouped into 15 different management populations. The distribution of Canada Goose and Cackling Goose populations are shown in Figures 31a, 31b and 31c.

Table 15 presents overall harvest estimates for Canada and the United States. However, these numbers are composed of birds from more than one population. Because the surveys cannot differentiate among the different populations of Canada Goose and Cackling Goose, they are inadequate for estimating the harvest level of each population. Partitioning of the harvest requires comprehensive banding programs or analysis of molecular markers. Harvest of Canada Geese and Cackling Geese has been on the rise, with the continental harvest surpassing 3 million annually since 2001. The estimated Canada and Cackling Goose harvest in 2011 was 730 316 geese in Canada, whereas an estimated 2 185 054 of these geese were harvested in the U.S. (Table 15).

North Atlantic Population Canada Goose

Canada Geese belonging to the North Atlantic Population (NAP), which is thought to be primarily composed of the subspecies *B. c. canadensis*, breed in Labrador, insular Newfoundland and eastern Quebec, including Anticosti Island (Figure 31a). The breeding population is surveyed by the helicopter plots of the Eastern Waterfowl Survey. An expanded helicopter plot survey was initiated in 2001 when it became evident that neither the original Eastern Waterfowl Survey nor the fixed-wing transects carried out by the USFWS adequately covered the breeding range of this population. Efforts to integrate data from the two survey platforms are ongoing.

Stratum 2 of the Eastern Waterfowl Survey approximates the breeding range of the NAP. A method for integrating the results of the two survey

platforms is currently under development in partnership with the USFWS; in the interim, the data from the helicopter plots only is presented in Figure 32. In 2012 the total of estimated indicated pairs was 43 177 (± 6293), which is above the average of the past decade (42 045; Figure 32).

Efforts to band geese breeding in southern Labrador were initiated in the summer of 2007 and continued in 2009 and 2011. In 2012, this banding effort was broadened in an attempt to band geese breeding on the Island of Newfoundland as well as in Labrador. Banding operations during the summer of 2007 identified the presence of Canada Geese banded as juveniles in several northeastern U.S. states. As has been documented for other Canada Goose populations (see below), the presence of moulting, temperate-breeding migrant geese is a concern in terms of both the accuracy of breeding survey estimates and the potential effects on North Atlantic goose populations due to competition for resources. The utility of banding NAP Canada Geese on the breeding grounds is scheduled for review by program partners in February 2013 to determine if current delivery of this program is meeting management needs.

Atlantic Population Canada Goose

Atlantic Population (AP) Canada Geese (composed largely of *B. c. interior)* nest throughout northern Quebec, especially along the shores of Ungava Bay and eastern Hudson Bay. A recent review by Mallory *et al.* (2005) added locations on Baffin and Somerset islands, Nunavut, that are more northerly than the known breeding range. Eastward across Baffin Bay, Canada Geese breeding in western Greenland appear related to the AP birds, based on measures of morphology and genetic characteristics (Fox *et al.* 1996; Scribner *et al.* 2003). AP Canada Geese winter from New England to South Carolina, with the largest concentration occurring on the Delmarva Peninsula (Figure 31a).

A breeding ground survey has been conducted every year in northern Quebec since 1993 to estimate the number of breeding pairs on the Ungava Peninsula (Harvey and Rodrigue 2012). Estimates produced by this survey are not adjusted for visibility bias and thus represent an index to the population. This survey covers the three regions that were shown previously to include the highest densities of nesting geese: the region of inland tundra, the region of flat coastal tundra (coastal Ungava Bay and Hudson Bay) and the region of taiga.

The number of Canada Goose breeding pairs (observed as pairs or single birds, together representing the number of indicated breeding pairs) was estimated at 190 340 (SE 20 448) pairs in 2012, which was similar (P=0.41) to the 2011 estimate of 216 032 pairs (SE 23 230) (Harvey and Rodrigue 2012; Figure 33). The total population estimate ((indicated pairs x 2) + non-breeders) of 871 198 (SE = 93 379) in 2012 was also similar to the 2011 estimate of 980 181 (SE 104 201). While the breeding pair and total population estimates have both risen nearly five-fold since 1995 (record low level of about 30 000 pairs), caution should be used when interpreting the estimate of total population size, as it includes breeding pairs, non-breeders, failed breeders and moulting migrants from other areas. Harvey and Rodrigue (2009) noted that the difference in density of breeding pairs has become much more obvious since 2001, with the Hudson Bay coast now supporting more than four times the density of breeding pairs as the Ungava Bay coast. This could be related to a number of factors, including differential survival or productivity rates. Regardless, the potential for growth appears to be more limited for geese nesting along the Ungava Bay coast (Harvey and Rodrigue 2011). In 2012, the approach used to estimate the abundance of the AP Canada Geese was revised. The previous approach, using a stratification based on ecological zones, was replaced by a stratification based on breeding pair density. Estimates for previous years (1994–2011) were recalculated using the new stratification, so they are not comparable to those in previous years (Harvey and Rodrique 2012).

In 1996, a recruitment study was initiated for AP Canada Geese breeding on the Ungava Peninsula in Nunavik, in northern Quebec. Each year during incubation (early to mid-June), one or more sites along the coastal lowlands of Ungava Bay are visited (Cotter 2011). In 2012, no sites were surveyed.

In 1997, a preseason banding program was initiated for AP Canada Geese breeding on the Ungava Peninsula. Each year from late July to mid August, banding crews capture and band brood flocks of Canada Geese along the northern Hudson Bay coast and along the south and west coasts of Ungava Bay. For the first time since 1997, there was only one crew banding along Hudson Bay in 2012. In all 628 adults and 794 goslings (total 1422 geese) along Ungava Bay and 804 adults and 1344 goslings (total 2148 geese) along Hudson Bay were banded. Combining both regions, a total of 3570 geese were banded, and the preliminary Immature:Adult ratio (2138 goslings/1432 adults) in the catches was 1.49, slightly higher than the long-term average (1997–2011) of 1.44. In conclusion, productivity of AP Canada Geese from the Ungava Peninsula in 2012 was good.

In the boreal forest, Canada Geese are counted as part of the Eastern Waterfowl Survey. Estimates for the recent decade (1999–2008) clearly remain above those for the 1990–1998 period. The region

covered by the Eastern Waterfowl Survey is at the southern limit of the nesting range of AP Canada Geese.

Temperate-breeding Canada Goose in Eastern Canada

This population of Canada Geese nests in southern Ontario, southwestern Quebec, New Brunswick, Nova Scotia and Prince Edward Island. There is also a growing population in New Brunswick, Nova Scotia and Prince Edward Island, following deliberate re-establishment of local Canada Goose flocks beginning in the late 1960s. Though sometimes referred to as "resident," many migrate as far north as James and Hudson bays in Ontario and to northern Quebec during the moulting period, and some winter as far south as Virginia. In turn, an increasing number are remaining to overwinter in southern Ontario (Dennis *et al.* 2000). In addition to the growing numbers breeding in Canada, temperate-breeding Canada Geese in the eastern United States have also increased rapidly, and large numbers of subadults and failed breeders move to Canada for the moulting period.

As recently as 1970, Canada Geese did not commonly nest in southern Ontario. However, results of the Southern Ontario Waterfowl Plot Survey show that the population south of the French and Mattawa rivers has grown since the 1970s to just over 80 000 pairs (average since 2006; Figure 34). Increasing at a rate of 9.7% annually from 1971 to 2012, population growth appears to have slowed, with an average annual increase of 3.8% since 2000 (Table 1a). A relatively small but increasing number of birds also breeds north of the surveyed area, but south of the range of Ontario's two sub-arctic breeding populations. The 2012 fall flight for the Ontario temperate-breeding population is estimated to be around 410 000 individuals. In 2012, 4736 temperate-breeding Canada Geese were banded in southern and central Ontario.

In southern Quebec, the 2010 estimates along the shoreline of the St. Lawrence River was 900 indicated breeding pairs, and the 2012 estimates in the St. Lawrence lowlands was 2100 pairs (C. Lepage, unpubl. data). The species has expanded rapidly into southwestern Quebec since 2004, with an increasing trend of 4.4% annually along the St. Lawrence shoreline (2004–2010) and 8.2% in the lowlands (2004–2012; Table 1b).

Contemporary estimates of breeding effort in Maritime Canada (as derived from the Eastern Waterfowl and Agricultural Landscape survey plots) suggest an average of roughly 6200 indicated breeding pairs broadly distributed across the region in spring, with the highest densities found in agricultural areas. Banding operations initiated in Maritime Canada in 2007 continued through 2012 in an attempt to assess the contribution of this population to overall goose harvest in the region. Nearly 2700 Canada geese have been banded in the Maritimes in the past six years.

Southern James Bay Population Canada Goose

The Southern James Bay Population (SJBP) is composed of Canada Geese of the subspecies *Branta canadensis interior*, which nest on the southwestern James Bay coast and interior lowland muskeg of Ontario and on Akimiski Island, Nunavut. This population winters in an area extending from southern Ontario, Michigan and Ohio to Mississippi, Alabama and South Carolina (Abraham *et al.* 2008; Figure 31a). Monitoring of the SJBP includes spring population surveys, ground searches for nests and banding, all of which contribute essential information for management of this population.

The spring population has been surveyed annually since 1990, and there has been no real change in its size since the survey began. The total spring population in 2012 was estimated at 94 943 (72 500–117 385) geese, similar to the 2011 estimate of 98 900 geese (80 600–117 300) (Brook and Hughes 2012a; Figure 35).

The 2012 estimate of 77 503 (57 800–97 200) breeding birds (number of indicated breeding pairs x 2) for Akimiski Island and the mainland combined was not significantly different from 2011 and was well above the threshold level of 50 000 birds, at which changes to harvest regulations would be considered. Also, there was no significant change detected in indicated breeding pair numbers between 2012 and the previous 5-year average on Akimiski Island or for the mainland taken separately (Brook and Hughes 2012a).

Spring phenology was earlier on the mainland in 2012 compared to the short-term (5-year) average, but closer to average for Akimiski Island.

Nesting studies in 2012 on Akimiski Island indicated lower nest density than in 2011, but above the long-term average. Nesting success was near the long-term average (~76%) despite poor conditions (several days of driving snow and below-freezing temperatures) during the late incubation period (R. Brook, OMNR, pers. comm.).

In July 2012, 2898 Canada Geese were banded along the southwestern coast of James Bay and on the northern coast of Akimiski Island. The ratio of goslings to adults among geese captured was 0.99 (Hagey *et al*. 2012). Large numbers of moult-migrant temperate-breeding Canada Geese move to Akimiski Island and to coastal areas of James and Hudson bays. In 2012, 474 temperate-breeding moult-migrant Canada Geese were captured and

banded on the SJBP breeding range (Hagey *et al.* 2012). On breeding areas they may compete for food resources with SJBP goslings and, as a result, contribute to the high gosling mortality that is observed on Akimiski Island in some years.

Mississippi Valley Population Canada Goose

The Mississippi Valley Population (MVP) of Canada Goose (*B. c. interior*) is bounded between the Eastern Prairie Population to the west and the SJBP to the east. This population nest in northern Ontario, principally in the Hudson Bay Lowlands, west of Hudson and James bays, and winter in southern Illinois, southern Indiana, western Kentucky and western Tennessee. Monitoring of the MVP includes spring population surveys, ground searches for nests and banding, all of which contribute essential information for management of this population.

Spring phenology was near average in 2012 compared to the 5-year average (2007 to 2011). Snowmelt and river breakups were near average (Brook and Hughes 2012b). The estimated 2012 breeding population of 268 891 (229 300–308 400) (number of indicated breeding pairs x 2) was almost identical to that found in 2011 (269 840; CI 229 300–308 400) but was about 25% below the 1989-2011 average of 357 071 breeding birds (Figure 36). Considerably more flocked birds were observed than in recent years, including the coastal stratum, suggesting that there were far more yearlings and non-breeding adults in the population than in recent years. Surveys indicated a total population of 402 844 (332 262–473 426) Canada Geese, which was well above that of 2011 (300 208; CI 248 200–352 200) (Brook and Hughes 2012b).

In 2012, nest monitoring at Burntpoint Creek found fewer total nests (231) than in 2011 which is slightly lower than the average for the 2001–2011 period (254). Total percent of failed nests was 53% (123 of 231 nests). This rate, while lower than the very poor year of 2009, is relatively high compared to earlier years (K. Abraham, OMNR, pers. comm.). In July 2012, 4438 Canada Geese were banded on the coast of western James Bay north of Attawapiskat and the Ontario coast of Hudson Bay. The ratio of goslings to adults among geese captured was 2.04 (Hagey *et al*. 2012). Also, 454 temperate-breeding moult-migrant Canada Geese were banded on the coast of western James Bay north of Attawapiskat and on the Hudson Bay coast (Hagey *et al.* 2012).

Eastern Prairie Population Canada Goose

This Canada Goose population (*B. c. interior*) nests in the Hudson Bay lowlands of Manitoba. The birds overwinter in Manitoba, Minnesota and Missouri (Figure 31b). Spring surveys of Eastern Prairie Population (EPP) Canada Geese have been flown annually since 1972, providing good baseline data for this population.

The 2012 survey estimate of single and paired EPP geese was 116 300 (99 300– 133 300), 13% lower than last year's estimate of 133 100 (113 500 - 152 700, P = 0.205). The 2012 spring total population was estimated at 262 500 (227 400 - 297 600), 36% higher than the 2011 estimate of 192 900 (168 600–217 200, P = 0.001) (USFWS 2012; Figure 37).

Western Prairie Population/Great Plains Population Canada Geese

The Western Prairie Population (WPP) (*B. c. interior, moffitti* and *canadensis*) breeds in eastern Saskatchewan and western Manitoba, while the Great Plains Population (GPP) (*B. c. moffitti*) results from restoration efforts in Saskatchewan, North Dakota, South Dakota, Nebraska, Kansas, Oklahoma and Texas. Both populations winter with other Canada Geese along the Missouri River in South Dakota and on reservoirs from southwestern Kansas to Texas (Figure 31b).

These two populations are managed jointly. Separate indices for these two populations are not available from mid-winter surveys, as the fall and winter ranges of the WPP and GPP overlap. During the 2012 midwinter survey, 550 800 WPP/GPP geese were counted, 10% above last year's estimate of 499 000 geese. The midwinter estimates showed no significant trend from 2003–2012 (USFWS 2012).

Canada Geese on the Canadian Prairies are also counted during the Waterfowl Breeding Population and Habitat Survey. A comparison of results from this survey and those of smaller-scale surveys in east-central Saskatchewan indicated that the spring waterfowl surveys provide a good measure of trends in populations (Nieman *et al.* 2000). Overall, Canada Goose numbers on the Canadian prairies have increased steadily over the last several decades. The spring surveys in 2012 estimated 1 800 500 (1 555 000–2 046 100) geese, 54% higher than last year's count of 1 171 700 (USFWS 2012).

Hi-Line Population Canada Goose

The Hi-Line Population (HLP) is composed of large Canada Geese (*B. c. moffitti*) that nest in southeastern Alberta, southwestern Saskatchewan, eastern Montana and Wyoming, and Colorado. This population winters in Colorado and in central New Mexico (Figure 31c).

The HLP of Canada Geese is also counted during the Waterfowl Breeding Population and Habitat Survey. Results of the surveys in the Canadian Prairies indicated a considerable increase (1089%) in the population between 1970 and 1999 (Nieman *et al.* 2000). The 2012 Waterfowl Breeding Population and Habitat Survey estimate for Saskatchewan, Alberta, Montana and Wyoming was 494 400 geese, 80% higher than last year's estimate of 274 000. The Waterfowl Breeding Population and Habitat Survey population estimates have increased an average of 6% per year during 2003–2012 (P = 0.015; USFWS 2012).

Rocky Mountain Population Canada Goose

The Rocky Mountain Population (RMP) of Canada Geese nests in southern Alberta, the inter-mountain regions of Utah, Idaho, Nevada, Colorado and Wyoming, and in western Montana. They winter in central and southern California, Arizona, Nevada, Utah, Idaho and Montana (Figure 31c).

RMP Canada Geese are also counted during the Waterfowl Breeding Population and Habitat Survey. Results from the surveys in the Canadian Prairies indicated a considerable increase in the population (508%) between 1970 and 1999 (Nieman *et al.* 2000). In 2012, the spring waterfowl surveys in southern Alberta and RMP states provided an estimate of 143 400 geese, 37% higher than the estimate from 2011 (105 000) (USFWS 2012).

Pacific Population Canada Goose

The Pacific Population (PP) of Canada Geese nests and winters west of the Rocky Mountains from northern Alberta and B.C. south through the Pacific Northwest to California (Figure 31c). In Canada, this goose population breeds in central and southern British Columbia and comprises both migratory and non-migratory (resident) segments.

Breeding Pacific Canada Geese are surveyed in the course of the Waterfowl Breeding Population and Habitat Survey and two major surveys are used to estimate trends in duck populations in British Columbia: the large-scale (11-million-hectare) aerial survey of the B.C. Interior, and the replicated series of ground counts covering selected wetlands of the Southern and Central Interior Plateau of B.C. Ground counts were modified in 2007 to focus on managed and protected wetlands. The estimate of the PP in 2012 was 221 600 geese, 11% higher than the prior year's count of 200 000 (USFWS 2012).

The Waterfowl Breeding Population Survey of the British Columbia Central Interior Plateau has tracked the PP of Canada Geese since 2006. CWS analyses estimated the presence of 39 722 individuals in the Central Interior Plateau in 2012, 130% more than in 2011. The non-migratory segment is concentrated in the urban and suburban areas of southwestern British Columbia (particularly the Greater Vancouver and Greater Victoria areas) and nearby agricultural lands (A. Breault, pers. comm.).

Problem populations of resident and urban Canada Geese are primarily controlled by municipalities and through federal hunting regulations. Key management practices include egg addling (operational in the lower mainland of B.C. for over 10 years), prevention of nesting, landscape management and relocation of moulting flocks to areas where they can be subjected to hunting mortality. Split hunting seasons have been successful in increasing the number of Canada Geese harvested in some agricultural areas, and special permits are issued to protect crops and property (A. Breault, pers. comm.).

Short Grass Prairie Population Canada/Cackling Goose

The Short Grass Prairie Population (SGPP) of geese breeds in the western Arctic on Victoria and Jenny Lind islands, and on the Nunavut and Northwest Territories mainland from Queen Maud Gulf to the Mackenzie River and south into northern Alberta. They winter in the dry agricultural lands of southeastern Colorado and northeastern New Mexico, and in the Oklahoma and Texas panhandles (Figure 31c). Counts on the wintering grounds provide an index of SGPP Canada Geese. In 2012, the SGPP was estimated at 292 800, 5% lower than the 2011 estimate of 309 600 (USFWS 2012). Aerial transect surveys covering much of the breeding range of these Canada and Cackling Geese populations in the Inuvialuit Settlement Region (ISR), on the mainland, and on Victoria and Banks islands, were conducted in June 1989–1993 (Hines *et al.* 2000). Repeat surveys of many of these transects were carried out in 2002–2006. The aerial counts indicated that there were more than 70 000 SGPP Canada and Cackling Geese in or near the survey area. However, the survey did not cover all of the breeding range of geese in the ISR. Overall, the counts indicate that geese (predominantly *B. hutchinsii*) on Victoria Island and Banks Island have apparently increased in numbers and have possibly

extended their breeding range northward over the past few decades. In contrast, results of spring waterfowl surveys suggested that SGPP Canada Geese in the boreal forest and taiga of the Northwest Territories, Yukon and eastern Alaska had remained relatively stable since the 1960s (Hines *et al.* 2000).

The spring 2012 waterfowl surveys in the western part of the Northwest Territories estimated 207 600 geese, similar to last year's estimate of 225 100. Estimates from the spring breeding survey have increased an average of 11% per year since 2003 (P=0.002; USFWS 2012).

Tall Grass Prairie Population Cackling Goose

The Tall Grass Prairie Population (TGPP) of Cackling Goose (*B. h. hutchinsii)* nests on Baffin (the Great Plains of the Koukdjuak), Southampton and King William islands, in tundra habitats along the northern mainland coast of Nunavut, and along the shores of the west coast of Hudson Bay. It winters mainly in Arkansas, Louisiana, Oklahoma, Texas and northeastern Mexico (Figure 31b).

Aerial surveys of TGPP Cackling Geese were initiated in 1992 (Rusch *et al.* 1996) and, unlike other spring surveys, are conducted during the brood-rearing period. Estimates available for Baffin Island from 1996 through 2009 indicate a population of about 160 000 Cackling Geese. Of the past several years of study, there were three years when almost no young were produced (1992, 1996 and 1999). TGPP Cackling Geese are also counted on the wintering grounds, but because they mix with other populations of Canada and Cackling Geese, it is difficult to estimate population size accurately. During the 2012 midwinter survey in the Central Flyway, 450 800 TGPP geese were counted, 6% more than the 427 100 estimate of 2011 (USFWS 2012).

A preliminary study of nesting geese on Southampton Island was conducted in 2010 at East Bay, and results suggest that Cackling Goose numbers have increased greatly since similar studies were conducted in 1979–1980 (K.F. Abraham, pers. comm.). In addition, systematic aerial surveys of Southampton and Coats islands were conducted for the first time by a joint CWS-USFWS survey crew in late June of 2010. Surveys indicated high densities of nesting Cackling Geese in lowland habitats near Boas River and East Bay on Southampton Island. High densities of Cackling Geese were also noted in much of the lowland habitat surveyed on Coats Island.

Brant

Based on breeding and wintering ranges, as well as on genetic differentiation, there are four distinct populations of brant (*Branta bernicla*) recognized in North America (Reed *et al.* 1998b). Compared to most other geese, brant are more vulnerable to sporadic heavy losses from starvation and periodic nesting failures, because of their strong dependence on specific forage plants and the harsh environments where some populations live. This vulnerability requires careful regulation of hunting and monitoring of the status of populations (Reed *et al.* 1998b). Reed *et al.* (1998b) provide a review of the information available on this species in North America.

Atlantic Brant

This population of the subspecies *B. b. hrota* nests around Foxe Basin in the eastern low Arctic. It winters along the Atlantic Coast from Massachusetts to North Carolina (Reed *et al.* 1998b). The 2012 mid-winter population estimate for Atlantic Brant was 149 200, similar to the 2011 estimate of 148 900 (Figure 38). The population estimates have shown no trend during the past decade (P=0.617; USFWS 2012).

Eastern High Arctic Brant

This group of *B. b. hrota* breeds on islands of the eastern high Arctic, migrating via Greenland and Iceland to winter in Ireland (Reed *et al.* 1998b). There are no surveys currently conducted on the Canadian breeding grounds, and little information is available about the distribution within breeding range. The number of Eastern High Arctic Brant is estimated through counts on the staging areas in Iceland and the wintering grounds in Ireland, where the population grew from fewer than 10 000 birds in the late 1960s to more than 33 000 in 2004–2005. Results of the 2010 International Census estimated a population of about 38 216 geese. Numbers were slightly higher (0.6%) than the previous year (Wildfowl and Wetlands Trust 2011).

The percentage of young is also assessed during the fall census. As is the case for most arctic birds, productivity fluctuates markedly between years: only 1–2% of the population is composed of young birds in poor years, with the percentage increasing to as high as 20–30% in good years. Although breeding success was slightly higher in 2011 than in 2009, overall it was a poor breeding season, with the proportion of young being well below the most recent 10-year mean (2000/01–2009/10, 13% ± 3.5 SE) (Wildfowl and Wetlands Trust 2011).

Black Brant

This population of brant (*B. b. nigricans*) nests in the central and western low Canadian Arctic, Alaska and western Russia. It winters along the Pacific Coast, but mainly in Mexico (Reed *et al.* 1998b). The mid-winter index for Brant was 147 614 in 2011, 3% higher than in 2010. There were no surveys in 2011 and 2012 (Figure 39; Olson *et al.* 2012). Note that Black Brant numbers are obtained by subtracting Western High Arctic Brant counts in north Puget Sound (Padilla, Samish and Fidalgo bays [Washington]; D. Kraege, pers. comm.) from the total mid-winter counts in the Pacific, and Black Brant counts could also include a small proportion of Western High Arctic Brant.

There are no regular surveys of their breeding grounds, but aerial surveys of Black Brant were conducted in June 1995–1998 in the Inuvialuit Settlement Region. The results suggested that the total population of the Mackenzie Delta, Tuktoyaktuk Peninsula and Liverpool Bay likely exceeded 6000 birds (Hines and Wiebe Robertson 2006). Preliminary mark-recapture and band-recovery estimates suggest that survival rates of adult brant are relatively high (J. Hines, unpubl. data).

Part of the Black Brant population stages along the coast of British Columbia during spring migration. It is estimated that 3000 to 7000 brant stop over in the Queen Charlotte Islands on their way to northern breeding grounds. Roughly 25 000–30 000 Black Brant stage in the Strait of Georgia, B.C., with the Fraser River delta and the Parksville-Qualicum area on Vancouver Island being the two most important sites. A statistical model was developed to estimate the volume (total number) of birds moving through the Strait (Hagmeier 2002; Hagmeier *et al.* 2008).

Historically, between 1000 and 10 000 brant spent the winter in British Columbia. More recent estimates of the wintering population in B.C. indicate that approximately 2500 individuals are found in three major wintering areas locations: the Fraser River Delta (2000+ birds), the Queen Charlotte Islands (200+ birds) and Vancouver Island (100+ individuals) (A. Breault, unpubl. data). In the areas of Boundary Bay and Robert's Banks of the Fraser River Delta, the wintering brant population has been generally increasing since 1992. The British Columbia peak winter population was estimated at 1229 brant during the winter of 2012, a 49% decrease over the 2414 birds observed during the previous winter (Olson *et al.* 2012). The reasons for the increase in the number wintering in the Fraser River Delta is unknown, but it is likely due to a combination of increased recruitment in the local population, a reduction in the sport harvest and an influx of Western High Arctic Brant from Washington State (S. Boyd, pers. comm.).

Western High Arctic Brant

This population (also known as Gray-bellied Brant) is intermediate in appearance between *B. b. nigricans* and *B. b. hrota*, and is thought by some biologists to be a unique subspecies. It breeds on islands of the western High Arctic and winters in Puget Sound, Washington (Reed *et al.* 1998b). Mid-winter counts suggest relatively large fluctuations in the population size of Western High Arctic Brant (Figure 39).

The Western High Arctic index mid-winter count from Washington State for 2012 was 6700 birds, 21% fewer than in 2011 (8500) (USFWS 2012).

Western High Arctic Brant are of management concern given their limited number, potentially unique subspecies status and restricted winter distribution. In 2005, Western High Arctic Brant were satellite-tagged on their moulting grounds in the Arctic. The resulting data were used to map southward and northward migration routes, timing of migration, important staging sites, and habitat use patterns at Izembek Lagoon, Alaska, an important fall staging site. In addition to marking birds, blood samples were taken to test the degree of genetic distinctiveness of the Western High Arctic Brant from other brant stocks breeding and wintering in North America. DNA lab analyses have been completed, and the results will be published soon (S. Boyd, pers. comm.).

Population Status of Swans

Two species of swans are native to Canada: the Tundra Swan (*Cygnus columbianus*) and Trumpeter Swan (*C. buccinator*).

Tundra Swan

Eastern population

There are two management populations of Tundra Swans. The western population breeds along the coastal lowlands of western Alaska and migrates through western Canada and along the Pacific Coast. This population winters primarily in California, Utah and the Pacific northwest. The eastern population of Tundra Swans breeds from the Seward Peninsula of Alaska to the northeast shore of Hudson Bay and Baffin Island, and migrates through the Prairie provinces and Eastern Canada.

This population winters in coastal areas from Maryland to North Carolina along the mid-Atlantic coast, as well as in the lower Great Lakes.

The 2012 mid-winter survey of Eastern Population Tundra Swans observed 111 700 swans (swans counted in Ontario and the Atlantic and Mississippi flyways), higher than the 2011 count of 97 700 (USFWS 2012). These estimates have exhibited no trend during the 2003–2012 10-year term (P=0.723) (USFWS 2012).

The Mackenzie Delta region and nearby parts of the Western Arctic mainland are one of the most important breeding areas for Tundra Swans in North America and support about one-third of the Eastern Population of this species.

The number of individuals from the Eastern Population killed and retrieved in the U.S. in 2011 was 3669, slightly lower than the previous year's estimate (Klimstra and Paddling 2012). There are no open seasons for Tundra Swans in Canada.

A migration study using satellite transmitters placed on Tundra Swans captured on Lake Erie (Petrie and Wilcox 2003) demonstrated that eastern Tundra Swans migrated between the wintering areas on the Atlantic coast and staging points in the northern prairies along a narrow corridor passing through the southern Great Lakes. From there, three major routes were followed to breeding areas in western Hudson Bay, the central High Arctic and the Mackenzie River Delta. To see the migration routes taken by the swans, visit the following website: www.bsc-eoc.org/research/lpwwrf/index.jsp?lang=EN&targetpg=lpwwrfTUSWtrack.

Western population

The western population of Tundra Swans is counted on its wintering areas. In 2010 and 2011, several important wintering areas in California were not covered during the mid-winter survey. However, in 2012 all formerly surveyed areas were covered. The 2012 estimate of the western population of Tundra Swan was 117 200 birds (USFWS 2012). This count was 11% higher than the last year of full survey coverage (2009; 105 200 swans; USFWS 2009). The harvest of western Tundra Swans in 2011 was estimated at 1127 birds, which is similar to last year's harvest estimate (Klimstra and Padding 2012).

Trumpeter Swan

There are three management populations of Trumpeter Swans in North America (Figure 21): the Pacific Coast Population, the Rocky Mountain Population and the Interior Population. The size of each of those populations is assessed at 5-year intervals across their entire breeding range in North America. The first survey in 1968 estimated the population at 3722 Trumpeters. The most recent survey completed in 2010 estimated the population at 46 225 birds, with each of the three populations achieving record-high abundance estimates. Cygnets accounted for approximately 26% of the total population, indicating good production of young. The population has been increasing at an annual growth rate of 6% since 1968 (Groves 2012).

In previous surveys, the Pacific Coast Population range in Canada and part of the Rocky Mountain Population range in Canada (Yukon, north-central/northwestern British Columbia) were surveyed using a sampling procedure, and in the remainder a total count was attempted. Because of their increasing abundance and expanding breeding range, in 2010, for the first time, the entire Canadian breeding range of the Pacific Coast Population and Rocky Mountain Population (excluding some very sparsely occupied regions of northern Yukon and north-central British Columbia) was surveyed using a stratified random sampling procedure. The survey used 1:50 000 topographic maps as sample units. A total of 185 maps were surveyed by aircraft in Yukon, British Columbia, Alberta and the Northwest Territories (Figure 21). The Pacific Coast Population in western Yukon and northwestern British Columbia grew 17% from 1236 to 1443. The Canadian portion of the Rocky Mountain Population is now estimated at 8950±1631 (95% CI), based on extrapolation from 4150 swans observed during the survey. This estimate is up 90% from 4718 in 2005. All Canadian areas of the Rocky Mountain Population showed growth since the 2005 survey, ranging from 17% in Yukon to over 150% in Alberta. The change in survey methodology is thought to be responsible for some of the apparent increase in the Rocky Mountain Population in British Columbia, Alberta and the Northwest Territories; previous surveys in these areas were likely underestimating the population.

Small numbers of Trumpeter Swans of the Pacific Coast Population are also encountered in the annual Yukon Roadside Waterfowl Breeding Population Survey. The results show highly significant increases over the past 10, 15 and 21 years (Figure 24); however, there is no trend in the past five years.

In Canada, the Interior Population breeds primarily in Ontario, but small numbers have become established in western Saskatchewan and adjacent Manitoba. The only formal survey in Saskatchewan/Manitoba in 2010 was in Riding Mountain National Park, where 49 swans were recorded, up from 30 in 2005 (Parks Canada, unpubl. data). In Ontario, a re-introduction program begun in 1982 had, by 2005, achieved its goal of at

least 500 free-living swans (H. Lumsden, unpubl. data). Surveys in Ontario conducted in 2005 as part of the continental 5-year survey showed a total population of 644 swans in Ontario (Moser 2006). The captive-breeding and release program ended in 2006. The known current (2010) summer distribution in Ontario is shown in Figure 21. The southern Ontario flock has continued to grow, and in 2010, 839 swans were estimated based on winter counts: observed cygnets at all wintering sites were added to an estimate of the adult and subadult population derived from mark/recapture calculations using wing-tagged birds (H. Lumsden, unpubl. data). Breeding Trumpeter Swans have now also become established in northwestern Ontario. In summer 2010, as part of the 5-year continent-wide monitoring program, several aerial surveys and some other observations yielded a total of 274 birds in regions west and north of Thunder Bay. Another flock has become established in eastern Ontario, numbering at least 54 in summer 2010 (H. Lumsden, unpubl. data).

During the winter period, over 40% of the Pacific Coast Trumpeter Swan population is present on the coastline, wetlands and agricultural fields of Vancouver Island and the Fraser River Valley in British Columbia; this is the largest wintering Trumpeter Swan concentration in North America. Aerial surveys of the area's wintering population have been conducted every three years over this entire area, to identify regional and habitat-specific trends in use of the area by swans. During the most recent survey in January and February 2006, estuaries, coastal marshes, farmland and freshwater lakes were the most important wintering sites on Vancouver Island, and swans were distributed almost equally between tidal marshes and upland habitats in the Fraser River Valley. The survey estimated a total of 7570 swans, an 11.7% increase over the 6775 swans observed in 2000–2001. The mid-winter survey of Vancouver Island and the southwest mainland coast scheduled for winter 2009–2010 was cancelled because of flying restrictions around Vancouver and the Strait of Georgia due to the 2010 Olympics, and it has been permanently cancelled following an internal survey assessment.

Approximately 3000 Trumpeter Swans have died in Washington State and British Columbia since 1999, primarily because of ingestion of lead shot (A. Breault, pers. comm.). International efforts overseen by the Washington Department of Fish and Game and the CWS were initiated in 2001 to locate the source(s) of lead. Telemetry studies identified Judson Lake, on the Canada-U.S. border, as a key site responsible for the lead shot poisoning, and hazing activities have been conducted on the lake since 2009. Hazing activities have decreased but not eliminated swan mortalities. As of 22 February 2012, 213 Trumpeter Swan mortalities were recorded during the fall 2011–winter period (L. Wilson, pers. comm.). Lead poisoning was the suspected cause of death for 102 birds, powerline collisions for 46 birds, 3 birds were shot and the cause of death was unknown for 62 birds. This winter, an exclusion zone covering about half the lake was set up to prevent swans from accessing the section of the lake with the highest lead shot density and a camera was set up to allow remote monitoring of the exclusion area. The reason for the continued poisoning is thought to be Nuphar polysepala (yellow pond lily) roots that prevent the lead shot from sinking into sediments. A proposal has been developed that calls for the herbicide treatment of 60 acres of Nuphar in an area with high lead shot density on the U.S. side of the border over the next several years and a pilot treatment of 5 acres was sprayed in the summer of 2011.

Population Status of Other Hunted Migratory Birds

Thick-billed and Common Murres

Thick-billed Murres (*Uria lomvia*) and Common Murres (*U. aalge*) have traditionally been hunted off the coast of Newfoundland and Labrador for generations. Although murres are not migratory game birds, when the province joined Canada in 1949, the importance of murre hunting to residents of Newfoundland and Labrador was recognized, and a variety of legislative and regulatory amendments have allowed for the legal harvest of murres in Newfoundland and Labrador (see Chardine *et al.* 2008 for details). Through the 1970s and 1980s, large harvests (Elliot *et al.* 1991) necessitated improved hunter education, regulatory changes and enforcement (Elliot 1991). Those efforts appear to have been successful in reducing the harvest from upwards of 750 000 birds to about 250 000 birds harvested annually by the early 2000s (Chardine *et al.* 1999). Current harvests estimated at less than 100 000 birds are probably well below levels that would compromise population sustainability (using the population model in Wiese *et al*. 2004). Reduced ice cover appears to lead to reductions in harvest pressure (Gaston 2002a; Gaston and Robertson 2010), so with climate change, reductions in winter ice cover in the future should lead to restrictions in the number available for harvest. Population counts at colonies are indicating that murre populations are healthy, with most colonies showing signs of growth, or at least maintaining themselves (Gaston 2002b; Chardine *et al.* 2003; Robertson *et al.* 2004; Regular

et al. 2010).

Tracking studies using geolocation tags are showing that many breeding-age murres do not use coastal habitats at all during the winter period, and surprisingly some birds are wintering beyond the continental shelf (Hedd *et al.* 2011; Gaston *et al.* 2011). There are differences in wintering areas among birds from various colonies; murres of both species breeding in Labrador make use of coastal waters more than birds from other colonies, while birds breeding in the High Arctic winter in areas that are exposed to harvests in Greenland. Other colonies, such as those in the low Arctic (Thick-billed Murres on Coats and Digges islands, and Common Murres breeding in insular Newfoundland), spend very little or no time in coastal waters (McFarlane Tranquilla, unpubl. data). These results corroborate previous banding results, which show very few recoveries of breeding-age adults (Robertson *et al.* 2006).

Overall populations of murres are doing well in the northwest Atlantic, and current levels of harvest, even when coupled with other impacts such as chronic oiling (which also appears to be declining; Wilhelm *et al.* 2009), are probably not at levels sufficient to affect the population. Common Murre colonies in Labrador are showing signs of slow declines, so targeted management to support these colonies may be warranted once the cause(s) of the declines is/are understood. In contrast to the northwest Atlantic, many murre populations are not faring well globally, as this species responds poorly and dramatically to climate changes and disruptions of its food web (Irons *et al.* 2008). Therefore, continued monitoring of this species in Canada will continue to determine whether environmental conditions remain favorable so that murre populations can sustain the current harvest levels.

In 2011, 65 851 (SE = 9899) murres were estimated to have been harvested in Newfoundland and Labrador, which is 27% more than the 2010 estimate (M. Gendron, pers. comm.).

American Woodcock

The status of American Woodcock (*Scolopax minor*) in North America is monitored through the Singing-ground Survey, which consists of a spring count of male courtship displays at dusk. Counts of singing males provide indices to American Woodcock populations and can be used to monitor annual population changes (Cooper and Rau 2012). The survey covers the central and northern portions of the woodcock breeding range. Analyses of band recoveries indicate that there are two relatively discrete populations, and as a result, American Woodcock are managed on the basis of two regions: Eastern and Central. In Canada, woodcock breeding in Manitoba and Ontario belong to the Central Population, while those breeding in Quebec and the Maritimes are part of the Eastern Population.

Population indices for short-term, 10-year and long-term (1968–2012) trends were estimated using hierarchical modeling methods (Sauer *et al.* 2008 in Cooper and Parker 2011). In 2012, there were significant long-term declines in the breeding populations in the Eastern and Central Regions. Trend indices for singing American Woodcock males in the Eastern and Central Regions were not significantly different from 2011. There was no significant 10-year trend (2002–2012) in both management regions. This marks the ninth straight year that the Eastern Region trend has remained stable, while it is the second year that the trend has remained stable in the Central Region (Figure 40; Cooper and Rau 2012).

In Canada, the only significant trends observed in the number of American Woodcock were long-term (1968–2012) declines in Nova Scotia and Ontario (Cooper and Rau 2012).

The major causes for American Woodcock population declines are believed to be degradation and loss of suitable (early succession) habitat on both the wintering and breeding grounds (Kelley *et al.* [eds] 2008).

An indirect measurement of recruitment or annual productivity of woodcock breeding populations is derived from age ratios of wings collected from the harvest (Wing-collection Survey). The 2011 recruitment index for the Eastern Region (1.7 immatures per adult female) was 13% greater than the 2010 index and about 6% greater than the long-term (1963–2010) regional average of 1.6. In the Central Region, the 2011 recruitment index (1.5 immatures per adult female) was about 6% lower than the 2010 index (1.6) and the long-term regional average of 1.6 (Cooper and Rau 2012).

The harvest of American Woodcock in Canada and the U.S. has been declining over recent decades; this decline, however, was much more pronounced in the U.S. (Figure 41). In 2010, there were 20 142 woodcock harvested in Canada, about 36% below the 10-year average (Figure 41). The number of woodcock hunters in Canada is undergoing a long-term decline, from about 20 000 in the late 1970s to about 2 000–-3 000 at present. In the U.S., the 2011 harvest was estimated at 308 700 woodcock, an decrease over the harvest of 332 900 birds in 2010 and 3% above the 10-year average.

Mourning Dove

Mourning Doves (*Zenaida macroura*) are among the most widely distributed and abundant birds in North America, and are monitored in Canada through the Breeding Bird Survey (www.ec.gc.ca/reom-mbs/default.asp?lang=en&n=416B57CA). Mourning Dove populations in the Lower Great Lakes/St. Lawrence Plain, Atlantic Northern Forest and Prairie Pothole ecozones have increased significantly over the long term (1970–2009). Populations in other ecozones do not show any significant trend over that time period. Similarly, there were no significant trends in any ecozone over the past decade (1999–2009), except in the Lower Great Lakes/St. Lawrence Plain ecozone where a significant decrease was observed.

In the U.S., Mourning Dove populations are monitored through the Mourning Dove Call-count Survey, which has been developed to provide an annual index to population size during the breeding season. Mourning Doves are managed on the basis of the three regions where dove populations are largely independent. These areas are referred to as the Eastern, Central and Western Management Units. Results from the call-count survey (heard) indicated that abundance of doves decreased in all three management units during the long term (1966–2012). Over the most recent 10-year period (2003–2012), there was no evidence for a change in Mourning Dove abundance in the Eastern Management Unit, but there was evidence of a decline in the Central and Western Management Units. Over the most recent two years there was no evidence for a change in abundance in any of the management units (Seamans *et al.* 2012).

Dove hunting is permitted in several states in each of the three management units in the United States. In Canada, Mourning Doves are hunted in British Columbia. The harvest in British Columbia varies considerably from year to year, ranging from an estimated high of 5391 doves killed in 1977 to 95 during the 2008 season. No doves were reported harvested in Canada in 2011. The preliminary estimate of harvest in the U.S. for 2011 was 16,580,900 ± 452,200, a 4% decrease from the harvest of the 2010 season (Seamans *et al.* 2012).

Wilson's (Common) Snipe

Wilson's Snipe (*Gallinago delicata*) in Canada are monitored through the Breeding Bird Survey (www.ec.gc.ca/reom-mbs/default.asp?lang=en&n=416B57CA). Over the long term, populations of Wilson's Snipe in the Northwestern Interior (1986–2009), Northern Rockies (1973–2009) and Prairie Pothole (1973–2009) ecozones have increased significantly. Over this same time period, populations in the Great Basin (1973–2009) and Atlantic Northern Forest (1970–2009) ecozones showed a significant decline. No long-term trends were observed elsewhere in the country. No 10-year (1999–2009) trends were observed anywhere in the country, except in the Great Basin ecozone where they declined significantly. The harvest of this species in Canada appears to have stabilized at a low level over the past decade (Figure 42). In 2011, there were 2453 snipe harvested in Canada, similar to last year's harvest estimate. The estimated harvest in the U.S. for 2011 was 136 300 birds, which was higher than the previous year's estimate (Raftovich *et al.* 2012).

Sandhill Crane

The Mid-continent Population of Sandhill Cranes is the largest of all North American crane populations. This population is composed of approximately two-thirds Lesser (*Grus canadensis canadensis*), one-fourth Canadian (*G. c. rowani*), and the remainder Greater Sandhill Cranes (*G. c. tabida*). Mid-continent Sandhill Cranes breed from southern Ontario northwestward through the Arctic and Alaska and into eastern Siberia. This population winters in western Oklahoma, New Mexico, southeastern Arizona, Texas and Mexico.

The Mid-continent Population of Sandhill Cranes is monitored through a spring aerial transect survey at the key staging area in Nebraska. Indices corrected for visibility bias are available since 1982. They have been relatively stable since the early 1980s. The uncorrected population index in spring 2012 was 259 576 birds, which was significantly lower than the previous five years likely due to later timing of the survey period and an early spring migration (Kruse *et al.* 2012; Figure 43). The photocorrected 3-year average for 2009–11 was 579 863, which is above the established population-objective range of 349 000 472 000 cranes.

The Canadian hunting season for Mid-continent Sandhill Cranes is currently open only in Manitoba, Saskatchewan and the Yukon Territory. The crane harvest in Canada has been quite variable, but trending upward since the 1970s (Figure 44). However, the harvest in both Manitoba and Saskatchewan showed sharp declines in the late 2000s. The overall Canadian harvest of Mid-continent Sandhill Cranes was 10 431 in 2011, which is an increase compared to last year's estimate (6574; Figure 44). The harvest of Mid-continent Sandhill Cranes has been increasing in the U.S. over the years. In 2011, the harvest decreased by 25% to 16 059 compared to the previous year

(21 520; Figure 44; Kruse *et al.* 2012).

The Eastern population of Sandhill Cranes has rebounded from near extirpation in the late 1800s to over 30 000 cranes by 1996 (Kruse *et al.* 2012). Now, the Eastern population is rapidly expanding in size and geographic range (Case and Sanders 2009). This population breeds in Ontario, Quebec and several Great Lakes states. The USFWS has conducted a survey of the Eastern population of Sandhill Cranes since 1979 on their major migratory staging areas. The survey occurs during the last week of October and provides a fall index of the population. Overall, the survey has documented a long-term increasing trend in Eastern population cranes. The 2011 index was 72 233 cranes (Kruse *et al.* 2012). Eastern population Sandhill Cranes are presently not harvested anywhere within their range. However, the Atlantic and Mississippi Flyway Councils developed a Management Plan for the Eastern Population due to their increasing abundance. This plan sets the guidelines for potential harvest. In 2011, the state of Kentucky held the first hunting season for Eastern population Sandhill Cranes. In Ontario, an ongoing study is examining the physiology, behaviour and habitat use of Sandhill Cranes along the north shore of Lake Huron. Fall staging counts were conducted in 2009 and 2011 and showed that over 7 000 cranes stage in this area during the fall; peak count was approximately 9 000 cranes in October 2009. In addition, telemetry data from marked cranes show that these birds overwinter as far south as Florida but during mild winters, some will tend to overwinter in more northerly states such as Indiana. It is expected that this study will conclude in early 2014. (S. Meyer, pers. comm.).

In Quebec, the 2012 population estimate from the Eastern Waterfowl Survey helicopter plots was 4000 indicated breeding pairs. Interestingly, the Eastern Waterfowl Survey only surveys the southernmost portion of what is thought to be the core breeding area of Sandhill Cranes in Quebec. The 1996–2012 trend in the survey area indicates an increase of 13.1% annually (C. Lepage, pers. comm.).

Band-tailed Pigeon

In Canada, the Band-tailed Pigeon (*Columba fasciata*) is found in forested habitats of coastal British Columbia. This species has a very low reproductive rate of one egg per pair, but some nest twice each season. The Breeding Bird Survey (BBS) provides an annual index to the abundance of the Band-tailed Pigeon since 1970 (www.ec.gc.ca/reom-mbs/default.asp?lang=En&n=0D74F35F-1). Results from the Breeding Bird Survey indicate no significant trend in the population over the long term (1973–2009) or in the last 10 years (1999–2009) in Canada.

The Mineral Site Survey, implemented in 2004, was developed as an alternative mechanism by which to understand population trends in Pacific Coast Band-tailed Pigeons (Sanders 2012). The Mineral Site Survey involves a visual count of Band-tailed Pigeons at several mineral sites throughout the population's range (California, Washington State, Oregon and British Columbia). Results from this survey suggest that the abundance of the Band-tailed Pigeon has decreased -4.7% per year since 2004, but these results are inconclusive (Sanders 2012).

The Canadian hunting season for this species was closed from 1994 through 2001. Population increases in Washington State were primarily responsible for the limited opening implemented in British Columbia in 2001 (where the bag limit was reduced from 10 birds to 5 and the season length reduced from 30 to 15 days). The harvest continues to decline in comparison to the early 1970s, when between 3000 and 5000 were harvested annually. In 2011 in Canada, an estimated 201 pigeons were harvested, more than twice last year's number. The estimated total U.S. harvest for 2011 was 13 700 Band-tailed Pigeons, a 41% decrease from 2010 (Raftovich *et al.* 2012).

American Coot

During the Waterfowl Breeding Population and Habitat Survey, American Coots (*Fulica americana*) are also recorded in the Canadian Prairies. Results of this survey show that American Coot population estimates have fluctuated greatly over the duration of the survey (Figure 45), with a tendency to show an increasing trend. In 2012, the population increased to 2 942 139 coots, similar to the 2011 estimate of 2 051 146. The 2012 estimate was 106% above the most recent 10-year average (1 425 737).

The harvest of American Coots in Canada has fallen considerably over time. In 2011 in Canada, the American Coot harvest was estimated at 2043, an increase of 128% from the previous year. The total harvest in the U.S. in 2011 was 416 600, an increase over the 2010 harvest estimate of 302 600 (Raftovich *et al*. 2012).

Rails

Although rails are counted during the Breeding Bird Survey, their sometimes secretive nature and infrequent calling means they are likely to be missed during the survey. The results of trend analyses should therefore be viewed with caution

(www.ec.gc.ca/reom-mbs/default.asp?lang=En&n=0D74F35F-1). There is sufficient sample size to estimate trends for Virginia Rails (*Rallus limicola*) for the country as a whole during the long-term period (1970–2009), as well as for the last 20-year (1989–2009) trend in the Lower Great Lakes/St. Lawrence Plain. However, none of these trends is significant.

Sora (*Porzana carolina*) trends are available for the Boreal Taiga Plains, Great Basin, Northern Rockies, Prairie Pothole, Boreal Hardwood Transition, Great Lakes/St. Lawrence Plain and Atlantic Northern Forest ecozones. The only significant change was a negative 20-year (1989–2009) trend in the Boreal Hardwood Transition ecozone. Trends are not reliable for the Yellow Rail (*Coturnicops noveboracensis*) or King Rail (*Rallus elegans*), because of relatively low numbers observed or heard during the surveys.

The only province with an open season on hunting rails is Ontario (excluding King Rails and Yellow Rails). Other provinces previously held seasons, but they have been closed in recent years. The collection of harvest data for rails began in 1989 as part of the National Harvest Survey. Since that time, the harvest has been decreasing. None were reported harvested in 2010.

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Appendices

APPENDIX A – SPECIAL CONSERVATION MEASURES FOR FALL 2012 AND SPRING 2013

Measures in Quebec Concerning Overabundant Species

Area	Period during which Snow Geese may be killed	Additional hunting method or equipment
District A	September 1 to December 10 and May 1 to June 30	Recorded bird calls(*d*)(*f*)
District B	September 15 to December 29	Recorded bird calls(*d*)(*f*)
District C and D	September 1 to September 14(*a*), September 15 to December 29 and March 1 to May 31(*a*)	Recorded bird calls(*d*)(*f*)
District E	September 1 to September 14(*a*), September 15 to December 29 and March 1 to May 31(*a*)	Recorded bird calls(*d*)(*f*) and bait or bait crop area(*e*)
District F	September 6 to September 21(*a*), September 22 to January 5 and March 1 to May 31(*a*)(*b*)(*c*)	Recorded bird calls(*d*)(*f*) and bait or bait crop area(*e*)
District G	September 29 to December 26	Recorded bird calls(*d*)(*f*)

(*a*) Hunting and hunting equipment are allowed only on farmland.
(*b*) In District F, no person shall hunt south of the St. Lawrence River and north of the road right-of-way of Route 132 between the western limit of the municipality of Montmagny and the eastern limit of the municipality of Cap-Saint-Ignace.
(*c*) In District F, on the north shore of the St. Lawrence River, no person shall hunt north of the St. Lawrence River and south of a line located at 1000 m north of Highway 40 between Montée St-Laurent and the Maskinongé River. On the south shore of the St. Lawrence River, no person shall hunt south of the St. Lawrence River and north of the railroad right-of-way located near Route 132 between the Nicolet River in the east and Lacerte Road in the west.
(*d*) "Recorded bird calls" refers to bird calls of a species referred to in the heading of column 2.
(*e*) Hunting with bait or in a bait crop area is permitted if the Regional Director has given consent in writing pursuant to section 23.3.
(*f*) Snow Goose call recordings may be used, but if used with decoys, the decoys may only represent white or blue phase Snow Geese, or any combination of them.

Measures in Ontario Concerning Overabundant Species

Item	Area	Period during which Snow Geese may be killed	Additional hunting method or equipment
1.	Wildlife Management Unit 65	March 1 to May 31(*a*)	Recorded bird calls(*b*)(*c*)

(*a*) Hunting and hunting equipment are allowed only on farmland.
(*b*) “Recorded bird calls” refers to bird calls of a species referred to in the heading of column 2.
(*c*) Snow Goose call recordings may be used, but if used with decoys, the decoys may only represent white phase Snow Geese or blue phase Snow Geese, or any combination of them.

Measures in Manitoba Concerning Overabundant Species

Area	Period during which Snow Geese may be killed	Additional hunting method or equipment
Zone 1	August 15 to August 31 and April 1 to June 15	Recorded bird calls(*a*)
Zones 2, 3 and 4	April 1 to May 31	Recorded bird calls(*a*)

(*a*) "Recorded bird calls" refers to bird calls of a species referred to in the heading of column 2.

Measures in Saskatchewan Concerning Overabundant Species

Area	Period during which Snow Geese may be killed	Additional hunting method or equipment
East of 106°W longitude	April 1 to May 31	Recorded bird calls(*a*)
West of 106°W longitude	April 1 to April 30	Recorded bird calls(*a*)

(*a*) "Recorded bird calls" refers to bird calls of a species referred to in the heading of column 2.

Measures in Nunavut Concerning Overabundant Species

Item	Area	Period during which Snow Geese may be killed	Additional hunting method or equipment
1.	Throughout Nunavut	August 15 to August 31 and May 1 to June 30	Recorded bird calls(*a*)(*b*)

(*a*) "Recorded bird calls" refers to bird calls of a species referred to in the heading of column 2.
(*b*) Snow Goose call recordings may be used but, if used with decoys, the decoys may only represent white phase Snow Geese or blue phase Snow Geese, or any combination of them.

APPENDIX B – FIGURES

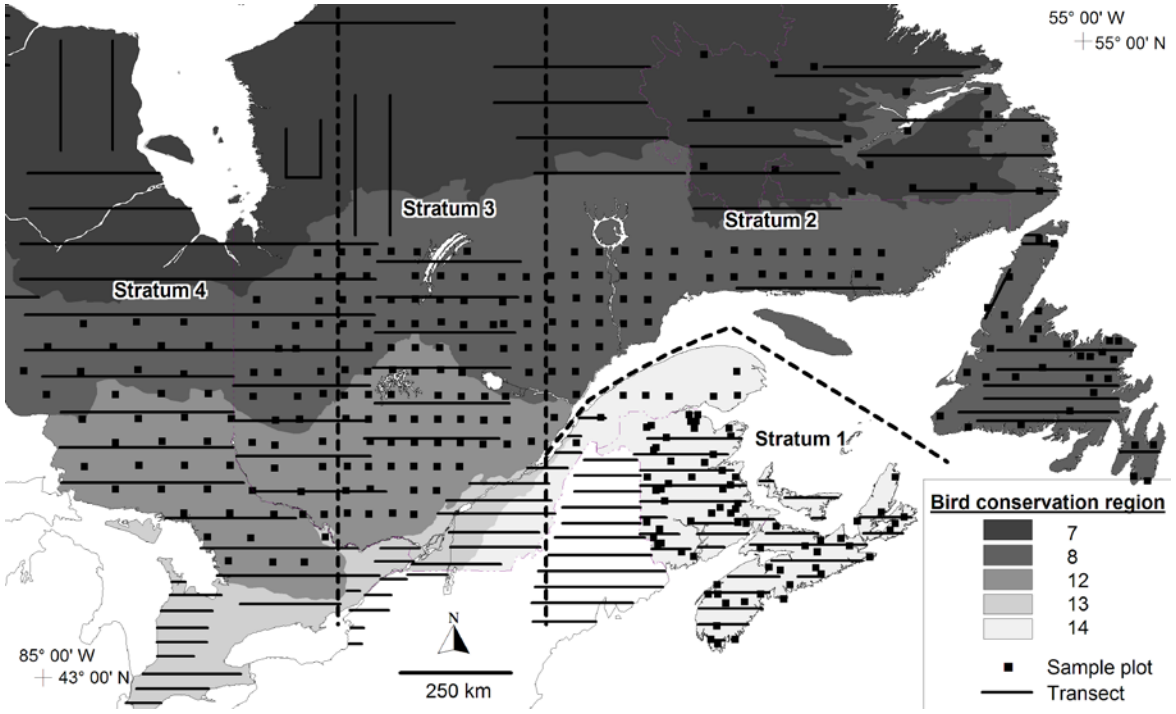

Figure 1. Eastern Waterfowl Survey Area in Eastern Canada
(Source: C. Lepage and M. Melançon,CWS, Quebec region)

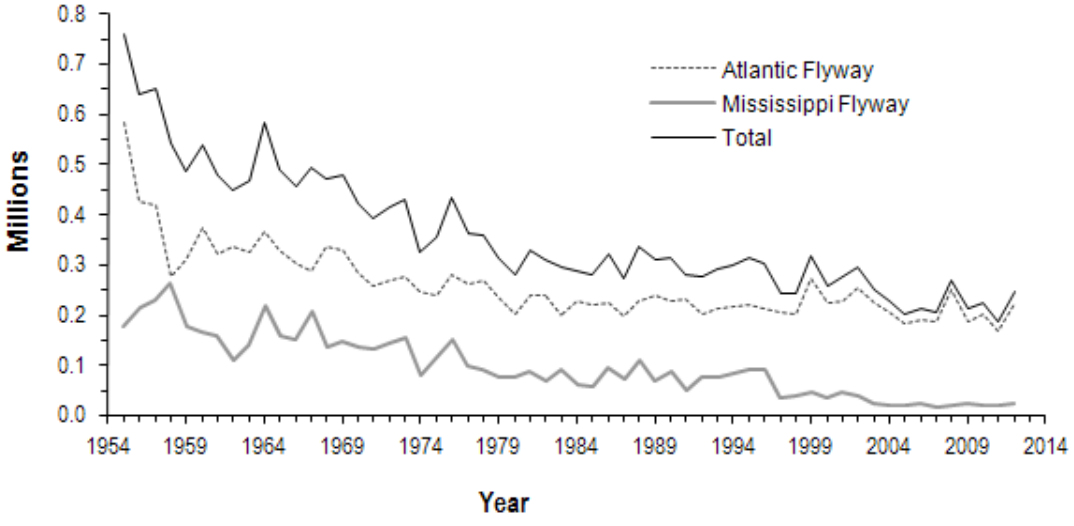

Figure 2. American Black Ducks in the Atlantic and Mississippi Flyways in Mid-winter
Survey results in the Atlantic Flyway for 2001 and in the Mississippi Flyway for 1993 and 1998 were incomplete in some states.
(Source: Klimstra and Padding 2012)

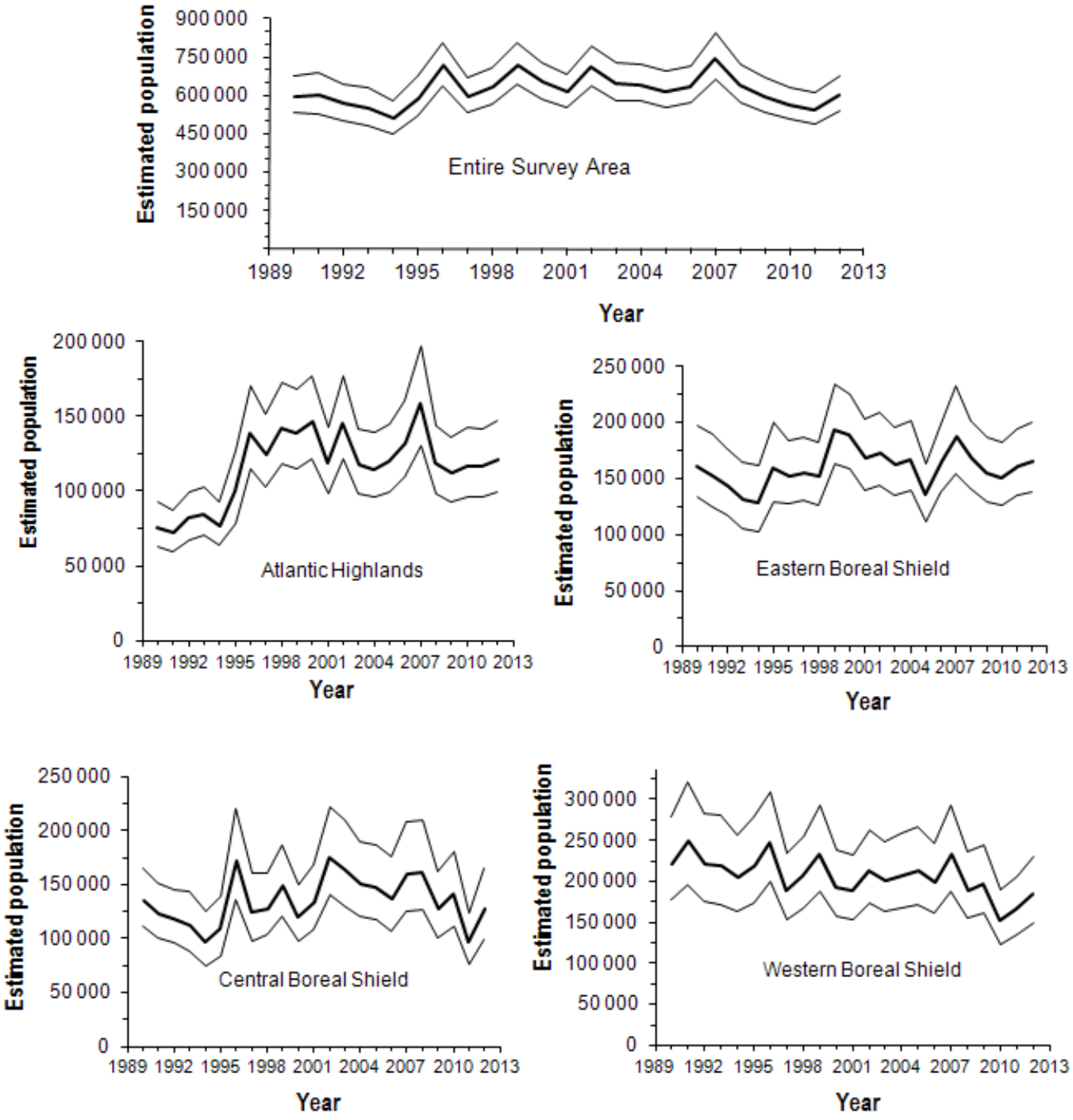

Figure 3. American Black Ducks in the Eastern Waterfowl Survey Area
Population Estimate and 90% credible intervals. The figures represent the combined results of helicopter and fixed-wing aircraft surveys.

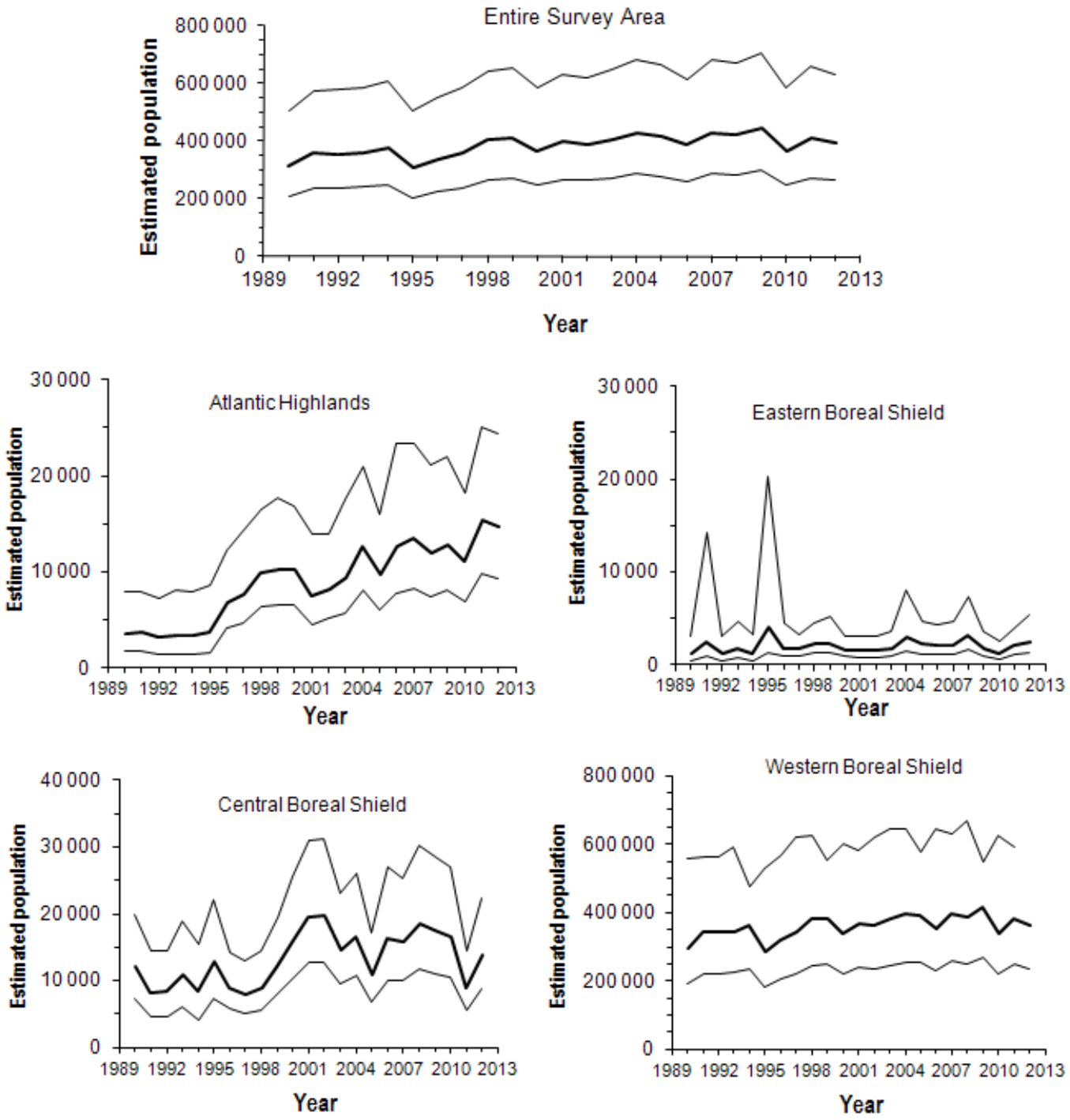

Figure 4a. Mallards in the Eastern Waterfowl Survey Area
Population Estimate and 90% credible intervals. The figures represent the combined results of helicopter and fixed-wing aircraft surveys.

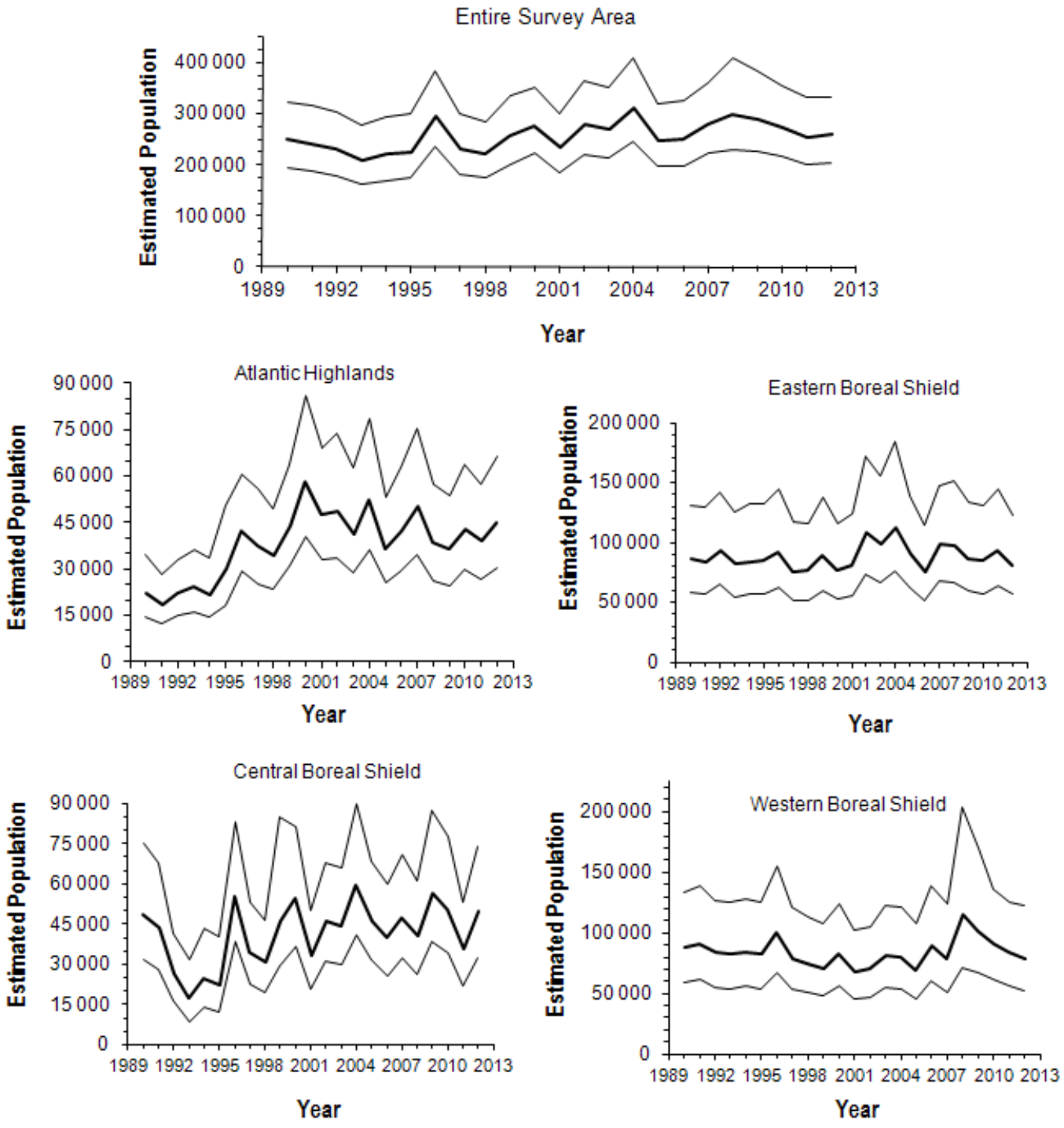

Figure 4b. American Green-winged Teal in the Eastern Waterfowl Survey Area
Population Estimate and 90% credible intervals. The figures represent the combined results of helicopter and fixed-wing aircraft surveys.

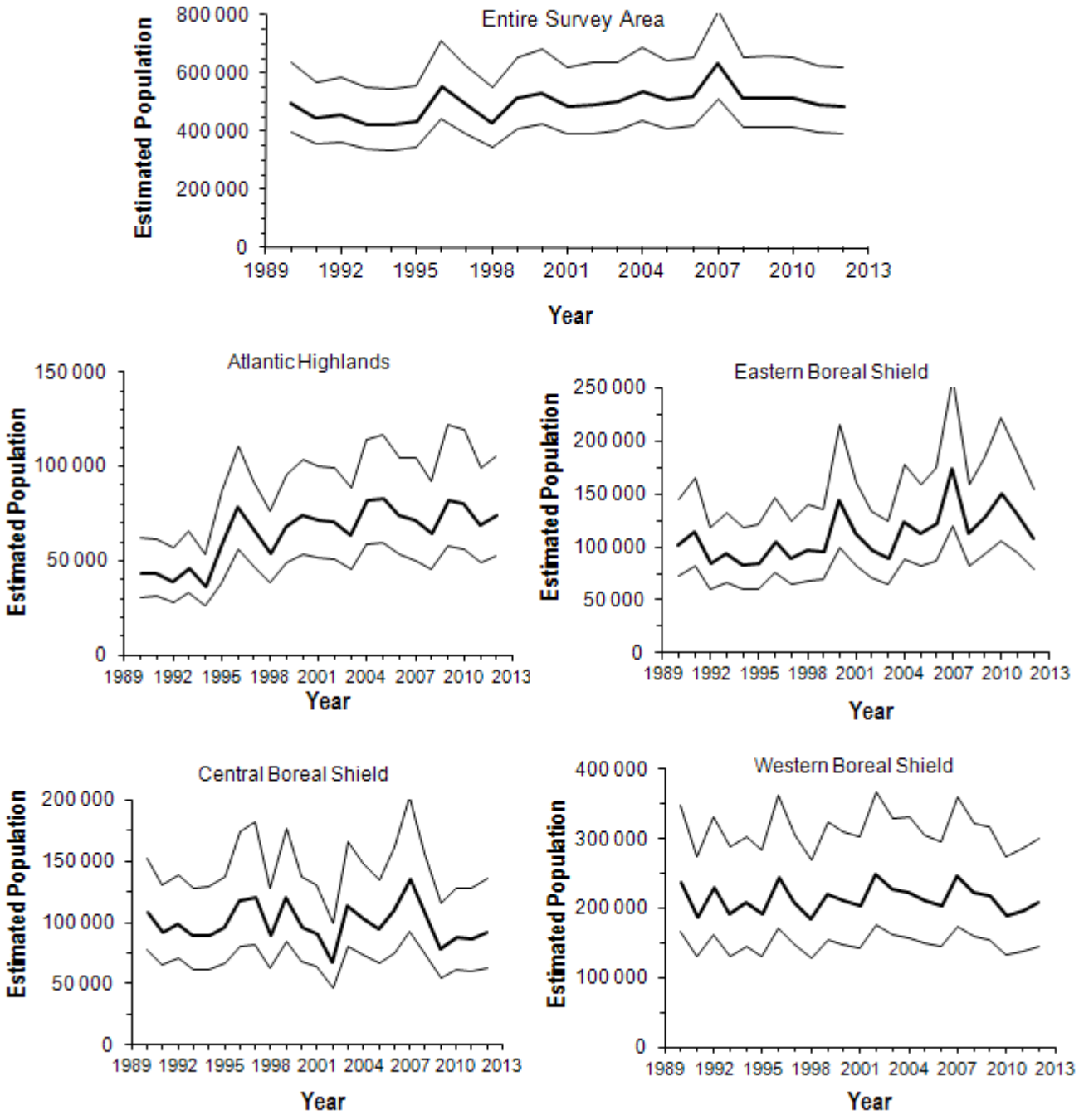

Figure 4c. Ring-necked Ducks in the Eastern Waterfowl Survey Area
Population Estimate and 90% credible intervals. The figures represent the combined results of helicopter and fixed-wing aircraft surveys.

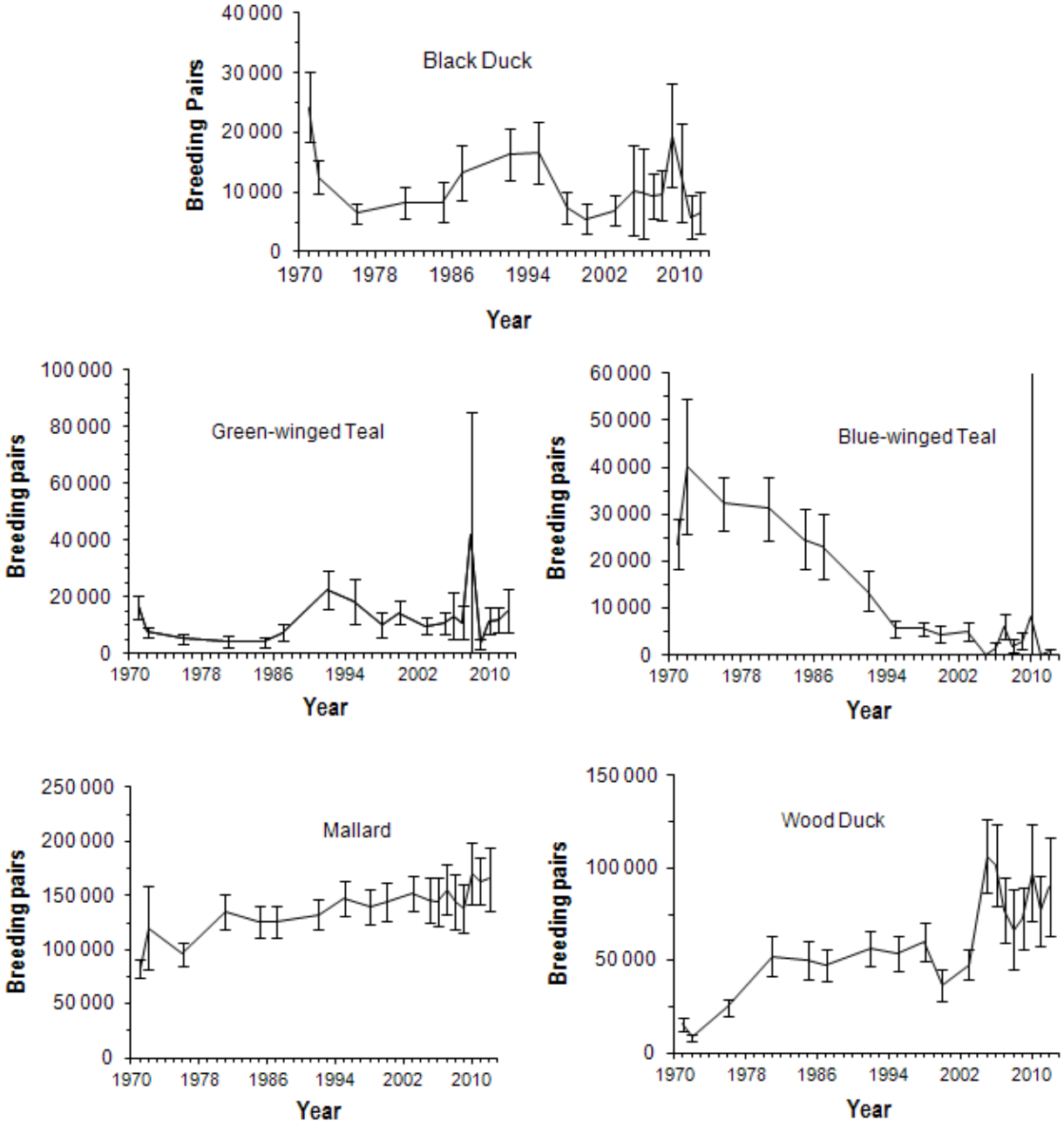

Figure 5a. Estimated Breeding Pairs (±1 SE) of Dabbling Duck Species in Southern Ontario, based on Ground Survey Plots, 1971–2012
(Source: S. Meyer, CWS, Ontario Region)

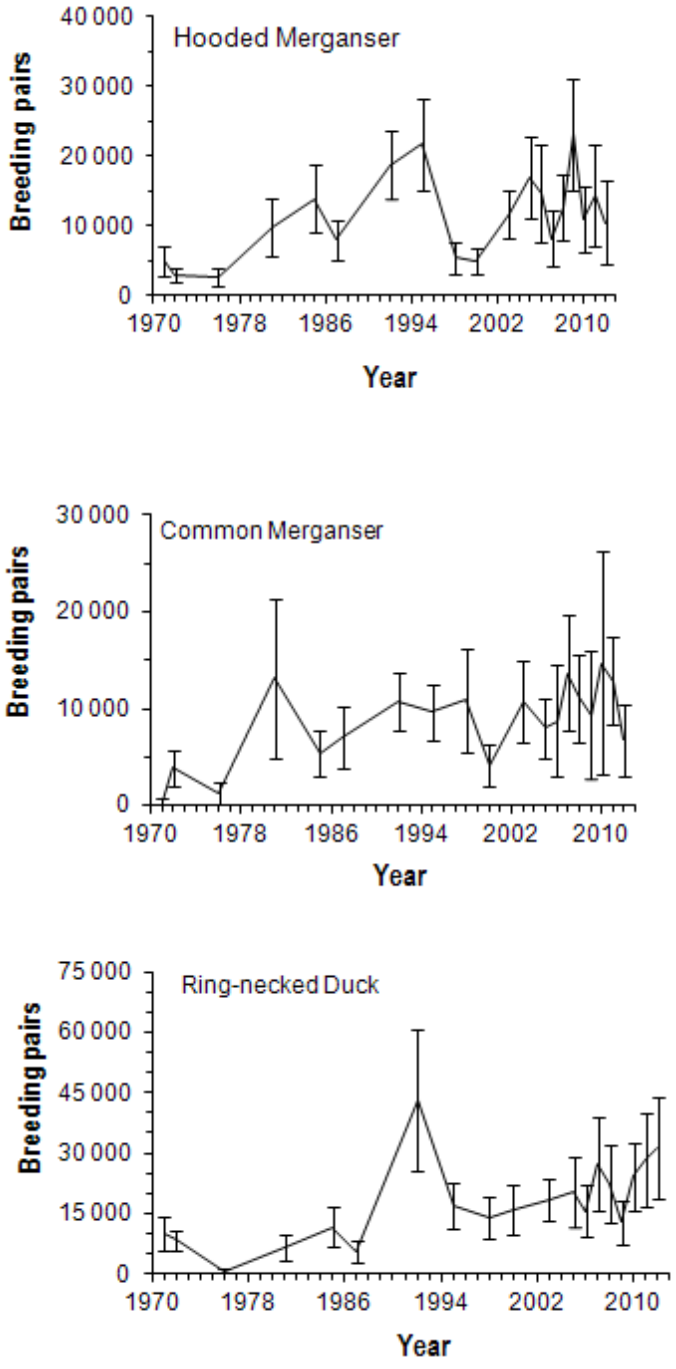

Figure 5b. Estimated Breeding Pairs (±1 SE) of Diving Duck Species in Southern Ontario, based on Ground Plots, 1971–2012
(Source: S. Meyer, CWS, Ontario Region)

Regions of the WBPHS

1.	Strata 1-11	Alaska
2.	Strata 12-25, 50, 75-77	Western Boreal Canada
3.	Strata 26-40	Canadian Prairies
4.	Strata 41-49	U.S. Prairies

Figure 6. Waterfowl Breeding Population and Habitat Survey of Western Canada: Traditional Survey Area of Western Canada and the United States

(Source: U.S. Department of the Interior and Environment Canada)

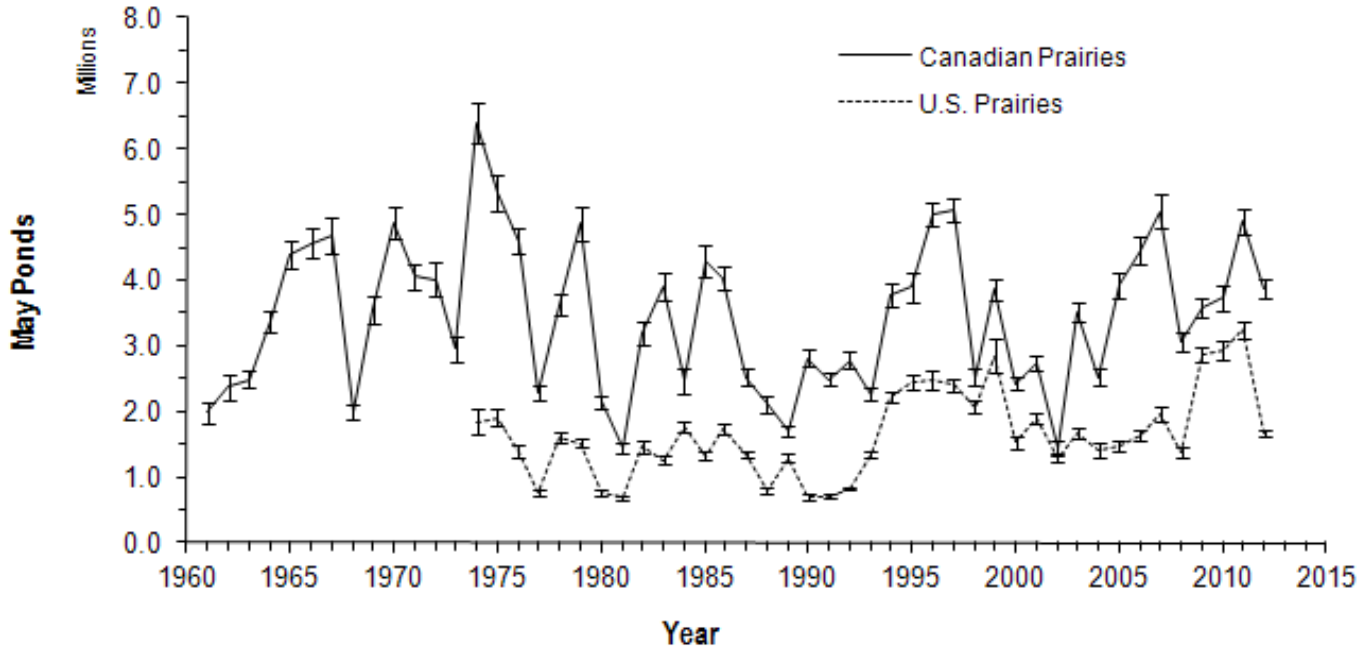

Figure 7. May Ponds in the Canadian and U.S. Prairies
Estimated number of ponds ± 1 SE.

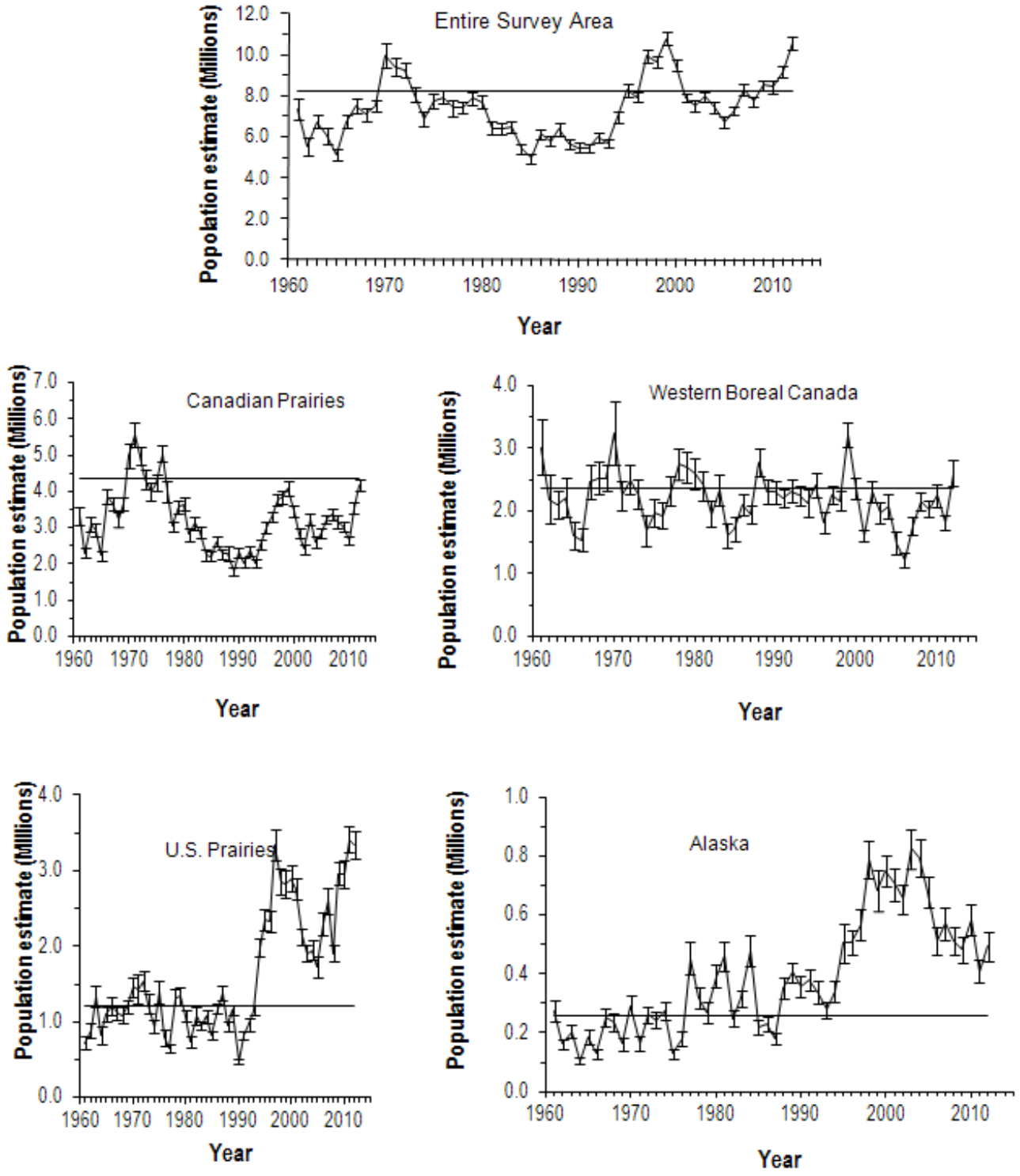

Figure 8. Mallard Breeding Population in the Traditional Survey Area of the Waterfowl Breeding Population and Habitat Survey

Data shown are population estimates (± 1 SE). The horizontal line represents the NAWMP population goal.

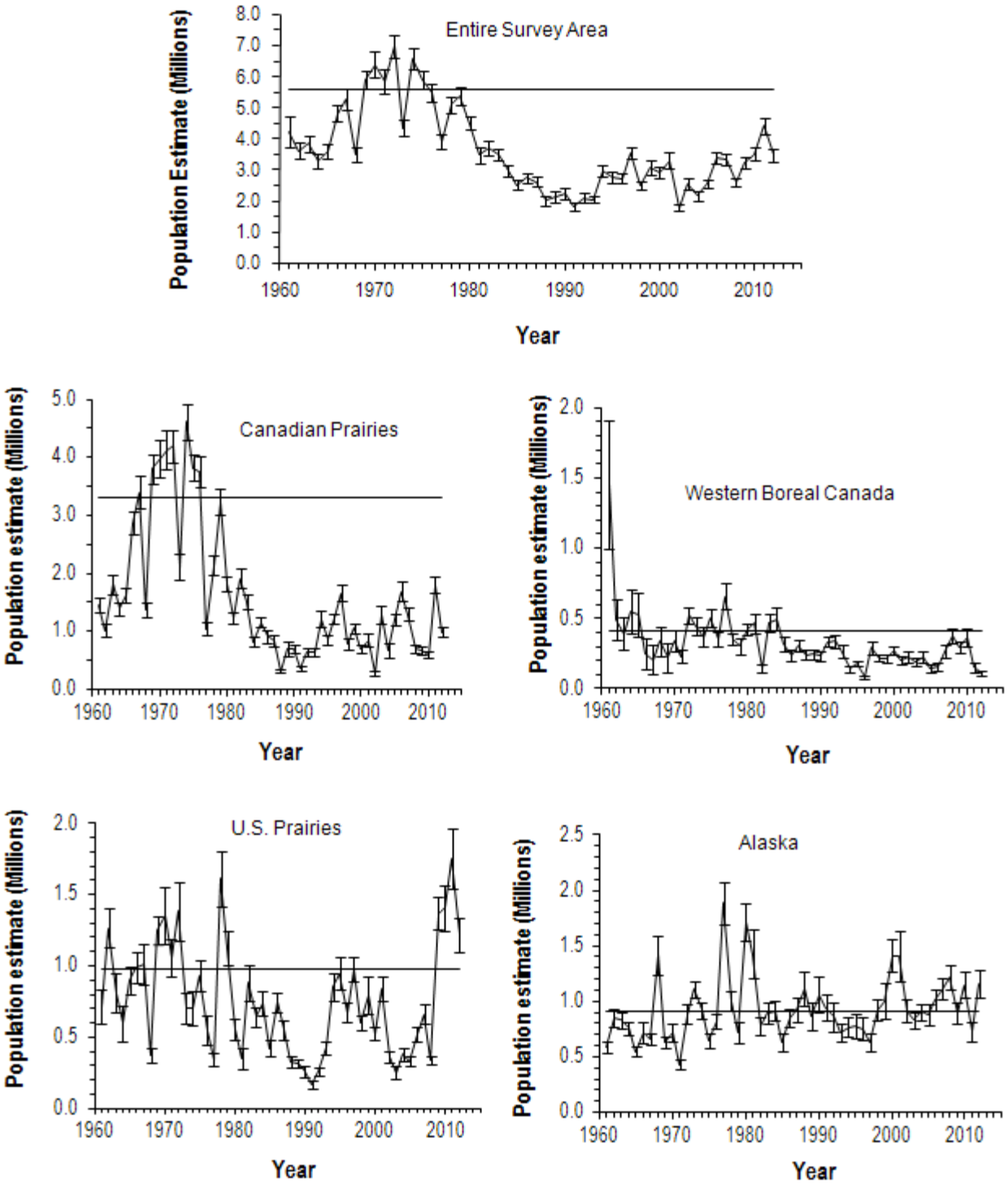

Figure 9. Northern Pintail Breeding Population in the Traditional Survey Area of the Waterfowl Breeding Population and Habitat Survey

Data shown are population estimates (± 1 SE). The horizontal line represents the NAWMP population goal.

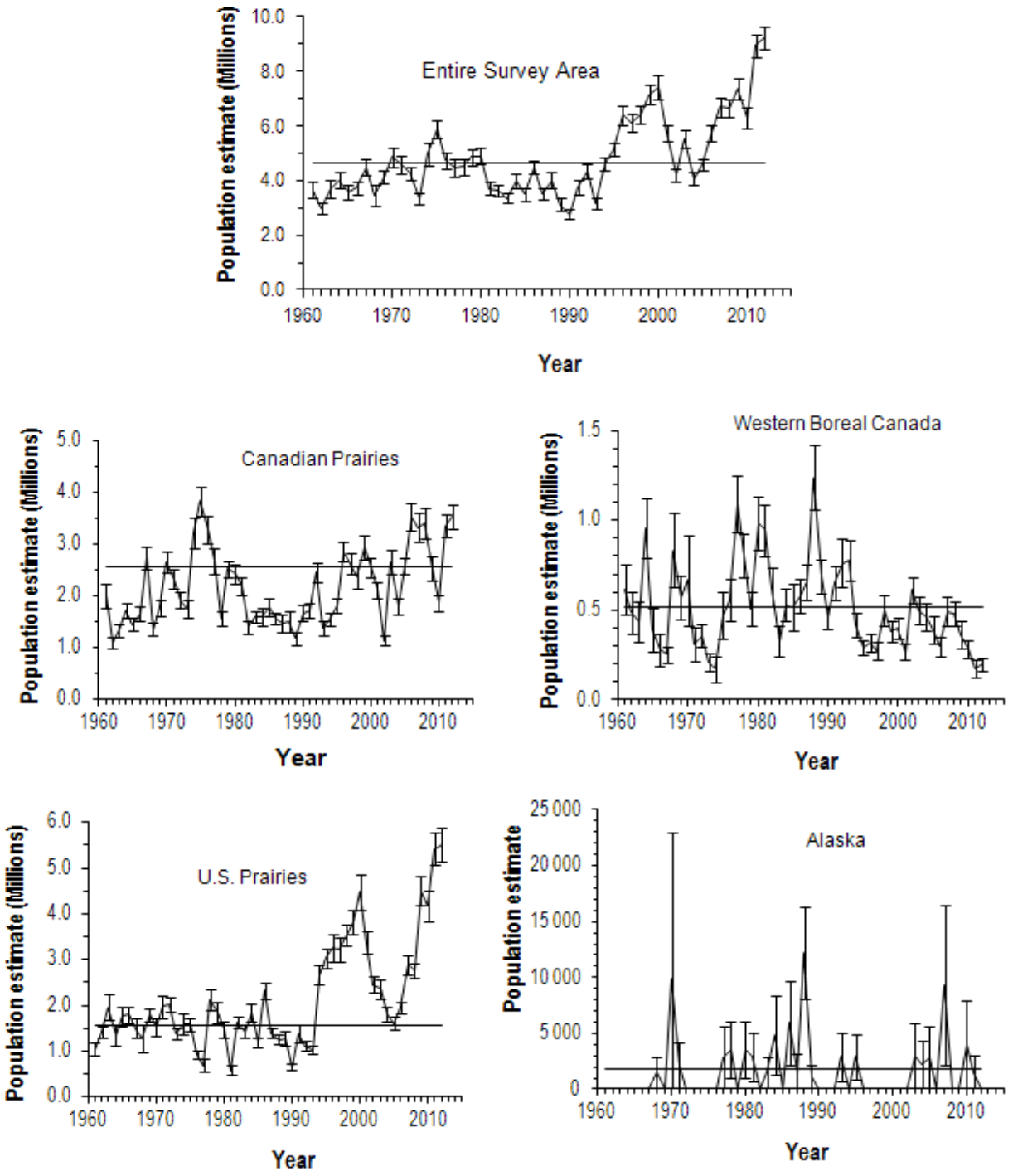

Figure 10. Blue-winged Teal Breeding Populations in the Traditional Survey Area of the Waterfowl Breeding Population and Habitat Survey

Data shown are population estimates (± 1 SE). The horizontal line represents the NAWMP population goal.

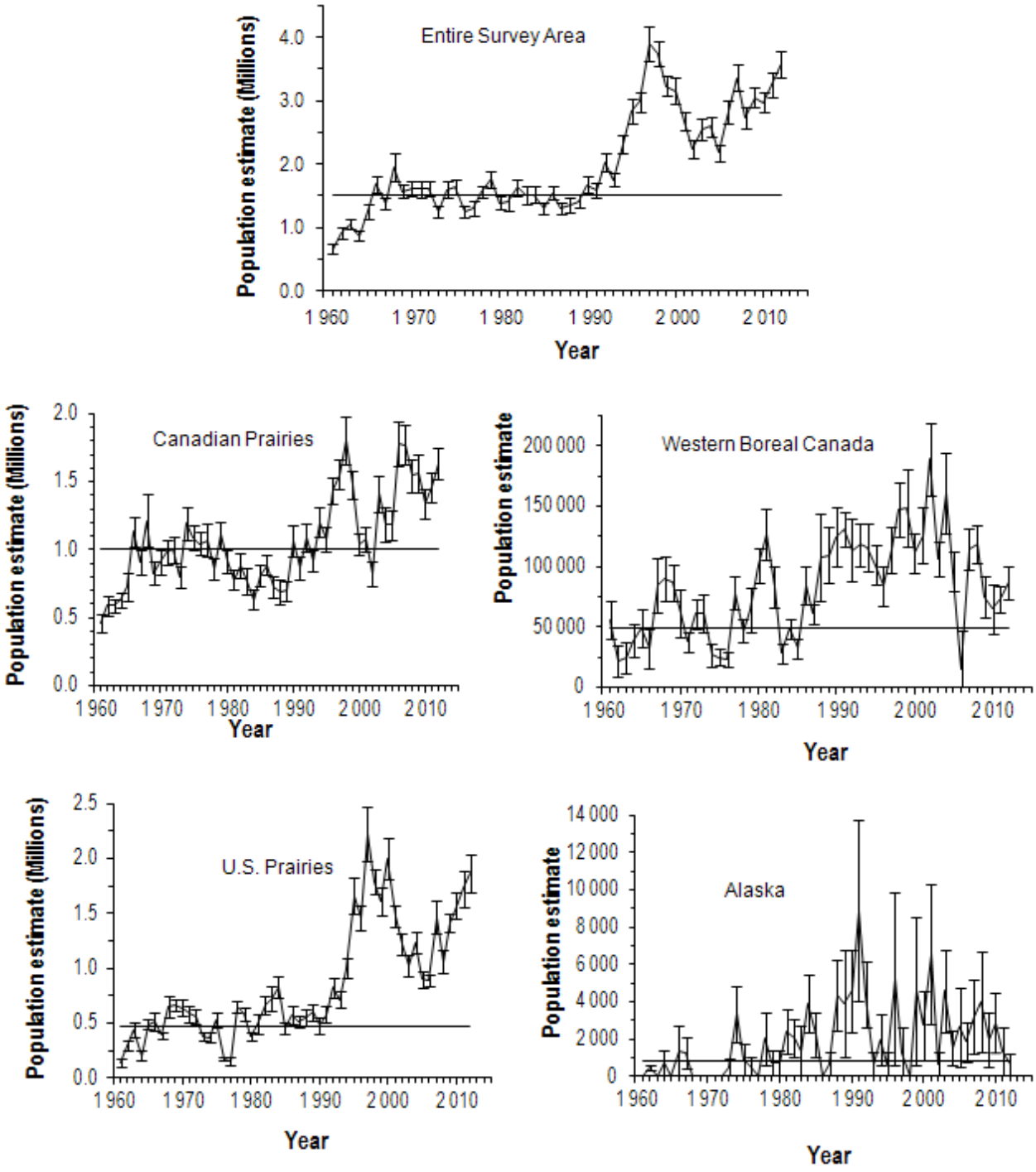

Figure 11. Gadwall Breeding Populations in the Traditional Survey Area of the Waterfowl Breeding Population and Habitat Survey

Data shown are estimates (± 1 SE). The horizontal line represents the NAWMP population goal.

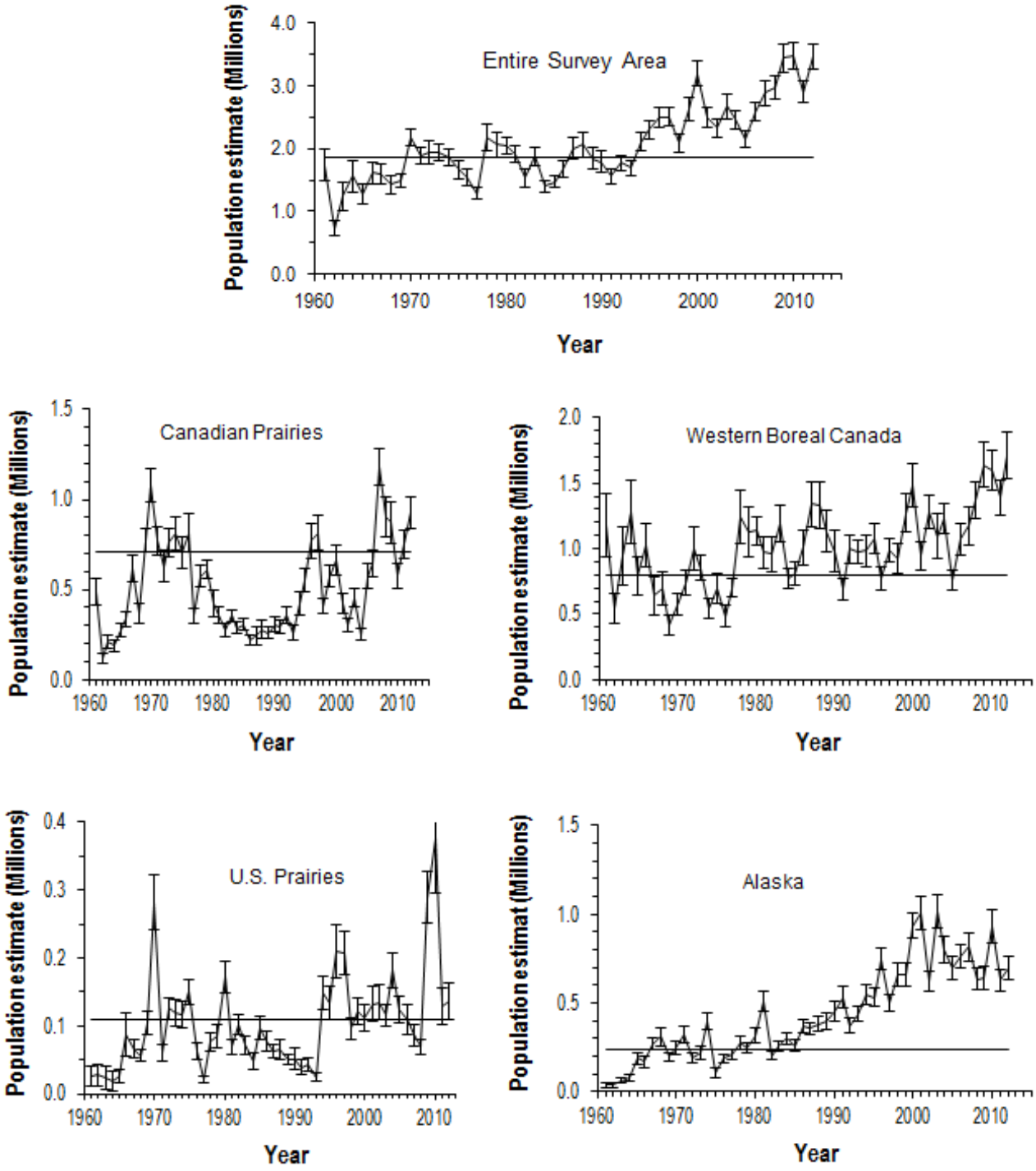

Figure 12. Green-winged Teal Breeding Populations in the Traditional Survey Area of the Waterfowl Breeding Population and Habitat Survey

Data shown are estimates (± 1 SE). The horizontal line represents the NAWMP population goal.

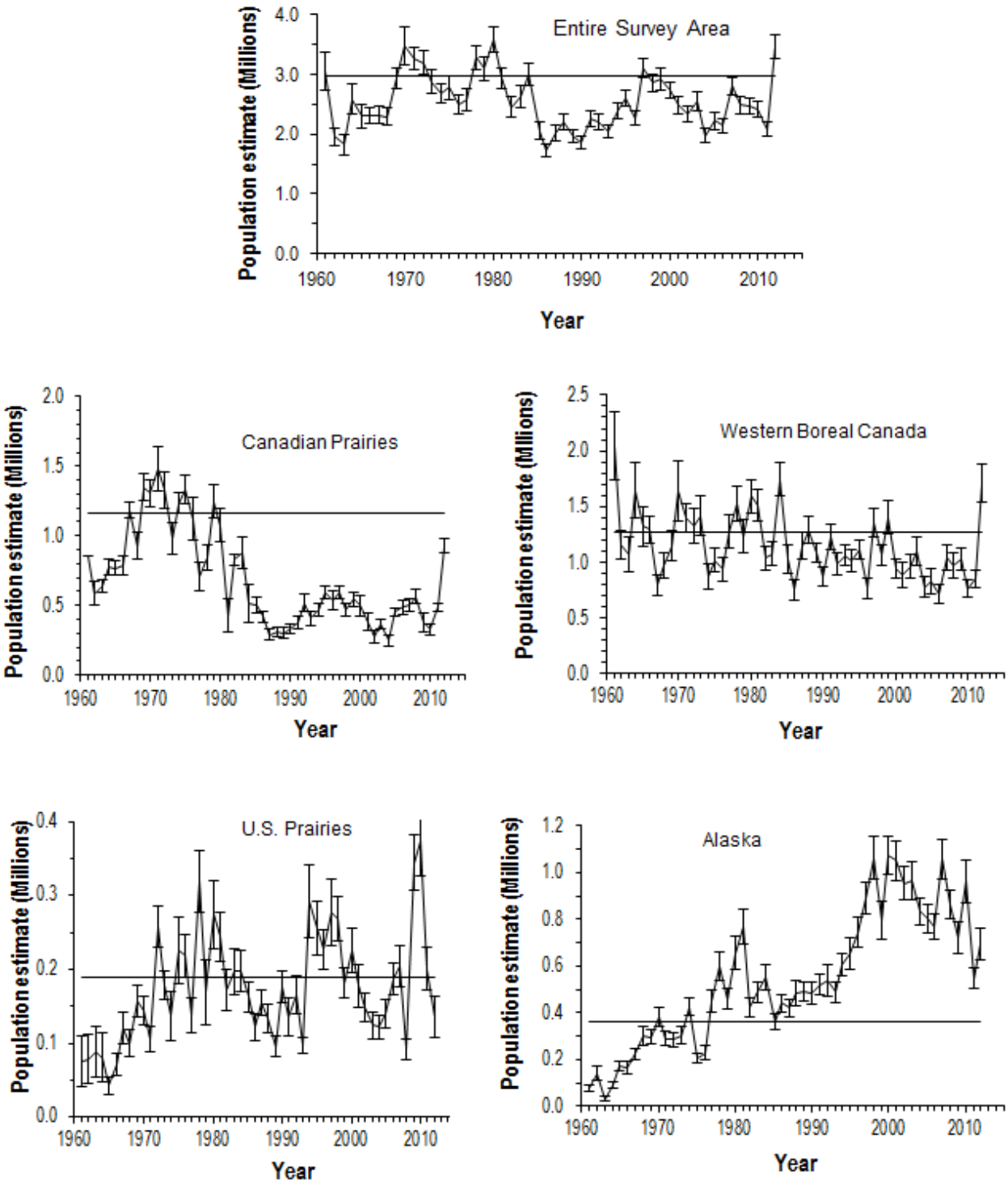

Figure 13. American Wigeon Breeding Populations in the Traditional Survey Area of the Waterfowl Breeding Population and Habitat Survey

Data shown are estimates (± 1 SE). The horizontal line represents the NAWMP population goal.

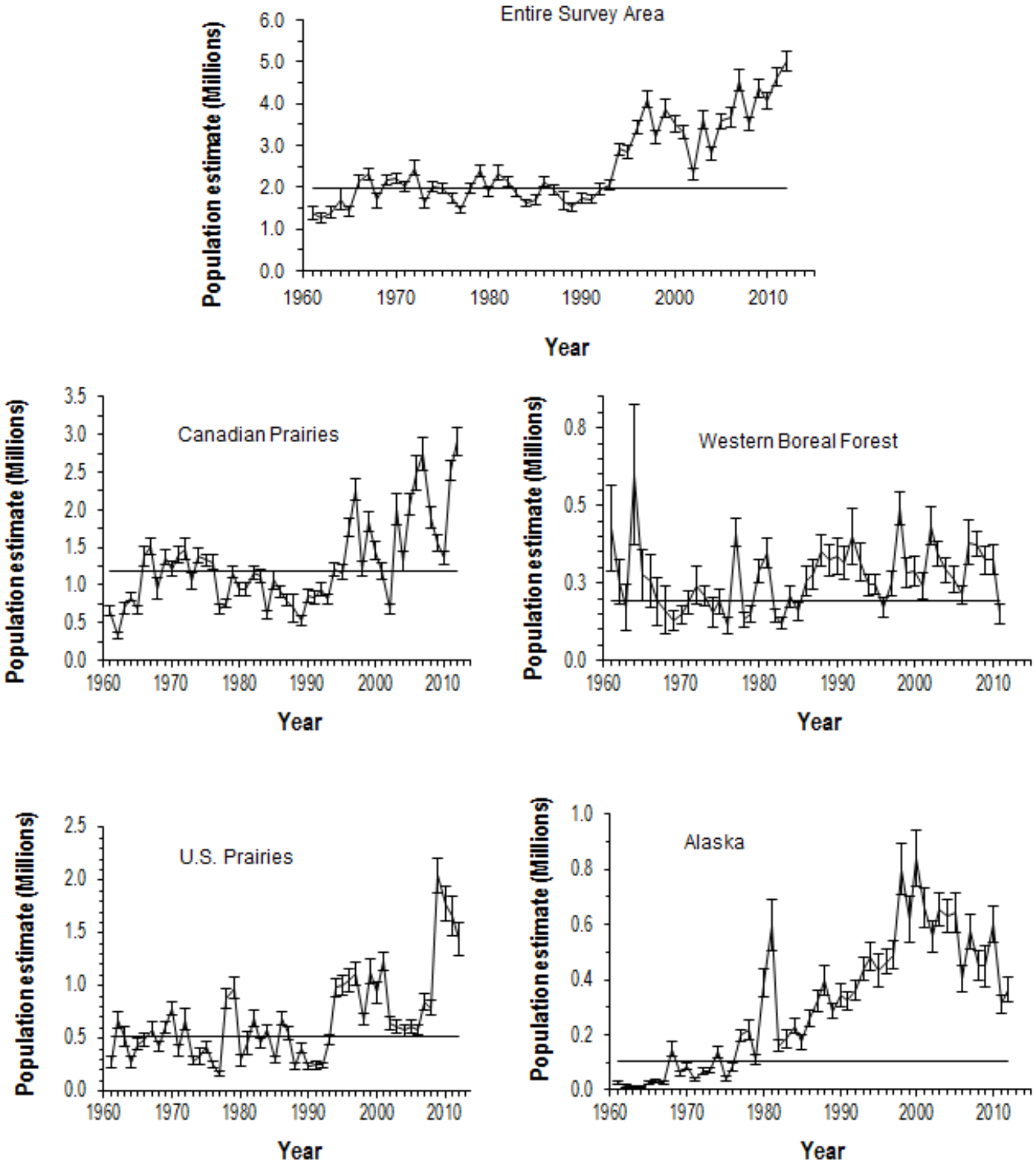

Figure 14. Northern Shoveler Breeding Populations in the Traditional Survey Area of the Waterfowl Breeding Population and Habitat Survey

Data shown are estimates (± 1 SE). The horizontal line represents the NAWMP population goal.

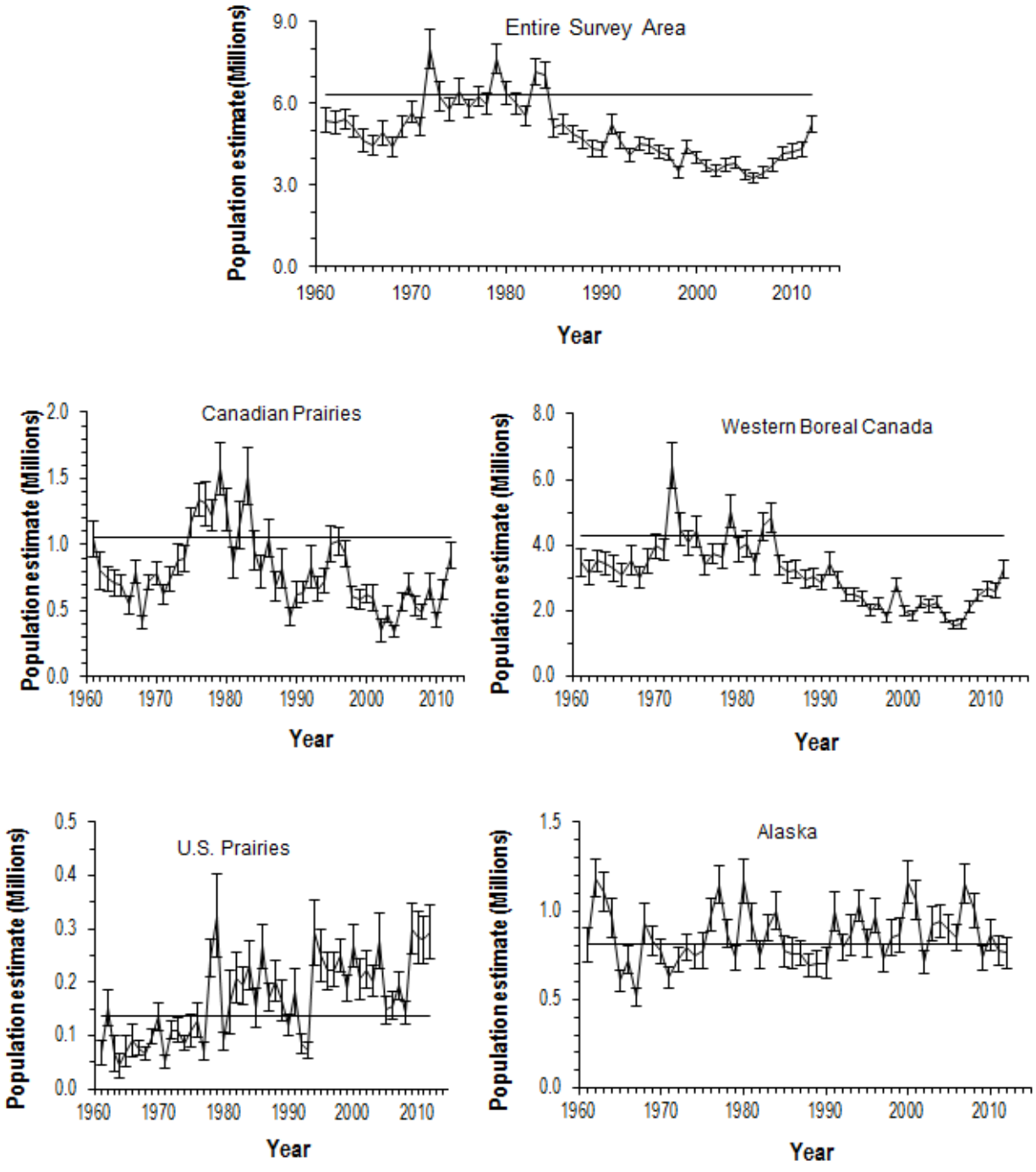

Figure 15. Scaup spp. Breeding Populations in the Traditional Survey Area of the Waterfowl Breeding Population and Habitat Survey

Data shown are estimates (± 1 SE). The horizontal line represents the NAWMP population goal.

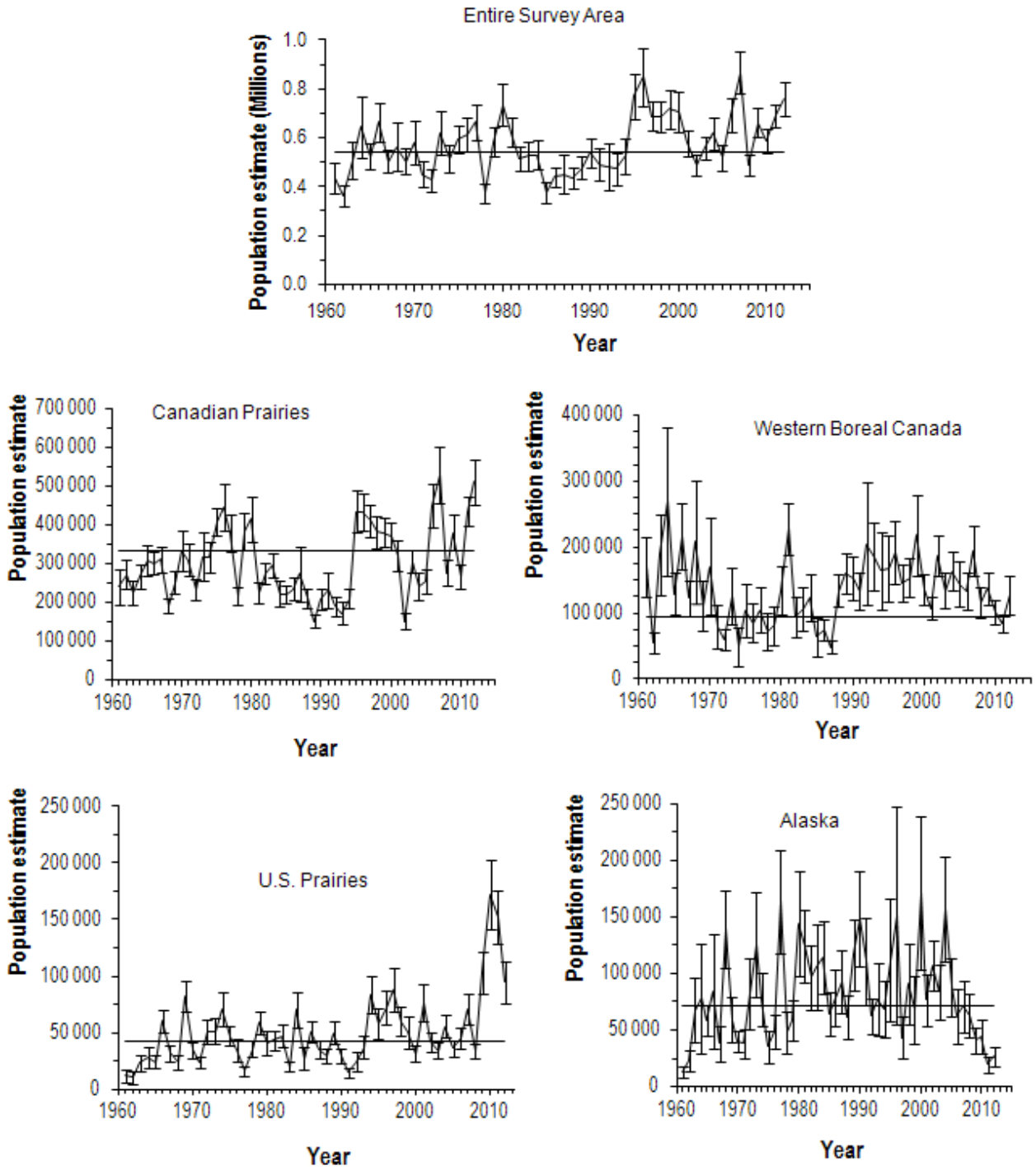

Figure 16. Canvasback Breeding Populations in the Traditional Survey Area of the Waterfowl Breeding Population and Habitat Survey

Data shown are estimates (± 1 SE). The horizontal line represents the NAWMP population goal.

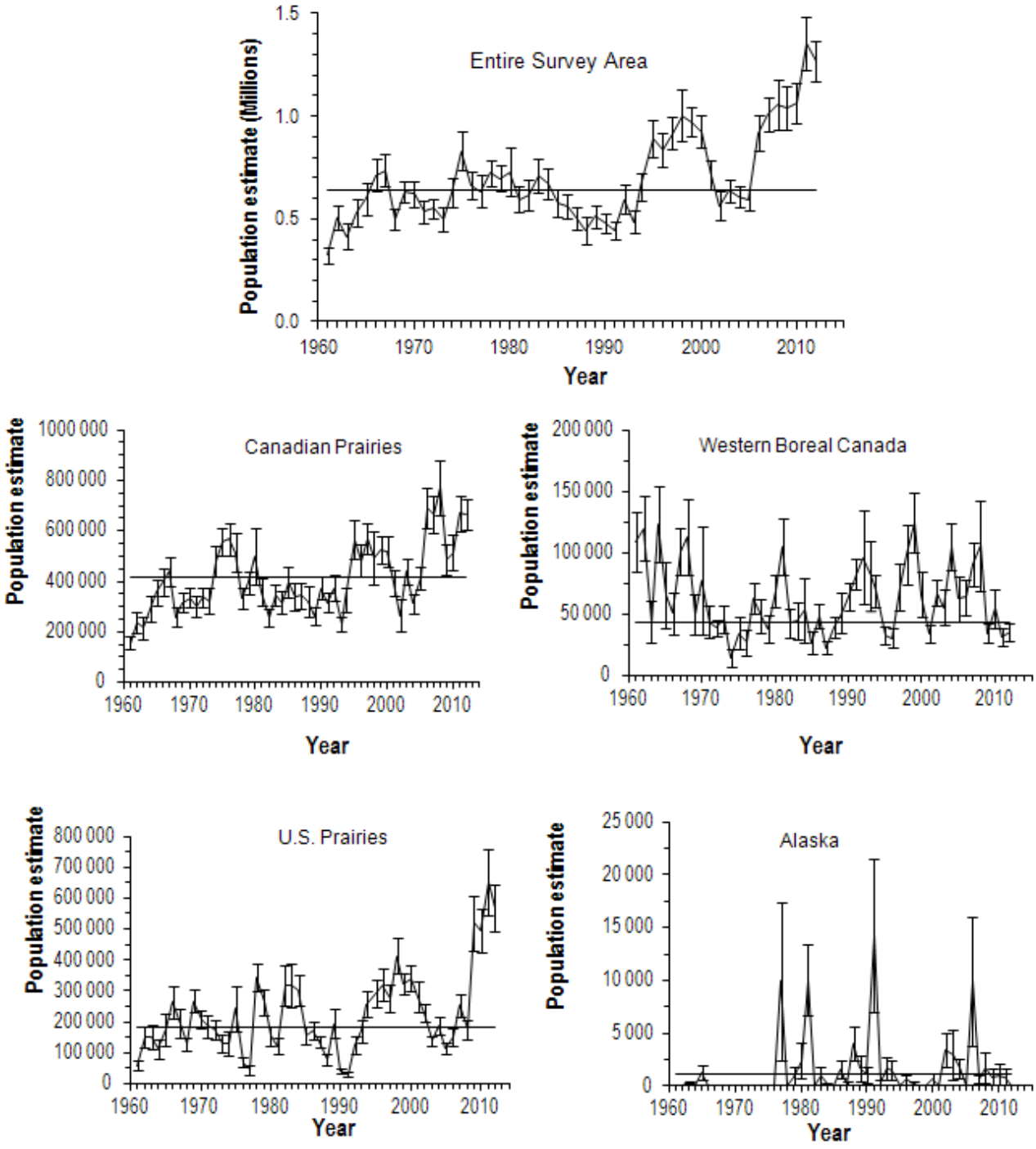

Figure 17. Redhead Breeding Populations in the Traditional Survey Area of the Waterfowl Breeding Population and Habitat Survey

Data shown are estimates (± 1 SE). The horizontal line represents the NAWMP population goal.

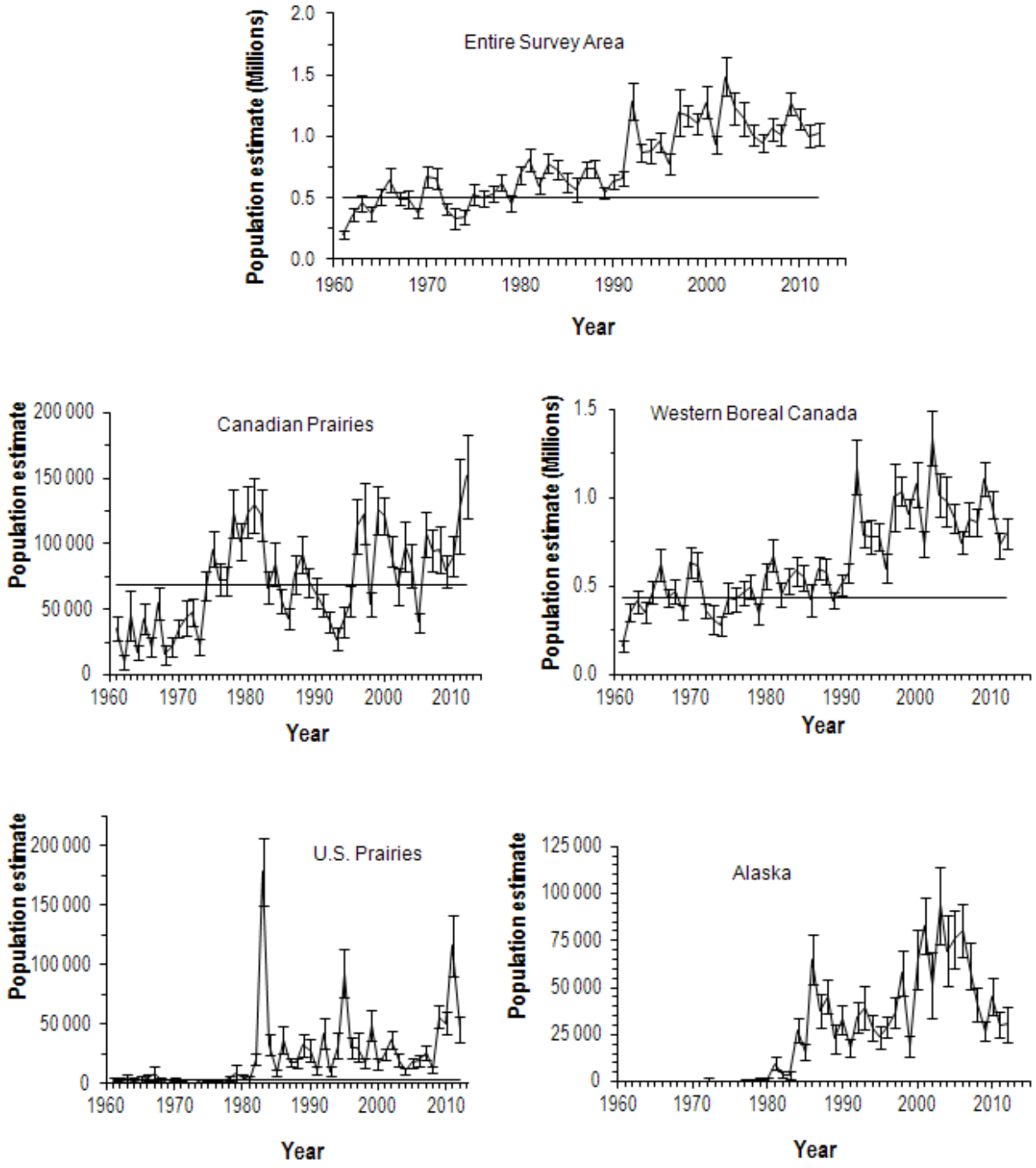

Figure 18. Ring-necked Duck Breeding Populations in the Traditional Survey Area of the Waterfowl Breeding Population and Habitat Survey

Data shown are estimates (± 1 SE). The horizontal line represents the NAWMP population goal.

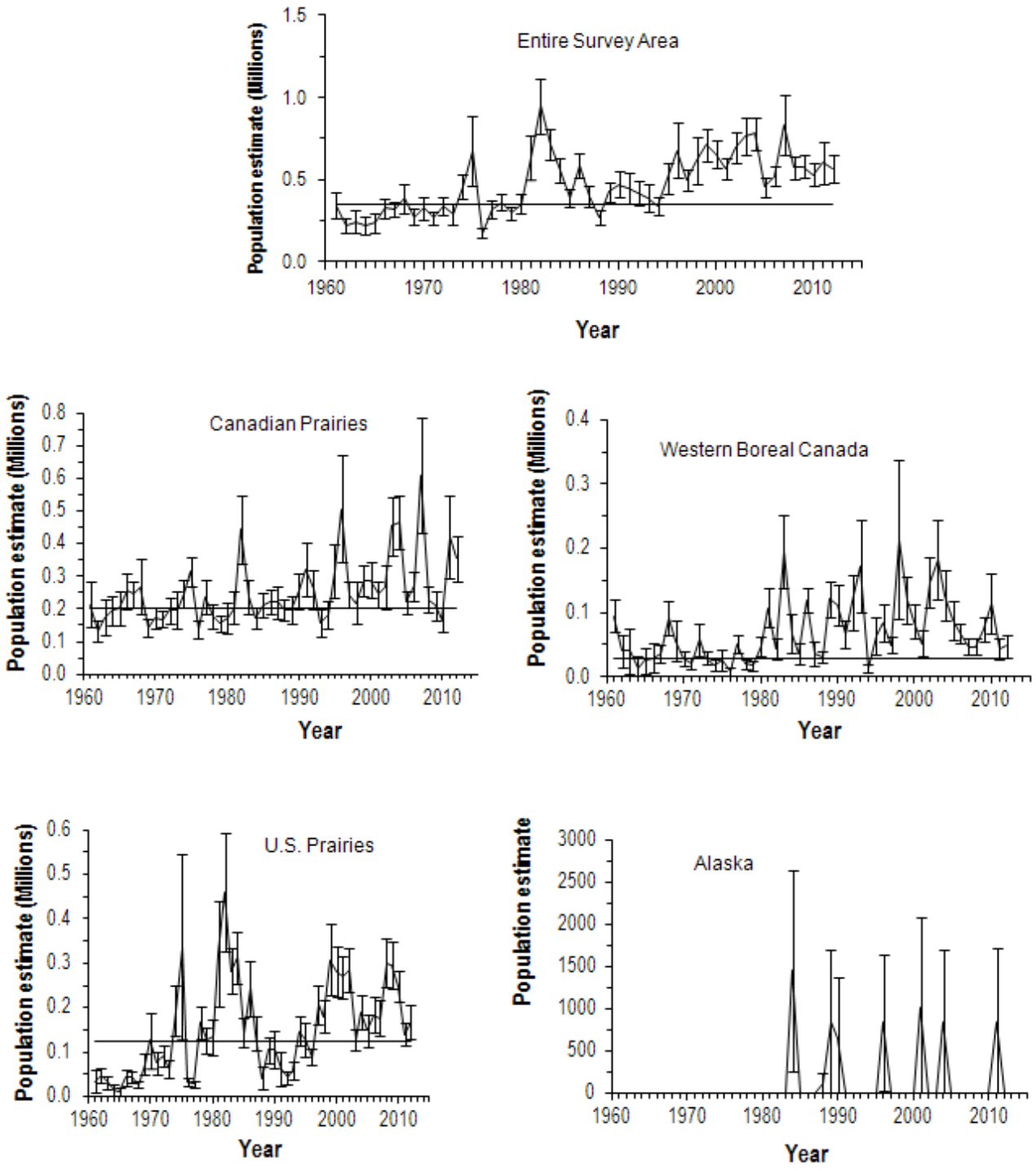

Figure 19. Ruddy Duck Breeding Populations in the Traditional Survey Area of the Waterfowl Breeding Population and Habitat Survey

Data shown are estimates (± 1 SE). The horizontal line represents the NAWMP population goal.

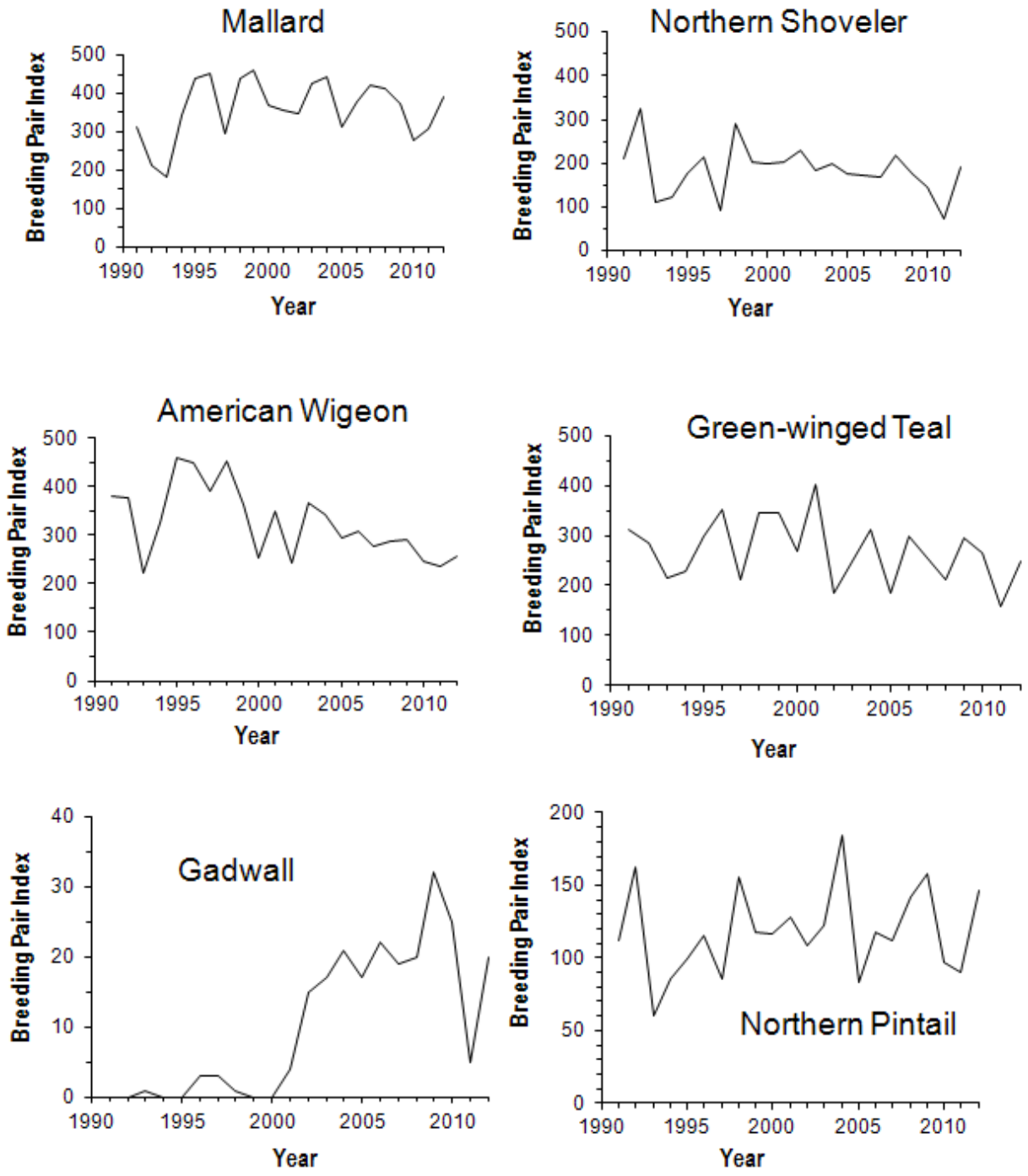

Figure 20. Breeding Pair Index for Dabbling Ducks in Southern Yukon 1991-2012
(Source: J. Hawkings, CWS, Pacific and Yukon Region)

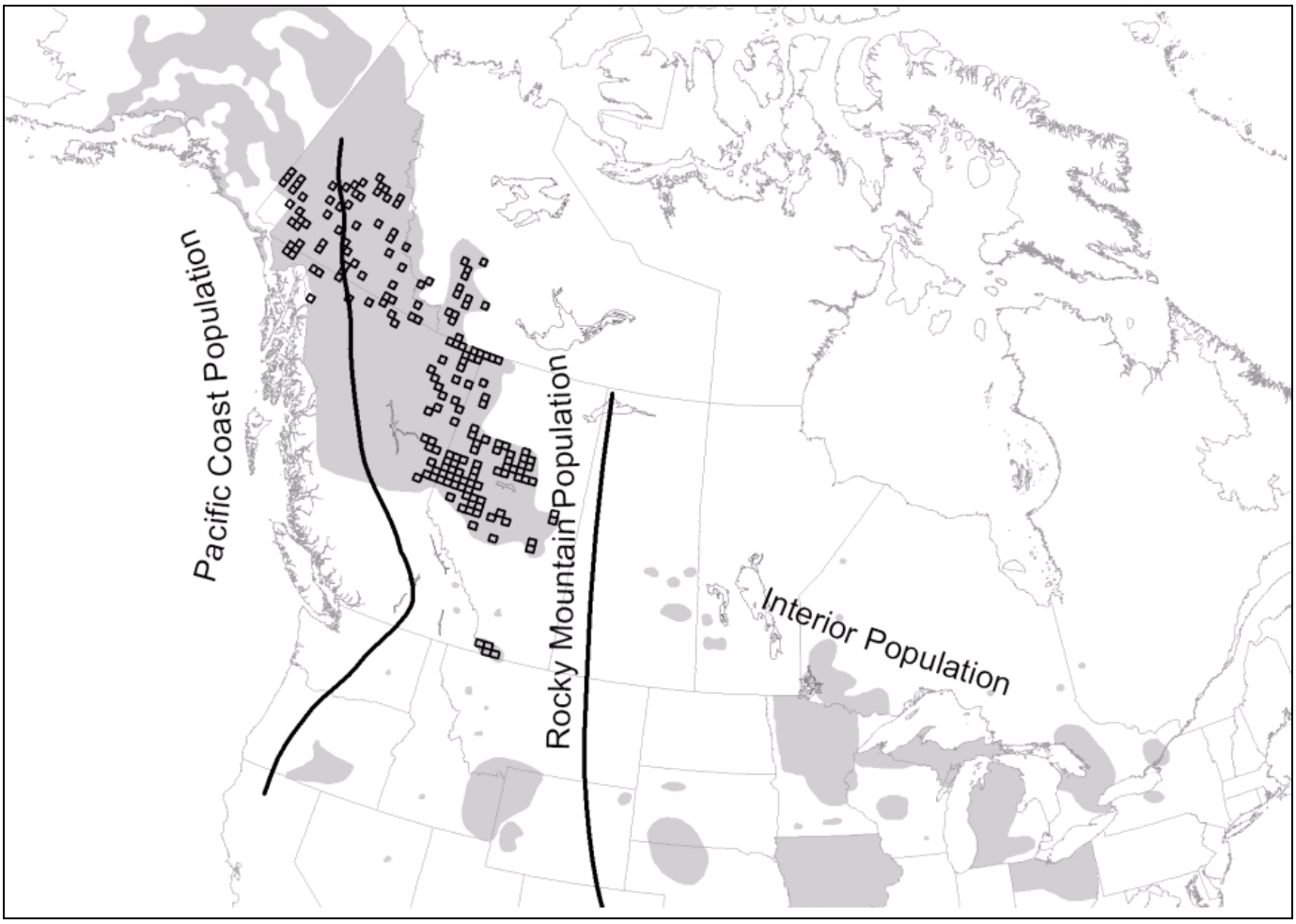

Figure 21. 2010 Breeding Distribution of Trumpeter Swan Populations in North America, Showing Individual Maps Sampled in Western Canada as Part of the 2010 North American Trumpeter Swan Survey
(Source: Groves 2012 USFWS)

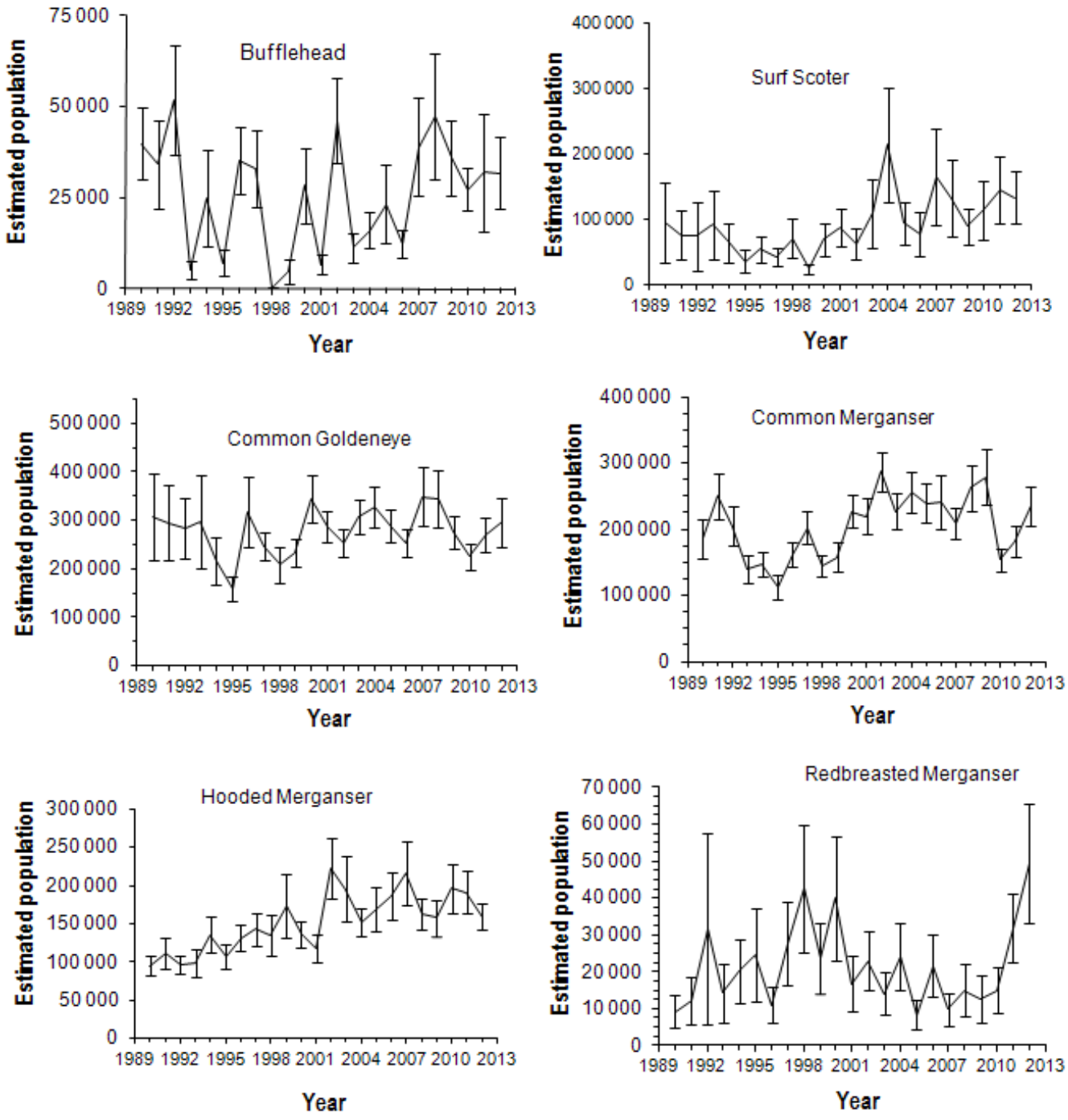

Figure 22. Bufflehead, Surf Scoter, Common Goldeneye, Common Merganser, Hooded Merganser and Redbreasted Merganser in the Eastern Waterfowl Survey Area

The figures represent results from the helicopter surveys only (estimate and SE).

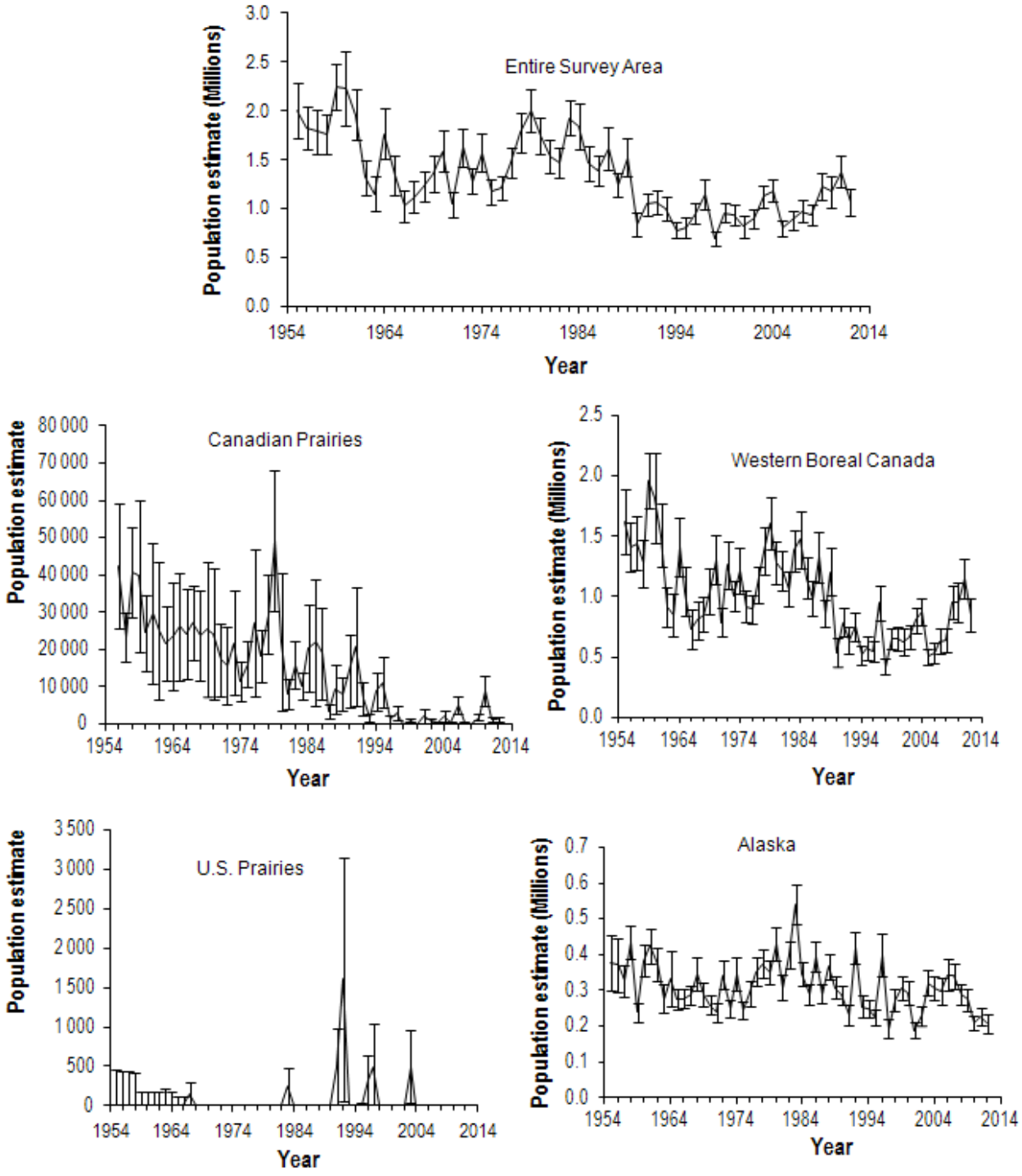

Figure 23. Scoter spp. Breeding Population Estimates in the Traditional Survey Area of the Waterfowl Breeding Population and Habitat Survey

Data shown are population estimates (± 1 SE).

The horizontal line represents the NAWMP population goal.

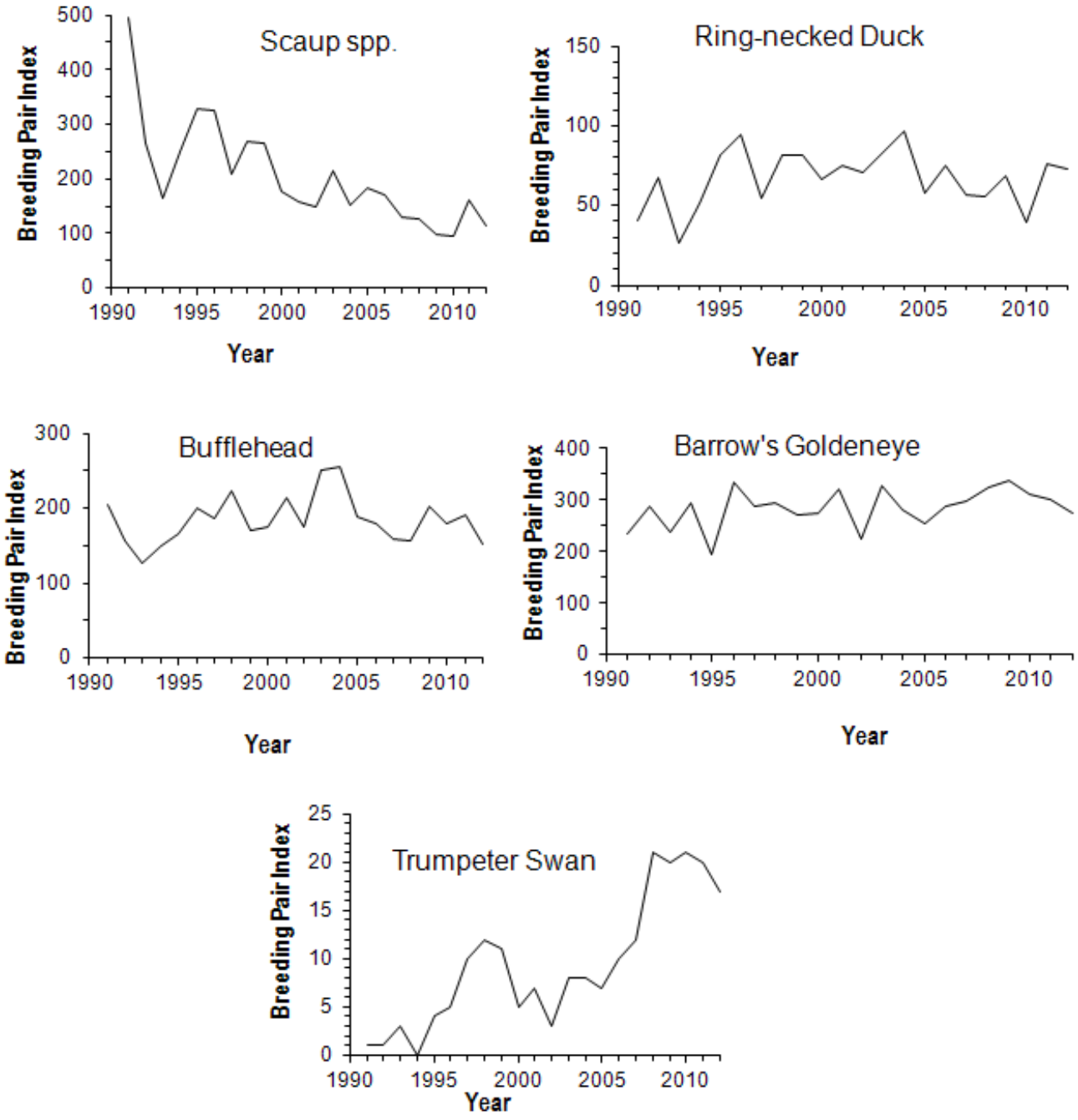

Figure 24. Breeding Pair Index for Diving Ducks, Sea Ducks and Trumpeter Swan in Southern Yukon 1991–2012
(Source: J. Hawkings, CWS, Pacific and Yukon Region)

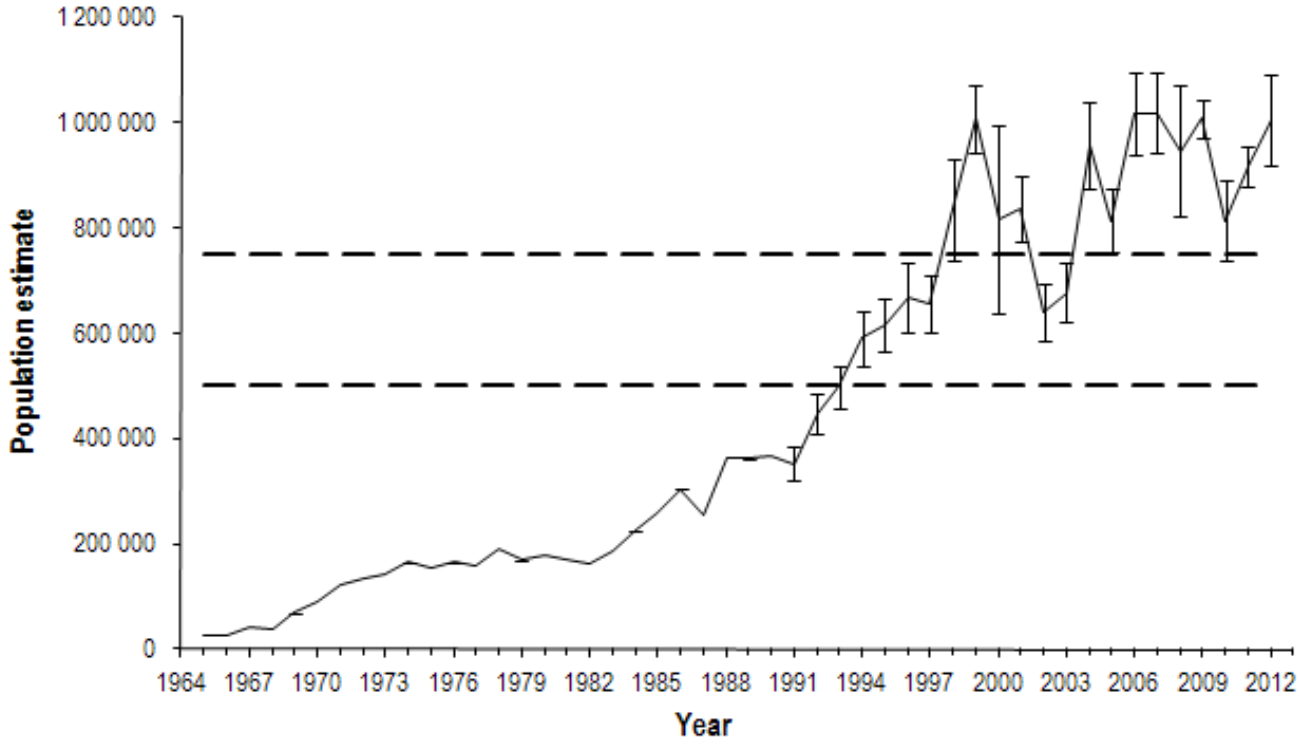

Figure 25. Greater Snow Goose Spring Population Estimates (95% CI) in the St. Lawrence River Valley

The horizontal lines represent the target range for the population.

(Source: Lefebvre 2012)

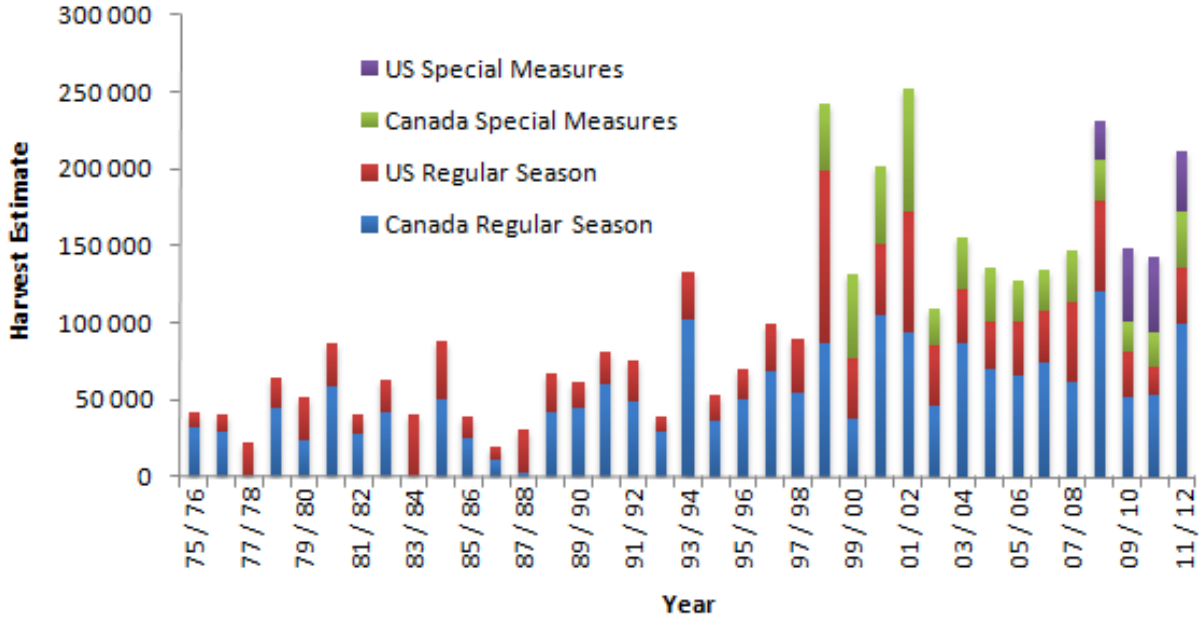

Figure 26. Harvest of Greater Snow Geese
Numbers include geese harvested during special conservation measures initiated in spring 1999 in Canada and 2009 in the United States.
(Source: Smith and Gendron 2012; and Raftovich et al. 2012)

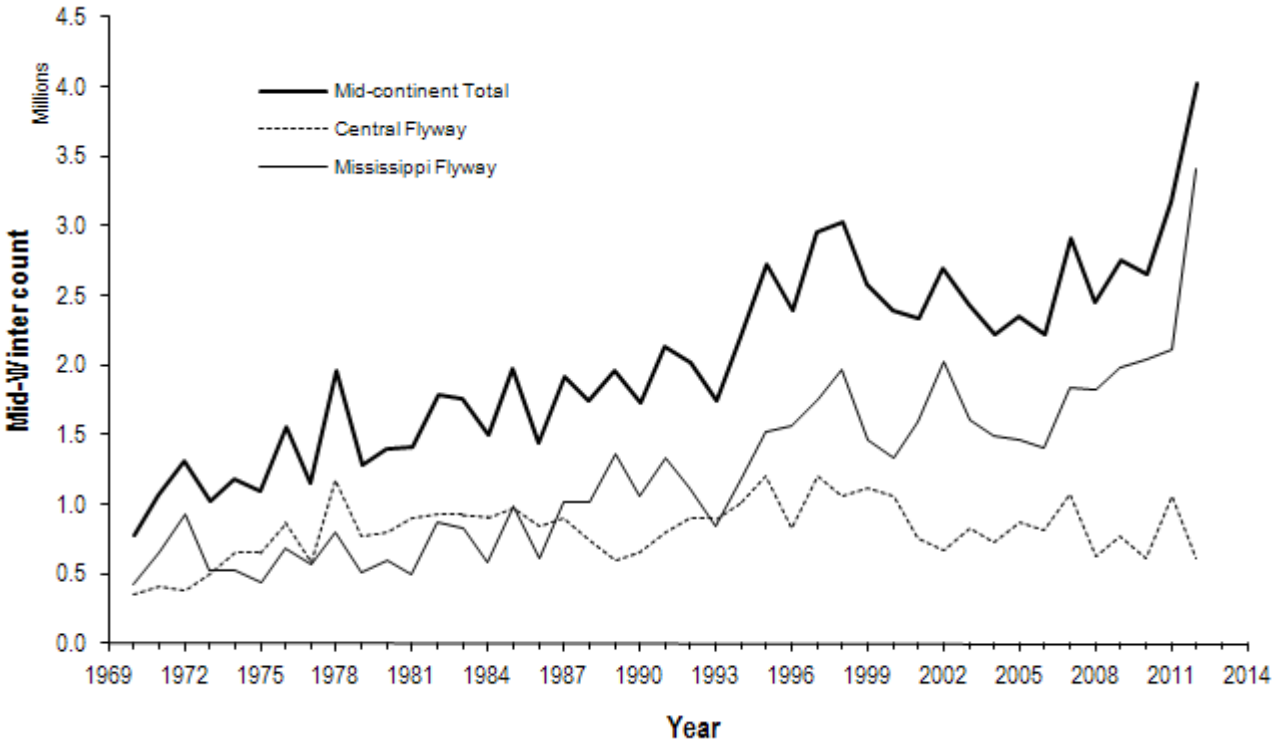

Figure 27. Mid-continent Lesser Snow Geese Populations in Mid-winter
Counts include some Ross' Geese.
(Source: Fronczak 2012)

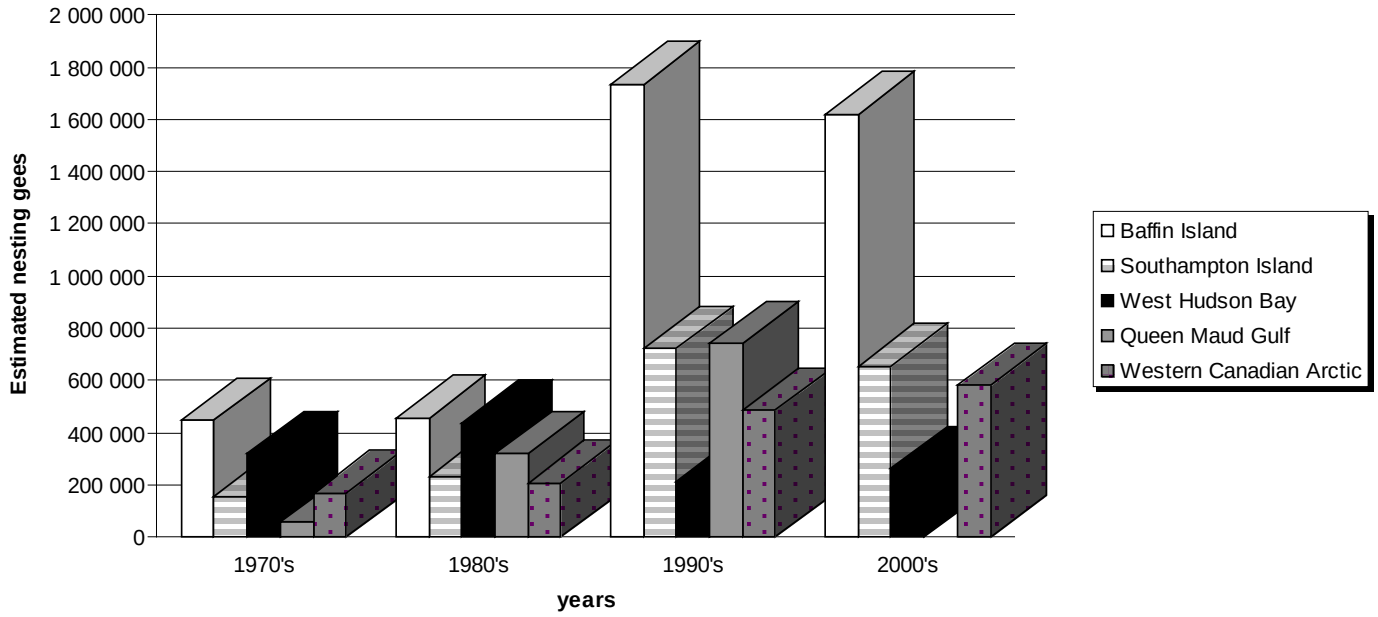

Figure 28. Number of Nesting Lesser Snow Geese Estimated Through Photo-inventories of Major Breeding Colonies in Canada

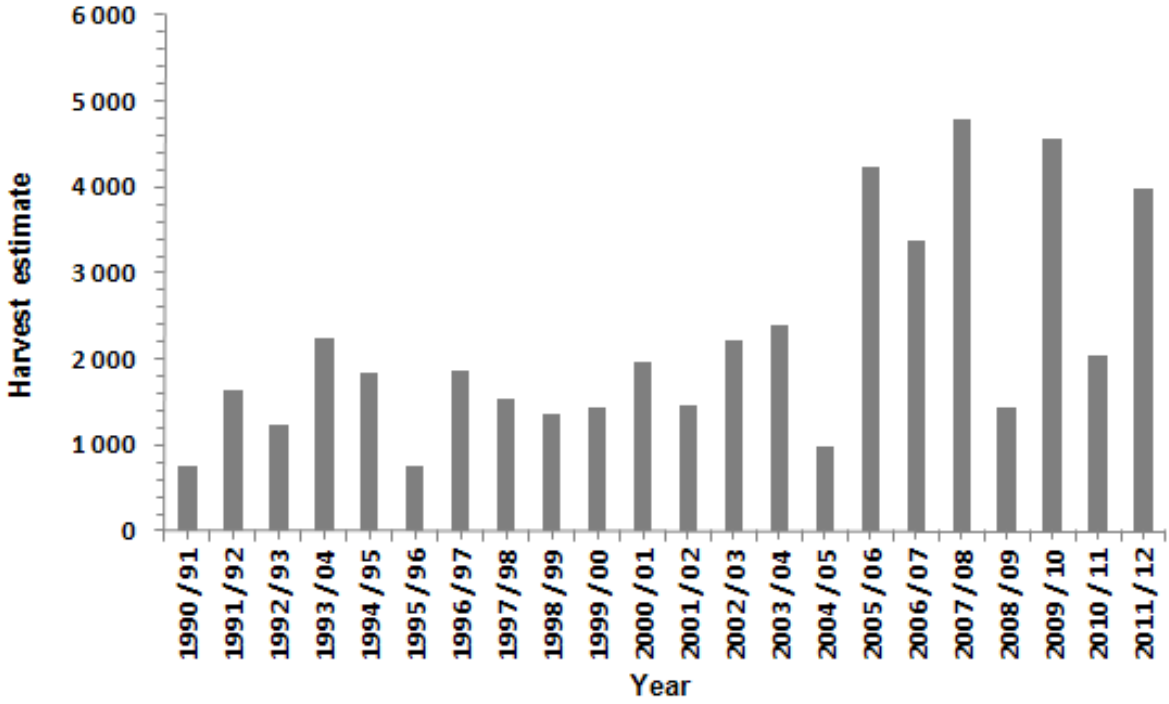

Figure 29. Lesser Snow Geese Harvest Estimates for the Wrangel Island Population
Estimates include a +20% adjustment for cripple loss.
(Source: A. Breault, CWS, Pacific and Yukon Region).

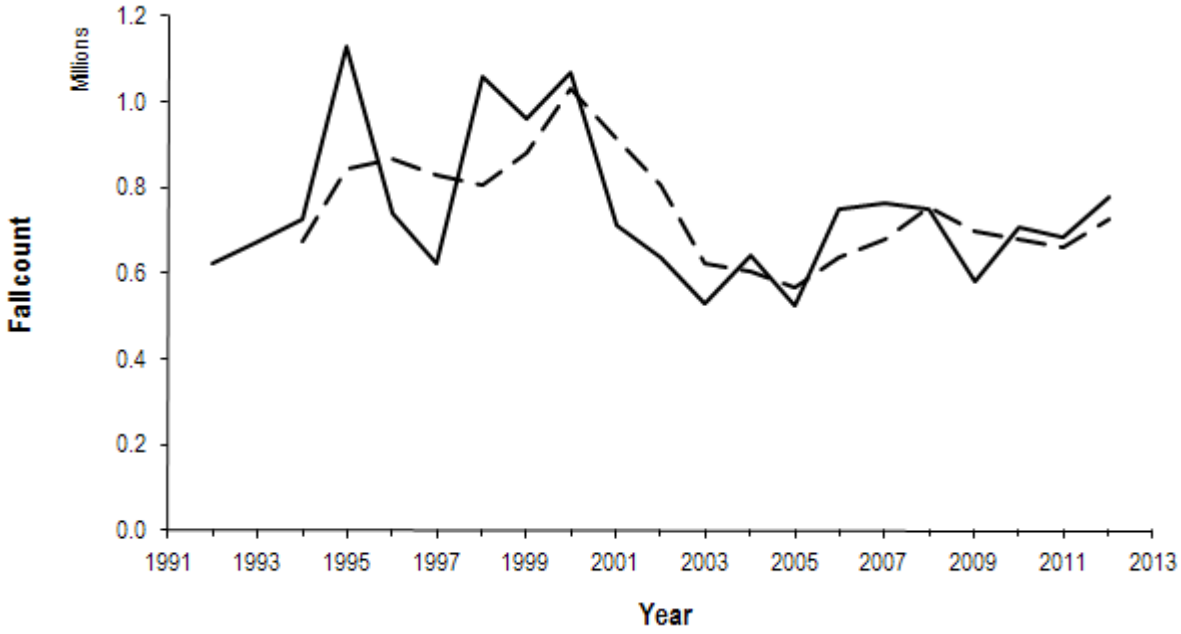

Figure 30. Greater White-fronted Geese of the Mid-Continent
Fall survey on staging areas in Saskatchewan and Alberta (K. Warner, CWS, Prairie and Northern region). The solid line represents actual counts, and the dashed line represents the running three-year mean.

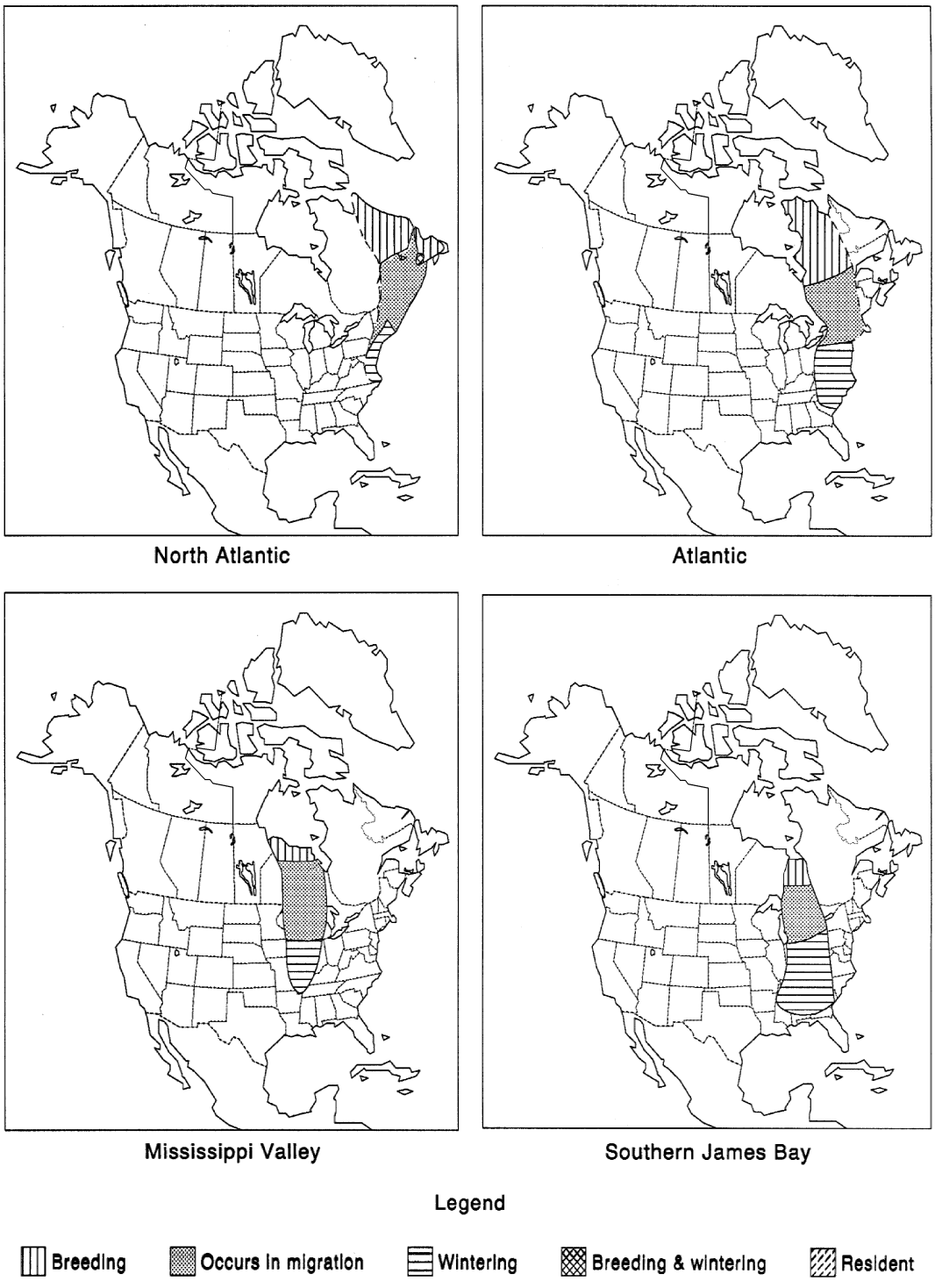

Figure 31a. Canada Goose Populations in North America: NAP, AP, MVP and SJBP

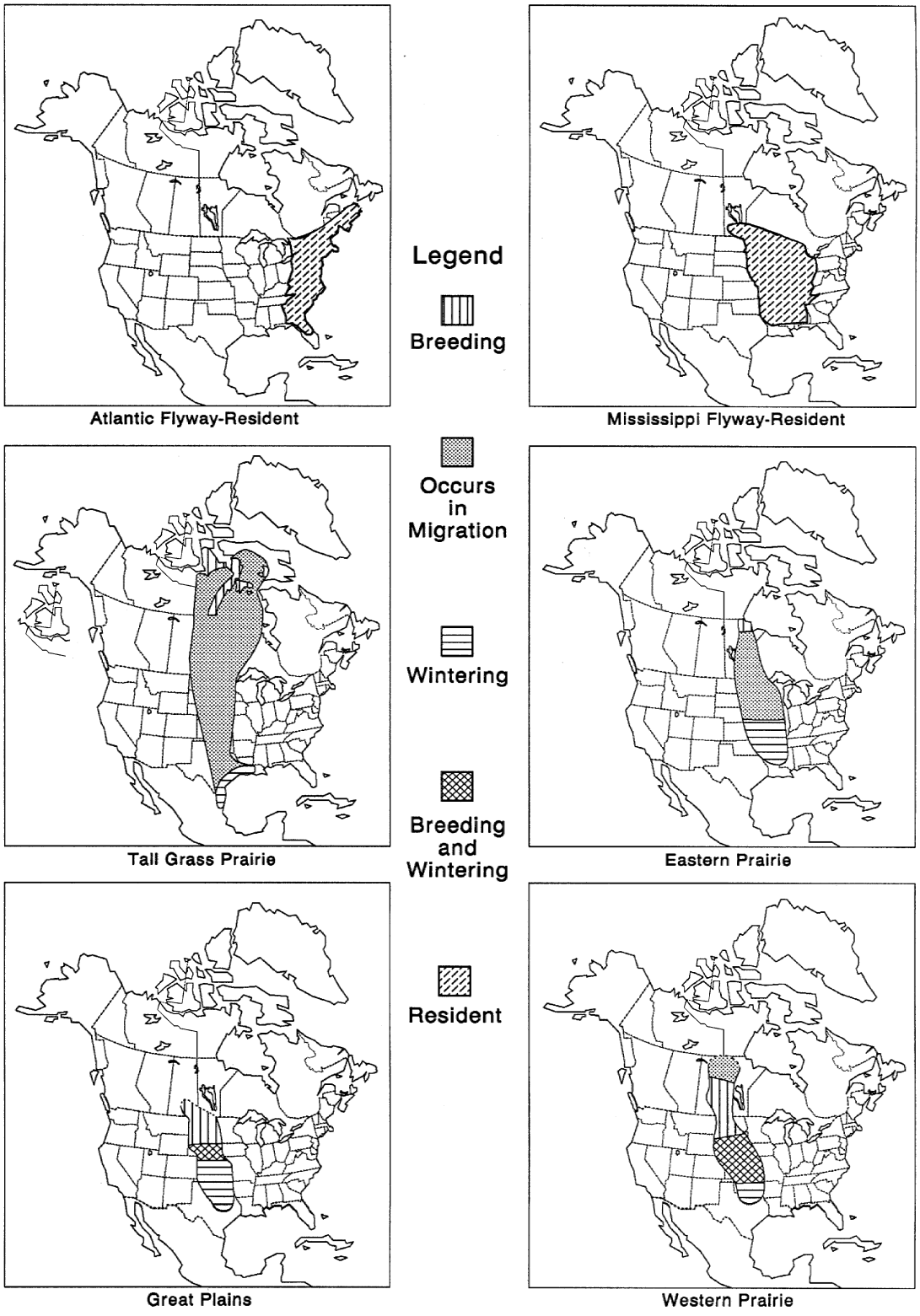

Figure 31b. Canada Goose Populations in North America: AFRP, MFRP, EPP, GPP and WPP. Cackling Goose Population: TGPP

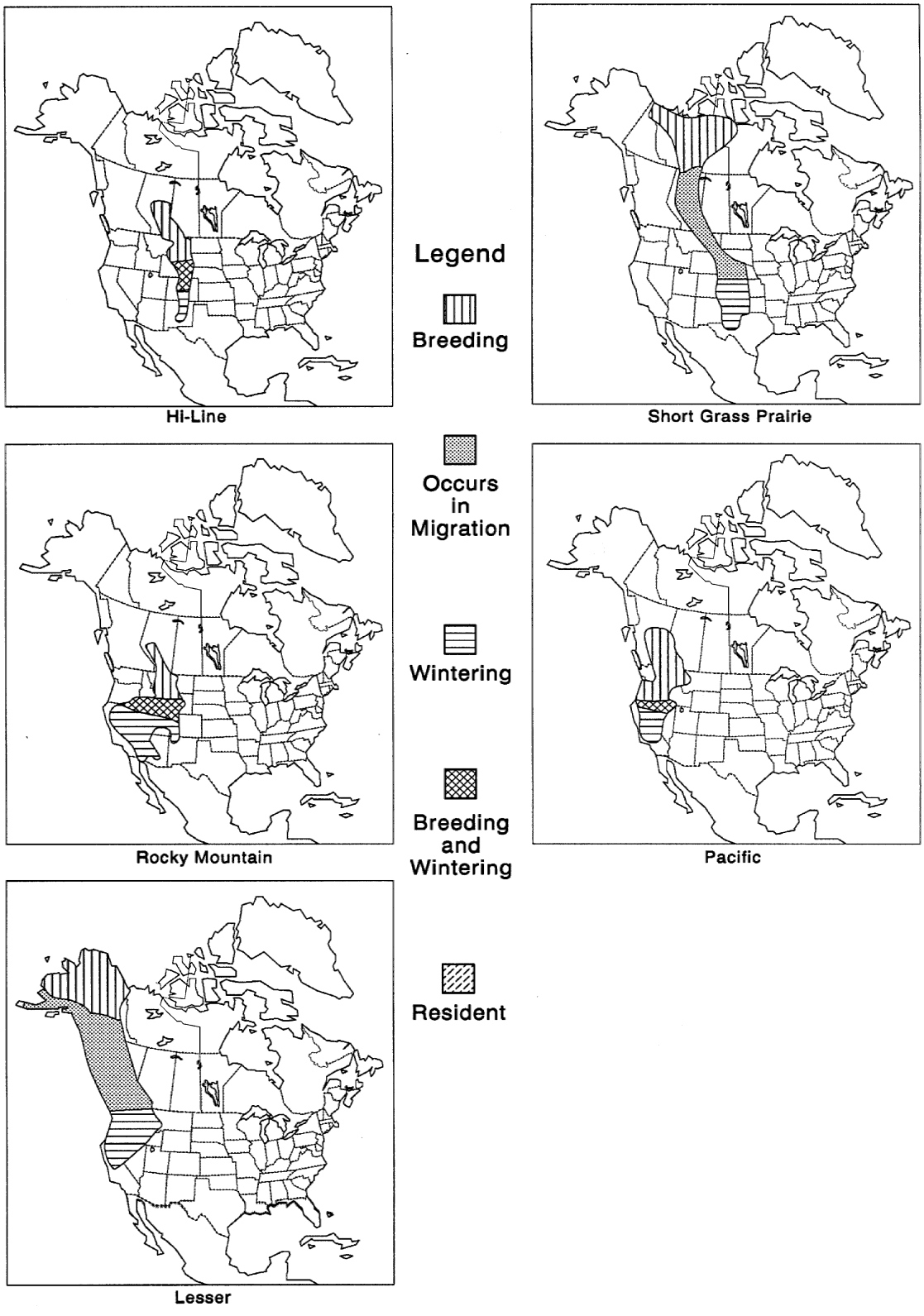

Figure 31c. Canada Goose Populations in North America: HLP, RMP, PP and LP. Mixed Cackling / Canada Goose Population: SGPP.

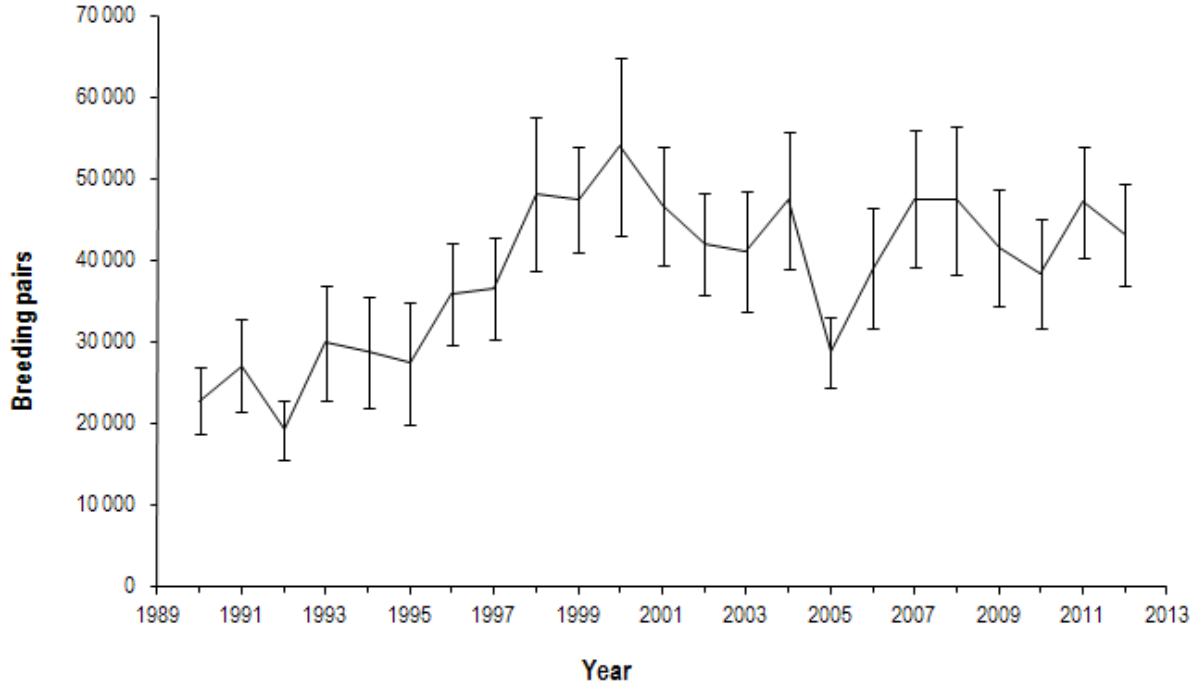

Figure 32. Breeding Pairs of the North Atlantic Population Canada Geese in Stratum 2 of the Eastern Waterfowl Survey Area (see Figure 1)

(Breeding pairs (±1 ET), *Source: Adam Smith, CWS, National Capital Region)*

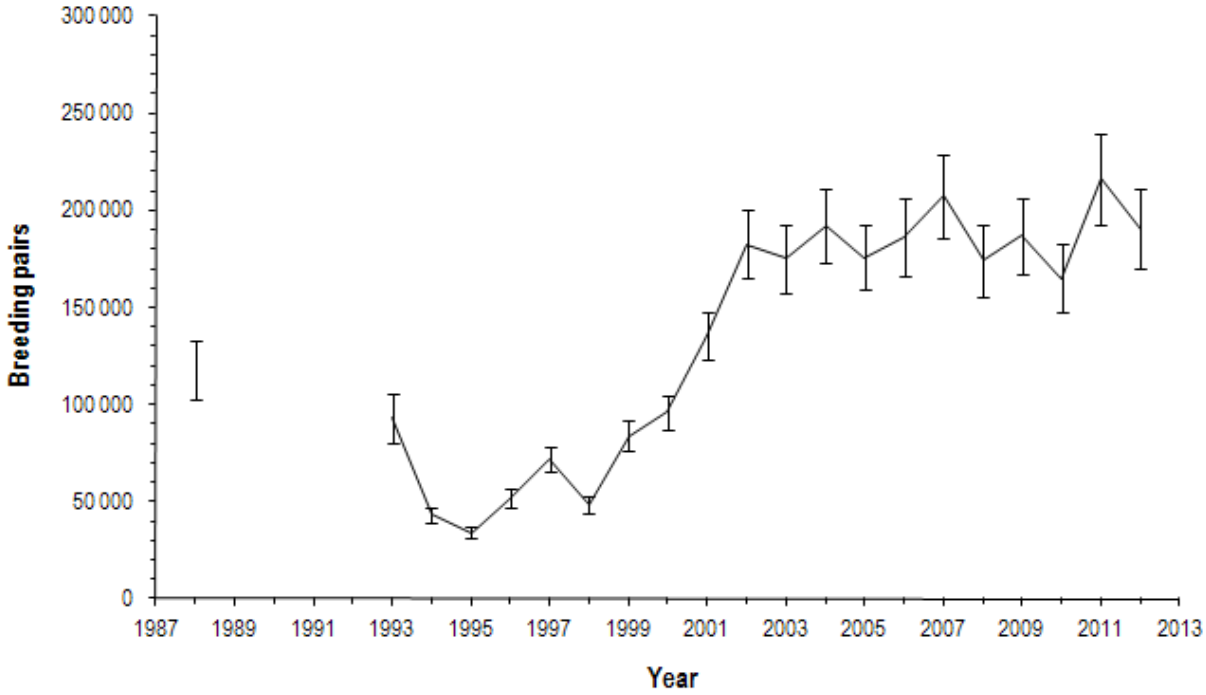

Figure 33. Breeding Pairs of the Atlantic Population Canada Geese in the Ungava Peninsula of northern Quebec

Breeding pairs ± 1SE. No surveys were conducted from 1989–1992.

(Source: Harvey and Rodrigue 2012)

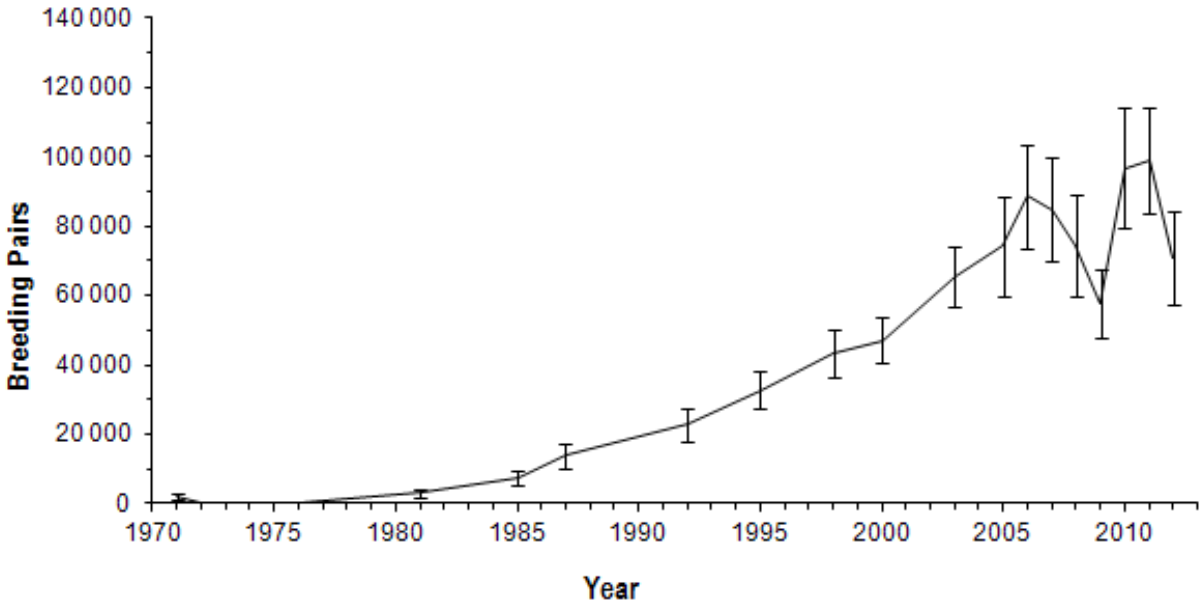

Figure 34. Estimated Breeding Pairs of Temperate-breeding Canada Geese (± 1 SE) in Southern Ontario Population, 1971–2012
(Source: S. Meyer, CWS, Ontario Region)

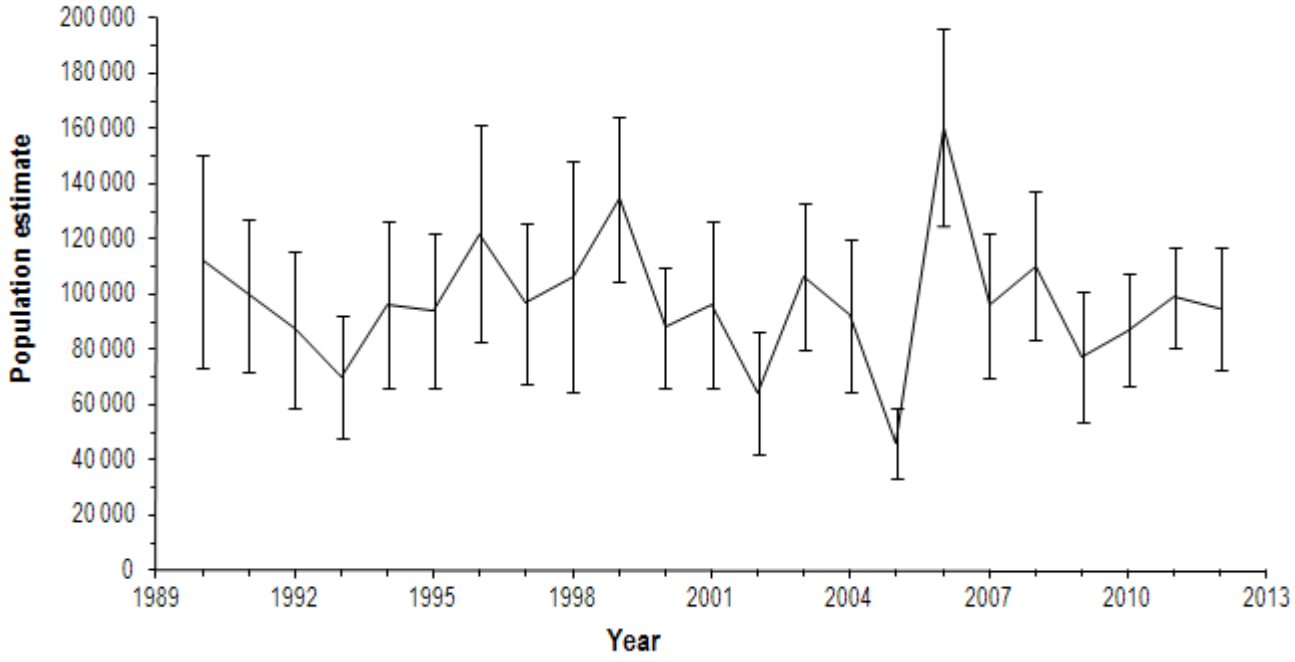

Figure 35. Southern James Bay Population Canada Geese Spring Estimates (± *95% CI)*
Changes in the survey design made the population estimates since 2007 not directly comparable to those of previous years *(Source: Brook and Hughes 2012a).*

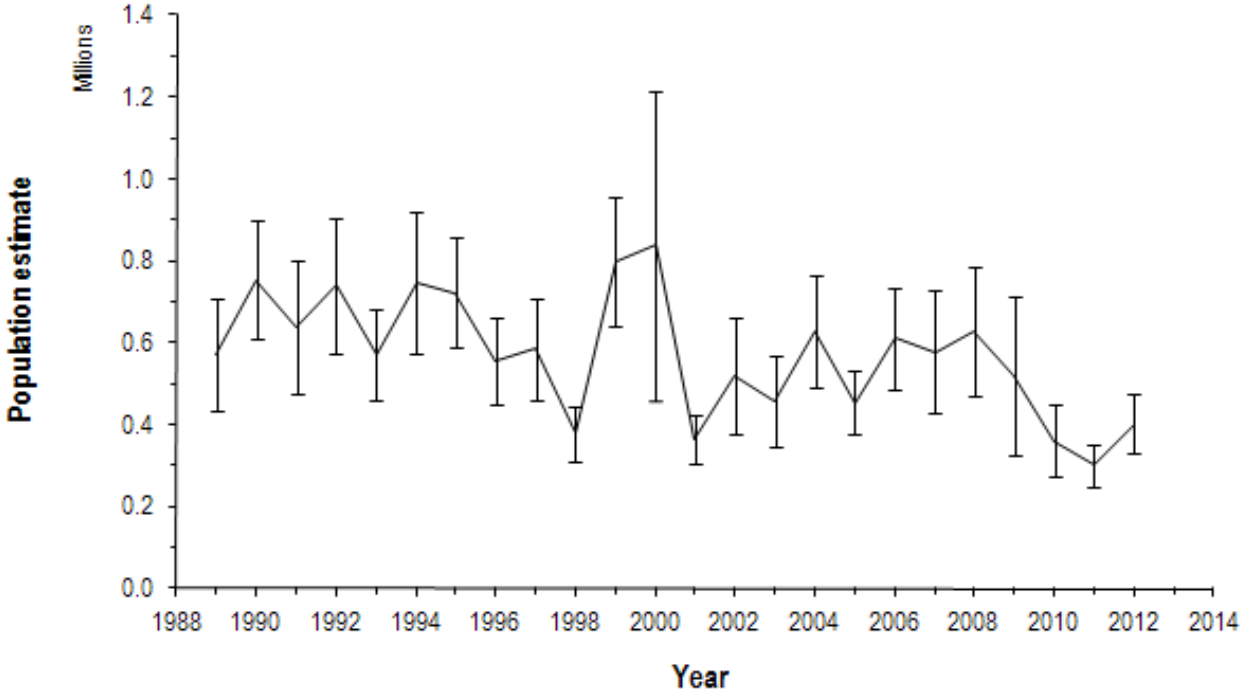

Figure 36. Mississippi Valley Population Canada Geese Spring Estimates (± 95% CI)
(Source: Brook and Hughes 2012b)

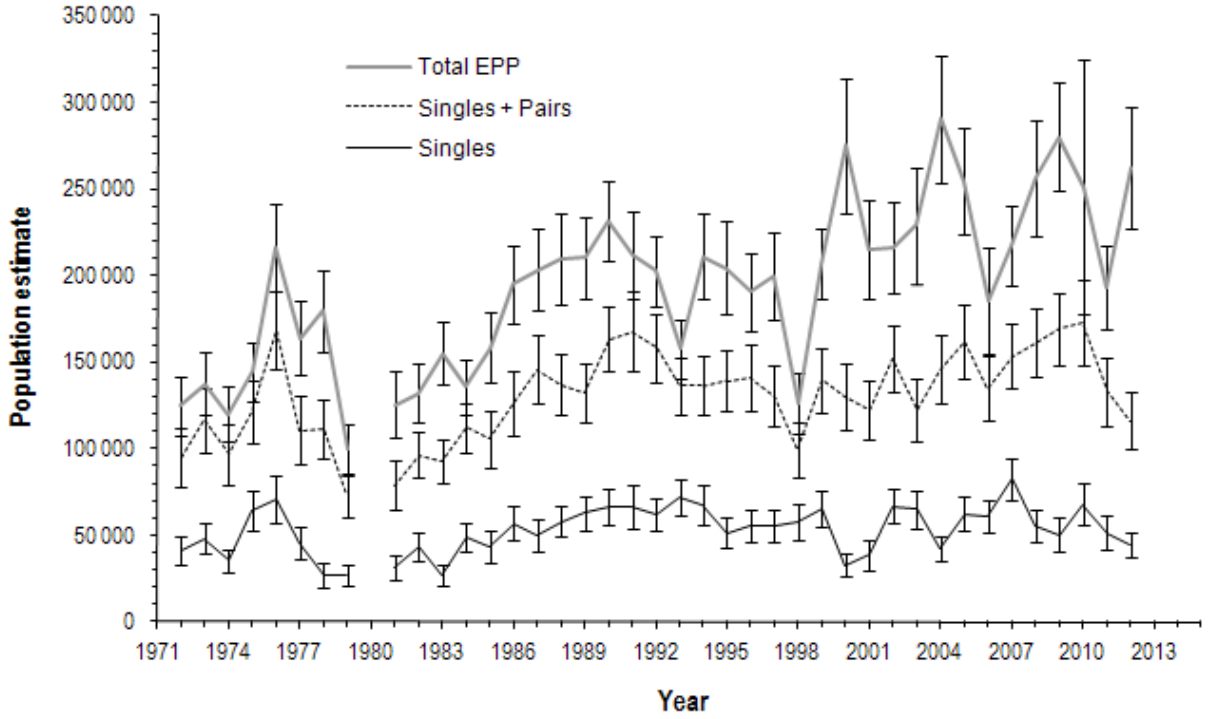

Figure 37. Eastern Prairie Population Canada Geese Spring Estimates (± 95% CI)
No survey was conducted in 1980.
(Source: D. Fronczak 2012)

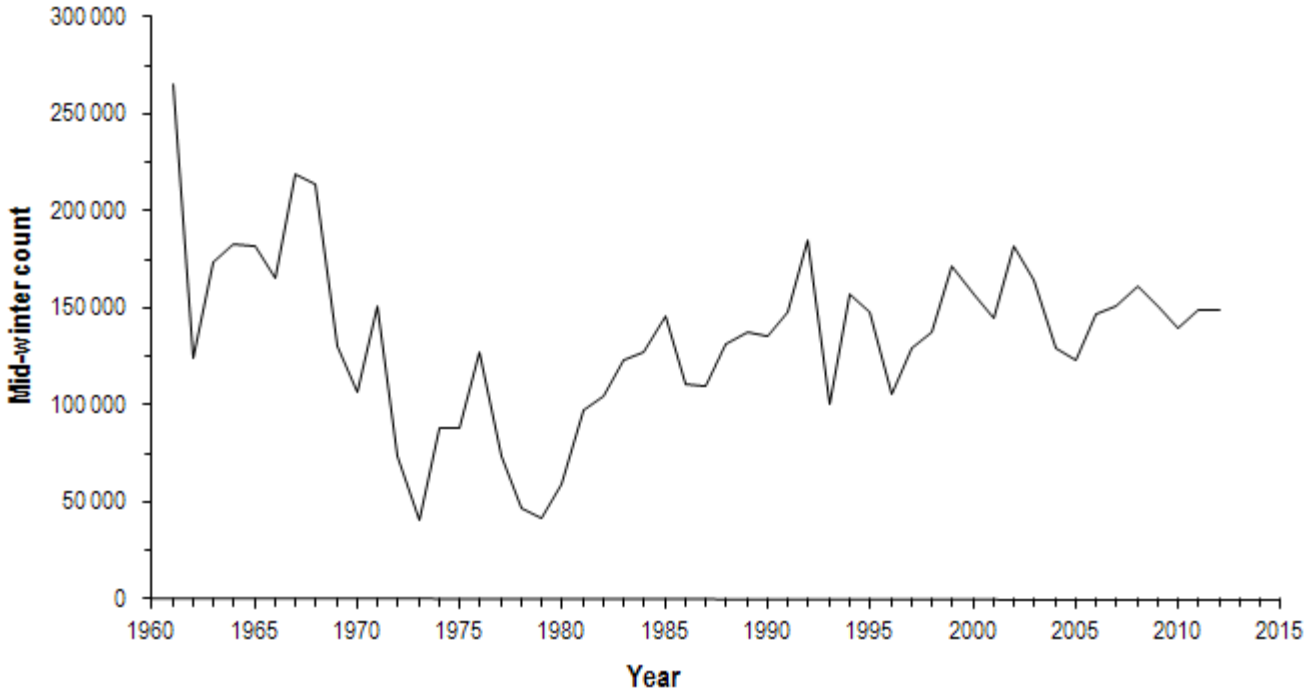

Figure 38. Mid-winter Inventory of Atlantic Brant in the Atlantic Flyway
(Source: Klimstra and Padding, 2012)

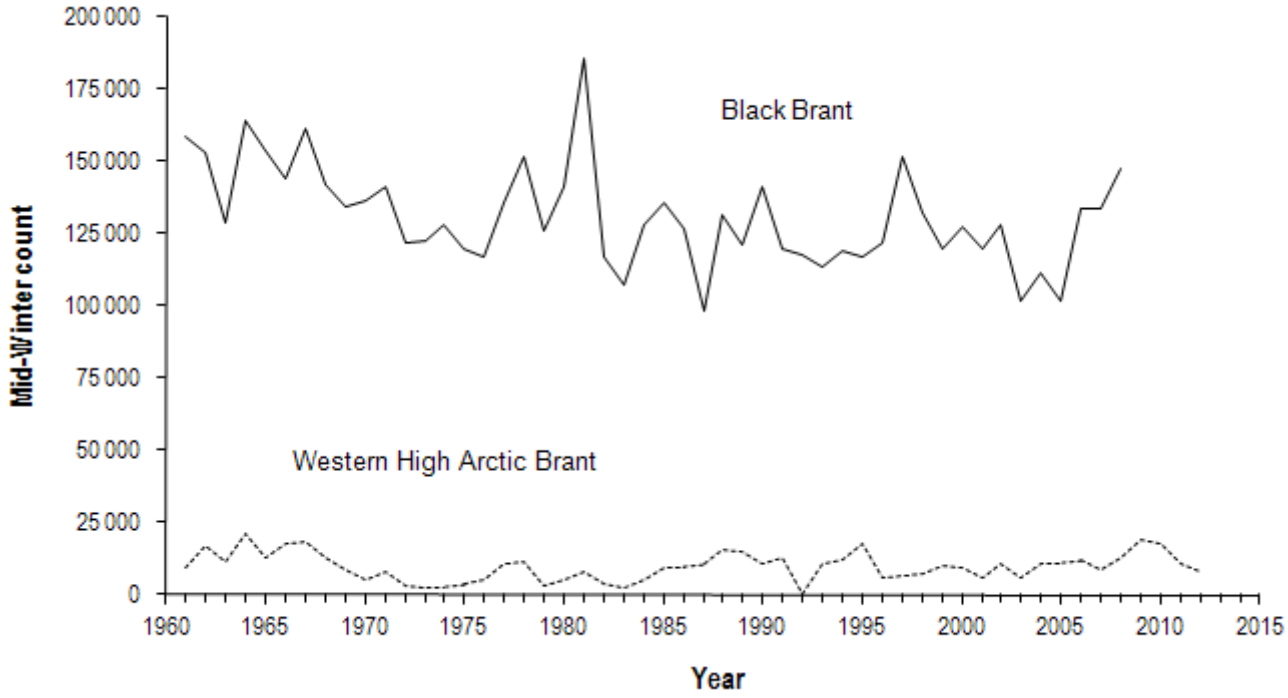

Figure 39. Mid-winter Inventory of Black and Western High Arctic Brant
Note that beginning in 1986 Black Brant numbers include counts along the Alaska coast.
No surveys in 2009, 2011 and 2012.
(Source: Olson and Trost 2012)

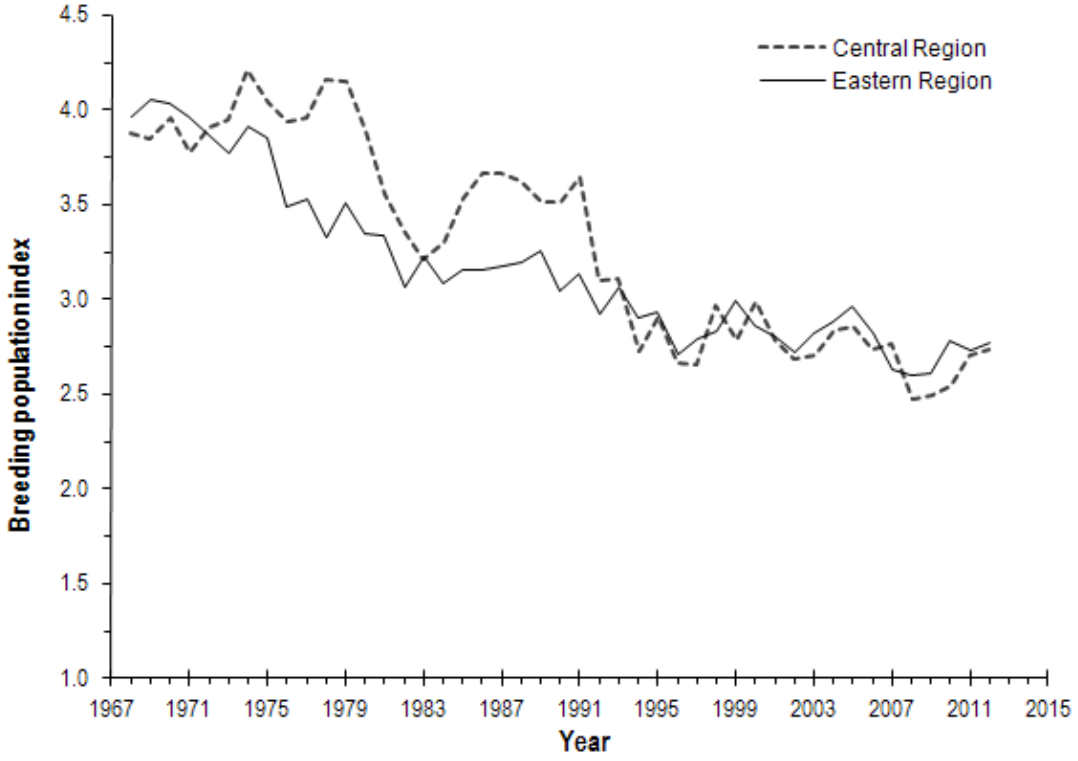

Figure 40. American Woodcock Breeding Population Indices
Indices (singing males per route) from the Singing-ground Survey.
(Source: Cooper and Rau 2012)

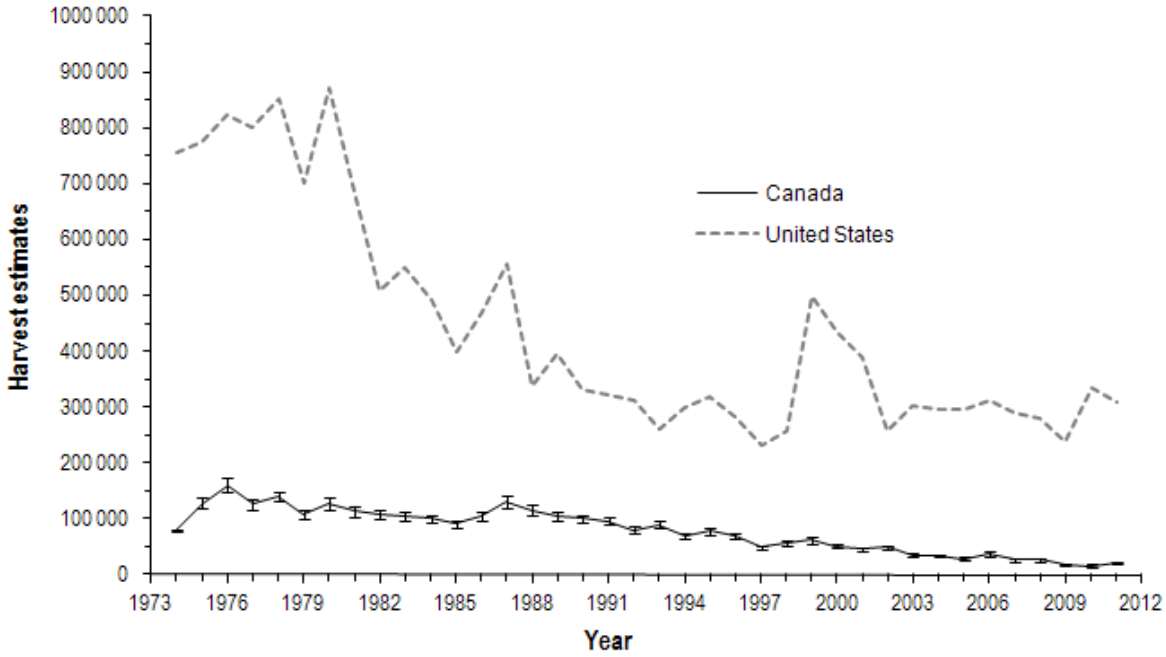

Figure 41. American Woodcock Harvest in Canada and the United States
The USFWS results from 1999 onward are not directly comparable to those prior to 1999.
(Source: Gendron and Smith 2012; Cooper and Rau 2012)

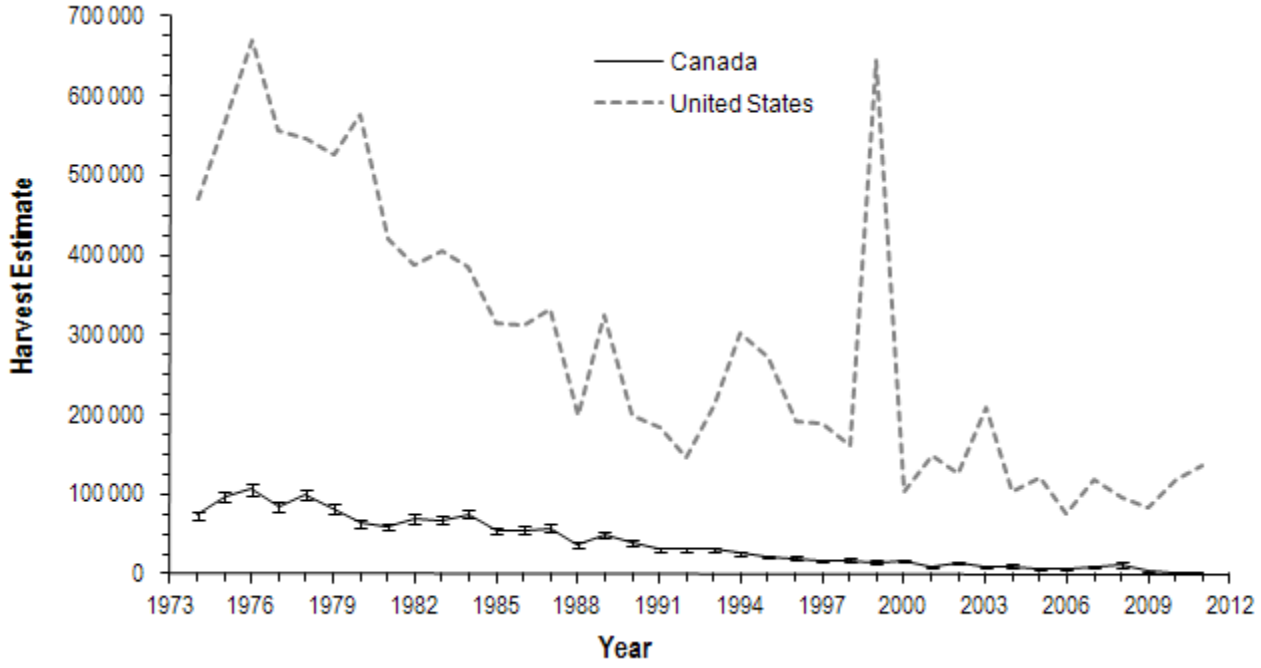

Figure 42. Wilson's Snipe Harvest Estimates in Canada and the United States
The USFWS results from 1999 onward are not directly comparable to those prior to 1999.
(Source: Gendron and Smith 2012; and Raftovich et al. 2012)

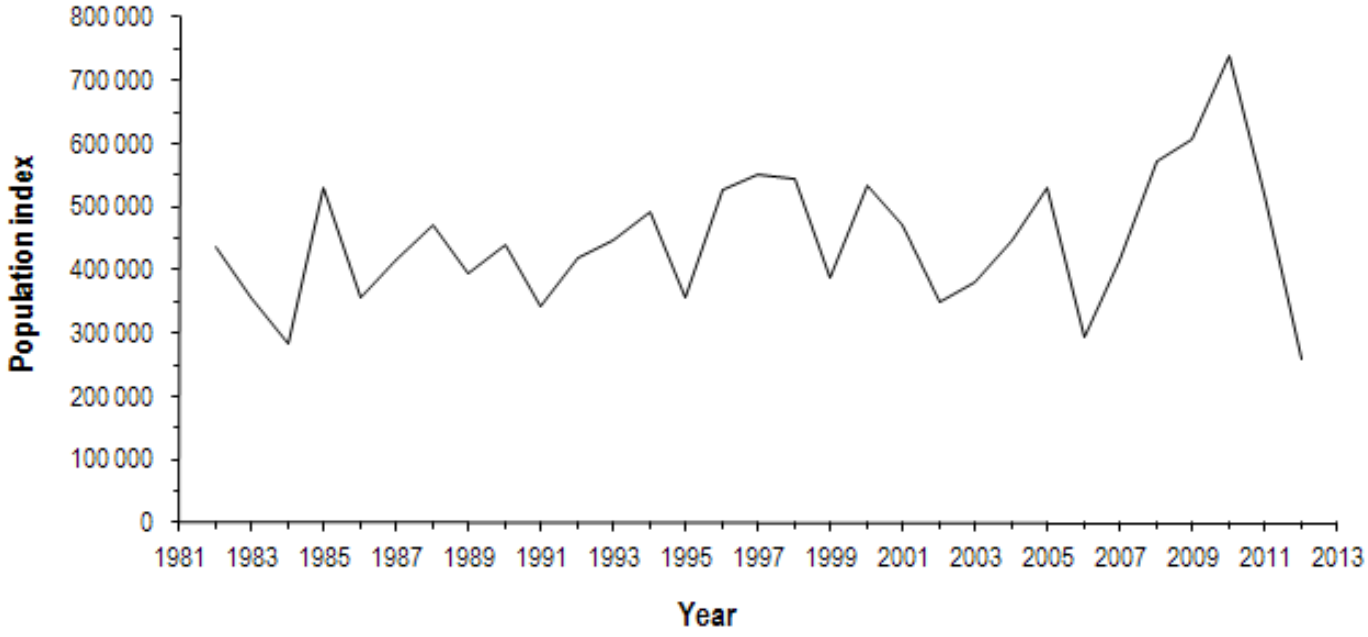

Figure 43. Mid-continent Population Sandhill Crane Spring Indices
Note: the 2012 value is for the Central Platte River Valley only,
and is uncorrected for visibility bias.
(Source: Kruse et al. 2012)

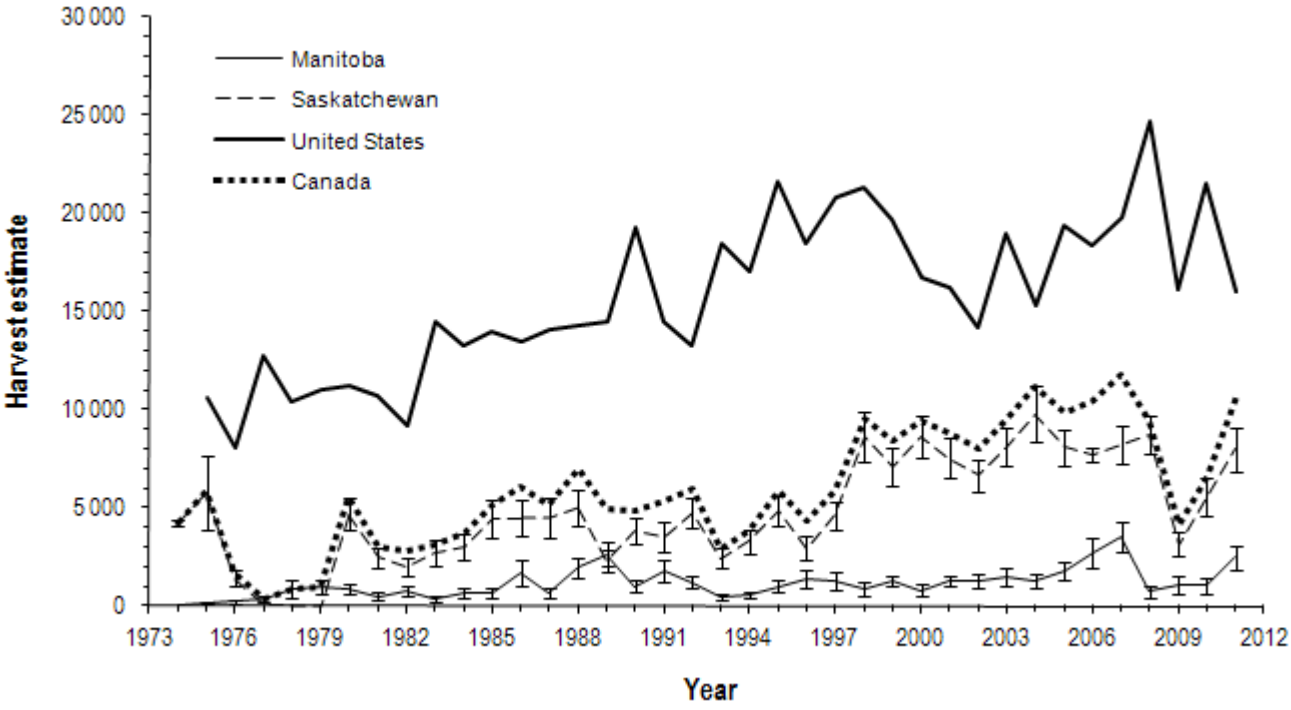

Figure 44. Harvest Estimates of Sandhill Cranes in Canada and the United States
Canadian harvest estimates ±1 SE (Gendron and Smith 2012), and U.S. harvest estimates (Kruse *et al.* 2012). The USFWS results for years prior to 1999 are not directly comparable to those from 1999 onward.

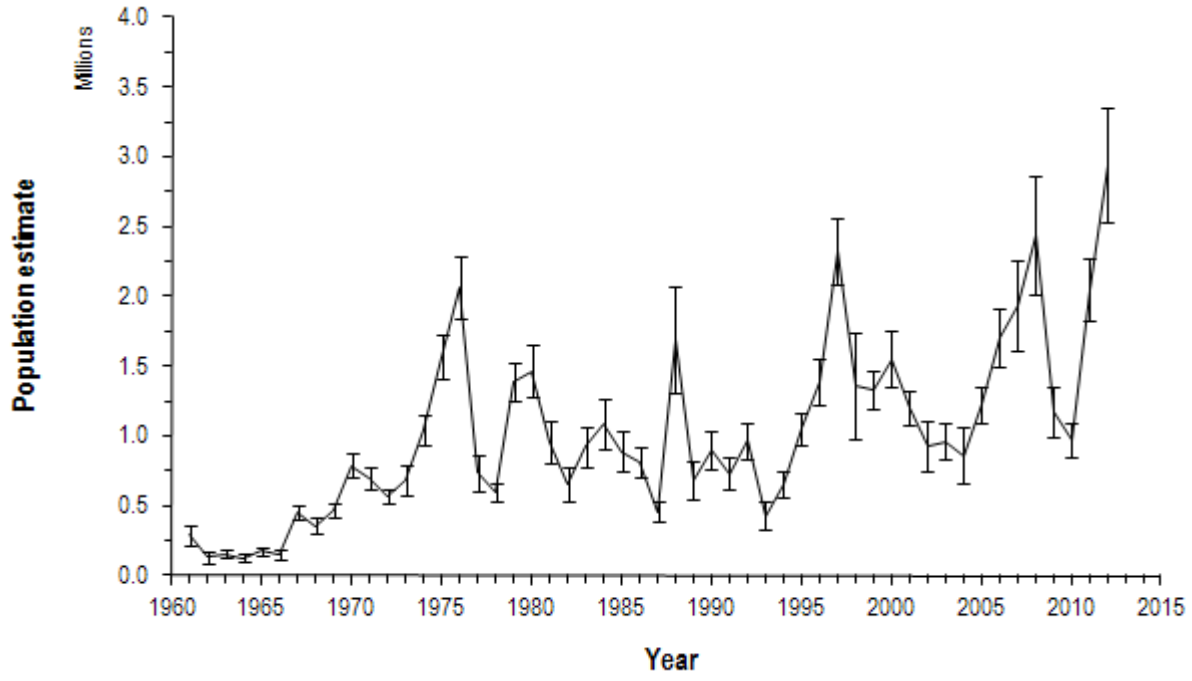

Figure 45. American Coot Breeding Population in the Canadian Prairies (± 1 SE) from the Waterfowl Breeding Population and Habitat Survey

APPENDIX C – TABLES

Table 1a. Trends in indicated breeding pairs of inland duck species in southern Ontario from 1971 to 2012. Data from breeding waterfowl surveys of ground and helicopter plots.

	Long-term	Recent
Species	1971 - 2012	2000 - 2012
American Black Duck	-0.8%	2.8%
Mallard	1.1%	1.0%
Wood Duck	4.0%	5.9%
Green-winged Teal	1.4%	-0.4%
Blue-winged Teal	-5.7%	4.0%
Ring-necked Duck	4.3%	4.5%
Hooded Merganser	2.7%	5.1%
Common Merganser	4.6%	5.4%
Canada Goose	9.7%	3.8%

Data source: CWS, Ontario Region

Note: Trends are expressed as an annual percentage change. Methods to test statistical significance of these trends have not yet been developed. No indication of significance can be given.

Table 1b. Abundance and trends in indicated breeding pairs of duck species in Southern Québec Lowlands (data from helicopter surveys)

Species	Abundance 2004-2009	Abundance 2012	Trend 2004-2012	Trend 2008-2012
Mallard	13 100	13 200	0.6%	-4.3%
American Black Duck	5100	3800	-3.6%	-14.6%
Green-winged Teal	2800	4200	5.2%	12.6%
Wood Duck	2200	2800	10.2%	15.9%
Canada Goose	2000	2100	8.2%	-9.6%
Ring-necked Duck	800	900	1.5%	34.5%

Data source: CWS, Québec Region

Note: Trends are expressed as an annual percentage change. Methods to test statistical significance of these trends have not yet been developed. No indication of significance can be given.

Table 2. Harvest estimates of American Black Ducks in Canada and the United States

	Canada													United States[1]				Continental
	NF	PE	NS	NB	QC	ON	MB	SK	AB	BC	NT/NU	YT	Total	AF	MF	CF	Total	Total
1974	19 543	11 684	29 594	14 008	75 534	61 702	511						212 576	294 700	93 300	999	388 999	601 575
1975	35 354	14 620	59 467	21 876	90 593	85 070	262	118					307 360	275 000	81 000	1 197	357 197	664 557
1976	23 770	21 891	48 624	23 342	120 622	96 761	180	586	143	64			335 983	327 500	97 800	837	426 137	762 120
1977	38 835	18 044	46 186	20 568	129 618	82 886	727	547		48			337 459	194 900	78 900	249	274 049	611 508
1978	49 008	19 660	47 874	34 598	130 379	89 818	379			66			371 782	262 200	74 600		336 800	708 582
1979	44 658	12 732	33 687	24 339	112 926	87 557	242	363	256	266			317 026	231 000	68 300		299 300	616 326
1980	32 316	21 568	67 341	28 094	120 602	91 503	2 171	268					363 863	309 200	87 100	751	397 051	760 914
1981	38 047	16 133	58 692	26 460	105 733	76 298	337	213		41			321 954	230 900	59 000	505	290 405	612 359
1982	26 961	25 771	47 447	32 130	117 514	86 650	161	426					337 060	186 700	48 400		235 100	572 160
1983	32 956	25 049	57 725	31 007	101 637	60 454	259						309 087	139 100	58 800	317	198 217	507 304
1984	26 119	23 256	51 880	33 283	106 868	64 272	327		518				306 523	147 800	53 900		201 700	508 223
1985	28 556	18 535	44 397	32 261	110 998	64 692	427	135					300 001	148 100	41 700	180	189 980	489 981
1986	27 278	18 650	46 612	27 896	114 493	60 461	367	260	151				296 168	140 700	37 400	442	178 542	474 710
1987	20 184	18 114	39 138	27 218	129 612	61 176							295 442	135 400	36 700	112	172 212	467 654
1988	20 137	20 364	44 311	30 193	127 134	58 840		151	92				301 222	124 600	29 000	512	154 112	455 334
1989	29 299	11 548	47 322	25 582	99 675	47 518	144						261 088	148 800	44 600	326	193 726	454 814
1990	22 663	11 369	38 012	26 743	105 277	38 357	106	621	286	103			243 537	110 600	32 300	422	143 322	386 859
1991	15 073	14 499	39 295	20 122	85 220	48 670	1 189	312	1 329	229			225 938	126 400	40 900	220	167 520	393 458
1992	13 487	8 043	41 079	23 090	82 134	38 228	138	239	73				206 511	97 700	37 900	106	135 706	342 217
1993	13 133	10 741	36 298	19 591	87 869	34 556	1 125						203 313	105 400	41 200	66	146 666	349 979
1994	16 507	10 221	32 670	23 389	67 440	24 774	254	169				35	175 459	101 600	28 600	266	130 466	305 925
1995	15 461	13 355	40 546	29 332	54 776	33 470		204		17			187 161	126 500	42 300		168 800	355 961
1996	19 447	9 469	39 759	20 418	49 219	25 289							163 601	84 000	34 500		118 500	282 101
1997	18 816	12 982	32 666	17 966	56 103	26 309	265	147	215				165 469	110 200	41 500	79	151 779	317 248
1998	22 410	6 789	33 852	22 802	49 065	23 091	165		81	124			158 379	119 600	56 100	236	175 936	334 315
1999[2]	19 058	10 782	44 658	22 445	51 385	26 579	36						174 943	111 400	42 200		153 600	328 543
2000	21 605	6 980	43 922	18 083	43 476	19 995	204	653					154 918	127 500	52 000		179 500	334 418
2001	16 800	9 465	26 729	12 879	38 717	19 185	293						124 068	94 559	30 636		125 195	249 263
2002	18 021	6 214	28 310	14 449	36 346	19 130		76	89				122 635	128 620	47 465	453	176 538	299 173
2003	10 174	7 228	26 010	15 219	35 077	15 176		334					109 218	95 108	33 971	134	129 213	238 431
2004	12 888	4 827	16 969	9 775	30 588	16 710							91 757	76 263	35 692		111 955	203 712
2005	9 333	4 560	16 717	9 031	34 472	15 276	191						89 580	93 406	36 365	115	129 886	219 466
2006	16 529	5 168	20 630	11 159	33 900	16 644							104 030	93 356	35 840		129 196	233 226
2007	20 485	7 054	24 180	10 391	27 596	13 462	140	503					103 811	98 705	38 692		137 397	241 208
2008	22 067	5 829	22 764	12 285	29 154	11 094	160	184					103 537	90 196	29 641	312	120 150	223 687
2009	13 583	5 049	18 788	9 719	29 150	14 173	155						90 617	81 287	30 373	220	111 880	202 497
2010	8 908	7 660	12 913	12 131	31 408	14 096	90			52			87 258	92 204	27 073	340	119 617	206 875
2011	8 919	5 866	22 236	9 237	31 678	13 926							91 862	66 203	21 992	156	88 351	180 213

[1]AF: Atlantic Flyway, MF: Mississippi Flyway, CF: Central Flyway.

[2]The USFWS implemented an improved national harvest survey in 1999. The results for years prior to 1999 are not directly comparable to those from 1999 onward.

Data source: M. H. Gendron and A. Smith 2012 (CWS), and R.V. Raftovich *et al.* 2012 (USFWS).

Table 3. **Estimates of trends in numbers of May ponds and Duck breeding populations in the traditional survey area of the Waterfowl Breeding Population and Habitat Survey.**

Species	Time Period	Region								Entire Survey Area	
		Alaska		Western Boreal Canada		Canadian Prairies		U.S. Prairies			
		(11 strata)		(17 strata)		(15 strata)		(9 strata)		(52 strata)	
May ponds[1]	1974-2012	N/A		N/A		0.1	(15)	1.7 *	(9)	N/A	
	2003-2012	N/A		N/A		2.5 *	(15)	6.6 *	(9)	N/A	
	2008-2012	N/A		N/A		8.3	(15)	5.1	(9)	N/A	
Total ducks[2]	1961-2012	1.5 *	(11)	-0.3	(17)	0	(15)	1.9 *	(9)	0.5 *	(52)
	2003-2012	-3.1 *	(11)	1.0	(17)	2.6 *	(15)	12 *	(9)	3.9 *	(52)
	2008-2012	-4.2 *	(11)	9.1 *	(17)	7.0	(15)	15.2 *	(9)	6.1 *	(52)
Mallard	1961-2012	2.8 *	(11)	-0.3	(17)	-0.3	(15)	2.3 *	(9)	0.4	(52)
	2003-2012	-6.0 *	(11)	3.3	(17)	2.3 *	(15)	7.6 *	(9)	3.4 *	(52)
	2008-2012	-2.3	(11)	2.7	(17)	7.3 *	(15)	13.5 *	(9)	7.3 *	(52)
Gadwall	1961-2012	6.5	(9)	2.4	(17)	1.5 *	(15)	3.5 *	(9)	2.3 *	(50)
	2003-2012	-10	(9)	-6.6	(17)	1.7	(15)	7.2 *	(9)	3.9 *	(50)
	2008-2012	-		-6.3	(17)	0.5	(15)	14.2 *	(9)	6.3	(50)
American Wigeon	1961-2012	4.0 *	(11)	-0.8 *	(17)	-2.2 *	(15)	1.4	(9)	-0.2	(52)
	2003-2012	-3.5 *	(11)	-0.7	(17)	3.0 *	(15)	7.6 *	(9)	-0.3	(52)
	2008-2012	-8.0 *	(11)	-4.5	(17)	-0.6	(15)	6.6	(9)	-4.5	(52)
Green-winged Teal	1961-2012	4.5 *	(11)	1.2 *	(17)	0.9	(15)	2.4 *	(9)	1.6 *	(52)
	2003-2012	-2.7 *	(11)	6.3	(17)	9.7 *	(15)	4.5	(9)	4.2 *	(52)
	2008-2012	1.6	(11)	2.9	(17)	-1.0	(15)	5.5	(9)	1.3	(52)
Blue-winged Teal	1961-2012	5.9	(8)	-0.8	(16)	0.8	(15)	2.0 *	(9)	1.2 *	(48)
	2003-2012	-54	(8)	-9.3 *	(16)	2.6 *	(15)	14.6 *	(9)	7.9 *	(48)
	2008-2012	-		-22 *	(16)	3.7	(15)	17.0 *	(9)	8.9 *	(48)
Northern Shoveler	1961-2012	7.3 *	(11)	0.8	(17)	1.7 *	(15)	2.1 *	(9)	2.0 *	(52)
	2003-2012	-6.2 *	(11)	-2.1	(17)	2.5 *	(15)	15.8 *	(9)	4.5 *	(52)
	2008-2012	-7.6 *	(11)	-12	(17)	14.4	(15)	10.4	(9)	8.1 *	(52)
Northern Pintail	1961-2012	0.6	(11)	-1.9 *	(17)	-2.5 *	(15)	-0.7	(9)	-1.3 *	(52)
	2003-2012	1.5	(11)	-0.5	(17)	-1.5	(15)	23.2 *	(9)	5.5	(52)
	2008-2012	-3.0	(11)	-26 *	(17)	18.5 *	(15)	32.7 *	(9)	9.3 *	(52)
Redhead	1961-2012	-0.2	(10)	-0.1	(17)	1.3 *	(15)	1.6 *	(9)	1.2 *	(51)
	2003-2012	-33	(10)	-8.6 *	(17)	5.8 *	(15)	21.5 *	(9)	9.7 *	(51)
	2008-2012	-		-20	(17)	0.2	(15)	29.4 *	(9)	6.5	(51)
Canvasback	1961-2012	0.4	(11)	0.4	(17)	0.4	(15)	2.1 *	(9)	0.5 *	(52)
	2003-2012	-16 *	(11)	-4.3 *	(17)	4.9 *	(15)	16.9 *	(9)	2.1	(52)
	2008-2012	-21.5	(11)	-3.0	(17)	14.7 *	(15)	27.7 *	(9)	9.7 *	(52)
Scaup spp.	1961-2012	0.2	(11)	-1.4 *	(17)	-0.9	(15)	2.5	(9)	-0.9 *	(52)
	2003-2012	-2.3	(11)	5.4 *	(17)	5.6 *	(15)	5.2	(9)	3.6 *	(52)
	2008-2012	-4.8 *	(11)	9.9 *	(17)	13.0 *	(15)	14.6 *	(9)	7.4 *	(52)
Ring-necked Duck	1961-2012	46.0 *	(11)	2.3 *	(17)	2.5 *	(15)	8.6	(9)	2.5 *	(52)
	2003-2012	-13 *	(11)	-1.6	(17)	6.3	(15)	21.5 *	(9)	-0.7	(52)
	2008-2012	-4.6	(11)	-5.6	(17)	15.2	(15)	40.4 *	(9)	-2.1	(52)
Ruddy Duck	1961-2012	-		2.2	(16)	1.1	(15)	3.6 *	(9)	1.8 *	(44)
	2003-2012	-		-10	(16)	-3.6	(15)	3.1	(9)	-2.2	(44)
	2008-2012	-		-4.8	(16)	16.9	(15)	-17	(9)	0.2	(44)

Trends were calculated using the estimating equations technique (Link and Sauer 1994) and are expressed as an annual percentage change.

The number of strata is given in parentheses (a minimum of 5 strata was deemed necessary to perform a trend analysis).

* Trend significant at $p < 0.05$

[1]Adjusted May pond estimates for the U.S. Prairies are only available since 1974; pond estimates from strata 75 and 76 (Western Boreal Canada) which are counted since 1989 were excluded from the analysis.

[2]Total ducks include all species of ducks observed during the survey, including sea ducks.

Table 3 cont'd. **Estimates of trends in numbers of May ponds and Duck breeding populations in the traditional survey area of the Waterfowl Breeding Population and Habitat Survey.**

Species	Time Period	Region								Entire Survey Area (52 strata)	
		Alaska (11 strata)		Western Boreal Canada (17 strata)		Canadian Prairies (15 strata)		U.S. Prairies (9 strata)			
Mergansers	1961-2012	7.9 *	(11)	1.9 *	(17)	5.9 *	(15)	6.0	(9)	2.0 *	(52)
	2003-2012	3.6	(11)	-4.4	(17)	15.0	(15)	13.2	(9)	-3.5	(52)
	2008-2012	5.4	(11)	-4.0	(17)	-14.8	(15)	38.5	(9)	-4.1	(52)
Goldeneyes	1961-2012	-0.6	(11)	1.4	(17)	3.1 *	(15)	-0.9	(8)	1.3 *	(51)
	2003-2012	-8.1 *	(11)	4.0	(17)	-1.3	(15)	-		2.1	(51)
	2008-2012	-4.4	(11)	8.4	(17)	-3.1	(15)	-		5.5	(51)
Bufflehead	1961-2012										
	2003-2012	0.3	(11)	1.9 *	(17)	3.2 *	(15)	6.3 *	(9)	2.0 *	(52)
	2008-2012	1.6	(11)	2.2	(17)	4.8	(15)	14.7	(9)	2.8 *	(52)
	1961-2012	-3.8	(11)	5.5	(17)	14.5 *	(15)	17.6	(9)	7.1 *	(52)
Long-tailed Duck	2003-2012										
	2008-2012	-1.6 *	(11)	-3.5 *	(15)	0.7	(7)	-		-2.7 *	(34)
	1961-2012	-0.9	(11)	4.3	(15)	-		-		2.0	(34)
	2003-2012	-3.6	(11)	29.8 *	(15)	-		-		12.8	(34)
Scoter spp.	2008-2012										
	1961-2012	-0.5	(11)	-1.1 *	(17)	-10.5 *	(12)	-		-0.9 *	(44)
	2003-2012	-5.1 *	(11)	4.6	(17)	7.9	(12)	-		2.1	(44)
	2008-2012	-8.0 *	(11)	7.8	(17)	813.1 *	(12)	-		3.9	(44)

Trends were calculated using the estimating equations technique (Link and Sauer 1994) and are expre

The number of strata is given in parentheses (a minimum of 5 strata was deemed necessary to perform a trend analysis).

* Trend significant at $p < 0.05$

Table 4. Harvest estimates of Mallards in Canada and the United States

	Canada													United States[1] (including Alaska)					Continental
	NF	PE	NS	NB	QC	ON	MB	SK	AB	BC	NT/NU	YT	Total	AF	MF	CF	PF	Total	Total
1974	154	130	406	761	50 036	191 532	105 723	366 291	488 448	62 595			1266 076	383 600	2 245 000	809 469	1 166 691	4 604 760	5 870 836
1975	774	405	972	583	57 791	296 173	159 142	567 985	521 935	122 725	1 698	797	1730 980	409 200	2 518 100	934 916	1 158 971	5 021 187	6 752 167
1976	770	256	753	748	71 851	322 047	204 598	606 239	609 576	114 198	3 229	898	1935 163	478 400	2 409 400	975 705	1 226 374	5 089 879	7 025 042
1977	836	196	1 155	992	81 835	268 878	165 257	391 986	510 396	131 066	3 073	584	1556 254	388 400	2 270 200	789 526	987 899	4 436 025	5 992 279
1978	850	259	2 659	452	61 507	322 006	239 298	395 276	382 319	115 038	2 098	1 290	1523 052	442 500	2 257 000	1 059 753	1 265 553	5 024 806	6 547 858
1979	555	465	3 077	725	70 597	266 018	245 016	419 509	485 014	117 176	1 182	1 673	1611 007	437 600	2 346 100	923 077	1 065 704	4 772 481	6 383 488
1980		948	3 056	1 436	82 027	290 941	210 152	355 042	480 188	104 768	2 551	2 473	1533 582	435 100	2 347 500	786 838	1 081 558	4 650 996	6 184 578
1981	2 945	1 461	2 536	2 491	91 946	279 541	175 213	231 119	392 273	114 672	1 703	1 033	1296 933	444 600	2 062 000	784 424	1 051 566	4 342 590	5 639 523
1982	438	410	1 406	1 792	93 288	335 813	148 862	241 734	296 124	92 492	1 552		1213 911	395 900	1 781 600	683 066	1 047 074	3 907 640	5 121 551
1983	1 067	937	4 044	2 557	87 349	297 944	160 521	284 403	364 000	121 758	2 417	603	1327 600	417 400	2 017 900	772 567	1 211 534	4 419 401	5 747 001
1984	1 097	738	2 120	1 668	67 432	284 128	117 207	183 300	306 234	89 453	4 501	1 366	1059 244	382 700	1 796 100	742 790	1 002 926	3 924 516	4 983 760
1985	794	1 149	3 310	3 258	97 037	293 333	87 172	158 302	180 117	81 943	4 153	914	911 482	319 900	1 532 900	510 761	957 871	3 321 432	4 232 914
1986	2 933	755	3 135	2 526	84 303	265 491	112 363	151 384	182 748	72 263	811	433	879 145	362 700	1 550 100	586 619	870 893	3 370 312	4 249 457
1987	1 020	728	3 692	3 141	116 452	315 101	136 678	154 961	211 929	75 591	1 120	192	1020 605	340 300	1 458 800	612 465	792 950	3 204 515	4 225 120
1988		902	2 304	1 620	83 748	233 556	64 324	75 853	139 565	63 700	2 543	412	668 527	257 200	874 500	324 709	532 958	1 989 367	2 657 894
1989	1 280	925	4 339	2 246	79 419	263 152	70 132	75 645	188 516	57 269	438	773	744 134	321 400	1 094 500	335 216	582 170	2 333 286	3 077 420
1990	1 162	1 028	3 557	3 183	86 524	261 267	60 851	79 494	175 921	60 395	866	290	734 538	267 000	1 091 000	326 984	602 541	2 287 525	3 022 063
1991	949	1 106	3 712	4 582	84 483	229 026	60 932	70 050	122 105	51 458	94	641	629 138	317 600	1 189 600	293 744	553 618	2 354 562	2 983 700
1992	863	199	6 407	5 243	87 824	196 647	65 991	68 765	94 795	52 172	605	298	579 809	294 100	1 250 400	366 488	627 239	2 538 227	3 118 036
1993	1 025	1 178	5 029	3 755	100 032	202 647	42 969	50 351	83 094	45 181	1 178	560	536 999	312 500	1 338 200	398 079	687 879	2 736 658	3 273 657
1994	795	864	3 305	2 894	107 222	197 833	57 923	88 848	113 068	50 412	2 042	205	625 411	328 500	1 524 700	510 957	744 432	3 108 589	3 734 000
1995	532	751	4 822	5 131	83 307	176 680	74 206	104 296	111 048	40 782	1 509	278	603 342	424 100	2 347 100	694 402	940 265	4 405 867	5 009 209
1996	351	1 024	4 286	4 044	82 201	176 869	91 265	121 608	115 668	42 447	1 326		641 089	408 000	2 493 900	764 215	1 185 491	4 851 606	5 492 695
1997	1 461	417	8 047	5 371	77 594	178 169	107 379	133 017	151 167	55 513	437	126	718 698	478 900	2 852 000	886 166	1 161 510	5 378 576	6 097 274
1998	1 628	1 011	5 440	7 512	76 320	164 431	104 469	129 461	119 826	52 663	881	276	663 918	445 500	2 762 800	953 367	1 428 079	5 589 746	6 253 664
1999[2]	1 188	667	6 305	4 866	69 568	131 901	82 637	182 714	105 126	48 002		220	633 194	438 000	3 060 800	878 434	1 121 810	5 499 044	6 132 238
2000	1 511	1 915	5 481	5 999	81 655	162 352	78 201	195 276	107 203	49 272	510	72	689 447	499 100	3 041 100	1 112 643	1 025 082	5 677 925	6 367 372
2001	600	1 192	5 720	7 046	79 895	166 628	92 114	107 411	94 698	35 574	642	229	591 749	467 064	2 768 031	1 151 367	997 216	5 383 678	5 975 427
2002	299	2 175	6 498	6 001	66 532	147 844	77 991	118 856	80 706	37 370	1 701	609	546 582	554 703	2 423 134	1 003 381	934 379	4 915 597	5 462 179
2003	694	803	4 711	6 509	58 871	138 096	66 402	126 396	73 086	35 383	409	109	511 469	427 301	2 571 468	942 199	1 078 236	5 019 204	5 530 673
2004	1 985	1 100	5 245	5 227	65 284	132 186	75 968	129 627	78 269	28 515	275	36	523 717	439 216	2 199 931	958 774	929 374	4 527 295	5 051 012
2005	754	1 681	4 544	4 732	72 231	115 284	87 315	144 393	78 798	33 586	688		544 006	444 305	2 049 383	867 238	1 075 713	4 436 639	4 980 645
2006	753	1 122	5 460	6 389	72 245	124 751	111 026	174 174	88 533	28 928	215		613 626	399 651	2 286 643	709 241	1 272 876	4 668 411	5 282 037
2007	1 837	1 289	5 711	7 030	65 187	119 403	68 121	163 912	82 133	30 167	897	265	545 952	429 917	2 514 119	812 291	1 102 055	4 858 382	5 404 334
2008	48	1 725	4 748	5 662	69 899	119 971	60 690	150 906	97 567	35 924		488	547 628	503 480	2 282 128	666 271	1 103 089	4 554 968	5 102 596
2009	80	651	4 079	3 377	65 216	106 537	61 460	135 546	62 778	32 736		67	472 527	419 543	2 076 235	734 079	884 262	4 114 119	4 586 646
2010	1 319	2 197	4 057	4 683	57 138	105 904	48 076	127 207	67 681	28 057			446 319	394 670	2 228 872	604 931	937 780	4 166 253	4 612 572
2011	670	3 434	5 296	5 501	62 037	105 529	59 170	143 258	91 670	32 990	334		509 889	315 897	2 240 248	788 254	1 064 697	4 409 096	4 918 985

[1]AF: Atlantic Flyway, MF: Mississippi Flyway, CF: Central Flyway, PF: Pacific Flyway (including Alaska)

[2]The USFWS implemented an improved national harvest survey in 1999. The results for years prior to 1999 are not directly comparable to those from 1999 onward.

Data source: M. H. Gendron and A. Smith 2012 (CWS), and R.V. Raftovich *et al.* 2012 (USFWS).

Table 5. Harvest estimates of Northern Pintails in Canada and the United States

	Canada													United States[1] (PF includes Alaska)					Continental
	NF	PE	NS	NB	QC	ON	MB	SK	AB	BC	NT/NU	YT	Total	AF	MF	CF	PF	Total	Total
1974	939	820	659	790	14 043	8 296	7 545	39 226	69 214	14 281			155 813	34 500	122 900	162 518	928 387	1 248 305	1 404 118
1975	1 092	431	612	787	21 999	9 644	20 611	55 909	81 637	23 758	72	417	216 969	41 200	206 500	273 525	1 045 461	1 566 686	1 783 655
1976	1 507	651	2 663	352	27 578	17 112	17 545	34 693	59 532	38 626	385	277	200 921	42 200	157 100	194 803	928 063	1 322 166	1 523 087
1977	2 438	1 653	1 717	607	39 581	14 333	11 243	20 469	69 905	29 464	137	313	191 860	50 700	213 700	179 906	540 749	985 055	1 176 915
1978	824	829	1 892	1 039	21 298	13 077	21 072	14 051	38 039	22 830	698	216	135 865	35 800	210 600	239 442	851 665	1 337 507	1 473 372
1979	1 693	579	1 056	382	14 958	9 326	19 745	30 588	48 505	17 735	691	287	145 545	48 670	213 600	228 806	829 316	1 320 392	1 465 937
1980	905	510	757	1 384	16 722	13 248	12 872	16 868	44 003	21 392		108	128 769	38 600	215 600	193 055	633 316	1 080 571	1 209 340
1981	1 536	747	951	1 144	17 437	11 977	16 099	2 430	39 745	18 658	91	148	110 963	27 900	208 000	151 027	403 876	790 803	901 766
1982		1 531	1 009	1 479	20 791	10 946	13 290	12 598	29 130	14 021			104 795	38 600	126 500	158 668	467 585	791 353	896 148
1983	2 805	523	694	303	15 867	10 767	11 195	17 056	27 154	13 385	1 864	175	101 788	18 600	187 200	138 918	465 099	809 817	911 605
1984	1 698	1 047	717	908	9 253	10 132	13 131	12 343	34 016	19 661	168	337	103 411	34 600	153 500	165 663	312 492	666 255	769 666
1985	1 459	748	1 460	1 817	16 486	15 345	9 668	8 117	24 051	11 244		810	91 205	21 700	125 000	83 916	292 714	523 330	614 535
1986	634	565	846	1 841	13 163	9 057	6 988	9 077	8 632	8 885		296	59 984	19 000	90 200	72 074	274 961	456 235	516 219
1987	807	2 218	632	1 017	11 864	6 020	5 478	8 386	19 668	10 945		158	67 193	15 800	88 300	122 425	311 417	537 942	605 135
1988	1 998	1 449	486	715	12 160	8 019	13 779	5 320	14 667	10 831			69 424	7 200	39 200	36 392	116 308	199 100	268 524
1989	1 421	660	344	1 406	15 460	11 511	7 560	4 326	11 766	8 549	45		63 048	14 500	65 100	43 595	139 517	262 712	325 760
1990	4 114	450	653	1 707	19 568	8 231	5 279	10 087	13 483	7 750	281	41	71 644	10 500	49 400	43 207	133 164	236 271	307 915
1991	351	542	901	844	9 357	4 742	4 407	4 023	5 689	4 179	112	73	35 220	14 200	40 400	28 687	126 414	209 701	244 921
1992		910	79	464	6 221	4 861	5 236	2 126	6 914	6 393	136	77	33 417	12 200	56 200	31 508	116 250	216 158	249 575
1993	1 090	1 336	852	706	11 401	5 156	5 172	3 253	4 025	4 701	61		37 753	13 000	52 300	42 486	140 620	248 406	286 159
1994	934	765	1 163	1 136	11 307	4 649	4 866	7 302	7 518	4 738		64	44 442	18 000	81 100	61 088	150 361	310 549	354 991
1995	1 727	454	965	1 240	7 831	4 552	8 974	6 521	7 573	4 476			44 313	32 700	136 200	94 351	259 351	522 602	566 915
1996	1 246	478	897	1 234	5 043	4 011	10 323	14 477	9 621	5 367			52 697	19 200	124 000	95 340	281 630	520 170	572 867
1997	785	139	116	493	7 423	5 560	13 248	13 656	13 883	5 422	37		60 762	23 800	145 000	186 191	340 419	695 410	756 172
1998	1 026		653	757	7 735	6 361	14 347	11 099	11 119	6 462	19	276	59 854	33 100	177 000	123 391	238 677	572 168	632 022
1999[2]	390	1 137	755	1 790	8 956	6 457	9 830	10 610	10 304	5 464		0	55 693	25 200	148 299	133 317	232 704	539 520	595 213
2000	470	509	499	581	6 480	5 397	8 766	16 168	13 603	5 825	50		58 348	20 752	155 082	134 252	201 163	511 249	569 597
2001	137		400	610	4 910	3 708	9 215	7 050	8 730	4 806	18	59	39 643	19 276	122 522	135 039	158 115	434 952	474 595
2002	1 153	77	542	702	5 526	9 908	13 878	13 053	7 640	4 549			57 028	17 089	102 481	60 469	143 370	323 409	380 437
2003	571	598	227	1 270	6 794	10 420	8 998	8 687	8 204	1 947	234		47 950	18 134	123 318	55 080	144 581	341 113	389 063
2004	30	316	129	701	6 393	5 207	12 623	23 801	8 379	2 361			59 940	11 226	90 542	62 724	141 540	306 032	365 972
2005	256	313	308	536	4 677	3 178	6 653	13 450	10 769	3 675			43 815	17 339	107 276	78 610	203 037	406 262	450 077
2006	176	939	90	382	5 067	4 861	8 579	11 853	12 527	2 004	39		46 517	20 282	104 286	66 313	239 460	430 341	476 858
2007	228	584	660	634	5 533	5 059	13 329	18 054	10 085	2 410	224		56 800	19 076	162 416	88 770	251 736	521 998	578 798
2008	427	252	393	427	4 887	5 745	7 911	15 076	12 833	2 989			50 940	21 395	158 218	71 897	285 009	536 519	587 459
2009		190	104	504	4 039	4 684	4 582	17 226	6 138	2 837		2	40 306	15 056	106 727	90 721	286 258	498 762	539 068
2010	321	943	824	609	6 266	6 480	4 862	13 530	6 728	2 228			42 791	23 522	196 185	116 127	358 696	694 530	737 321
2011	302		578	263	3 287	1 670	6 188	20 217	14 053	2 755			49 313	17 971	212 499	187 436	384 194	802 100	851 413

[1]AF: Atlantic Flyway, MF: Mississippi Flyway, CF: Central Flyway, PF: Pacific Flyway (including Alaska).

[2]The USFWS implemented an improved national harvest survey in 1999. The results for years prior to 1999 are not directly comparable to those from 1999 onward.

Data source: M. H. Gendron and A. Smith 2012 (CWS), and R.V. Raftovich *et al.* 2012 (USFWS).

Table 6. Harvest estimates of Lesser Scaup in Canada and the United States

	Canada													United States[1] (PF includes Alaska)					Continental
	NF	PE	NS	NB	QC	ON	MB	SK	AB	BC	NT/NU	YT	Total	AF	MF	CF	PF	Total	Total
1974	3 601	37	688	731	22 326	43 359	16 244	10 698	9 432	1 612			108 728	35 900	330 800	58 855	23 575	449 130	557 858
1975	6 323	166	1 450	943	28 681	43 739	21 748	10 861	18 870	2 661	369	661	136 472	33 200	250 400	48 734	24 456	356 790	493 262
1976	656	89	1 139	238	34 714	50 152	27 108	16 747	14 470	2 243	169	386	148 111	59 100	326 700	96 295	49 009	531 104	679 215
1977	1 033	61	3 552	146	31 895	46 505	11 010	7 250	8 363	3 474	799	237	114 325	199 100	364 400	75 724	45 312	684 536	798 861
1978	1 666	43	1 857		23 451	26 854	14 537	10 400	13 551	3 114	215	341	96 029	39 500	177 300	59 233	38 782	314 815	410 844
1979	241		751	51	26 706	35 097	15 433	7 646	10 827	1 799	571		99 122	19 500	144 600	46 798	40 581	251 479	350 601
1980	2 844	73	662	746	28 850	55 807	27 541	4 910	13 112	1 906	599		137 050	21 100	154 300	34 618	25 958	235 976	373 026
1981	1 607		704	735	31 991	58 463	18 807	3 225	8 980	1 224	507	148	126 391	97 000	325 200	92 567	33 140	547 907	674 298
1982	126		387	309	20 981	37 287	27 394	6 655	13 226	1 721			108 086	39 000	241 000	45 835	31 038	356 873	464 959
1983	471	104	550	575	19 171	42 320	22 289	9 122	6 551	103		78	101 334	34 000	154 500	36 870	43 476	268 846	370 180
1984	1 695	31	352	912	17 696	53 451	18 336	10 861	5 435	975	98	74	109 916	83 900	380 800	151 243	45 752	661 695	771 611
1985	874		365	951	25 866	61 409	15 356	2 498	6 604	1 240	831		115 994	80 600	305 800	71 563	28 489	486 452	602 446
1986	1 839		430	1 646	23 080	47 546	14 674	5 382	5 974	1 191	170		101 932	20 700	164 000	44 452	18 909	248 061	349 993
1987	339	290	615	541	11 981	34 512	10 400	7 129	5 458	1 140		12	72 417	23 100	97 100	44 633	20 408	185 241	257 658
1988		87	943	544	22 429	32 983	6 885	5 019	3 341	496	424		73 151	26 100	84 900	28 418	9 202	148 620	221 771
1989	2 063	52	1 237	1 119	26 710	42 316	7 296	1 347	3 073	608	179		86 000	24 900	69 200	24 097	8 636	126 833	212 833
1990	1 757	35	1 051	1 696	24 047	25 772	6 592	2 557	3 888	778	191		68 364	13 300	58 900	17 035	12 992	102 227	170 591
1991	272		481	455	18 402	31 204	9 226	3 864	2 464	428	37		66 833	11 400	102 600	20 639	15 549	150 188	217 021
1992	1 004		171	116	15 249	24 587	8 227	778	2 320	650	33		53 135	13 200	132 300	28 886	12 712	187 098	240 233
1993	2 231		401	690	20 912	35 173	6 228	2 196	1 628	452	35	40	69 986	13 200	63 700	15 691	13 673	106 264	176 250
1994	510	99	445	244	11 479	27 137	12 344	2 742	3 247	378		52	58 677	20 400	102 000	34 342	20 232	176 974	235 651
1995			334	730	8 705	27 465	14 185	2 263	2 926	242			56 850	26 900	189 000	37 875	31 645	285 420	342 270
1996	178		331	156	7 460	17 344	9 258	2 415	2 800	1 162	331		41 435	35 700	293 800	92 121	38 166	459 787	501 222
1997	232		512	782	6 529	19 843	5 185	4 262	4 863	1 302	431		43 941	41 600	359 800	80 581	28 189	510 170	554 111
1998	1 455		223	1 300	11 513	16 069	5 400	6 287	2 695	311			45 253	61 500	319 300	149 241	30 138	560 179	605 432
1999[2]	470		131	110	8 339	19 599	10 233	2 143	939	181			42 145	70 900	82 900	34 358	21 991	210 149	252 294
2000	26			49	5 071	9 781	11 987	1 284	1 768	178	74	130	30 348	32 400	206 900	85 845	24 798	349 943	380 291
2001	414		60	138	5 082	13 530	8 117	1 777	861	119	128	8	30 234	97 228	165 746	71 646	29 515	364 135	394 369
2002	1 436	548	412	843	5 576	14 259	6 007	1 524	1 791	383		174	32 953	84 399	185 381	84 695	35 972	390 447	423 400
2003	682	183	433	265	8 602	11 995	2 376	3 980	2 311	175	117		31 119	60 939	153 617	44 850	39 190	298 596	329 715
2004	814		27	186	3 619	9 859	7 362	921	1 593	291			24 672	66 091	108 534	66 727	51 531	292 883	317 555
2005	381	304	189	266	3 459	10 088	4 683	2 520	1 777	120			23 787	63 698	111 357	54 404	28 105	257 564	281 351
2006	250		172	436	7 219	16 425	4 459	865	2 058	46	97		32 027	46 619	101 219	51 148	33 973	232 959	264 986
2007	146	47	341	209	1 953	10 813	10 291	907	5 852		224		30 783	46 594	84 791	40 963	51 092	224 053	254 836
2008	215	33	90	118	3 374	14 647	12 087		7 259	281			38 109	25 791	97 340	28 721	27 709	179 561	217 670
2009		48	247	343	2 710	7 063	8 238	826	7 700	202		22	27 399	35 908	111 522	44 084	30 553	222 067	249 466
2010	970		364	747	2 830	11 364	10 250	4 192	3 986	505			35 208	67 005	157 275	39 557	24 070	287 907	323 115
2011		209		186	2 987	7 722	5 553	2 029	2 162	218			21 066	46 195	114 903	43 080	23 248	227 426	248 492

[1] AF: Atlantic Flyway, MF: Mississippi Flyway, CF: Central Flyway, PF: Pacific Flyway (including Alaska).

[2] The USFWS implemented an improved national harvest survey in 1999. The results for years prior to 1999 are not directly comparable to those from 1999 onward.

Data source: M. H. Gendron and A. Smith 2012 (CWS), and R.V. Raftovich *et al.* 2012 (USFWS).

Table 7. Harvest estimates of Greater Scaup in Canada and the United States

	Canada													United States[1] (PF includes Alaska)					Continental
	NF	PE	NS	NB	QC	ON	MB	SK	AB	BC	NT/NU	YT	Total	AF	MF	CF	PF	Total	Total
1974	1 788	314	1 620	488	20 243	18 172	572	532		1 039			44 768	41 800	23 882	1 559	9 823	77 064	121 832
1975	1 321		2 401	283	25 353	36 056	1 136	176	1 215	2 986	69		70 996	29 400	24 342	1 160	10 488	65 390	136 386
1976	3 095		3 522	478	28 190	37 526	1 140	291		1 297			75 539	64 800	20 426	780	11 056	97 062	172 601
1977	2 436	217	1 895	244	21 126	44 900				617		64	71 499	55 300	26 696	3 778	29 157	114 931	186 430
1978	1 611		502	141	17 811	20 465	1 782			320		77	42 709	71 400	20 673	1 787	7 802	101 662	144 371
1979	637		959	97	20 315	26 367	677			1 391			50 443	28 400	13 523	385	7 442	49 750	100 193
1980	3 052	147	738	384	18 922	29 535	720			739			54 237	17 900	17 660	1 661	11 518	48 739	102 976
1981	344		170	818	22 891	23 762	1 139			548			49 672	34 600	27 834	4 137	19 712	86 283	135 955
1982	1 476	63	411	584	15 678	15 797				230			34 239	73 000	11 799	1 381	4 712	90 892	125 131
1983	427		1 289	574	13 443	38 628				924			55 285	22 800	30 966	623	13 454	67 843	123 128
1984	2 565	31	1 098	1 125	18 999	22 538	419	561	133	907			48 376	27 900	23 416	2 746	13 170	67 232	115 608
1985	2 423	428	759	272	17 880	28 128	1 022			134		63	51 109	31 700	21 169	1 517	5 627	60 013	111 122
1986	5 095	404	2 213	1 456	11 638	30 320	970	214	151	1 112			53 573	36 400	10 307	844	7 612	55 163	108 736
1987	1 103		672	1 323	6 941	13 103	746	131		318			24 337	18 000	11 445	1 450	8 817	39 712	64 049
1988	920		3 221	585	13 622	13 859				212			32 419	12 300	6 678	1 381	5 843	26 202	58 621
1989	5 264	51	2 547	1 498	9 380	14 701			182	242			33 865	14 300	6 620	317	3 845	25 082	58 947
1990	3 684	79	1 609	420	9 284	11 959	383		195	81			27 694	7 200	12 257	1 305	5 844	26 606	54 300
1991			1 657	267	6 314	9 815	626	474	387	153			19 693	6 700	5 541	1 930	4 706	18 877	38 570
1992	1 360		805	898	4 830	9 913	298			87			18 191	6 100	7 947	1 217	4 101	19 365	37 556
1993	5 959	176	1 161	362	8 589	8 651	163				21		25 082	8 600	11 522	1 036	5 994	27 152	52 234
1994	706		1 501	307	6 550	8 329	306			26			17 725	6 700	13 146	2 936	6 477	29 259	46 984
1995	508	82	920	542	5 080	12 861	268			97			20 358	14 600	19 758	5 204	13 456	53 018	73 376
1996	596	65	772	914	5 839	7 653	286		297				16 422	11 900	21 391	2 871	13 572	49 734	66 156
1997	677	83	919	1 119	3 627	6 002	157			379			12 963	9 700	23 636	12 687	16 860	62 883	75 846
1998	1 703	169	256	1 878	4 055	4 274	165		162				12 662	12 600	15 353	5 375	12 384	45 712	58 374
1999[2]	1 377		332	55	4 171	4 671	929					3	11 538	10 900	9 138	3 282	12 016	35 336	46 874
2000	1 075		1 157	659	2 961	3 190	120						9 162	12 800	15 644	1 912	12 097	42 453	51 615
2001	1 210		234	1 492	1 537	4 276	747			18			9 514	7 582	8 060	1 811	15 249	32 702	42 216
2002	1 125	77	437	1 517	2 725	4 816	690				151		11 538	17 809	30 216	3 591	20 642	72 258	83 796
2003	576	366	524	337	2 100	5 481			173				9 557	17 344	14 469	1 257	16 122	49 192	58 749
2004	964	39	90	503	3 040	7 029	285		161	26			12 137	17 254	28 056	3 782	22 035	71 127	83 264
2005	447		193	536	1 562	2 840	235						5 813	18 237	24 812	2 518	11 645	57 212	63 025
2006	705	287	191	430	4 002	3 010					19		8 644	10 523	21 454	2 746	13 057	47 780	56 424
2007	619	101	91	165	815	6 764	88			29			8 672	13 154	21 964	3 085	32 630	70 833	79 505
2008		41	414	243	1 445	5 876	343		140	35			8 537	10 646	24 649	2 656	11 514	49 465	58 002
2009			223	155	912	3 244	540					22	5 096	12 794	24 567	1 668	16 110	55 139	60 235
2010	442			2 624	939	2 835	46						6 886	23 535	23 692	1 573	21 014	69 814	76 700
2011					1 915	3 617							5 532	6 265	33 680	3 455	16 024	59 424	64 956

[1]AF: Atlantic Flyway, MF: Mississippi Flyway, CF: Central Flyway, PF: Pacific Flyway (including Alaska).

[2]The USFWS implemented an improved national harvest survey in 1999. The results for years prior to 1999 are not directly comparable to those from 1999 onward.

Data source: M. H. Gendron and A. Smith 2012 (CWS), and R.V. Raftovich *et al.* 2012 (USFWS).

Table 8. Harvest estimates of Canvasbacks in Canada and the United States.

	Canada													United States[1] (PF includes Alaska)					Continental
	NF	PE	NS	NB	QC	ON	MB	SK	AB	BC	NT/NU	YT	Total	AF	MF	CF	PF	Total	Total
1974					1 461	7 530	3 904	5 647	3 344	773			22 659	700	16 200	19 281	38 768	74 949	97 608
1975					2 116	18 757	8 205	9 065	4 262	1 051		17	43 473	1 700	30 500	15 898	45 663	93 761	137 234
1976				20	2 117	17 817	5 321	7 454	3 773	1 360			37 862	23 200	34 000	18 002	51 799	127 001	164 863
1977					1 036	6 162	2 770	4 019	2 076	198		44	16 305	7 100	24 700	10 831	32 486	75 117	91 422
1978					3 293	11 996	4 596	4 544	2 424	233			27 086	5 600	20 400	7 003	31 089	64 092	91 178
1979					3 769	14 208	7 922	7 585	2 239				35 723	9 200	39 300	17 320	26 027	91 847	127 570
1980					3 301	10 966	4 746	1 420	5 431	1 269			27 133	8 200	27 200	7 800	23 129	66 329	93 462
1981					625	8 327	3 883	1 066	5 193	534			19 628	8 200	20 000	4 898	24 932	58 030	77 658
1982					1 440	6 223	7 669	3 236	344				18 912	3 200	13 900	8 130	19 820	45 050	63 962
1983					400	10 970	6 696	2 638	4 040	240			24 984	14 300	31 000	14 207	21 601	81 108	106 092
1984					214	8 279	1 819	4 716	3 620	210		37	18 895	8 500	23 000	14 215	25 548	71 263	90 158
1985					1 435	8 673	3 349	3 617	1 427	201			18 702	9 000	23 200	10 417	37 309	79 926	98 628
1986	216		461		1 082	14 385	3 145	5 242	3 951	956	53		29 491	200	600	1 064	22 119	23 983	53 474
1987					503	6 158	2 945	638	709	463			11 416	100	800	783	17 714	19 397	30 813
1988					504	2 153	2 744	1 491	385	230			7 507	100	100	190	436	826	8 333
1989						3 636	1 255	219	869	45	45		6 069	300	500	333	9 749	10 882	16 951
1990						5 902	1 392	508	697		23		8 522	100	400	334	7 069	7 903	16 425
1991					198	4 206	473	2 473	1 855	98			9 303		200	360	7 163	7 723	17 026
1992					134	3 194	788	282	194	35			4 627		300	91	11 190	11 581	16 208
1993					88	1 602	2 505	1 862	570	25			6 652		200	257	12 765	13 222	19 874
1994						1 331	3 695	1 141	1 843	164			8 174	4 700	31 300	13 351	20 035	69 386	77 560
1995						5 444	4 016	1 303	1 542	119			12 424	13 200	59 800	19 482	15 749	108 231	120 655
1996					74	4 219	2 965	3 914	1 385				12 557	20 100	49 600	17 851	21 666	109 217	121 774
1997						7 585	5 802	1 708	1 387	55			16 537	12 200	59 800	22 731	25 905	120 636	137 173
1998						5 266	2 012	392	663	83	233		8 649	7 500	36 800	21 639	27 109	93 048	101 697
1999[2]						2 133	5 065		787	51			8 036	6 200	41 100	21 221	19 650	88 171	96 207
2000					111	3 085	4 022	588	1 095	0	12		8 913	16 500	44 100	25 485	17 570	103 655	112 568
2001						896	4 223	411	464	136			6 130	1 546	11 334	13 855	9 490	36 225	42 355
2002						951	3 195	756	253	95			5 250			604	1 152	953	2 709	7 959
2003						971	5 962	1 325	954	55			9 267	4 738	11 259	7 855	11 532	35 384	44 651
2004					57	1 837	2 026	428	145				4 493	9 772	10 824	8 857	14 945	44 398	48 891
2005						971	7 563	3 716	825	82			13 157	4 433	32 786	17 487	9 362	64 068	77 225
2006						3 173	4 131	2 633	320	15	19		10 291	1 228	45 640	18 093	26 925	91 886	102 177
2007						1 812	2 344	4 905	3 334	26			12 421	6 988	56 432	15 719	46 068	125 207	137 628
2008						1 018	3 667	2 310	2 265	35			9 295	68	1 234	15 802	1 069	18 173	27 468
2009						958	7 897	456	797				10 108	7 389	27 831	17 033	18 140	70 393	80 501
2010					121	1 972	2 095	518	1 120	59			5 885	22 989	72 703	24 237	25 757	145 686	151 571
2011					90	3 913	2 051	6 150	794				12 998	5 349	68 358	41 219	25 936	140 862	153 860

[1]AF: Atlantic Flyway, MF: Mississippi Flyway, CF: Central Flyway, PF: Pacific Flyway (including Alaska).

[2]The USFWS implemented an improved national harvest survey in 1999. The results for years prior to 1999 are not directly comparable to those from 1999 onward.

Data source: M. H. Gendron and a. Smith 2012 (CWS), and R.V. Raftovich *et al.* 2012 (USFWS).

Table 9. Black Scoters harvest estimates in Canada and the United States

	Canada													United States[1] (includes Alaska)					Continental
	NF	PE	NS	NB	QC	ON	MB	SK	AB	BC	NT/NU	YT	Total	AF	MF	CF	PF	Total	Total
1974	2 239		1 300	17	5 555	3 646							12 757	21 000	3 266	52		24 318	37 075
1975	126		2 788		11 105	11 628					23		25 670	16 100	2 687		246	19 033	44 703
1976	2 711		5 231	245	17 217	6 853							32 257	8 900	2 159	169	274	11 502	43 759
1977	5 210	94	3 547	40	25 536	3 671				90	198		38 386	15 300	4 368	133	142	19 943	58 329
1978	365		2 106		6 351	1 999				92			10 913	7 900	242			8 142	19 055
1979	1 830		3 078	43	11 455	1 973					85	107	18 571	11 800	1 095	69		12 964	31 535
1980	1 195		1 104		12 065	912							15 276	5 400	2 430			7 830	23 106
1981	3 406		5 231	165	11 438	2 883				55			23 178	8 700	3 213	185	145	12 243	35 421
1982	6 158		2 769		6 574	967							16 468	4 100	1 068	355		5 523	21 991
1983	880		2 308	49	5 390	2 303				37			10 967	3 600	580		154	4 334	15 301
1984	2 024		1 536		7 756	2 074	330			57			13 777	10 600	749	94	206	11 649	25 426
1985	884	209	1 094		7 005	3 502							12 694	13 500	2 299	76		15 875	28 569
1986	579		3 127		2 314	2 795						34	8 849	6 800	412			7 212	16 061
1987	572		1 359	678	7 195	843	414						11 061	9 900	228			10 128	21 189
1988	147		1 124	441	3 430	714							5 856	5 500	198			5 698	11 554
1989	463		650		5 006	705							6 824	5 400	1 365		50	6 815	13 639
1990	377		1 114	202	3 856	1 455							7 004	12 000	148		35	12 183	19 187
1991	783		2 330	94	3 253	907							7 367	6 600				6 600	13 967
1992	969		1 769		1 477	669						24	4 908	4 600	315			4 915	9 823
1993	570		1 166		4 882	656	618						7 892	3 000	634	41	49	3 724	11 616
1994	298		3 216	54	2 297	549	971			29		165	7 579	5 700	1 198	54		6 952	14 531
1995	1 543		1 978	149	679	563							4 912	3 000	100			3 100	8 012
1996	568		1 000	32	1 598	378							3 576	4 800	463	203	211	5 677	9 253
1997			1 324	43	2 202	205							3 774	4 500	940	105	123	5 668	9 442
1998	1 212	14	985	51	2 752	186							5 200	3 200	688			3 888	9 088
1999[2]	524		1 002		1 620	464							3 610	7 800	900	200	700	9 600	13 210
2000	29		1 354	677	497	260							2 817	5 300	1 000			6 300	9 117
2001	928		2 646		947	682							5 203	5 800	800			6 600	11 803
2002	838	158	1 462	72	610	243							3 383	10 800	800			11 600	14 983
2003	536		821	74	655	221							2 307	17 800	1 800		800	20 400	22 707
2004			1 737	36	790	96							2 659	11 400	900	100	1 400	13 800	16 459
2005	754		1 580		239								2 573	16 853	2 537		1 140	20 530	23 103
2006	250		740		1 215	288							2 493	8 498	619	311	215	9 643	12 136
2007			277		393	227							897	7 466	1 529	127		9 122	10 019
2008			823		1 723	126							2 672	5 172	883		194	6 249	8 921
2009			728	81	81	126							1 016	7 923	176	331	1 183	9 613	10 629
2010	228		2 421	182	1 797								4 628	14 902	611	0	0	15 513	20 141
2011			575		1 814								2 389	14 022	442	0	167	14 631	17 020

[1]AF: Atlantic Flyway, MF: Mississippi Flyway, CF: Central Flyway, PF: Pacific Flyway (including Alaska)

[2]The USFWS implemented an improved national harvest survey in 1999. The results for years prior to 1999 are not directly comparable to those from 1999 onward.

Data source: M. H. Gendron and A. Smith 2012 (CWS), J.D. Klimstra and P.Padding 2012 (USFWS)

Table 10. White-winged Scoters harvest estimates in Canada and the United States

	Canada													United States[1] (PF includes Alaska)					Continental
	NF	PE	NS	NB	QC	ON	MB	SK	AB	BC	NT/NU	YT	Total	AF	MF	CF	PF	Total	Total
1974		113	1 105	46	9 676	4 611	291		251	174			16 267	26 700	6 393	0	424	33 517	49 784
1975			1 742	233	4 934	4 277	141		357	143		54	11 881	33 000	1 944	117	125	35 186	47 067
1976	95	204	2 792	193	8 245	4 122	396		648	61		164	16 920	18 100	497	565	1 010	20 172	37 092
1977			2 253		10 277	4 393	183		118	57		247	17 528	12 200	2 341	257	1 531	16 329	33 857
1978	1 105	153	417	283	5 042	3 310		381	334	265			11 290	12 100	205	0	3 534	15 839	27 129
1979	565		989	117	8 018	5 845		364	172				16 070	8 730	966	0	748	10 444	26 514
1980	3 483		3 497	92	10 829	3 142				102			21 145	13 900	2 284	34	792	17 010	38 155
1981	728		1 231	114	7 831	2 510				689	116		13 219	11 900	1 644	126	1 172	14 842	28 061
1982	767		1 459	151	7 798	2 000			1 484	1 259			14 918	13 900	1 269	0	172	15 341	30 259
1983	710		1 418	199	7 842	2 470		516		162			13 317	9 600	2 339	0	177	12 116	25 433
1984	1 645	30	2 253		11 052	3 636					408		19 024	27 800	2 283	0	3 970	34 053	53 077
1985	1 028		791	97	7 792	2 892	283		252	66	1 661		14 862	19 300	2 074	36	425	21 835	36 697
1986	215		401	46	2 359	1 443		213		297			4 974	9 300	1 142	0	276	10 718	15 692
1987			1 090	90	6 950	3 618			106	78			11 932	20 300	2 885	101	1 019	24 305	36 237
1988	2 190		1 963	60	7 072	1 403				51			12 739	17 500	1 086	0	134	18 720	31 459
1989	202		1 515	128	8 078	1 858							11 781	7 100	1 197	70	43	8 410	20 191
1990	899		2 200	139	5 297	801	789						10 125	14 690	546	0	238	15 474	25 599
1991			465	90	2 505	1 096							4 156	18 391	1 036	312	88	19 827	23 983
1992	283		1 638		5 213	441							7 575	10 992	661	151	0	11 804	19 379
1993	544	379	1 238	123	4 415	2 041	162				35		8 937	8 293	380	0	247	8 920	17 857
1994	344		2 132		5 932	1 343							9 751	5 594	738	111	240	6 683	16 434
1995			1 846		1 795	672							4 313	7 995	314	0	239	8 548	12 861
1996	89		1 034		2 464	1 175							4 762	9 996	3 478	119	361	13 954	18 716
1997	58		1 191		2 306	470							4 025	6 800	568	0	499	7 867	11 892
1998	598		758	198	3 363	291							5 208	4 700	632	0	787	6 119	11 327
1999[2]	41		412		1 337	260						3	2 053	2 200	0	200	1 100	3 500	5 553
2000	47		313		527	104					24		1 015	4 900	0	100	1 200	6 200	7 215
2001	72		227	199	1 021	379	159	157		26			2 240	15 100	1 500	0	6 600	23 200	25 440
2002		158	680	52	1 179	282							2 351	7 300	800	200	800	9 100	11 451
2003	409		636	43	789	97			173				2 147	6 800	1 900	200	2 200	11 100	13 247
2004			156		1 238	137							1 531	6 800	1 900	200	2 200	11 100	12 631
2005			151	34	908	78							1 171	4 215	793	113	1 426	6 547	7 718
2006			407	42	1 202	404							2 055	8 725	697	0	2 865	12 287	14 342
2007			130	85	281	334							830	4 294	1 218	0	2 497	8 009	8 839
2008			480	31	949		64						1 524	5 643	336	0	1 653	7 632	9 156
2009			506		1 048	126			226	19			1 925	2 860	1 777	172	3 933	8 742	10 667
2010	1 652		1 436		988	318							4 394	5 359	1 118	0	320	6 797	11 191
2011			1 075	56	1 381								2 512	3 575	3 965	0	4 240	11 780	14 292

[1] AF: Atlantic Flyway, MF: Mississippi Flyway, CF: Central Flyway, PF: Pacific Flyway (including Alaska).

[2] The USFWS recently implemented an improved national harvest survey in 1999. The results for years prior to 1999 are not directly comparable to those from 1999 onward.

Data source: M. H. Gendron and A. Smith 2012 (CWS), J.D. Klimstra and P.Padding 2012 (USFWS)

Table 11. Surf Scoters harvest estimates in Canada and the United States

	Canada													United States[1] (PF includes Alaska)					Continental
	NF	PE	NS	NB	QC	ON	MB	SK	AB	BC	NT/NU	YT	Total	AF	MF	CF	PF	Total	Total
1974	1 074	34	2 714	243	9 757	2 645				322			16 789	22 200	4 381	59	746	27 386	44 175
1975		52	1 422	391	15 601	10 372	360	497		51			28 746	30 300	4 207		63	34 570	63 316
1976	4 357	714	7 220	1 168	20 035	8 684	566			77	69	41	42 931	16 300	442	308	1 117	18 167	61 098
1977	1 654	655	7 501	754	17 584	7 911							36 059	22 800	2 405	528	5 502	31 235	67 294
1978	671	54	1 279	640	8 842	3 118				207	45		14 856	14 700	512		1 842	17 054	31 910
1979	1 452		3 061	203	12 279	7 909							24 904	10 200	1 013		1 591	12 804	37 708
1980	1 569		4 190	655	10 321	5 162	89			103	634		22 723	9 800	874	201	1 056	11 931	34 654
1981	1 246		6 390	191	12 827	1 532	495			293	94		23 068	22 800	1 142		1 178	25 120	48 188
1982	9 936		2 776	355	14 879	1 285	260			171			29 662	5 800	635	633	952	8 020	37 682
1983	4 748		1 079		4 118	871	351		189	74	148		11 578	5 800	709	284	1 274	8 067	19 645
1984	4 145		2 957	152	7 942	3 063	284			307	112		18 962	18 300	1 980		7 092	27 372	46 334
1985	1 377		3 678	148	6 399	593	283			66	830		13 374	18 700	1 653		723	21 076	34 450
1986	2 338	82	2 456	186	2 060	1 994				29	124	34	9 303	19 100	844	295	344	20 583	29 886
1987	570		3 031	194	6 888	2 048		130		264			13 125	18 100	790		1 529	20 419	33 544
1988	987		2 397	282	7 331	634							11 631	6 300	241	79	2 094	8 714	20 345
1989	2 626		4 803		5 070	2 896				39			15 434	15 600	957		1 215	17 772	33 206
1990	3 410		7 552	432	5 184	1 152	714						18 444	14 900	301	131	632	15 964	34 408
1991	948		1 318	476	1 821	2 097	586	514					7 760	11 400	151	128	188	11 867	19 627
1992	655		1 399		3 479	577							6 110	11 200	377	124	221	11 922	18 032
1993	1 289	94	4 916	260	3 890	915	1 124			25	35	5	12 553	8 500	694	63	807	10 064	22 617
1994	3 601		7 683	69	6 890	669						35	18 947	16 100	787	141	46	17 074	36 021
1995	2 878		4 686	592	3 448	971				34			12 609	6 600	2 916	221	777	10 514	23 123
1996	313		1 354	87	2 970	758							5 482	11 400	1 901	311	1 198	14 810	20 292
1997	325		2 694	290	3 029	442							6 780	9 700	457		2 157	12 314	19 094
1998	982	1 215	6 704	326	2 400	310					76		12 013	15 100	542	25	1 521	17 188	29 201
1999[2]	2 215		4 642	120	2 836	43	285						10 144	8 633	3 028	182	2 777	12 196	22 340
2000	308		726	601	1 096	61							3 140	12 798	271	70	3 694	11 596	14 736
2001	520		806	108	1 549								2 983	15 044	332	80	1 478	13 095	16 083
2002	1 951	158	922	72	2 314	70				42			5 529	14 513	950	120	2 726	18 309	23 838
2003	706		1 588	15	636	349							3 294	38 507	1 145	173	383	40 208	43 502
2004	216		1 821		1 940	458							4 435	30 820	520	117	3 186	34 643	39 078
2005	1 637		731	108	176	117							2 769	21 057	1 591	0	4 272	26 920	29 689
2006	272		1 131	104	1 158								2 665	29 078	566	83	2 304	32 031	34 696
2007	86	212	741	131	1 068	202							2 440	29 033	1 691	182	6 097	37 003	39 443
2008	496		1 336	58	2 118	624							4 632	29 316	367	0	10 699	40 382	45 014
2009			275		156	270							701	25 915	1 646	113	6 248	33 922	34 623
2010	1 697		1 284	700	904								4 585	13 462	1 407	129	7 677	22 675	27 260
2011	1 792		1 102		1 113	126							4 133	27 740	1 607	0	6 329	35 676	39 809

[1]AF: Atlantic Flyway, MF: Mississippi Flyway, CF: Central Flyway, PF: Pacific Flyway (including Alaska).

[2] The USFWS implemented an improved national harvest survey in 1999. The results for years prior to 1999 are not directly comparable to those from 1999 onward.

Data source: M. H. Data source: M. H. Gendron and A. Smith 2012 (CWS), J.D. Klimstra and P.Padding 2012 (USFWS)

Table 12. Greater Snow Goose harvest estimates in Canada and the United States

An unknown proportion of the U.S. harvest is comprised of Lesser Snow Geese (harvest estimates of Snow Geese are combined in the U.S.).

	Canada													United States[1]		Continental
	NF	PE	NS	NB	QC	ON	MB	SK	AB	BC	NT/NU	YT	Total	AF	Total	Total
1975					32 436		153						32 589	9 200	9 200	41 789
1976					28 866	66							28 932	12 100	12 100	41 032
1977														22 200	22 200	22 200
1978					42 763	1 312		261	351				44 687	20 100	20 100	64 787
1979					23 190								23 190	28 000	28 000	51 190
1980					59 120	103							59 223	27 300	27 300	86 523
1981			33		27 475	107							27 615	13 500	13 500	41 115
1982			50		40 697	832	178	327					42 084	21 700	21 700	63 784
1983														40 400	40 400	40 400
1984	177				45 538	624	3 243	758					50 340	37 600	37 600	87 940
1985					24 660								24 660	14 800	14 800	39 460
1986				55	11 077								11 132	8 900	8 900	20 032
1987					2 125								2 125	28 500	28 500	30 625
1988					41 827			88					41 915	24 900	24 900	66 815
1989					44 185	253							44 438	17 100	17 100	61 538
1990	294				59 223				205				59 722	21 500	21 500	81 222
1991					48 568		621						49 189	26 400	26 400	75 589
1992				295	26 988	926	761	215					29 185	10 400	10 400	39 585
1993					97 539	429	2 010	2 282					102 260	30 400	30 400	132 660
1994					35 903	112							36 015	17 600	17 600	53 615
1995			21		50 267	252	391						50 931	18 800	18 800	69 731
1996	60		62	1 859	66 111	111	115						68 318	31 400	31 400	99 718
1997					55 056	164							55 220	34 700	34 700	89 920
1998			90	412	86 791	64			118				87 475	110 900	110 900	198 375
1999[2]				774	36 821	105			86				37 786	39 100	39 100	76 886
2000					103 615			554	334				104 503	47 000	47 000	151 503
2001					94 011				68				94 079	77 802	77 802	171 881
2002				225	45 890			531	220				46 866	39 295	39 295	86 161
2003					86 028	111		213		73			86 425	35 067	35 067	121 492
2004				433	66 326	1 394		1 610	83				69 846	31 548	31 548	101 394
2005					66 238								66 238	35 394	35 394	101 632
2006			135		73 585	331			364				74 415	33 256	33 256	107 671
2007				578	61 652								62 230	50 742	50 742	112 972
2008			75	209	114 776	51	233	5 322					120 666	58 752	58 752	179 418
2009			257		50 535	661							51 453	29 426	29 426	80 879
2010					52 606	301		1 428					54 335	18 293	18 293	72 628
2011					96 144	2 836							98 980	37 592	37 592	136 572

[1]AF: Atlantic Flyway.

[2]The USFWS implemented an improved national harvest survey in 1999. The results for years prior to 1999 are not directly comparable to those from 1999 onward.

Data source: M. H. Gendron and A. Smith 2012 (CWS), and R.V. Raftovich *et al.* 2012 (USFWS).

Table 13. Lesser Snow Goose harvest estimates for Canada and the United States

In the U.S., an unknown proportion of Lesser Snow Geese are also harvested in the Atlantic Flyway and are included with the Greater Snow Goose estimates (Table 12).

	Canada													United States[1] (PF includes Alaska)					Continental
	NF	PE	NS	NB	QC	ON	MB	SK	AB	BC	NT/NU	YT	Total	AF	MF	CF	PF	Total	Total
1975					6 545	18 075	51 180	13 159	14 911	2 625	324		106 495		167 700	350 057	92 871	610 628	717 123
1976					234	11 963	31 603	21 269	31 027	2 131	260		98 227		102 500	256 490	144 011	503 001	601 228
1977					20 695	7 012	31 006	13 061	29 709	508			101 991		126 800	306 302	81 841	514 943	616 934
1978				76	519	6 577	39 766	11 582	16 517	394			75 431		133 900	189 015	30 925	353 840	429 271
1979					5 300	9 898	98 426	13 276	11 399	1 944	552		140 243		165 600	338 391	32 628	536 619	676 862
1980			62		12 294	8 276	90 882	16 241	9 451	1 628			138 834		144 600	251 765	35 766	432 131	570 965
1981					593	6 734	87 996	14 947	14 065	3 055			127 390		110 900	289 869	61 109	461 878	589 268
1982					1 632	3 027	81 900	22 229	6 094	1 896			116 778		124 200	241 744	33 074	399 018	515 796
1983					46 188	1 502	81 880	32 584	6 932				169 086		187 300	245 748	46 829	479 877	648 963
1984					2 578	1 097	76 630	32 340	8 791	2 704			124 140		101 800	292 798	64 426	459 024	583 164
1985			50		390	2 010	103 348	33 698	11 768	4 096			155 360		99 200	216 868	82 223	398 291	553 651
1986						2 169	48 950	31 326	9 629				92 074		69 700	149 889	37 384	256 973	349 047
1987					37 803	4 845	69 524	23 320	4 091	2 122			141 705		56 400	182 585	38 236	277 221	418 926
1988					3 952	2 313	71 322	24 204	9 664	1 657			113 112		51 700	251 836	42 134	345 670	458 782
1989					1 183	5 609	92 892	26 752	11 020	917			138 373		97 300	286 271	32 955	416 526	554 899
1990				452	2 228	2 834	53 754	31 818	10 179	141	339	407	101 813		92 900	211 758	26 802	331 460	433 273
1991					2 710	2 819	65 871	22 407	5 510	2 642			101 959		110 900	249 950	30 999	391 849	493 808
1992			56		591	589	26 786	21 240	9 123	467			58 852		60 100	149 484	29 281	238 865	297 717
1993					7 649	2 543	51 314	19 674	5 304	2 094			88 578		71 800	270 235	55 293	397 328	485 906
1994					5 855	657	56 221	30 258	6 987	2 174	105		102 152		99 100	270 502	29 410	399 012	501 164
1995					855	1 286	61 603	31 323	8 680	1 589	306		105 336		191 200	331 957	37 807	560 964	666 300
1996					3 486	1 028	46 163	34 546	4 185	2 863			92 271		231 100	299 215	59 042	589 357	681 628
1997					8 853	336	69 683	62 635	9 261				150 768		239 000	348 989	35 501	623 490	774 258
1998				16	16 732	954	52 121	68 985	14 890	1 797			155 495		394 700	295 774	52 395	742 869	898 364
1999 [2]					6 747	115	14 150	116 313	15 416	1 990			154 731		317 412	487 753	51 190	856 355	1011 086
2000					5 686	1 350	31 699	68 377	12 881	2 559		128	122 680		234 699	380 158	39 039	653 896	776 576
2001					4 427	982	25 335	100 525	13 367	2 354			146 990		315 508	345 139	44 572	705 219	852 209
2002					2 699	697	24 252	85 933	9 612	7 284			130 477		197 297	268 572	46 526	512 395	642 872
2003					3 941	901	26 970	108 457	10 539	1 312			152 120		286 279	247 659	42 931	576 869	728 989
2004					82	642	23 158	76 709	3 654	1 188			105 433		192 256	216 089	40 724	449 069	554 502
2005					1 090	383	13 669	81 946	6 490	2 443			106 021		248 951	304 040	63 779	616 770	722 791
2006	131				1 349	1 122	31 936	116 278	11 430	3 170			165 416		213 274	255 995	71 479	540 748	706 164
2007					703	254	19 452	66 934	14 976	4 626			106 945		148 944	275 228	87 821	511 993	618 938
2008					1 678	70	31 601	112 986	9 570	2 406			158 311		168 482	240 597	87 274	496 353	654 664
2009					730	311	9 123	80 753	11 613	1 316			103 846		109 213	148 768	54 134	312 115	415 961
2010					1 377	422	11 854	78 415	15 162	983			108 213		82 934	153 759	65 034	301 727	409 940
2011					852	198	12 899	85 848	14 970				114 767		122 573	169 145	64 115	355 833	470 600

[1]MF: Mississippi Flyway, CF: Central Flyway, PF: Pacific Flyway (including Alaska).

[2]The USFWS implemented an improved national harvest survey in 1999. The results for years prior to 1999 are not directly comparable to those from 1999 onward.

Source des données : M.Gendron et A. Smith 2012 (SCF), et Raftovich *et al*. 2012 (USFWS)

Table 14. White-fronted Goose harvest estimates in Canada and the United States

	Canada													United States[1] (PF includes Alaska)					Continental
	NF	PE	NS	NB	QC	ON	MB	SK	AB	BC	NT/NU	YT	Total	AF	MF	CF	PF	Total	Total
1974															10 102	34 623	41 592	86 317	86 317
1975			281				451	45 687	14 345	389	122	142	61 295		29 282	47 621	38 485	115 388	176 683
1976							825	51 876	9 300			45	62 046		22 248	32 959	46 010	101 217	163 263
1977								43 341	15 862	82		2	59 287		18 660	49 154	35 566	103 380	162 667
1978							379	50 987	11 343	246		121	63 076		33 376	44 179	38 021	115 576	178 652
1979							101	47 200	12 092	72		247	59 712		29 119	54 655	24 395	108 169	167 881
1980							2 309	56 164	20 037	61			78 571	105	28 097	74 884	20 874	123 960	202 531
1981							1 505	36 781	14 648	303		5	53 242		94 871	80 886	22 851	198 608	251 850
1982							263	39 822	15 435				55 520	486	51 421	63 017	16 772	131 696	187 216
1983							119	46 947	5 634		570		52 700	257	61 646	51 828	17 137	130 868	183 568
1984						153	115	38 797	14 367	126		37	53 595	67	67 160	78 197	8 306	153 730	207 325
1985								37 605	12 482	277			50 364	77	46 812	51 473	15 671	114 033	164 397
1986					23		497	37 753	20 598				58 871		34 016	33 891	8 836	76 743	135 614
1987							125	36 856	11 184	84			48 249		32 148	55 016	10 962	98 126	146 375
1988								21 643	18 125	102			39 870		33 802	61 721	6 385	101 908	141 778
1989			43			45	119	34 374	18 738	48			53 367		47 655	80 462	11 479	139 596	192 963
1990	294						111	26 849	16 525	117	97		43 896		70 202	73 011	8 395	151 608	195 504
1991			51		82		549	31 649	11 540	65			43 936		72 199	54 510	11 658	138 367	182 303
1992							623	22 099	8 651	24			31 397		54 500	41 207	14 219	109 926	141 323
1993			50			171		21 822	7 016				29 059		42 000	64 830	13 839	120 669	149 728
1994								30 199	9 606	81			39 886		87 700	61 771	14 131	163 602	203 488
1995							79	45 011	14 888	42		64	60 084		68 600	60 880	13 523	143 003	203 087
1996			252			69	924	57 676	17 939	138			76 998		117 000	75 875	21 642	214 517	291 515
1997					180		296	37 326	15 009			37	52 848		122 400	59 913	27 205	209 518	262 366
1998							1 046	51 204	26 671	242			79 163		108 800	51 225	25 294	185 319	264 482
1999 [2]								47 316	15 033				62 349		111 434	114 010	29 458	254 902	317 251
2000								86 587	19 964	187			106 738		100 610	182 344	25 018	307 972	414 710
2001								61 391	31 722	81			93 194		108 928	91 438	29 307	229 673	322 867
2002							1 048	39 870	10 691			6	51 615		108 685	77 179	33 453	219 317	270 932
2003						101		49 733	15 348	86			65 268		110 611	80 017	26 153	216 781	282 049
2004							238	54 419	9 956				64 613		86 266	52 163	44 078	182 507	247 120
2005							172	55 315	19 947	130			75 564		92 956	113 663	45 167	251 786	327 350
2006					51			36 967	17 892	273			55 183		142 493	83 300	56 694	282 487	337 670
2007							992	42 467	26 300	199			69 958		176 444	111 083	64 835	352 362	422 320
2008							139	55 647	37 893	183			93 862		138 097	61 247	119 988	319 332	413 194
2009								30 882	22 173	158			53 213	2 510	71 451	70 290	60 993	205 244	258 457
2010					121			33 746	22 144	188			56 199		105 249	87 502	76 008	268 759	324 958
2011							630	52 762	27 650				81 042	788	70 836	101 001	62 183	234 808	315 850

[1]AF: Atlantic Flyway, MF: Mississippi Flyway, CF: Central Flyway, PF: Pacific Flyway (including Alaska).

[2]The USFWS implemented an improved national harvest survey in 1999. The results for years prior to 1999 are not directly comparable to those from 1999 onward.

Data source: M. H. Gendron and A. Smith 2012 (CWS), and D. Raftovich *et al.* 2012 (USFWS)

Table 15. Canada and Cackling Goose harvest estimates (all populations combined) in Canada and the United States

	Canada													United States[1] (PF includes Alaska)					Continental
	NF	PE	NS	NB	QC	ON	MB	SK	AB	BC	NT/NU	YT	Total	AF	MF	CF	PF	Total	Total
1974													0	338 700	289 000	133 136	188 413	949 249	949 249
1975	8 185	6 407	9 140	2 872	14 126	31 525	97 586	95 037	83 734	9 423		142	358 177	357 900	330 400	172 717	181 394	1 042 411	1 400 588
1976	8 443	17 949	11 192	6 087	24 322	37 216	65 993	71 148	67 533	7 159	52	163	317 205	366 700	340 600	172 467	172 169	1 051 936	1 369 141
1977	12 578	18 788	8 693	2 179	51 269	58 611	45 426	65 402	60 894	9 088	218	127	333 055	465 900	357 600	158 871	185 209	1 167 580	1 500 635
1978	12 743	11 987	6 707	3 239	65 536	53 563	83 152	70 254	77 226	10 837		325	395 569	327 000	425 800	200 815	252 894	1 206 509	1 602 078
1979	13 494	10 827	5 830	2 141	50 816	64 036	95 291	80 354	80 252	13 337		289	416 667	296 900	325 300	185 740	187 396	995 336	1 412 003
1980	10 242	19 137	8 219	2 854	49 377	74 352	74 517	93 609	100 652	16 763	497	525	450 247	474 900	316 300	187 176	187 925	1 166 301	1 616 548
1981	10 170	14 264	7 494	3 911	21 578	50 380	57 956	83 421	95 509	16 052		234	360 969	328 800	308 900	206 747	195 003	1 039 450	1 400 419
1982	11 186	13 296	5 378	2 817	25 897	69 234	74 265	86 257	94 170	13 696			396 196	383 700	290 100	213 544	206 567	1 093 911	1 490 107
1983	13 653	15 780	9 657	7 376	34 984	69 997	72 578	124 109	106 144	14 877		397	469 552	491 000	288 800	233 447	230 178	1 243 425	1 712 977
1984	13 995	13 962	6 508	3 048	22 379	63 612	88 937	94 123	97 422	15 835		270	420 091	408 900	310 400	235 786	199 428	1 154 514	1 574 605
1985	9 886	17 226	6 911	3 958	28 004	76 399	106 352	87 182	101 925	14 559		96	452 498	360 800	336 100	289 670	200 861	1 187 431	1 639 929
1986	16 829	21 970	8 785	5 677	38 877	85 310	92 206	81 626	87 528	14 836		190	453 834	413 900	337 000	212 901	147 111	1 110 912	1 564 746
1987	12 509	21 387	10 942	3 015	57 761	88 450	79 557	102 562	115 355	15 030	550	165	506 733	359 300	319 700	198 227	162 742	1 039 969	1 546 702
1988	9 380	24 906	9 671	3 374	19 922	76 755	56 679	79 879	99 787	15 146		174	395 673	268 900	446 200	240 786	163 230	1 119 116	1 514 789
1989	8 845	23 144	15 666	6 617	55 285	101 618	78 471	84 848	119 082	16 427	367		510 003	318 500	580 100	273 324	149 204	1 321 128	1 831 131
1990	6 521	25 207	6 580	7 273	52 350	97 514	73 822	95 962	121 504	14 831	96		501 564	302 000	510 400	282 879	184 871	1 280 150	1 781 714
1991	5 799	21 459	9 848	5 229	51 837	83 791	72 617	90 821	111 826	18 170	275	510	471 907	306 200	543 600	276 400	174 951	1 301 151	1 773 058
1992	6 436	11 640	4 290	5 350	27 182	79 880	57 464	81 009	91 103	15 961		154	380 469	247 400	484 300	223 610	196 798	1 152 108	1 532 577
1993	9 759	19 168	13 294	6 916	40 593	83 889	73 498	79 823	93 614	13 509		94	434 157	286 900	598 900	319 462	223 384	1 428 646	1 862 803
1994	6 924	28 216	6 935	5 820	15 879	85 233	60 302	82 753	107 925	14 072	21	140	414 199	306 400	644 400	382 799	259 035	1 592 634	2 006 833
1995	9 527	16 967	8 306	5 467	9 560	88 140	49 639	82 155	114 818	11 297		128	396 004	144 000	771 800	483 322	239 096	1 638 218	2 034 222
1996	7 503	22 451	8 758	4 470	10 822	87 781	93 437	111 467	137 440	15 477	417	82	499 688	219 400	814 800	610 074	268 314	1 912 588	2 412 276
1997	5 165	16 769	7 542	6 105	11 748	89 680	107 304	104 934	125 629	14 602			489 478	296 200	833 400	546 274	242 559	1 918 433	2 407 911
1998	9 746	23 781	10 802	6 225	16 882	109 731	94 033	136 736	104 831	18 586			531 353	330 600	738 900	672 326	272 552	2 014 378	2 545 731
1999 [2]	5 464	32 944	12 633	6 079	38 702	100 751	68 822	146 112	137 527	16 093	25	90	565 217	342 800	813 400	493 320	234 350	1 883 870	2 449 087
2000	8 223	25 932	13 507	8 418	38 941	125 308	74 632	167 929	132 609	16 544			612 043	371 000	896 400	662 562	315 925	2 245 887	2 857 930
2001	5 553	25 136	10 554	5 615	67 763	148 705	102 034	146 829	111 751	13 076			637 016	687 904	858 422	627 052	279 469	2 452 847	3 089 863
2002	6 744	22 126	10 831	4 962	87 177	160 474	108 306	125 588	108 758	10 459		239	645 664	716 689	906 351	587 253	270 148	2 480 441	3 126 105
2003	5 004	20 983	4 915	11 245	112 807	160 197	90 183	135 123	116 844	14 353			671 654	657 910	1103 880	734 402	359 383	2 855 575	3 527 229
2004	4 481	15 028	5 996	6 100	75 316	148 893	92 512	135 759	134 551	8 165			626 801	633 289	952 120	535 606	322 329	2 443 344	3 070 145
2005	5 516	16 109	5 240	6 908	104 530	155 746	118 570	139 194	148 589	11 640			712 042	774 515	928 457	621 738	331 020	2 655 730	3 367 772
2006	4 364	11 245	4 769	6 940	79 569	174 538	105 039	157 414	124 785	9 348			678 011	662 449	1078 650	565 467	339 099	2 645 665	3 323 676
2007	5 848	13 586	7 544	9 098	100 811	179 459	97 069	169 206	110 830	9 892		514	703 857	860 743	996 677	503 413	315 361	2 676 194	3 380 051
2008	6 871	16 468	10 040	9 916	114 167	194 293	91 804	155 728	125 624	10 642			735 553	919 976	1021 696	565 939	337 229	2 844 840	3 580 393
2009	4 025	11 926	9 056	9 638	126 678	190 433	99 955	140 922	102 591	15 873		116	711 213	854 268	975 895	565 387	310 122	2 705 672	3 416 885
2010	4 336	15 618	12 651	10 641	122 436	170 886	88 963	150 150	104 970	10 511			691 162	796 229	938 413	529 406	271 222	2 535 270	3 226 432
2011	4 118	14 970	7 719	11 475	119 596	199 396	86 956	173 045	98 639	14 402			730 316	530 630	883 440	474 715	296 269	2 185 054	2 915 370

[1] AF: Atlantic Flyway, MF: Mississippi Flyway, CF: Central Flyway, PF: Pacific Flyway (including Alaska).

[2] The USFWS implemented an improved national harvest survey in 1999. The results for years prior to 1999 are not directly comparable to those from 1999 onward.

Data source: M. H. Gendron and A. Smith 2012 (CWS), and D. Raftovich *et al.* 2012 (USFWS)

APPENDIX D – LIST OF ACRONYMS

AP	Atlantic Population of Canada Goose
BBS	Breeding Bird Survey
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CWS	Canadian Wildlife Service
EPP	Eastern Prairie Population of Canada Goose
GPP	Great Plains Population of Canada Goose
HLP	Hi-Line Population of Canada Goose
ISR	Inuvialuit Settlement Region
MSS	Mineral Site Survey
MVP	Mississippi Valley Population of Canada Goose
NAP	North Atlantic Population of Canada Goose
NAWMP	North American Waterfowl Management Plan
OMNR	Ontario Ministry of Natural Resources
PP	Pacific Population of Canada Goose
PWGSC	Public Works and Government Services of Canada
RMP	Rocky Mountain Population of Canada Goose
SCWDS	Southeast Cooperative Wildlife Disease Study
SDJV	Sea Duck Joint Venture
SGPP	Short-grass Prairie Population of Canada/Cackling Goose
SJBP	Southern James Bay Population of Canada Goose
TGPP	Tall Grass Prairie Population of Cackling Goose
USFWS	U.S. Fish and Wildlife Service
WPP	Western Prairie Population of Canada Goose

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Additional information can be obtained at:

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