U.S. Fish & Wildlife Service

Waterfowl

Population Status, 2012

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July 20, 2012

In North America the process of establishing hunting regulations for waterfowl is conducted annually. In the United States the process involves a number of scheduled meetings in which information regarding the status of waterfowl is presented to individuals within the agencies responsible for setting hunting regulations. In addition, the proposed regulations are published in the Federal Register to allow public comment. This report includes the most current breeding population and production information available for waterfowl in North America and is a result of cooperative efforts by the U.S. Fish & Wildlife Service (USFWS), the Canadian Wildlife Service (CWS), various state and provincial conservation agencies, and private conservation organizations. This report is intended to aid the development of waterfowl harvest regulations in the United States for the 2012–2013 hunting season.

Cover: 2012–2013 Duck stamp. A lone Wood Duck (*Aix sponsa*) by Joseph Hautman, winner of the 2011 federal duck stamp design competition.

Acknowledgments

Waterfowl Population and Habitat Information: The information contained in this report is the result of the efforts of numerous individuals and organizations. Principal contributors include the Canadian Wildlife Service, U.S. Fish & Wildlife Service, state wildlife conservation agencies, provincial conservation agencies from Canada, and Dirección General de Conservación Ecológica de los Recursos Naturales, Mexico. In addition, several conservation organizations, other state and federal agencies, universities, and private individuals provided information or cooperated in survey activities. Appendix A.1 provides a list of individuals responsible for the collection and compilation of data for the "Status of Ducks" section of this report. Appendix A.2 provides a list of individuals who were primary contacts for information included in the "Status of Geese and Swans" section. We apologize for any omission of individuals from these lists, and thank all participants for their contributions. Without this combined effort, a comprehensive assessment of waterfowl populations and habitat would not be possible.

Authors: This report was prepared by the U.S. Fish & Wildlife Service, Division of Migratory Bird Management, Population and Habitat Assessment Branch. The principal authors were Kathy Fleming, Pamela Garrettson, Walt Rhodes, and Nathan Zimpfer. The authors compiled information from numerous sources to provide an assessment of the status of waterfowl populations.

Report Preparation: The preparation of this report involved substantial efforts on the part of many individuals. Support for the processing of data and publication was provided by Emily Silverman, Guthrie Zimmerman, and John Sauer. Shawn Bayless, Jim Bredy, Steve Earsom, Mark Koneff, Terry Liddick, Ed Mallek, Rob Spangler, Phil Thorpe, Walt Rhodes, Jon Klimstra, and James Wortham provided habitat narratives, reviewed portions of the report that addressed major breeding areas, or provided helpful comments. Tom Cooper, Rebecca Rau, and Guthrie Zimmerman provided helpful comments on earlier drafts. Kathy Fleming provided the maps.

This report should be cited as: U.S. Fish and Wildlife Service. 2012. Waterfowl population status, 2012. U.S. Department of the Interior, Washington, D.C. USA.

All Division of Migratory Bird Management reports are available from our Web site (http://www.fws.gov/migratorybirds/NewsPublicationsReports.html).

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1 Status of Ducks

Abstract: In the traditional survey area, which includes strata 1–18, 20–50, and 75–77, the total duck population estimate was 48.6 ± 0.8 [SE] million birds. This estimate represents a 7% increase over last year's estimate of 45.6 ± 0.8 million birds and was 43% above the long-term average (1955–2011). Estimated mallard (*Anas platyrhynchos*) abundance was 10.6 ± 0.3 million birds, which was 15% above the 2011 estimate of 9.2 ± 0.3 million birds and 40% above the long-term average. Estimated abundance of gadwall (*A. strepera*; 3.6 ± 0.2 million) was similar to the 2011 estimate and 96% above the long-term average. Estimated abundance of American wigeon (*A. americana*; 2.1 ± 0.1 million) was similar to the 2011 estimate and 17% below the long-term average. The estimated abundance of green-winged teal (*A. crecca*) was 3.5 ± 0.2 million, which was 20% above the 2011 estimate and 74% above their long-term average. The estimate of blue-winged teal abundance (*A. discors*) was 9.2 ± 0.4 million, which was similar to the 2011 estimate and 94% above their long-term average. The estimate for northern pintails (*A. acuta*; 3.5 ± 0.2 million) was 22% below the 2011 estimate, and 14% below the long-term average. The northern shoveler estimate (*A. clypeata*) was 5.0 ± 0.3 million, which was similar to the 2011 estimate and 111% above the long-term average. Redhead abundance (*Aythya americana*; 1.3 ± 0.1 million) was similar to the 2011 estimate and 89% above the long-term average. The canvasback estimate (*A. valisineria*; 0.8 ± 0.07 million) was similar to the 2011 estimate and 33% above the long-term average. Estimated abundance of scaup (*A. affinis* and *A. marila* combined; 5.2 ± 0.3 million) was 21% above the 2011 estimate and similar to the long-term average. Habitat conditions during the 2012 Waterfowl Breeding Population and Habitat Survey were characterized by average to below-average moisture, a mild winter, and an early spring across the southern portion of the traditional and eastern survey areas. Northern habitats of the survey areas generally received average moisture and temperatures. The total pond estimate (Prairie Canada and U.S. combined) was 5.5 ± 0.2 million. This was 32% below the 2011 estimate and 9% above the long-term average (1974–2011) of 5.1 ± 0.03 million ponds. The 2012 estimate of ponds in Prairie Canada was 3.9 ± 0.1 million. This was 21% below last year's estimate (4.9 ± 0.2 million) and 13% above the long-term average (1961–2011; 3.4 ± 0.03 million). The 2012 pond estimate for the north-central U.S. was 1.7 ± 0.1 million, which was 49% below last year's estimate (3.2 ± 0.1 million) and similar to the long-term (1974–2011) average. The projected mallard fall-flight index is 12.7 ± 1.2 million birds. The eastern survey area was restratified in 2005 and is now composed of strata 51–72. However, estimates are presented for only a portion of the eastern survey area and include data from strata 51, 52, 63, 64, 66–68, and 70–72. The American black duck (*Anas rubripes*) estimate was 0.6 ± 0.04 million, which was 11% higher than the 2011 estimate and similar to the long-term average (1990–2011). Estimated abundance of mallards in the eastern survey area was 0.4 ± 0.1 million, which was similar to the 2011 estimate and the long-term average. Abundance estimates of green-winged teal, ring-necked ducks (*Aythya collaris*), goldeneyes (common [*Bucephala clangula*] and Barrow's [*B. islandica*] combined), and mergansers (red-breasted [*Mergus serrator*], common [*M. merganser*], and hooded [*Lophodytes cucullatus*] combined) were all similar to their 2011 estimates and long-term averages.

This section summarizes the most recent information about the status of North American duck populations and their habitats to facilitate the development of harvest regulations. The annual status of these populations is assessed using the databases resulting from surveys which include estimates of the size of breeding populations and harvest. This report details abundance estimates; harvest survey results are discussed in separate reports. The data and analyses were the most current available when this report was written. Future analyses may yield

slightly different results as databases are updated and new analytical procedures become available.

Methods

Waterfowl Breeding Population and Habitat Survey

Federal, provincial, and state agencies conduct surveys each spring to estimate the size of breeding waterfowl populations and to evaluate habitat conditions. These surveys are conducted using airplanes and helicopters, and cover over 2.0 million square miles that encompass principal breeding areas of North America. The traditional survey area (strata 1–18, 20–50, and 75–77) comprises parts of Alaska, Canada, and the north-central U.S., and covers approximately 1.3 million square miles (Appendix B). The eastern survey area (strata 51–72) includes parts of Ontario, Quebec, Labrador, Newfoundland, Nova Scotia, Prince Edward Island, New Brunswick, New York, and Maine, covering an area of approximately 0.7 million square miles (Appendix B). In Prairie and Parkland Canada and the north-central U.S., aerial waterfowl counts are corrected annually for visibility bias by conducting ground counts along a portion of survey segments. In some northern regions of the traditional survey area, visibility corrections were derived from past helicopter surveys. In the eastern survey area, duck estimates are adjusted using visibility-correction factors derived from a comparison of airplane and helicopter counts. Annual estimates of duck abundance are available since 1955 for the traditional survey area and since 1996 for all strata (except 57–59 and 69) in the eastern survey area; however, some portions of the eastern survey area have been surveyed since 1990. In the traditional survey area, visibility-corrected estimates of pond abundance in Prairie Canada are available since 1961, and in the north-central U.S., since 1974. Several provinces and states also conduct breeding waterfowl surveys using various methods; some have survey designs that allow calculation of measures of precision for their estimates. Information about habitat conditions was supplied primarily by biologists working in the survey areas. Unless otherwise noted, z-tests were used for assessing statistical significance, with alpha level set at 0.1; P-values are given in tables along with wetland and waterfowl estimates.

Since 1990, the U.S. Fish & Wildlife Service (USFWS) has conducted aerial transect surveys using airplanes in portions of eastern Canada and the northeast U.S., similar to those in the mid-continent, in order to estimate waterfowl abundance. Additionally, the Canadian Wildlife Service (CWS) has conducted a helicopter-based aerial plot survey in core American black duck breeding regions of Ontario, Quebec, and the Atlantic Provinces. Historically, data from these surveys were analyzed separately, despite overlap in geographic areas of inference. In 2004, the USFWS and CWS agreed to integrate the two surveys, produce composite estimates from both sets of survey data, and expand the geographic scope of the survey in eastern North America. Consequently, as of 2005, waterfowl population sizes for eastern North America (strata 51–72) are estimated using a hierarchical-modeling approach that combines USFWS and CWS data (Zimmerman et al. 2012). In cases where the USFWS has traditionally not recorded observations to the species level (i.e., mergansers, goldeneyes), estimates were produced for multi-species groupings. While estimates were generated for all strata in the eastern survey area, survey-wide composite estimates presented in this report currently correspond only to strata 51, 52, 63, 64, 66–68, and 70–72. These strata contain either (1) both USFWS airplane survey transects and CWS helicopter plots or (2) only helicopter plots (strata 71 and 72).

For widely distributed and abundant species (American black ducks, mallards, green-winged teal, ring-necked ducks, goldeneyes and mergansers), composite estimates of population size were constructed using a hierarchical model (Zimmerman et al. 2012) which estimated the mean count per unit area surveyed for each stratum, year, and method (i.e., airplane or helicopter). These mean counts were then extrapolated to the area of each stratum to produce a stratum/year/method-specific population estimate. Estimates for the airplane surveys were

adjusted for visibility bias by multiplying them by the total CWS helicopter survey population estimates for all years divided by the total USFWS airplane survey population estimates for all years that the two surveys overlapped. For strata containing both CWS and USFWS surveys (51, 52, 63, 64, 66–68, and 70), USFWS estimates were adjusted for visibility by CWS plot estimates, and the CWS and adjusted USFWS estimates were then averaged to derive stratum-level estimates. In strata with only USFWS survey estimates (53, 54, 56–59, 62, 65, and 69), traditional visibility-correction factors were used. No visibility adjustments were made for strata with only CWS plots (71 and 72). For two species groups, goldeneyes and mergansers, for which there are many survey units with no observations, a zero-inflated Poisson distribution (Martin et al. 2005) was used to fit the model. Using this technique, the binomial probability of encountering the species on a transect or a plot is modeled separately. This modified modeling approach was not adequate for the following species that occur at lower densities and are more patchily distributed in the eastern survey area: scaup, scoters (black [*Melanitta americana*], white-winged [*M. fusca*], and surf [*M. perspicillata*]), bufflehead (*Bucephala albeola*), and American wigeon. In previous years, we used design-based estimates and an overall mean weighted by precision to derive integrated annual population indices until the hierarchical models could adequately analyze the data for these species. Due to concerns about (1) the appropriateness of weighting estimates from these surveys by their precision, and (2) whether estimates for some species should be integrated given the data quality and coverage in the eastern survey, we have discontinued deriving these estimates. We will continue to investigate methods that will allow us to estimate populations of these rarer species within the hierarchical-modeling framework.

To produce a consistent index for American black ducks, total indicated pairs are calculated using the CWS method of scaling observed pairs. The CWS scaling is based on sex-specific observations collected during the CWS survey in eastern Canada, which indicate that approximately 50% of black duck pair observations are actually two drakes. Thus, observed black duck pairs are scaled by 1.5 rather than the 1.0 scaling traditionally applied by the USFWS. These indicated pairs are then used to calculate indicated birds based on the USFWS protocol. For all other species, the USFWS definitions are used to calculate indicated pairs and indicated birds (see Zimmerman et al. (2012) for further details).

This model-based approach and changes in analytical procedures for some species may preclude comparisons of results from 2008 forward to those in previous reports. We anticipate additional refinements to the survey design and analysis for eastern North America during the coming years, and composite estimates are subject to change in the future.

Waterfowl Production and Habitat Survey

Since 2004, we have not had the traditional Waterfowl Production and Habitat Survey (conducted in July) to verify the early predictions of our biologists in the field. The production survey was discontinued due to budget constraints within the migratory bird program and because modern analytical procedures reduced the utility of brood indices produced by the survey. In this report, we present habitat conditions as recorded during the months of May and June at the time of the Waterfowl Breeding Population and Habitat Survey.

Total Duck Species Composition

In the traditional survey area, our estimate of total ducks excludes scoters, eiders (*Somateria* and *Polysticta* spp.), long-tailed ducks (*Clangula hyemalis*), mergansers, and wood ducks (*Aix sponsa*), because the traditional survey area does not include a large portion of their breeding ranges.

Mallard Fall-flight Index

The mallard fall-flight index is a prediction of the size of the fall abundance of mallards originating from the mid-continent region of North

America. For management purposes, the mid-continent population has historically been composed of mallards originating from the traditional survey area, as well as Michigan, Minnesota, and Wisconsin. However, as of 2008, the status of western mallards has been considered separately in setting regulations for the Pacific Flyway, and thus Alaska–Yukon mallards (strata 1–12) have been removed from the mid-continent stock. The fall-flight index is based on the mallard models used for adaptive harvest management and considers breeding population size, habitat conditions, adult summer survival, and the projected fall age ratio (young/adult). The projected fall age ratio is predicted from models that depict how age ratios vary with changes in spring population size and Canadian pond abundance. The fall-flight index represents a weighted average of the fall flights predicted by the four alternative models of mallard population dynamics used in adaptive harvest management (U.S. Fish and Wildlife Service 2012).

Review of Estimation Procedures

Since the inception of the Waterfowl Breeding Population and Habitat Survey in 1955, there have been continual modifications to the conduct of the survey and analysis of the data, but the last comprehensive review was completed more than 15 years ago (Smith 1995). During this time new analytical approaches, personnel, and equipment were put in place. In addition, environmental conditions and management needs have changed. Therefore, the USFWS has initiated a review of operational and analytical procedures. We are currently addressing several issues, including the delineation of survey strata, methods of variance estimation, visibility corrections, and population change detection. These analyses, along with results from related investigations, will entail some modification to the existing time series, so that new methods do not affect evaluation of long-term trends. We intend to implement improvements to our estimation procedures, and estimates presented in future reports will reflect updates made as a result of this review. In an effort to streamline and facilitate the regulations cycle and to expedite data requests from cooperators, we are also in the process of updating current data collection, storage, and access procedures.

Results and Discussion

2011 in Review

Habitat conditions during the 2011 Waterfowl Breeding Population and Habitat Survey were characterized by average to above-average moisture and a normal winter and spring across both the traditional and eastern survey areas. The exception was a portion of the west-central traditional survey area that had received below-average moisture. The total pond estimate (Prairie Canada and U.S. combined) was 8.1 ± 0.2 million. This was 22% above the 2010 estimate of 6.7 ± 0.2 million ponds, and 62% above the long-term average of 5.0 ± 0.03 million ponds. Conditions across the Canadian prairies in 2011 were greatly improved relative to 2010. Building on excellent conditions from 2010 in portions of southern Alberta, Saskatchewan and Manitoba, the area of excellent conditions in the prairies expanded, including a region along the Alberta and Saskatchewan border that had been poor for the last two years. The 2011 estimate of ponds in Prairie Canada was 4.9 ± 0.2 million. This was 31% above the 2010 estimate (3.7 ± 0.2 million) and 43% above the 1961–2010 average (3.4 ± 0.03 million). As expected, residual water from summer 2010 precipitation remained in the parklands and the majority of the area was classified as good. Fair-to-poor conditions, however, were observed in the parklands of Alberta.

In 2011, wetland numbers and conditions were excellent in the U.S. prairies. The 2011 pond estimate for the north-central U.S. was 3.2 ± 0.1 million, which was similar to the 2010 estimate (2.9 ± 0.1 million) and 102% above the 1974–2010 average (1.6 ± 0.02 million). The eastern U.S. prairies benefited from abundant moisture in 2010 and the entire U.S. prairies experienced above-average winter and spring precipitation in 2010 and 2011, resulting in good-to-excellent conditions across nearly the entire region. Conditions in the western Dakotas and

eastern Montana improved from fair to poor in 2010 to good to excellent in 2011. Further, the abundant moisture and delayed farming operations in the north-central U.S. and southern Canadian prairies likely benefited early-nesting waterfowl.

In the bush regions of the traditional survey area (Northwest Territories, northern Manitoba, northern Saskatchewan, and western Ontario), spring breakup was late in 2011. Habitats improved from 2010 across most of northern Saskatchewan and Manitoba as a result of average to above-average summer and fall precipitation in 2010. Habitat conditions in the Northwest Territories and Alaska were classified as good in 2011. Dry conditions in the boreal forest of Alberta in 2010 persisted into 2011 as habitat conditions were again rated as fair to poor.

In the eastern survey area, winter temperatures were above average and precipitation was below average over most of the region, with the exception of the Maritimes and Maine, which had colder-than-normal temperatures and above-average precipitation. The boreal forest and Canadian Maritimes of the eastern survey area continued to have good-to-excellent habitat conditions in 2011. Habitat conditions in Ontario and southern Quebec improved from poor to fair in 2010 to good to excellent. Northern sections of the eastern survey area continued to remain in good-to-excellent condition in 2011.

In the traditional survey area, which includes strata 1–18, 20–50, and 75–77, the 2011 total duck population estimate was 45.6 ± 0.8 million birds. This estimate was 11% higher than the 2010 estimate of 40.9 ± 0.7 million birds and was 35% above the long-term average (1955–2010). In the eastern Dakotas, total duck numbers were similar to the 2010 estimate and 172% above the long-term average. The total duck estimate in southern Alberta was 66% above the 2010 estimate and similar to the long-term average. The total duck estimate was 56% higher than in 2010 in southern Saskatchewan, and 43% above the long-term average. In southern Manitoba, the total duck population estimate was 41% higher than the 2010 estimate and similar to the long-term average. The total duck estimate in central and northern Alberta, northeastern British Columbia, and the Northwest Territories was 19% lower than 2010 and similar to the long-term average. The estimate in the northern Saskatchewan–northern Manitoba–western Ontario survey area was similar to the 2010 estimate and 30% below the long-term average. The total duck estimate in the western Dakotas–eastern Montana area was 59% above the 2010 estimate and 92% above the long-term average. In the Alaska–Yukon Territory–Old Crow Flats region the total duck estimate was 32% lower than 2010, and similar to the long-term average.

Several states and provinces conduct breeding waterfowl surveys in areas outside the geographic extent of the Waterfowl Breeding Population and Habitat Survey of the USFWS and CWS. In California, the northeast U.S., Oregon, and Wisconsin, measures of precision for survey estimates are available. In Oregon, the total duck estimate was 23% less than in 2010, and 40% below the long-term average (1994–2010). The total duck estimate in California was similar to the 2010 estimate and the long-term average (1992–2010). Wisconsin's total duck estimate was 33% above the 2010 estimate, and similar to its long-term average (1973–2010). The total breeding duck estimate in the northeast U.S. was similar to 2010 and the long-term average (1993–2010). Of the states without measures of precision for total duck numbers, the 2011 estimate of total ducks in Michigan was lower than in 2010, while total ducks in Minnesota were higher than in 2010. Total duck estimates increased in Washington from 2010, and decreased in Nevada.

In the traditional survey area, the 2011 estimated mallard abundance was 9.2 ± 0.3 million, which was 9% above the 2010 estimate of 8.4 ± 0.3 million, and 22% above the long-term average of 7.5 ± 0.04 million. Estimated abundance of gadwall (3.3 ± 0.2 million) was similar to the 2010 estimate and 80% above the long-term average (1.8 ± 0.02 million). The estimate for American wigeon (2.1 ± 0.1 million) was 14% below the 2010 estimate and 20% below the long-term average. The estimated abundance of green-winged teal was 2.9 ± 0.2 million, which was 17% below the 2010 estimate and 47% above

Table 1: Estimated number (in thousands) of May ponds in portions of Prairie and Parkland Canada and the north-central U.S.

			Change from 2011			Change from LTA	
Region	2012	2011	%	*P*	LTA[a]	%	*P*
Prairie & Parkland Canada							
S. Alberta	807	1,086	-26	0.007	745	+8	0.215
S. Saskatchewan	2,678	3,151	-15	0.029	2,033	+32	<0.001
S. Manitoba	401	656	-39	<0.001	669	-40	<0.001
Subtotal	3,885	4,893	-21	<0.001	3,448	+13	0.003
North-central U.S.							
Montana & western Dakotas	428	969	-56	<0.001	563	-24	<0.001
Eastern Dakotas	1,231	2,271	-46	<0.001	1,088	+13	0.003
Subtotal	1,659	3,239	-49	<0.001	1,651	+1	0.879
Total	5,544	8,132	-32	<0.001	5,088	+9	0.004

[a] Long-term average. Prairie and Parkland Canada, 1961–2011; north-central U.S. and Total, 1974–2011.

the long-term average. The estimate of blue-winged teal abundance was 8.9 ± 0.4 million, which was 41% and 91% above the 2010 estimate and the long-term average, respectively. The estimate for northern pintails (4.4 ± 0.3 million) was 26% above the 2010 estimate of 3.5 ±0.2 million and similar to the long-term average. The northern shoveler estimate was 4.6 ± 0.2 million which was 14% above the 2010 estimate and 98% above the long-term average. Redhead abundance (1.4 ± 0.1 million) was 27% above the 2010 estimate and 106% above the long-term average. The canvasback estimate (0.7 ± 0.05 million) was similar to the 2010 estimate and 21% above the long-term average. Estimated abundance of scaup (4.3 ± 0.3 million) was similar to that of 2010 and 15% below the long-term average of 5.1 ± 0.05 million. In the eastern survey area, estimated abundance of mallards was 0.4 ± 0.1 million, which was similar to the 2010 estimate and the long-term average. We note that this value for mallards in the eastern survey is a composite estimate of CWS and USFWS data in several Canadian strata and Maine, and is not comparable to the eastern mallard estimate used for AHM (U.S. Fish and Wildlife Service 2012), which is based on data from northeastern U.S. plot surveys and USFWS transect data from strata 51–54 and 56. The estimated abundance of American black ducks was 0.5 ± 0.04 million, which was similar to the 2010 estimate and 13% below the long-term average of 0.63 million. Abundance estimates for goldeneyes, green-winged teal, and mergansers were similar to 2010 estimates and their 1990–2010 averages.

2012 Breeding Populations and Habitat Conditions

Overall Habitat and Population Status

Habitat conditions during the 2012 Waterfowl Breeding Population and Habitat Survey were characterized by average to below-average moisture, a mild winter, and an early spring across the southern portion of the traditional and eastern survey areas. Northern habitats of the traditional and eastern survey areas generally received average moisture and temperatures. The total pond estimate (Prairie Canada and U.S. combined) was 5.5 ± 0.2 million (Table 1, Figure 1, Appendix C.1). This was 32% below the 2011 estimate of 8.1 ± 0.2 million ponds, and 9% above the long-term average of 5.1 ± 0.03 million ponds. Conditions across the Canadian prairies declined relative to 2011. Residual moisture from prior years benefited more permanent wetlands of the coteau in Saskatchewan and near the Saskatchewan and Manitoba border, but temporary wetlands retained little moisture owing to a shallow

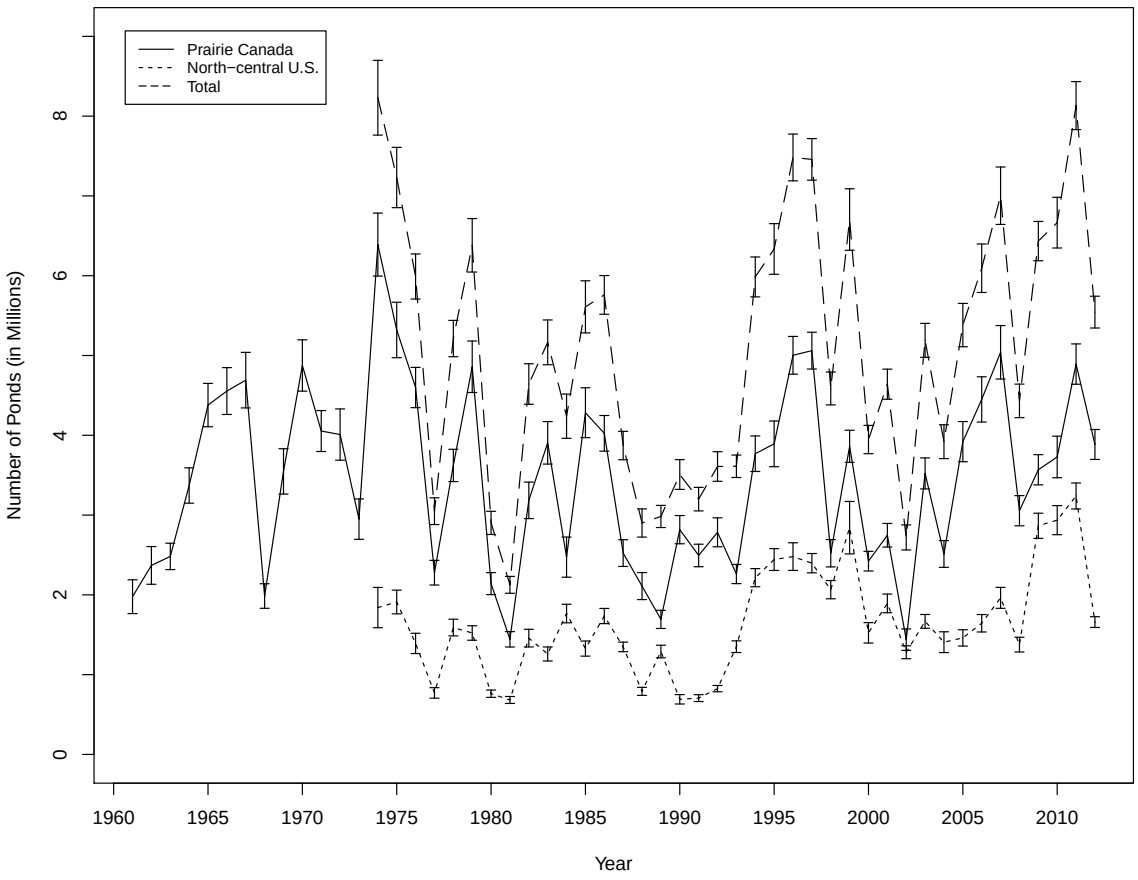

Figure 1: Number of ponds in May and 90% confidence intervals in Prairie Canada and the north-central U.S.

frost seal and below-average precipitation. The 2012 estimate of ponds in Prairie Canada was 3.9 ± 0.1 million. This was 21% below last year's estimate (4.9 ± 0.2 million) and 13% above the 1961–2011 average (3.4 ± 0.03 million). Much of the parkland was classified as good; however, habitat conditions declined westward toward Alberta. Following the completion of the survey, the Canadian prairies received above-average precipitation, which may improve habitat conditions for late-nesting waterfowl, renesting attempts, and brood rearing.

Significant declines in wetland numbers and conditions occurred in the U.S. prairies during 2012. The 2012 pond estimate for the north-central U.S. was 1.7 ± 0.1 million, which was 49% below last year's estimate (3.2 ± 0.1 million) and similar to the 1974–2011 average. Nearly all of the north-central U.S. was rated as good to excellent in 2011; however, only the coteau of North and South Dakota was rated as good in 2012, and no areas were rated as excellent this year. Drastic wetland declines in western South Dakota and Montana resulted in mostly poor-to-fair habitat conditions. In the bush regions of the traditional survey area (Alaska, Yukon, Northwest Territories, northern Alberta, northern Manitoba, northern Saskatchewan, and western Ontario), spring breakup was slightly early in 2012. Average to above-average annual precipitation over much of the bush and ice-free habitats benefited arriving waterfowl. Drier conditions were observed in northern Alberta and Saskatchewan and habitat was classified as fair. A similar trend was noted in western Ontario where habitat conditions declined from excellent in 2011 to good in 2012.

Most of the eastern survey area had mild

Table 2: Total duck[a] breeding population estimates (in thousands) for regions in the traditional survey area and other regions.

			Change from 2011			Change from LTA	
Region	2012	2011	%	*P*	LTA[b]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	4,455	3,756	+19	0.004	3,689	+21	<0.001
C. & N. Alberta–N.E. British Columbia–NWT	8,799	7,095	+24	0.001	7,119	+24	<0.001
N. Saskatchewan–N. Manitoba–W. Ontario	2,754	2,439	+13	0.181	3,490	-21	<0.001
S. Alberta	4,845	4,372	+11	0.081	4,242	+14	0.003
S. Saskatchewan	11,318	10,681	+6	0.202	7,551	+50	<0.001
S. Manitoba	1,538	1,554	-1	0.896	1,528	+1	0.925
Montana & Western Dakotas	2,467	3,135	-21	0.017	1,659	+49	<0.001
Eastern Dakotas	12,400	12,523	-1	0.852	4,737	+162	<0.001
Total	48,575	45,554	+7	0.006	34,015	+43	<0.001
Other regions							
California	525	559	−6	0.673	589	−11	0.276
Northeast U.S.[c]	1,310	1,265	+4	0.735	1,395	−6	0.387
Oregon	276	169	+63	< 0.001	276	0	0.988
Wisconsin	521	514	+1	0.103	440	+18	0.129

[a] Includes 10 species in Appendix A plus American black duck, ring-necked duck, goldeneyes, bufflehead, and ruddy duck (*Oxyura jamaicensis*); excludes eiders, long-tailed duck, scoters, mergansers, and wood duck.
[b] Long-term average for regions in the traditional survey area, 1955–2011; years for other regions vary (see Appendix C.2)
[c] Includes all or portions of CT, DE, MD, MA, NH, NJ, NY, PA, RI, VT, and VA.

winter temperatures with below-average precipitation, although northern survey areas in Labrador, Newfoundland and eastern Quebec experienced more normal conditions, with some areas receiving heavy snowfall. While habitat quality declined overall relative to 2011, good conditions persisted over the majority of the eastern survey area. Exceptions were northwestern Quebec, northern Maine, and New Brunswick where, despite an early spring, inadequate precipitation caused wetland conditions to deteriorate.

In the traditional survey area, which includes strata 1–18, 20–50, and 75–77, the total duck population estimate was 48.6 ± 0.8 [SE] million birds. This represents a 7% increase over last year's estimate of 45.6 ± 0.8 million, and is 43% higher than the long-term average (1955–2011; Table 2, Appendix C.4). In the eastern Dakotas, total duck numbers were similar to the 2011 estimate and 162% above the long-term average. The total duck estimate in southern Alberta was 11% above last year's estimate and 14% higher than the long-term average. The total duck estimate was similar to 2011 in southern Saskatchewan, and 50% above the long-term average. In southern Manitoba, the total duck population estimate was similar to last year's estimate and the long-term average. The total duck estimate in central and northern Alberta, northeastern British Columbia, and the Northwest Territories was 24% higher than both last year's estimate and the long-term average. The estimate in the northern Saskatchewan–northern Manitoba–western Ontario survey area was similar to the 2011 estimate and 21% below the long-term average. The total duck estimate in the western Dakotas–eastern Montana area was 21% below the 2011 estimate and 49%

above the long-term average. In the Alaska–Yukon Territory–Old Crow Flats region the total duck estimate was 19% higher than last year, and 21% above the long-term average.

Several states and provinces conduct breeding waterfowl surveys in areas outside the geographic extent of the Waterfowl Breeding Population and Habitat Survey of the USFWS and CWS (Appendix C.2). In California, the northeast U.S., Oregon, and Wisconsin, measures of precision for survey estimates are available (Table 2). In Oregon, the total duck estimate was 63% higher than in 2011, and similar to the long-term average (1994–2011). The total duck estimate in California was similar to the 2011 estimate and the long-term average. Wisconsin's total duck estimate was similar to the 2011 estimate and its long-term average. The total breeding duck estimate in the northeast U.S. was similar to 2011 and the long-term average. Of the states without measures of precision for total duck numbers, the 2012 estimate of total ducks in Michigan was higher than in 2011, while total ducks in Minnesota were lower than in 2011. Total duck estimates increased in Washington from 2011, and increased in Nevada (see Regional Habitat and Population Status section for estimates).

Trends and annual breeding population estimates for 10 principal duck species from the traditional survey area are provided in this report (Tables 3–12, Figure 2, Appendix C.3). Percent change was computed prior to rounding and therefore may not match calculations that use the rounded estimates presented in the tables and text. The mallard estimate in the traditional survey area was 10.6 ± 0.3 million birds, which was 15% above the 2011 estimate of 9.2 ± 0.3 million birds and 40% above the long-term average (Table 3). In the eastern Dakotas, the mallard estimate was similar to last year's count, and 161% above the long-term average. The mallard estimate in southern Alberta was 34% above last year's and was 18% above the long-term average. In the eastern Montana–western Dakotas survey area, mallard counts were similar to the 2011 estimate and 56% higher than the long-term average. In the central and northern Alberta–northeastern British Columbia–Northwest Territories region the mallard estimate was 59% higher than 2011 and 44% higher than the long-term average. In the northern Saskatchewan–northern Manitoba–western Ontario survey area, the mallard estimate was similar to that of 2011 and the long-term average. Mallard numbers were similar to the 2011 estimate and 35% higher than their long-term average in the Alaska–Yukon Territory–Old Crow Flats region. In the southern Manitoba survey area, the mallard estimate was 23% below last year's and similar to the long-term average. In southern Saskatchewan, mallard numbers were 20% above last year and 22% above the long-term average. In the eastern survey area, Estimated abundance of mallards was 0.4 ± 0.1 million, which was similar to the 2011 estimate and the long-term average (Table 13). We note that this value for mallards in the eastern survey is a composite estimate of CWS and USFWS data in several Canadian strata and Maine, and is not comparable to the eastern mallard estimate used for AHM (U.S. Fish and Wildlife Service 2012), which is based on data from northeastern U.S. plot surveys and USFWS transect data from strata 51–54 and 56.

Mallard abundance with estimates of precision are also available for other areas where surveys are conducted (California, Nevada, Oregon, Wisconsin, the northeast U.S., as well as Michigan and Minnesota). Mallard numbers in California were similar to last year and the long-term average. The mallard estimate in Nevada was higher than in 2011. In Wisconsin, mallards were similar to last year and the long-term average. The mallard estimate in Oregon was 42% higher than 2011, and similar to the long-term average. The mallard estimate was similar to the 2011 estimate in the northeast U.S., but was 19% below the long-term average. In Michigan, the 2012 mallard estimate was similar to the 2011 estimate and the long-term average. In Minnesota, the 2012 mallard estimate was similar to last year's estimate. In Washington, mallards increased relative to 2011.

In the traditional survey area the estimate of blue-winged teal (9.2 ± 0.4 million) was similar to the 2011 estimate and 94% above the long-

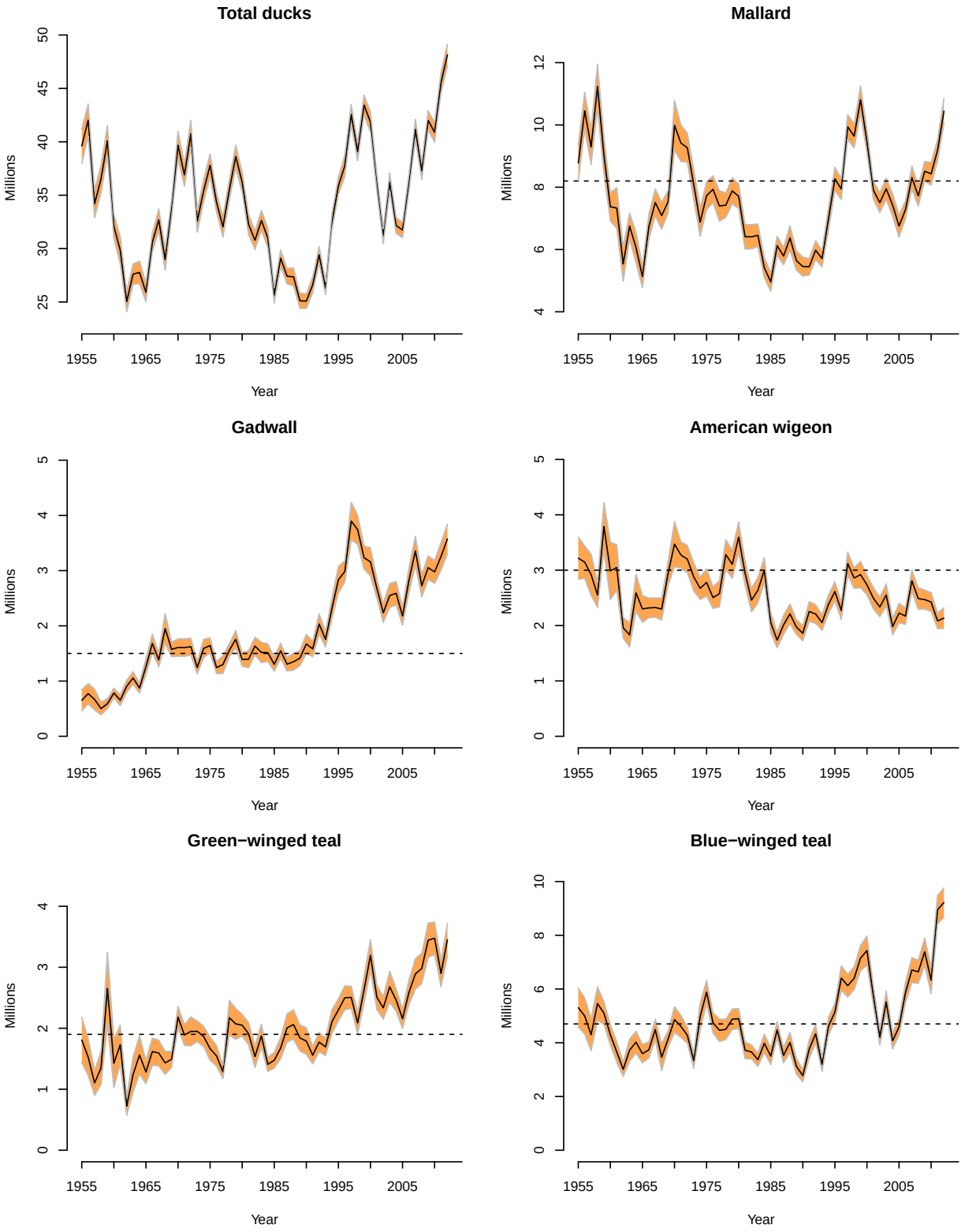

Figure 2: Breeding population estimates, 90% confidence intervals, and North American Waterfowl Management Plan population goals (dashed line) for selected species in the traditional survey area (strata 1–18, 20–50, 75–77), and midwinter counts of American black duck.

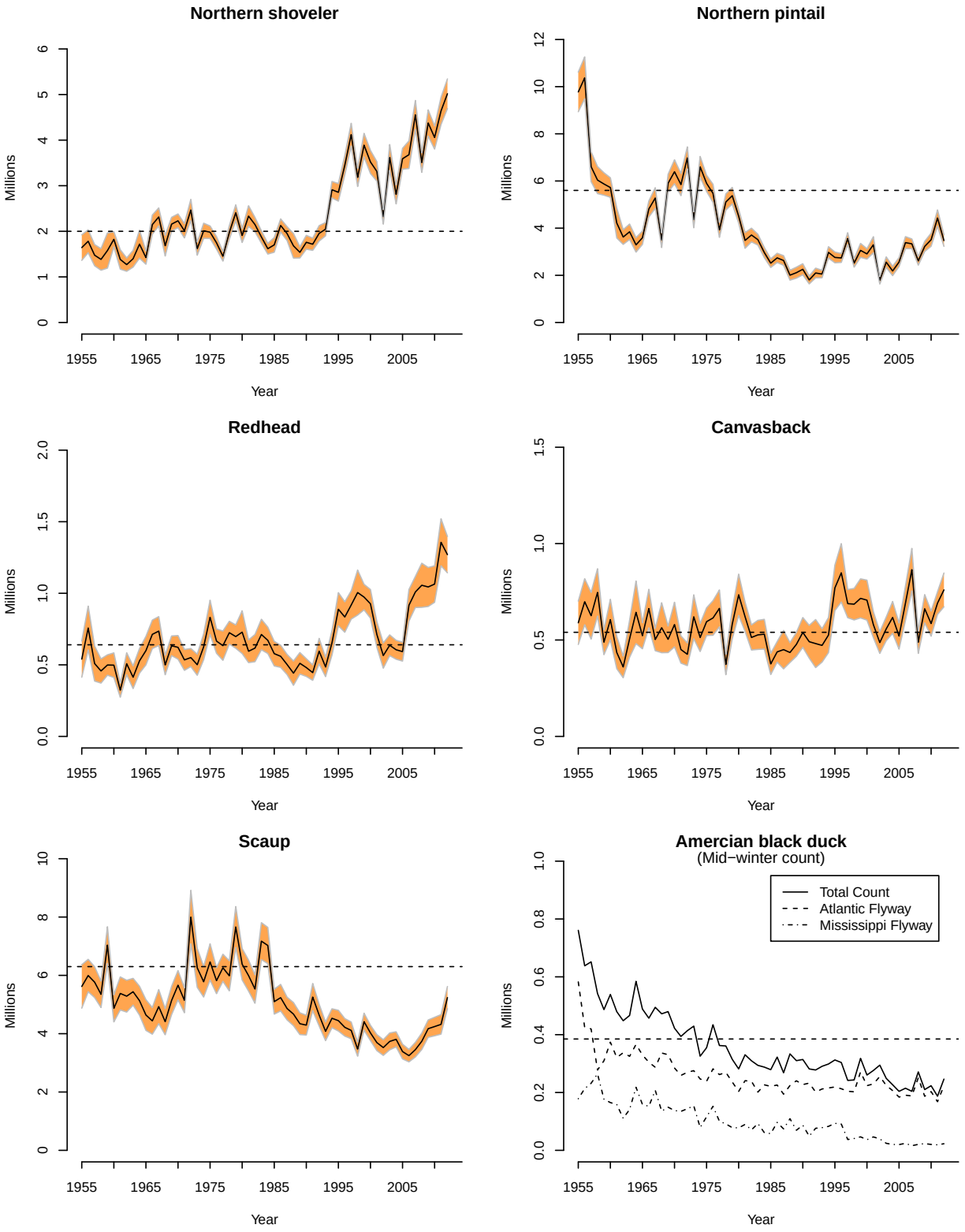

Figure 2: Continued.

Table 3: Mallard breeding population estimates (in thousands) for regions in the traditional and eastern survey areas, and other regions.

			Change from 2011			Change from LTA	
Region	2012	2011	%	*P*	LTA[a]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	506	416	+22	0.162	375	+35	0.011
C. & N. Alberta–N.E. British Columbia–NWT	1,547	975	+59	<0.001	1,077	+44	<0.001
N. Saskatchewan–N. Manitoba–W. Ontario	1,039	828	+25	0.277	1,127	-8	0.608
S. Alberta	1,261	939	+34	0.003	1,069	+18	0.029
S. Saskatchewan	2,502	2,093	+20	0.032	2,057	+22	0.001
S. Manitoba	401	521	-23	0.086	383	+5	0.700
Montana & Western Dakotas	793	837	-5	0.688	507	+56	0.002
Eastern Dakotas	2,554	2,574	-1	0.929	980	+161	<0.001
Total	10,602	9,183	+15	0.001	7,574	+40	<0.001
Eastern survey area	395	410	−4	−−[b]	385	+3	−−[b]
Other regions							
California	382	315	+21	0.337	365	+5	0.756
Michigan	439	259	+70	0.302	358	+23	0.633
Minnesota	225	283	−21	0.383	226	−1	0.979
Northeast U.S.[c]	613	586	+5	0.668	755	−19	0.003
Oregon	96	68	+42	0.001	101	−4	0.579
Wisconsin	197	188	+5	0.801	183	+8	0.610

[a] Long-term average. Traditional survey area 1955–2011; eastern survey area 1990–2011; years for other regions vary (see Appendix C.2).
[b] *P*-values not provided because these data were analyzed with Bayesian methods.
[c] Includes all or portions of CT, DE, MD, MA, NH, NJ, NY, PA, RI, VT, and VA.

term average of 4.8 ± 0.04 million. The estimated abundance of gadwall (3.6 ± 0.2 million) was similar to the 2011 estimate and 96% above the long-term average (1.8 ± 0.02 million). The estimate for American wigeon (2.1 ± 0.1 million) was similar to the 2011 estimate and 17% below the long-term average of 2.6 ± 0.02 million. The estimated abundance of green-winged teal was 3.5 ± 0.2 million, which was 20% above the 2011 estimate and 74% above the long-term average (2.0 ± 0.02 million). The northern shoveler estimate (5.0 ± 0.3 million) was similar to the 2011 estimate and 111% above the long-term average of 2.4 ± 0.02 million. The estimate for northern pintails (3.5 ± 0.2 million) was 22% below the 2011 estimate of 4.4 ± 0.3 million and 14% below the long-term average of 4.0 ± 0.04 million. The estimated abundance of redheads (1.3 ± 0.1 million) and canvasbacks (0.8 ± 0.07 million) were similar to their 2011 estimates and were 89% and 33% above their long-term averages of 0.7 ± 0.01 million and 0.6 ± 0.01 million, respectively. Estimated abundance of scaup (5.2 ± 0.3 million) was 21% above the 2011 estimate and similar to the long-term average of 5.0±0.05 million. In the eastern survey area, abundance estimates for goldeneyes, green-winged teal, ring-necked ducks, and mergansers were similar to last year's estimates and their 1990–2011 averages (Table 13, Figure 3, Appendix C.5).

The longest time series of data available to assess the status of the American black duck is provided by the midwinter surveys conducted

Table 4: Gadwall breeding population estimates (in thousands) for regions in the traditional survey area.

			Change from 2011			Change from LTA	
Region	2012	2011	%	*P*	LTA[a]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	1	1	-53	0.633	2	-68	0.041
C. & N. Alberta–N.E. British Columbia–NWT	56	41	+37	0.313	51	+10	0.667
N. Saskatchewan–N. Manitoba–W. Ontario	31	33	-6	0.829	26	+17	0.489
S. Alberta	378	347	+9	0.649	316	+20	0.245
S. Saskatchewan	1,144	1,020	+12	0.385	612	+87	<0.001
S. Manitoba	113	92	+22	0.506	71	+58	0.115
Montana & Western Dakotas	254	470	-46	0.010	206	+23	0.275
Eastern Dakotas	1,609	1,253	+28	0.107	549	+193	<0.001
Total	3,586	3,257	+10	0.252	1,833	+96	<0.001

[a] Long-term average, 1955–2011.

Table 5: American wigeon breeding population estimates (in thousands) for regions in the traditional survey area.

			Change from 2011			Change from LTA	
Region	2012	2011	%	*P*	LTA[a]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	686	621	+10	0.407	551	+25	0.024
C. & N. Alberta–N.E. British Columbia–NWT	680	650	+5	0.831	891	-24	0.075
N. Saskatchewan–N. Manitoba–W. Ontario	130	126	+3	0.912	238	-45	<0.001
S. Alberta	234	200	+17	0.485	283	-17	0.212
S. Saskatchewan	243	281	-14	0.470	410	-41	<0.001
S. Manitoba	5	5	+1	0.977	56	-91	<0.001
Montana & Western Dakotas	85	92	-7	0.820	111	-23	0.177
Eastern Dakotas	81	109	-26	0.228	54	+49	0.099
Total	2,145	2,084	+3	0.738	2,594	-17	0.002

[a] Long-term average, 1955–2011.

Table 6: Green-winged teal breeding population estimates (in thousands) for regions in the traditional survey area.

			Change from 2011			Change from LTA	
Region	2012	2011	%	*P*	LTA[a]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	705	641	+10	0.484	399	+77	<0.001
C. & N. Alberta–N.E. British Columbia–NWT	1,567	1,251	+25	0.150	789	+99	<0.001
N. Saskatchewan–N. Manitoba–W. Ontario	136	126	+7	0.752	203	-33	0.003
S. Alberta	274	275	0	0.986	197	+39	0.091
S. Saskatchewan	497	422	+18	0.401	257	+93	<0.001
S. Manitoba	157	55	+185	0.001	51	+206	<0.001
Montana & Western Dakotas	19	19	0	0.995	42	-55	0.002
Eastern Dakotas	117	110	+6	0.861	53	+122	0.014
Total	3,471	2,900	+20	0.034	1,991	+74	<0.001

[a] Long-term average, 1955–2011.

Table 7: Blue-winged teal breeding population estimates (in thousands) for regions in the traditional survey area.

			Change from 2011			Change from LTA	
Region	2012	2011	%	*P*	LTA[a]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	0	1	-100	0.332	1	-100	<0.001
C. & N. Alberta–N.E. British Columbia–NWT	147	144	+2	0.960	273	-46	<0.001
N. Saskatchewan–N. Manitoba–W. Ontario	51	31	+66	0.333	245	-79	<0.001
S. Alberta	596	470	+27	0.217	608	-2	0.891
S. Saskatchewan	2,608	2,489	+5	0.686	1,309	+99	<0.001
S. Manitoba	327	393	-17	0.360	375	-13	0.360
Montana & Western Dakotas	661	894	-26	0.220	278	+138	0.003
Eastern Dakotas	4,853	4,526	+7	0.480	1,673	+190	<0.001
Total	9,242	8,948	+3	0.622	4,762	+94	<0.001

[a] Long-term average, 1955–2011.

Table 8: Northern shoveler breeding population estimates (in thousands) for regions in the traditional survey area.

			Change from 2011			Change from LTA	
Region	2012	2011	%	*P*	LTA[a]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	377	322	+17	0.325	289	+30	0.049
C. & N. Alberta–N.E. British Columbia–NWT	275	133	+107	0.065	219	+26	0.433
N. Saskatchewan–N. Manitoba–W. Ontario	11	7	+61	0.457	40	-72	<0.001
S. Alberta	915	878	+4	0.786	395	+131	<0.001
S. Saskatchewan	1,858	1,496	+24	0.044	713	+160	<0.001
S. Manitoba	138	148	-7	0.720	109	+26	0.278
Montana & Western Dakotas	341	430	-21	0.496	160	+112	0.068
Eastern Dakotas	1,104	1,227	-10	0.541	457	+142	<0.001
Total	5,018	4,641	+8	0.275	2,383	+111	<0.001

[a] Long-term average, 1955–2011.

Table 9: Northern pintail breeding population estimates (in thousands) for regions in the traditional survey area.

			Change from 2011			Change from LTA	
Region	2012	2011	%	*P*	LTA[a]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	1,176	746	+58	0.004	927	+27	0.046
C. & N. Alberta–N.E. British Columbia–NWT	79	121	-35	0.229	363	-78	<0.001
N. Saskatchewan–N. Manitoba–W. Ontario	16	10	+59	0.481	38	-58	0.006
S. Alberta	357	655	-45	0.003	685	-48	<0.001
S. Saskatchewan	605	1,106	-45	<0.001	1,165	-48	<0.001
S. Manitoba	22	38	-43	0.053	104	-79	<0.001
Montana & Western Dakotas	244	279	-12	0.616	263	-7	0.657
Eastern Dakotas	974	1,473	-34	0.033	494	+97	<0.001
Total	3,473	4,429	-22	0.004	4,038	-14	0.004

[a] Long-term average, 1955–2011.

Table 10: Redhead breeding population estimates (in thousands) for regions in the traditional survey area.

			Change from 2011			Change from LTA	
Region	2012	2011	%	*P*	LTA	%	*P*
Alaska–Yukon Territory–Old Crow Flats	0	1	-100	0.339	2	-100	<0.001
C. & N. Alberta–N.E. British Columbia–NWT	16	15	+10	0.830	40	-59	<0.001
N. Saskatchewan –N. Manitoba–W. Ontario	19	17	+17	0.710	26	-26	0.217
S. Alberta	183	167	+10	0.716	123	+50	0.079
S. Saskatchewan	383	438	-13	0.476	210	+82	<0.001
S. Manitoba	99	65	+52	0.199	73	+36	0.189
Montana & Western Dakotas	20	40	-49	0.152	11	+85	0.283
Eastern Dakotas	549	614	-11	0.617	188	+192	<0.001
Total	1,270	1,356	-6	0.595	672	+89	<0.001

[a] Long-term average, 1955–2011.

Table 11: Canvasback breeding population estimates (in thousands) for regions in the traditional survey area.

			Change from 2011			Change from LTA	
Region	2012	2011	%	*P*	LTA[a]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	35	22	+56	0.314	88	-60	<0.001
C. & N. Alberta–N.E. British Columbia–NWT	93	51	+81	0.174	75	+24	0.532
N. Saskatchewan– N. Manitoba–W. Ontario	27	31	-12	0.734	53	-49	0.005
S. Alberta	146	33	+339	<0.001	64	+127	0.003
S. Saskatchewan	313	335	-7	0.719	191	+64	0.016
S. Manitoba	52	68	-22	0.227	56	-6	0.694
Montana & Western Dakotas	10	17	-39	0.479	9	+15	0.788
Eastern Dakotas	84	135	-38	0.076	37	+125	0.010
Total	760	692	+10	0.407	573	+33	0.007

[a] Long-term average, 1955–2011.

Table 12: Scaup (greater and lesser combined) breeding population estimates (in thousands) for regions in the traditional survey area.

			Change from 2011			Change from LTA	
Region	2012	2011	%	*P*	LTA[a]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	849	847	0	0.987	920	-8	0.423
C. & N. Alberta–N.E. British Columbia–NWT	2,839	2,165	+31	0.049	2,531	+12	0.236
N. Saskatchewan–N. Manitoba–W. Ontario	338	367	-8	0.666	565	-40	<0.001
S. Alberta	294	228	+29	0.343	337	-13	0.327
S. Saskatchewan	521	347	+50	0.065	405	+29	0.156
S. Manitoba	102	85	+20	0.648	128	-20	0.448
Montana & Western Dakotas	18	38	-53	0.011	50	-65	<0.001
Eastern Dakotas	277	242	+14	0.595	108	+155	0.001
Total	5,239	4,319	+21	0.020	5,045	+4	0.520

[a] Long-term average, 1955–2011.

in January in states of the Atlantic and Mississippi flyways. Measures of precision are not available for the midwinter surveys (Figure 2). In 2012, the total midwinter count of American black ducks in both flyways combined was 246,300, which was 8% above the most recent 10-year average (2002–2011) of 228,500. In the Atlantic Flyway, the 2012 black duck midwinter index was 223,500, which was 9% above the flyway's 10-year average of 205,800. In the Mississippi Flyway, the black duck midwinter index in 2012 was 22,800, which was 12% below the 10-year flyway average of 25,900. Another time series for assessing changes in American black duck population status is provided by the breeding waterfowl surveys conducted by the USFWS and CWS in the eastern survey area (Table 13, Figure 3). The American black duck estimate in the eastern survey area was 603,000, 11% higher than the 2011 estimate of 544,000 and similar to the 1990–2011 average of 622,000. Black duck population estimates for northeast states from New Hampshire south to Virginia are available from the Atlantic Flyway Breeding Waterfowl Survey. The estimate from the 2012 survey (28,600) was not significantly different from the 2011 estimate (38,700) but was 55% below the 1993–2011 average (63,700).

Trends in wood duck populations are available from the North American Breeding Bird Survey (BBS). The BBS, a series of roadside routes surveyed during May and June each year, provides the only long-term range-wide breeding population index for this species. Wood ducks are encountered with low frequency along BBS routes, which limits the amount and quality of available information (Sauer and Droege 1990). However, hierarchical analysis of these data (J. Sauer, U.S. Geological Survey/Biological Resources Division, unpublished data) incorporated adjustments for spatial and temporal variation in BBS route quality, observer skill, and other factors that may affect detectability (Link and Sauer 2002). This analysis also produces annual abundance indices and measures of variance (95% credible intervals), in addition to the trend estimates (average % per year) and associated 95% credible intervals presented here. In the Atlantic and Mississippi flyways combined, the BBS wood duck index increased by an average of 1.8% (UCL 2.3%, LCL 1.2%) per year over the entire survey period (1966–2011), 2.4% (UCL 3.1%, LCL 1.6%) over the past 20 years (1992–2011), and 2.5% (UCL 3.8%, LCL 1.2%) over the most recent (2002–2011) 10-year period. The Atlantic Flyway wood duck index increased by an average of 1.4% (UCL 2.2%,

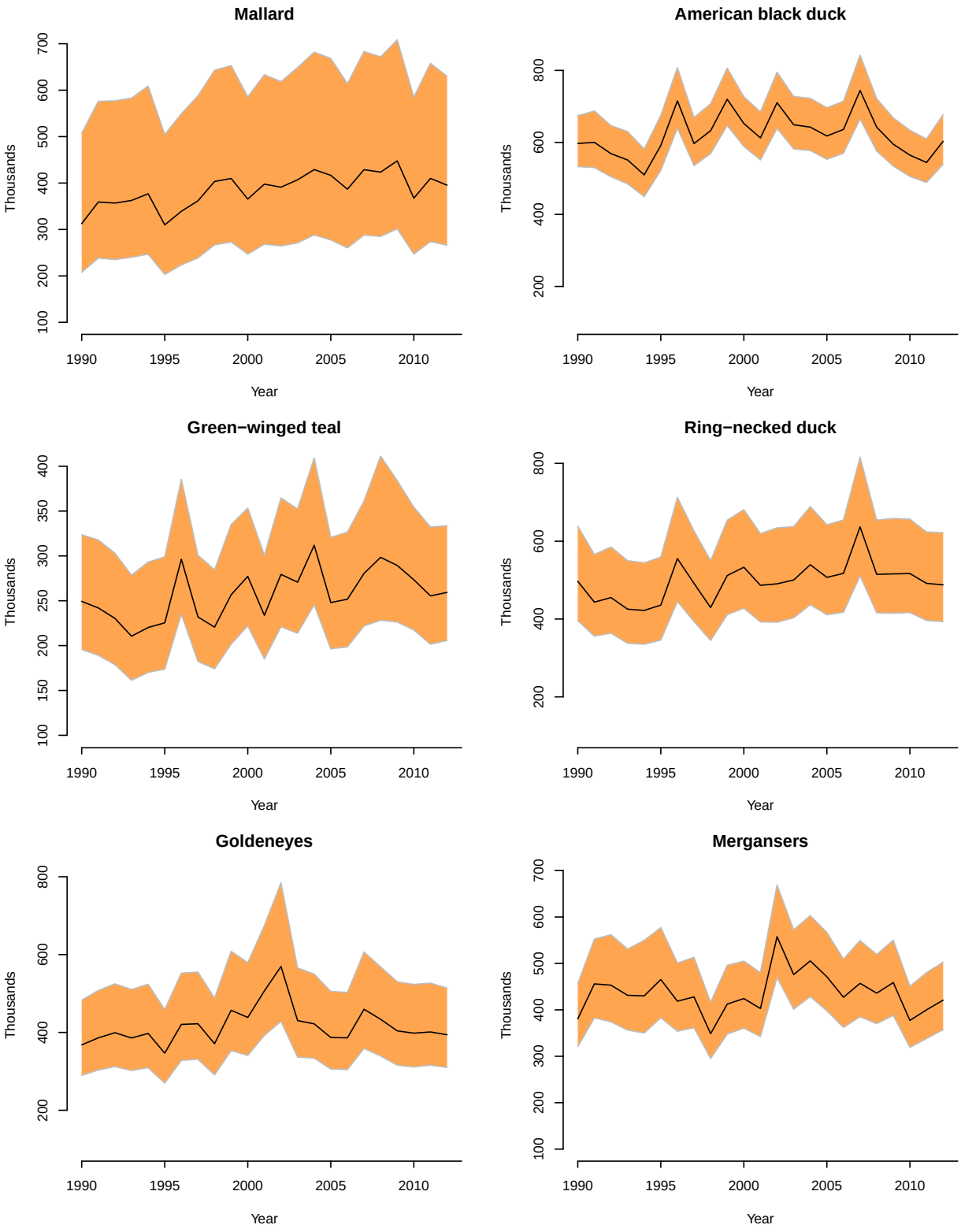

Figure 3: Breeding population estimates and 90% credible intervals from Bayesian hierarchical models for species in the eastern survey area (strata 51, 52, 63, 64, 66–68, 70–72).

Table 13: Duck breeding population estimates[a] (in thousands) for 6 most abundant species in the eastern survey area.

Species	2012	2011	% Change from 2011	Average[b]	% Change from average
Mallard	395	410	-4	385	+3
American black duck	603	544	+11[c]	622	-3
Green-winged teal	259	256	+1	257	+1
Ring-necked duck	488	492	-1	496	-2
Goldeneyes (common and Barrow's)	394	401	-2	418	-6
Mergansers (common, red-breasted, and hooded)	421	400	+5	437	-4

[a] Estimates from Bayesian hierarchical analysis using USFWS and CWS data from strata 51, 52, 63, 64, 66–68, 70–72.
[b] Average for 1990–2011.
[c] Indicates significant change. Significance determined by non-overlap of Bayesian credibility intervals with zero.

LCL 0.7%) annually over the entire time series (1966–2011), by 2.4% (UCL 3.6%, LCL 1.3%) over the past 20 years (1992–2011), and by 2.6% (UCL 4.8%, LCL 0.5%) from 2002 to 2011. In the Mississippi Flyway, the corresponding BBS wood duck indices increased by 1.9% (UCL 2.7%, LCL 1.2%, 1966–2011), 2.3% (UCL 3.3%, LCL 1.3%, 1992–2011), and 2.5% (UCL 4.1%, LCL 0.8%, 2002–2011; J. Sauer, U.S. Geological Survey/Biological Resources Division, unpublished data). An independent wood duck population estimate is available for the northeast states from New Hampshire south to Virginia, from the Atlantic Flyway Breeding Waterfowl Survey. The estimate from the 2012 survey (418,900) was 9% above the 2011 estimate (382,700) and 10% above the 1993–2011 average (378,200).

Regional Habitat and Population Status

A description of habitat conditions and duck populations for each of the major breeding areas follows. In the past this information was taken from more detailed reports of specific regions available under Waterfowl Breeding Population Surveys, Field Crew Reports located on the Division of Migratory Bird Management's Web site on the Publications page http://www.fws.gov/migratorybirds/NewReportsPublications/WPS.html). Although these reports are no longer produced, habitat and population status for each region will continue to be summarized here. More detailed information on regional waterfowl and habitat conditions during the May waterfowl survey is also available on the flyways.us website (http://www.flyways.us/status-of-waterfowl).

Southern Alberta (strata 26–29, 75–76)

The majority of southern Alberta experienced a warmer and drier winter and spring in 2011–2012. Temperatures averaged as much as 5°C above normal and precipitation ranged from 40% to 85% of normal. An exception was an area southwest of Slave Lake that received near-normal precipitation. There was a substantial decrease in the number of shallower, seasonal wetlands in the short grass prairie region, particularly in the eastern and southeastern portions of Alberta. Portions of the prairie near the Milk River Ridge and extreme western edge had better wetland conditions. Water levels were lower but larger, semi-permanent and permanent wetland basins fared better than seasonal wetlands. Wetland conditions in the aspen parklands declined from 2011; however, from Lloydminster northward into the Cold Lake region an area of good conditions existed. The Peace River region is still experiencing dry conditions, although wetlands were slightly improved from last year. Some April storms did assist in recharging wetlands across the region.

Overall, in southern Alberta May ponds were 26% lower than the 2011 estimate and similar

to the long-term average. The total duck estimate was 11% higher than 2011 and 14% higher than the long-term average. The mallard estimate was 34% higher than 2011, and 18% higher than the long-term average. Blue-winged teal, gadwall, and American wigeon were all similar to their 2011 estimates and their long-term averages. The green-winged teal estimate was similar to last year but 39% above the long-term average. The northern shoveler estimate was similar to 2011 and 131% above the long-term average. Northern pintails were 45% lower than 2011 and 48% lower than the long-term average. Redheads were similar to 2011 and 50% higher than their long-term average. Canvasback were 339% higher than 2011 and 127% higher than their long-term average. Scaup estimates were similar to last year and their long-term average.

Southern Saskatchewan (strata 30–33)

Habitat conditions ranged from fair to excellent across the survey area. Wetland basins throughout central and southern Saskatchewan remained in good condition despite a hot-and-dry period from summer 2011 through late winter 2012. This was most likely due to the well-above-average precipitation received during 2010 through early 2011 and some early spring rains in 2012. Western and northwestern portions of the survey area, however, exhibited drier conditions and were considered fair in 2012.

Low fall and winter precipitation coincided with above-normal temperatures that occurred throughout the summer of 2011 and continued into the 2011–2012 fall and winter months. Beginning in September 2011, monthly average temperatures ranged from 2–5°C above normal. January 2012, for example, had a monthly-mean temperature >5°C above normal. April 2012 temperatures were normal to below normal. The majority of the survey area received well-below-normal winter precipitation (November 2011–March 2012). The parklands were driest with less than 40% of normal precipitation received during winter. Spring and early summer brought much needed precipitation to the survey area, and most areas had received well-above-normal (115–200%) precipitation from April through June 2012. A small area in the northern grasslands received over 200% of normal precipitation. The recent moisture greatly improved wetland conditions across the survey area and provided good-to-excellent brood-rearing habitat. Wetland flooding during this time may have had negative effects on late nesting ducks, forcing renesting or abandonment of nests and resulting in lower recruitment from some species this year.

April rains replenished water levels in many wetlands but dry areas were still apparent and most of the grasslands appeared only fair in regards to duck production. The Missouri coteau, running through the center of the survey area from southeast to northwest, had better wetland and upland habitat conditions and was rated as good to excellent.

The western aspen parklands have continued to dry out. The region is in fair condition, with poorer areas near the Alberta border. Some replenishing rains were needed to maintain water levels for brood rearing later in the summer. The eastern aspen parklands have better habitat conditions as both upland and wetland habitats benefited from April precipitation. Water levels in many areas were high and flooded wetland basins. This should have provided good brood habitat and fair-to-good waterfowl production is expected from this region.

The 2012 May pond estimate in this survey area was 15% lower than in 2011, and 32% higher than the long-term average. Total duck numbers were similar to 2011, and 50% above the long-term average. Mallards were 20% higher than 2011 and 22% above the long-term average. Blue-winged teal were similar to last year and 99% above the long-term average. Northern shovelers were 24% above 2011 and 160% above the long-term average. The green-winged teal estimate was similar to last year, but still 93% above its long-term average. Gadwall numbers were similar to 2011 and 87% above their long-term average. American wigeon were similar to last year but 41% lower than their long-term average. Northern pintail were 45% lower than in 2011, and 48% below the long-term average. Redheads were similar to 2011 and 82% above their long-term average. Canvasback were similar to 2011 and 64% higher

than the long-term average. The scaup estimate was 50% above 2011 and similar to the long-term average.

Southern Manitoba (strata 34–40; includes southeast Saskatchewan)

Habitat conditions declined over most of the survey area in 2012. Annual precipitation averaged 60–85% of normal from Melita to north of Dauphin and eastward across Manitoba. An area of poor conditions was observed north of Winnipeg and east of Riding Mountain National Park where approximately only 25% of wetland basins held water. Wetland habitats were good to excellent in southwestern Manitoba and southeastern Saskatchewan due to annual precipitation that was 85–115% of normal and excellent carryover moisture from 2010–2011. This was the only portion of the survey area that remained similar to 2011.

From the parklands farther north into the boreal forest near The Pas, conditions declined from 2011. Slightly below-average annual precipitation resulted in mostly fair habitat but some good areas were observed.

Rains from March through May should aid conditions across the survey area. Fall precipitation in 2011 was only 40–60% of normal but spring precipitation has been as much as 200% above normal, which will recharge wetlands across prairie, grain belt and parkland habitats. Additionally, mean temperatures were 3–5°C above normal during winter and spring, which may have resulted in early growth of vegetative cover. The 2012 May pond estimate was 39% lower than the 2011 estimate and 40% lower than the long-term average. The total duck estimate was similar to 2011 and the long-term average. Mallard numbers were 23% lower than 2011 and similar to the long-term average. Gadwall, blue-winged teal, and northern shoveler estimates were all similar to last year's estimates and their long-term averages. Green-winged teal were 185% higher than in 2011 and 206% higher than their long-term averages. American wigeon were similar to the 2011 estimate and 91% below their long-term average. Northern pintails were 43% below the 2011 estimate, and 79% lower than the long-term average. Redhead, canvasback, and scaup estimates were all similar to their last year's estimates and their long-term averages in this survey area.

Montana and Western Dakotas (strata 41–44)

May 2012 habitat conditions across the entire survey area were much drier compared to last year. The 2010–2011 winter featured record snowfall, which contrasted greatly with the extremely mild 2011–2012 winter and arrival of spring about 1 to 2 weeks earlier than normal across the Dakotas and Montana. With a reduced snowpack, most temporary and seasonal wetlands were dry, resulting in fewer wetlands available for nesting waterfowl across the majority of the survey area.

Wetland conditions in western South Dakota (stratum 44) were fair with a few areas being rated as good. Similarly, wetland conditions in northwestern South Dakota and southwestern North Dakota were fair. Wetland conditions in western North Dakota (stratum 43) were good with some areas rated as fair. Habitat conditions in the east-central portion of Montana (stratum 42) ranged from fair and poor with a few small areas in the southernmost area of this stratum rated as good. The northeastern portion of Montana (stratum 41) was rated as good. However, conditions quickly deteriorated to between poor and fair westward from the Canadian border to the East Front of the Rockies, where the only available water was found in stock ponds, dugouts and some of the larger wetlands that still retained precipitation from 2011. Along with the decreased wetland habitat, oil field activity in the Dakotas (especially North Dakota) and CRP conversion to small grains has reduced available nesting habitat for this year's breeding waterfowl population.

The 2012 May pond count in this survey area decreased by 56% from last year, and 24% from the long-term average. Total duck numbers decreased by 21% from 2011, and were 49% above the long-term average. The mallard estimate was similar to 2011 and 56% higher than the long-term average. The gadwall estimate was 46% below 2011, and was similar to the long-term average. American wigeon and northern

pintail were both similar to last year and the long-term average. Green-winged teal were similar to 2011 and 55% below their long-term average, while blue-winged teal were similar to 2011 but 138% above the long-term average. The northern shoveler estimate was similar to the 2011 estimate and 112% above the long-term average. Redhead and canvasback estimates were similar to 2011 and their long-term averages. The scaup estimate was 53% lower than in 2011 and 65% lower than the long-term average.

Eastern Dakotas (strata 45–49)

May 2012 habitat conditions in the survey area were dry compared to those in 2011. The survey area was wet in 2011 due to above-average snowfall the prior winter and heavy spring rains. This trend dramatically changed through the winter of 2011–2012 with below-normal snowfall and continued in spring 2012 with below-average precipitation. Upland vegetation had already begun to green up and trees had already begun to leaf out at the beginning of the survey. Spring phenology appeared to be early this year and was well advanced compared to 2011.

Conditions were fair in the prairies and good on the coteau in eastern South Dakota (strata 48 and 49). Permanent wetland basins contained water but vegetation margins were present in nearly all of them. Very few wetlands were more than 70% full. Most semi-permanent and seasonal wetlands were dry or contained little water and the majority of streams and rivers were well within their banks. With the below-average winter and spring moisture, farming activity was on or ahead of schedule and 70-plus percent of corn had been planted and beans were being sowed during the survey. A significant rain event beginning 5 May and lasting several days may have delayed the completion of corn planting in southeastern South Dakota but provided some much needed moisture. This delayed farming activity should be beneficial to nesting activities throughout South Dakota.

In northern and eastern North Dakota (strata 45 and 46) habitat conditions also were fair to good. Like South Dakota, prairie habitats were mainly fair and the coteau region was good, but overall North Dakota was drier than South Dakota. Similar to strata 48 and 49, virtually all of the permanent wetland basins in the coteau region were at least 70% full but vegetation margins were present and semi-permanent and seasonal wetlands were dry to less than 50% full. Sheet water was absent. More farming activity than usual was observed in North Dakota, particularly in the western part of the state. The Souris River was well within its banks and Devil's Lake and Lake Sakakawea were lower with exposed beach areas, something not seen in a few years. The Red River Valley (stratum 47) was noticeably drier than any of the other strata due to the excessive draining and tiling. No waterfowl were observed on many of the segments.

Overall, conditions in the Eastern Dakotas were fair with the coteau regions rated as good, and 2012 should be an average year for waterfowl production. Some regions were poor, particularly stratum 47 as well as the portions of other strata bordering the stratum. Northwestern North Dakota was also dry and had many poor segments. Conditions in this area were dry enough that reduced visibility from dust rising from tractors working fields and semi-tractor trailers delivering pipe to oil wells along section roads was an issue over a large area.

In this survey area, the 2012 May pond estimate was 46% lower than 2011, and 13% higher than the long-term average. The total duck estimate was similar to last year and 162% above the long-term average. Mallard numbers were similar to 2011 and 161% higher than the long-term average. The gadwall estimate was similar to 2011 and 193% above the long-term average. The American wigeon estimate was similar to 2011, and was 49% above the long-term average. Green-winged teal were similar to 2011, but were 122% higher than the long-term average. Blue-winged teal were similar to last year and 190% higher than their long-term average. Northern shovelers were similar to last year and 142% above their long-term average. The northern pintail estimate was 34% lower than their 2011 estimate, and 97% higher than their long-term average. The redhead estimate was similar to last year and 192% above the long-term av-

erage. The canvasback estimate was 38% lower than 2011 and 125% above their long-term average. Scaup numbers were similar to last year and 155% above their long-term average in this survey area.

Northern Saskatchewan, Northern Manitoba, and Western Ontario (strata 21–25, 50)

This survey area generally received normal precipitation and above-average temperatures. Precipitation from September 2011 through June 2012 was normal (85–115%). Winter precipitation (November 2011–March 2012) was normal from in the vicinity of Prince Albert, Saskatchewan, eastward towards Thompson, Manitoba. However, Stony Rapids, Saskatchewan, experienced well-below-normal winter precipitation (<40%) and the region from Buffalo Narrows, Saskatchewan, northwest to Fort MacMurray, Alberta, was below normal (60–85%) as well. Spring precipitation (April–June 2012) was above normal (>115%) through central Saskatchewan but areas north towards Stony Rapids and east to Thompson and Gillam, Manitoba, were drier (40–85%).

Temperatures during fall and winter 2011–2012 were above normal across the entire survey area. Mean monthly temperatures from September 2011 through March 2012 ranged from 1–>5°C above average, following a trend experienced in many crew areas. Normal spring temperatures prevailed throughout the survey area. Overall, habitat conditions were rated as fair in the west and north and good through the southcentral and east portions of the survey area.

Habitat conditions in western Ontario (stratum 50) were slightly worse than the rest of the survey area. The region was drier than normal. Despite an early spring, wetlands were visibly dry and larger, more permanent lakes were much lower than past years. Natural wetlands were reduced to small trickles of water insufficient to provide adequate nesting cover. Smaller rivers and creeks appeared too small to ensure safe passage of downy young from land-based predators. However, beaver-pond habitat was strong and beaver marshes were abundant, offering safe havens for nesting birds.

The 2012 total duck estimate in this survey area was similar to last year and 21% lower than the long-term average. The mallard estimate was similar to last year and to the long-term average. Gadwall numbers were similar to 2011 and the long-term average. The American wigeon estimate was similar to 2011, and 45% lower than the long-term average. Green-winged teal were similar to last year and 33% lower than the long-term average. Blue-winged teal estimates were similar to 2011 and still 79% lower than their long-term average. Northern shovelers and northern pintails were both similar to last year but 72% and 58% lower than their respective long-term averages. The redhead estimate was similar to 2011 and the long-term average. Canvasback were similar to 2011 and 49% lower than the long-term average. The scaup estimate was similar to 2011 but 40% lower than the long-term average.

Central and Northern Alberta, Northeastern British Columbia, and Northwest Territories (strata 13–18, 20, 77)

The large size of this survey area offered a contrast in habitat conditions. Northern Alberta continued a dry trend. Precipitation from September 2011 to June 2012 was below average (40–85%) from Fort McMurray west to Peace River and north to the Northwest Territories border. Only the area in the vicinity of Slave Lake experienced average to above-average precipitation during the same period. Temperatures across northern Alberta were generally average to above average for fall and winter and spring was 1–2°C below normal. Consequently, wetlands throughout northern Alberta continued to be recessed, with many smaller wetlands dry.

Habitat conditions improved in a northerly direction starting at roughly the Northwest Territories border. This trend was similar to 2011 when the entire Mackenzie River Valley was rated as good. Temperatures across the Territories from October 2011 to May 2012 were generally average to slightly above average, except for March 2012 (>5°C below average). Precipitation was also average to above average over the same interval, with higher rainfall

amounts towards Inuvik, NWT. Wetlands were fully charged and some basins along the last few northern transects were outside their borders. No ice jams were observed on the Mackenzie River in 2012 and delta habitats were not flooded, unlike conditions in 2011.

The total duck estimate for 2012 was 24% higher than both the 2011 estimate and the long-term average. Mallard numbers were 59% higher than 2011 and 44% higher than the long-term average. The American wigeon estimate was similar to 2011 and 24% lower than the long-term average. Gadwall were similar to last year and the long-term average. Green-winged teal were similar to 2011 and 99% above the long-term average. Blue-winged teal were similar to the 2011 estimate and 46% below the long-term average. Northern shovelers were 107% above the 2011 estimate and similar to the long-term average. Northern pintails were similar to 2011 and 78% below the long-term average. Redheads were similar to 2011 and 59% below the long-term average. Canvasbacks were similar to last year and to the long-term average. Scaup were 31% higher than last year and similar to the long-term average.

Alaska, Yukon Territory, and Old Crow Flats (strata 1–12)

Habitat conditions in Alaska were classified as good with the exception of the Yukon–Kuskokwim Delta which was classified as fair. The 2012 total duck estimate in this survey area was 19% higher than in 2011 and 21% higher than the long-term average. Mallard numbers were similar to last year and 35% above the long-term average. Gadwall were similar to last year and 68% lower than their long-term average. American wigeon were similar to last year and 25% higher than their long-term average. Green-winged teal were similar to last year's estimate and 77% higher than their long-term average. Blue-winged teal were similar to 2011 but 100% below their long-term average. The northern shoveler estimate was similar to last year and 30% above the long-term average. Northern pintails were 58% higher than 2011 and 27% higher than their long-term average. Redheads and canvasbacks were both similar to 2011 but 100% and 60% lower than the long-term averages, respectively. The scaup estimate was similar to 2011 and the long-term average.

Eastern survey area (strata 51–72)

Much of southern Ontario and western Quebec experienced below-average winter precipitation and warm temperatures. This combined with the earlier-than-normal snowmelt left many water bodies with exposed margins. These drier conditions were most evident in agricultural areas southwest of Toronto and east of the St. Lawrence River. While rivers and streams were not full, more permanent water bodies in the boreal regions generally remained in good condition, and some areas northwest of Kingston in strata 51, 52, 53 and 68 were in excellent condition. Conditions then trended drier moving northeast in stratum 68, with Lake Peribonca showing a great deal of drawdown and blowing sand.

Tree leaf-out was well underway when the survey began on 29 April, which was 9 days earlier than the 2011 start date. In the southern part of stratum 54, all species had at least swollen buds, if not leaves. This was also the case in most low-elevation areas near the Great Lakes and the St. Lawrence River. After a string of good weather, we caught up with leaf-out during the survey, and most of stratum 68 (the last and highest elevation stratum) was still in the bud stage when we finished. All water bodies were melted though a very few patches of snow were noted on north-facing slopes. Much of eastern Ontario and southwestern Quebec was good or excellent, but habitat conditions in southern Ontario near London were fair. New York was characterized by a very early spring. Wetlands were in good shape and habitats were ready and available for nesting waterfowl.

Eastern Quebec (stratum 70) has become more developed from timber extraction and hydro-electric exploitation in proportion to its relatively small area. Spring timing was normal and wetlands and habitats were adequately charged. Habitat conditions were good to excellent in this stratum. Spring timing was normal to late in northern Quebec (stratum 68)

with little precipitation. Although most habitats are more permanent in nature, string bogs can be a favorite nesting site for some species, including Canada geese, and many of these more ephemeral marshes were reduced or completely unavailable to nesting birds. Drier conditions were mostly concentrated in the northwest portion of the stratum where habitat conditions were fair. The remainder of the stratum was considered good.

Southern regions of the Maine and Maritime Provinces crew area (strata 62–67) experienced a relatively warm and dry winter and early spring. Snow totals were below normal in the south and warm temperatures in early spring contributed to an early snow melt and ice-out. Waterfowl breeding phenology was somewhat earlier than normal throughout Maine and the southern Maritimes. Lack of snow and early spring precipitation resulted in low flows on rivers and streams and drier wetland conditions throughout Maine and the Maritimes until heavy rains recharged habitats in late April. Exceptions were extreme northern Maine and northwestern New Brunswick, which did not receive as much late April rainfall as other areas. At the time of the survey, habitats in most areas in Maine or the Maritimes were classified as good while fair conditions were encountered in northern Maine and New Brunswick.

Newfoundland was ice and snow free during the survey and survey timing appeared optimal with respect to waterfowl-breeding phenology. Northern portions of the crew area in Labrador received heavy snows during the winter of 2011–2012, and seasonal snow totals were high. Snow and ice were encountered during the survey in Labrador, particularly at high elevations. Spring phenology was slightly late in Labrador. Heavy snow melt caused local flooding of riparian areas and other wetland basins. Overall, however, habitat conditions were classified as good at the time of the survey.

Estimated abundance of mallards in the eastern survey area was similar to the 2011 estimate and the long-term average. The estimated abundance of American black ducks was 11% higher than the 2011 estimate and similar to the long-term average of 0.62 million. Abundance estimates for goldeneyes, green-winged teal, ring-necked ducks, and mergansers were similar to last year's estimates and their 1990–2011 averages.

Other areas

In the Pacific Flyway, below normal winter precipitation and snowpack were offset by abundant spring precipitation, leading to good habitat conditions in many areas. In the core breeding range for waterfowl in California–the Central Valley and northeastern California–late spring rains produced good habitat conditions. Although wetland conditions declined from 2011, especially in northeastern California, overall mallard production is predicted to be above-average for most of the state. In California, the total duck estimate in 2012 was 524,500, which was similar to last year's estimate and their long-term average of 588,500. The mallard estimate in 2012 was 381,900, also similar to the 2011 estimate and their long-term average (364,800). In Nevada, winter precipitation and run-off was well below normal, but last year's abundant precipitation left reservoir storage well above average in northern Nevada. Most wetlands in northern Nevada including the Carson Sink area (Stillwater NWR, Carson Lake WMA) have 70–80% coverage with additional water still coming into the systems. The Humboldt Sink area (Rye Patch, Jessup Flat) is also receiving water; while water coverage in much of the sink is only at 20–30%, this is more than in most other years in this de-watered system. The total duck estimate for Nevada was 23,900, which was higher than the 2011 estimate of 11,700. The Nevada mallard estimate was 4,100, which was higher than the 2011 estimate of 2,300. Habitat conditions in Oregon this year were above average. In western Oregon prolonged spring precipitation contributed to good-to-excellent conditions, although high flows on several major river systems may have impacted nesting success for some species. Wetland conditions in southeastern Oregon were good to excellent mainly due to carryover of water from the excellent conditions last year. Similar to 2011, wetland areas in other areas of eastern Oregon were well above average, again due to snow pack runoff and above

average spring precipitation. In Oregon, the total duck estimate in 2012 was 276,000, which was 63% higher than 2011, and similar to the long-term average of 275,600. The 2012 mallard count was 96,300, which was 42% higher than last year, and similar to the long-term average (100,700). In Washington, the estimate for total ducks (172,700) increased from last year. Total mallards in Washington were estimated at 91,200, an increase from 2011. In British Columbia, the La Niña weather pattern experienced 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 (British Columbia River Forecast Centre 2012). As in previous years, some high-altitude wetlands (>4,500 feet) remained completely frozen during the entire survey period but water levels at mid-altitude (3,500 to 4,500 feet) were higher than last year and generally good. Water levels for low-elevation wetlands (below 3,500 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. In British Columbia, the total duck estimate was 296,200, which was similar to last year and the long-term average. The mallard estimate was 78,700, which was similar to last year and the long-term average.

In the Midwest, waterfowl arrived early to dry conditions and warm temperatures; however, significant rainfall in late spring improved wetland conditions. In Minnesota, by mid- to late May, wetland habitat improved dramatically, with flooding in some areas. The number of permanent or semi-permanent wetlands decreased 37% compared to 2011, and were below both the 10-year (−15%) and long-term (−10%) averages. The estimated mallard breeding population was 225,000, which was similar to last year's estimate of 283,300 mallards and similar to the long-term average. The estimate of total duck abundance, excluding scaup, was 469,000, which was lower than last year's estimate (687,000) and lower than the long-term average of 623,000 ducks. In Wisconsin, temperatures were 14–16°F degrees above normal in March, but a cooler period in April stalled migration and nesting behavior. Statewide, precipitation from March to May was 15% above normal, which improved wetland conditions, particularly in northern and central Wisconsin. The total Wisconsin breeding duck population estimate of 521,100 was similar to 2011 and the long-term average (1973–2011). The 2012 total mallard population estimate of 197,000 was similar to the 2011 estimate of 187,900 and the long-term average. Habitat conditions in Nebraska in 2012 appeared to be average or slightly below average, and declined from the above-average conditions of 2011. Wetland conditions in the Sandhills region of Nebraska were also drier than in 2011. Nebraska did not conduct a spring waterfowl survey in 2012.

In the northeast U.S., spring also arrived early, with drier than normal conditions. In Connecticut, warm weather resulted in earlier nest initiation, but with less than optimal wetland conditions. Nesting chronology was likely 2–3 weeks early but many smaller ponds were dry or nearly dry. Many early broods were observed and overall production is predicted to be average. In Massachusetts, many areas experienced drought or near drought conditions this spring, with temperatures substantially above average for the previous 9-month period. In late April and May, prolonged damp weather helped to restore water levels and brood habitat but may have reduced brood survival due to exposure from cool, wet weather. Conditions improved by mid-May, with some areas returning to normal moisture conditions. Habitat conditions in Vermont were dry except for a 2-week period in mid-May with rain falling during the peak hatching period. Grassland nesting habitat was lush and well utilized, with the majority of brood cover developing nicely. Average long-term conditions are predicted for food availability during the breeding season and during migration. Spring conditions in New Hampshire were early with excellent nesting conditions; in

Rhode Island, the early spring followed a winter that was much warmer than usual with snowfall amounts well below average. In New York, rainfall was above normal at the end of April and into early May. Temperatures fluctuated between higher than normal and below normal throughout April with the middle of April reaching very warm temperatures. Despite the rainy spring, some areas around the state reported low water levels because of the low snowfall during the mild winter. Habitat and weather conditions across Pennsylvania were drier than average in early spring. Statewide temperatures and resulting vegetation growth from March through May were significantly above average. First hatches of Canada goose and mallard broods appeared 1–2 weeks earlier than average. Precipitation was below average through May, except in northeastern Pennsylvania, where rainfall was near average. Average production is expected in 2012 due to the early onset of nesting and extended period for renesting attempts. One exception may be reduced nest and/or gosling and duckling survival rates across the Allegheny Mountain region in central and northern Pennsylvania due to a significant snow event overlapping the late incubation and early hatch period. In New Jersey winter precipitation was average and temperatures well above average. March was exceptionally dry with record high mean temperatures for the month throughout the state. As a result spring phenology was exceptionally early and water levels may have been the lowest they have been since the onset of the survey in the early 1990's. A lack of ephemeral habitats likely impacted mallards while Canada goose nest success was high due to the early spring conditions and virtual absence of flooding events during the nesting period. Closer to average rainfall and temperatures resumed in late April and into May. Habitat conditions in Delaware in 2012 differed substantially from previous years. The months from January through April 2012 were the warmest and driest in Delaware since 1895. Precipitation was below average and mean daily temperature was above average for both April and May 2012. Despite water conditions being below average, areas that traditionally held water still possessed wet habitat. In Maryland, spring arrived early, with temperatures warmer than normal during March and May, and average in April. Habitat conditions during March to May were considered only fair, and were drier than normal. Mallard, wood duck, and Canada goose broods hatched earlier this year due to the mild weather. The outlook for production in Maryland is average. Habitat conditions in Virginia during the spring of 2012 were fair to good. Dry wetland conditions during the early season were alleviated by significant precipitation during the middle and latter portions of the nesting period. Duck and goose nest initiation was 1–2 weeks earlier than average, which increased opportunities for renesting attempts. Unusually high spring tides in late April and early May resulted in flooding of coastal marshes and barrier islands, impacting nesting habitat in these areas, mainly for black ducks. Wood duck production is expected to be higher than the previous three years but still well below the long-term average, while mallard production is expected to be well above average. Total duck numbers from the 2012 Atlantic Flyway Breeding Waterfowl survey were 1.3 million, which was similar to the 2011 estimate and to the long-term (1993–2011) average of 1.4 million. Mallard numbers (612,600) were similar to the 2011 estimate of 586,100 and 19% below their long-term average of 754,500.

Mallard Fall-flight Index

The mid-continent mallard population is composed of mallards from the traditional survey area (revised in 2008 to exclude Alaska mallards), Michigan, Minnesota, and Wisconsin, and is estimated to be 12.7 ± 1.2 million birds in 2012 (Figure 4). This is similar to the 2011 estimate of 11.9 ± 1.1 million. (Note: recent adjustments to Michigan historical mallard estimates following a review of their database has resulted in a slightly different estimate for the 2011 mallard fall-flight index than was published last year.)

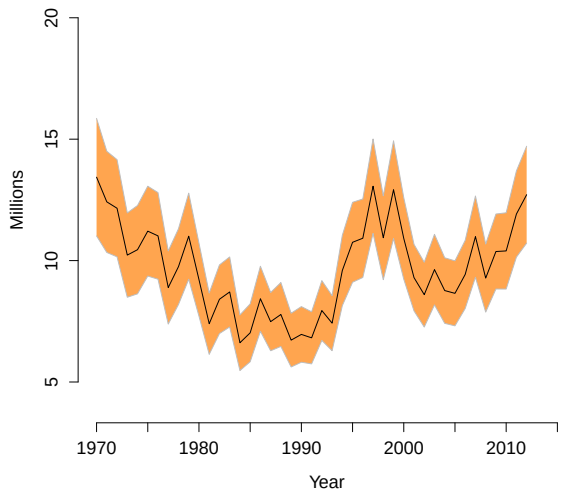

Figure 4: Estimates and 90% confidence intervals for the predicted size of the mallard population in the fall.

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2 Status of Geese and Swans

Abstract: We provide information on the population status and productivity of North American Canada geese (*Branta canadensis*), brant (*B. bernicla*), snow geese (*Chen caerulescens*), Ross's geese (*C. rossii*), emperor geese (*C. canagica*), white-fronted geese (*Anser albifrons*), and tundra swans (*Cygnus columbianus*). Production of arctic-nesting geese depends heavily upon the timing of snow and ice melt, and spring and early summer temperatures. In 2012, snowmelt timing was average or earlier than average throughout most of the important goose breeding areas. Conditions throughout Alaska and northwestern Canada were good. The exception was the Yukon-Kuskokwim Delta, where spring phenology was later than average, and flooding ensued when ice blockages trapped snowmelt. In addition, flooding on Southampton Island caused near-total nesting failure of the geese breeding there. Gosling production of Canada goose populations that migrate to the Atlantic and Mississippi Flyways should generally be average in 2012. In the central Arctic, phenology was earlier than average and earlier than last year, so above-average production of snow and Ross's geese and Mid-continent white-fronted geese nesting in the Queen Maud Gulf Sanctuary was expected. Pacific Flyway white-fronted geese, brant, and Canada geese nesting in the central Arctic should benefit as well. Indices of wetland abundance in the Canadian and U.S. prairies in 2012 fell dramatically from last year's record highs. However, early spring temperatures were warm throughout most of the U.S., so the resulting early nest initiations should have increased brood survival despite poorer wetland conditions. Breeding populations of most temperate-nesting geese were at or near record highs in 2012, despite efforts to reduce or stabilize them. Production of temperate-nesting Canada geese from most of their North American range is expected to be above-average in 2012.

Primary abundance indices increased for 16 goose populations and decreased for 10 goose populations in 2012 compared to 2011. Two populations remained the same. Primary abundance indices for both populations of tundra swans increased in 2012 from 2011 levels. The following populations displayed significant positive trends during the most recent 10-year period ($P < 0.05$): Mississippi Flyway Giant, Short Grass Prairie, and Hi-line Canada geese, Mid-continent and Western Central Flyway light geese, and Ross's geese. Only the Atlantic Flyway Resident Population showed a significant negative 10-year trend. The forecast for the production of geese and swans in North America is generally favorable in 2012.

This section summarizes information regarding the status, annual production of young, and expected fall flights of goose and tundra swan populations in North America. Information was compiled from a broad geographic area and is provided to assist managers in regulating harvest. Most populations of geese and swans in North America nest in the Arctic and subarctic regions of Alaska and northern Canada (Figure 5), but several Canada goose populations nest in temperate regions of the United States and southern Canada ("temperate-nesting" populations). The annual production of young by northern-nesting geese is influenced greatly by weather conditions on the breeding grounds, especially the timing of spring snowmelt and its impact on the initiation of nesting activity (i.e., phenology). Persistent snow cover reduces nest site availability, delays nesting activity, and often results in depressed reproductive effort and productivity. In general, goose productivity will be better than average if nesting begins by late May in western and central portions of the Arctic, and by early June in the eastern Arctic. Production usually is poor if nest initiations are delayed much beyond 15 June. For temperate-nesting Canada goose populations, recruitment rates are less variable, but productivity is influenced by localized drought and flood events.

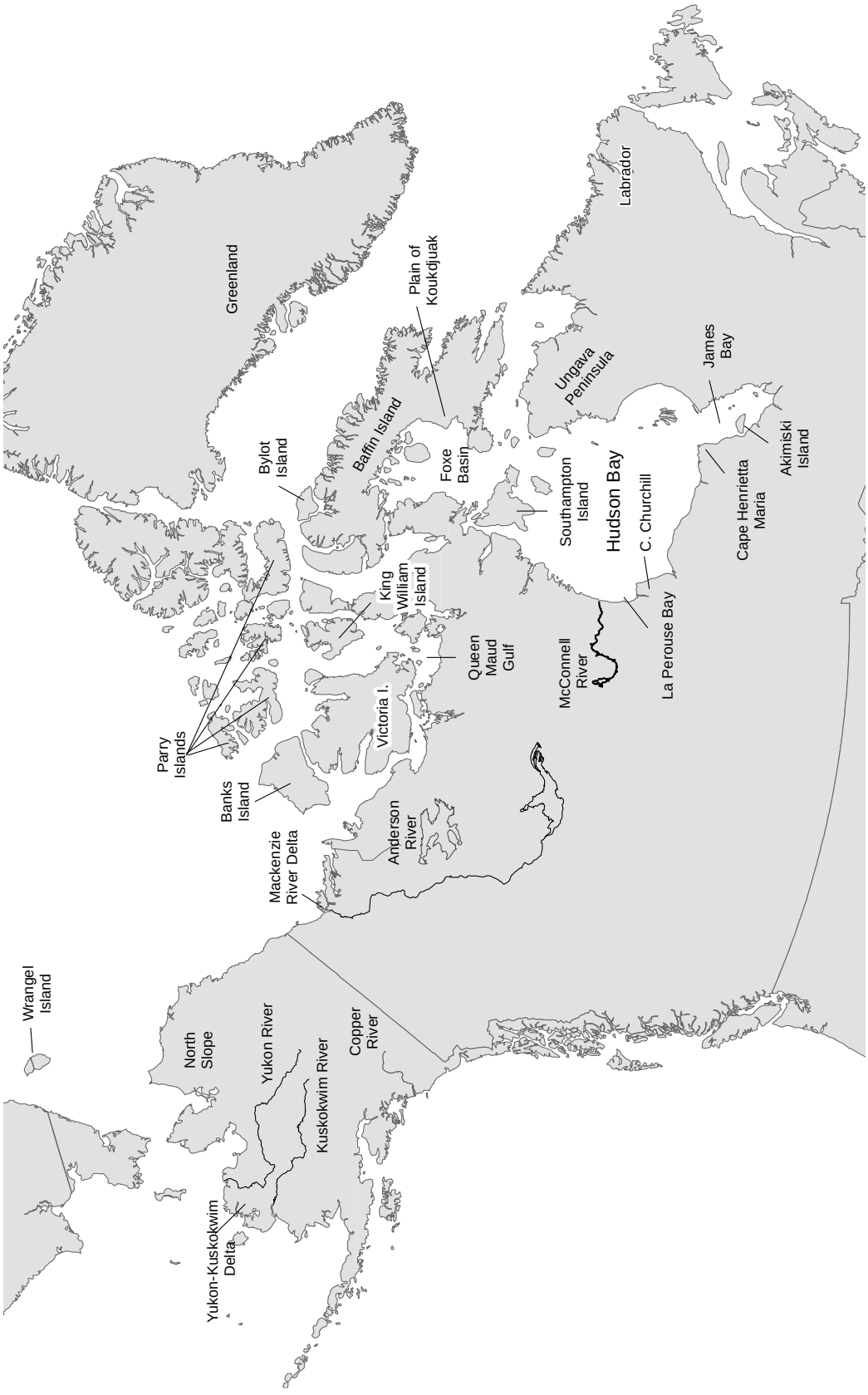


Figure 5: Important goose and swan nesting areas in Arctic and subarctic North America.

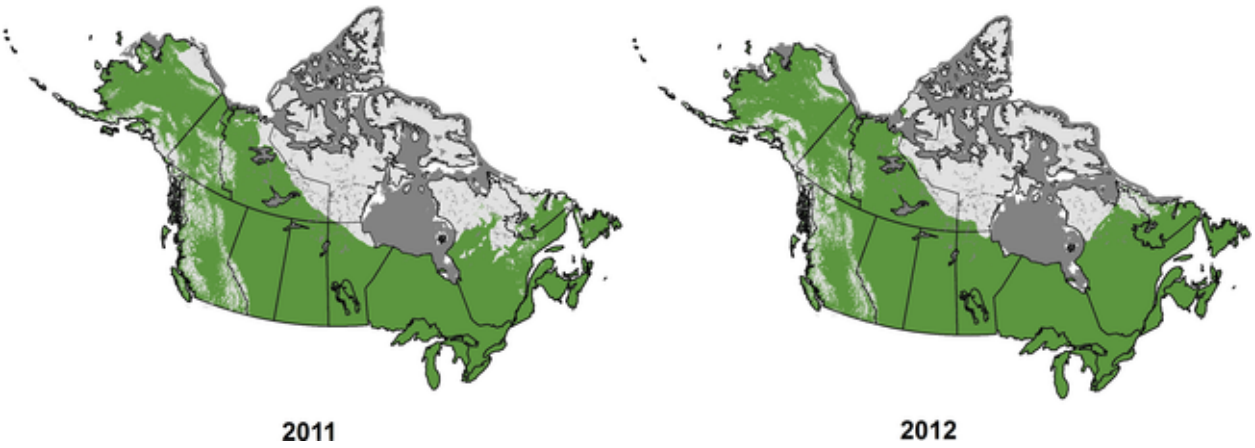


Figure 6: The extent of snow (light gray) and ice (dark gray) cover in North America on 2 June 2011 and 2 June 2012 (National Ice Center 2012).

Methods

We have used the most widely accepted nomenclature for various waterfowl populations, but they may differ from other published information. Species nomenclature follows the List of Migratory Birds in Title 50 of the Code of Federal Regulations, Section 10.13, revised 1 March 2010 (79 FR 9282). Some of the goose populations described herein are composed of more than one subspecies and some light goose populations contain two species (i.e., snow and Ross's geese).

Population estimates for geese (Appendices D.1, D.2, and D.3) are derived from a variety of surveys conducted by biologists from federal, state, and provincial agencies, or from universities (Appendices A.2). Surveys include the Midwinter Survey (MWS, conducted each January in wintering areas), the Waterfowl Breeding Population and Habitat Survey (WBPHS, see Status of Ducks section of this report), and surveys that are specifically designed for various goose populations. Where survey methodology allowed, 95% confidence intervals are presented in parentheses following population estimates. The 10-year trends of population estimates were calculated by regressing the natural logarithm of survey results on year, and slope coefficients were presented and tested for equality to zero (t-statistic). Changes in population indices between the current and previous years were calculated and, where possible, assessed with a two-tailed z-test using the sum of sampling variances for the two estimates. All statistical tests and analyses were conducted using an alpha level of 0.05. Primary abundance indices, those related to management plan population objectives, are described first in population-specific sections and graphed when data are available. Because this report was completed prior to final annual assessments of goose and swan reproduction, the annual productivity of most populations is only predicted qualitatively. Information on habitat conditions and forecasts of productivity were primarily based on observations made during various waterfowl surveys and interviews with field biologists. These reports provide reliable information for specific locations, but may not provide accurate assessment for the vast geographic range of waterfowl populations.

Results and Discussion

Conditions in the Arctic and Subarctic

Production of Arctic-nesting geese depends heavily upon the timing of snow and ice melt, and spring and early summer temperatures. In 2012, snowmelt timing was average or earlier than average throughout most of the important goose breeding areas. Exceptions were the Yukon–Kuskokwim Delta, where spring phenology was later than average, and flooding ensued when ice blockages trapped snowmelt. Elsewhere, flooding on Southampton

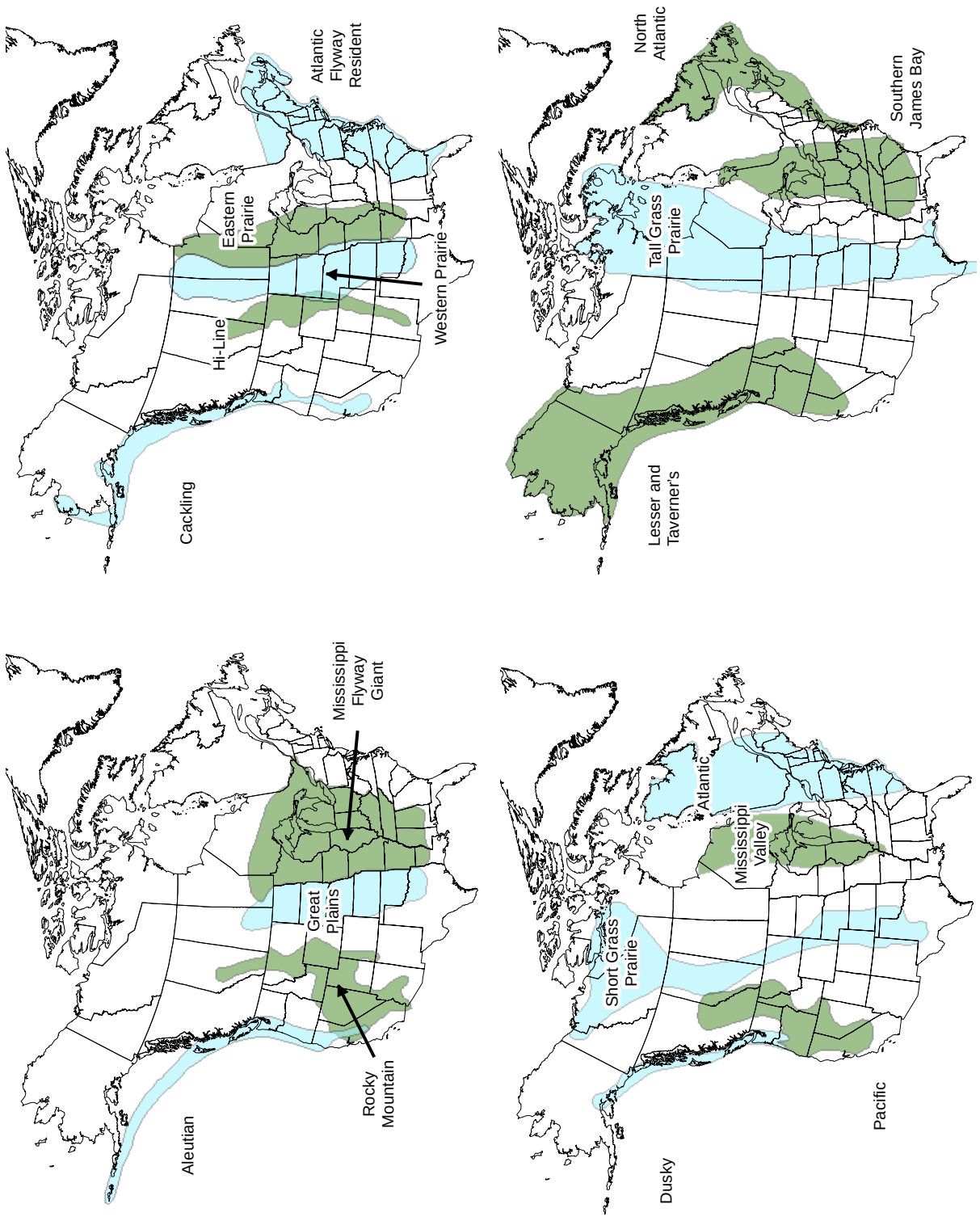


Figure 7: Approximate ranges of Canada goose populations in North America.

Island caused near-total nesting failure of the geese breeding there. The snow and ice cover graphics (Figure 6, National Oceanic and Atmospheric Administration, http://www.natice.noaa.gov/ims/) illustrate that the area covered with ice or snow on 2 June 2012 was less extensive than on the same date in 2011, as areas west of Hudson Bay and in northern Quebec and Labrador were snow-free.

Indices of Canada goose populations that migrate to the Atlantic and Mississippi Flyways were generally similar to those of 2011 and average production for the Atlantic, the Southern James Bay and the Mississippi Valley Populations of Canada Geese was expected. The Eastern Prairie population is still recovering from several years of poor production, but conditions on their nesting grounds are good in 2012. In the central Arctic, phenology was earlier than average and earlier than last year, so above-average production of snow and Ross's geese and Mid-continent white-fronted geese nesting in the Queen Maud Gulf Sanctuary was expected. Pacific Flyway white-fronted geese, brant, and Canada geese nesting in the central Arctic should benefit as well. Conditions in Alaska and northwestern Canada were good, except for the YKD, which was rated poor. Most of North America will see average fall flights of geese this year.

Conditions in Southern Canada and the United States

Conditions that influence the productivity of Canada geese vary less from year to year in these temperate regions than in the Arctic and subarctic. Given adequate wetland numbers and the absence of flooding, temperate-nesting Canada geese are reliably productive. Indices of wetland abundance in the Canadian and U.S. prairies in 2012 fell dramatically from last year's record highs. However, early spring temperatures were warm throughout most of the U.S., so the resulting early nest initiations should have increased brood survival despite poorer wetland conditions. Breeding populations of most temperate-nesting geese were at or near record highs in 2012, despite efforts to reduce or stabilize them.

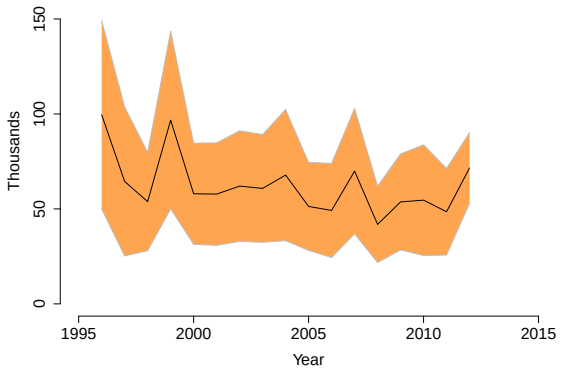


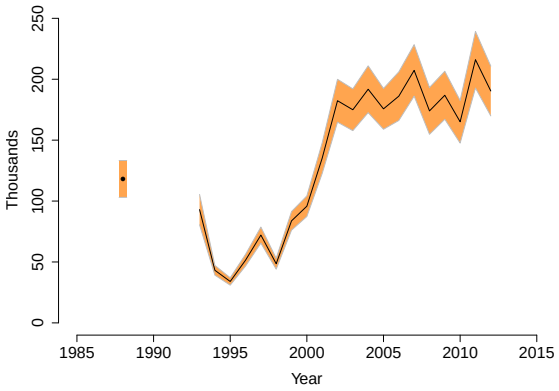
Figure 8: Estimated numbers (and 95% confidence intervals) of North Atlantic Population Canada geese (indicated pairs).

Production of temperate-nesting Canada geese from most of their North American range is expected to be above-average in 2012.

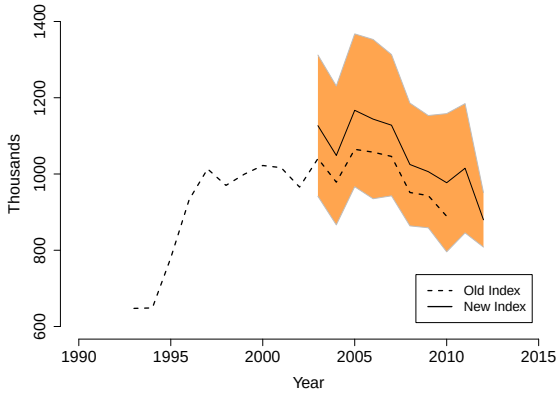
Status of Canada Geese

North Atlantic Population (NAP)

NAP Canada geese principally nest in Newfoundland and Labrador. They generally commingle during winter with other Atlantic Flyway Canada geese, although NAP geese have a more coastal distribution than other populations (Figure 7). Biologists are considering revising the index used to monitor this population to one that combines the WBPHS transect and the Canadian helicopter plot survey data. We continue to present interim indices until that new index has been adopted. During the 2012 WBPHS, biologists estimated 71,600 (35,200–108,000) indicated pairs (single birds plus pairs) within the NAP range (strata 66 and 67), 48% more than the 48,500 (25,700–71,300) estimated in 2011 ($P = 0.293$; Figure 8). Indicated pair estimates showed no trend over the period of 2003–2012 ($P = 0.818$). The 2012 estimate of total NAP Canada geese, 229,000 (95,200–362,900), was 50% higher than last year's estimate of 152,800 (73,300–232,300, $P = 0.337$). The timing of spring was normal in eastern Newfoundland, and about 2 weeks earlier than normal in western Newfoundland and in Labrador. CWS helicopter crews reported that icemelt was early, and that that very little ice was encountered during their survey. Preliminary data indicated a breeding pair density higher than last



9.1: Atlantic Population



9.2: Atlantic Flyway Resident Population

Figure 9: Estimated numbers (and 95% confidence intervals) of Atlantic Population (breeding pairs) and Atlantic Flyway Resident Population (breeding adults) Canada geese.

year's, and above the long-term average. In addition, many groups of non-breeders were observed, which may indicate good production.

Atlantic Population (AP)

AP Canada geese nest throughout much of Quebec, especially along Ungava Bay, the eastern shore of Hudson Bay, and on the Ungava Peninsula. The AP winters from New England to South Carolina, but the largest concentrations occur on the Delmarva Peninsula (Figure 7). Spring surveys in 2012 yielded an estimate of 190,300 (150,300–230,400) breeding pairs, similar ($P = 0.407$) to the 2011 estimate of 216,000 (170,500–261,600; Figure 9.1). Breeding pair estimates indicated no trend from 2003 to 2012 ($P = 0.489$). The estimated total spring population of 871,200 (688,200–1,054,200) in 2012 was similar to the 980,200 (797,200–1,163,200) estimate in 2011 ($P = 0.246$), and likewise, these estimates exhibited no trend ($P = 0.342$). The total population estimate may contain large numbers of molt migrant geese and should be interpreted cautiously. All estimates are uncorrected for visibility bias and thus represent indices to the population. All estimates were re-estimated using recalculated expansion factors. The 1994–2012 data were analyzed using strata based on goose density rather than ecological zones. Thus, the estimates presented here are not comparable to those reported in previous years. In 2012, snow melted in late May over much of the survey area, although the area near Kuujjuaq on the Ungava Bay coast was snow-free earlier. Habitat conditions were rated as average at the time of the survey, and 51% of indicated pairs were observed as singles, identical to the 1994–2012 average. Similarly, a model using May temperatures and June snowfall to predict recruitment suggested an average nesting season and an average fall flight.

Atlantic Flyway Resident Population (AFRP)

This population of large Canada geese inhabits southern Quebec, the southern Maritime provinces, and all states of the Atlantic Flyway (Figure 7). They are counted during the spring via the Atlantic Flyway Breeding Waterfowl Plot Survey. Since 2003, total indicated bird indices have been calculated by doubling pairs and single birds and adding them to grouped birds. A breeding population of 879,800 (739,500–1,020,100) AFRP Canada geese was estimated during the spring of 2012, similar ($P = 0.228$) to the 2011 estimate of 1,015,100 (845,600–1,184,600; Figure 9.2), and 18% below the long-term (2003–2012) average ($P = 0.047$). These indices have declined by an average of 2% per year since 2003 ($P = 0.005$). Across the entire survey area winter was extremely mild with

little to no snow. This resulted in drier than normal conditions, a marked difference compared to last year. Nesting chronology was advanced by about two weeks but because of the dry winter and early spring, nesting habitat was lacking. Temperatures and precipitation returned to average levels during the first part of May. However, with early nest initiation the weather change had the potential to impact broods that were already hatched. Across most of the survey area production was expected to be about average.

Southern James Bay Population (SJBP)

This population nests on Akimiski Island and in the Hudson Bay Lowlands to the west and south of James Bay. The SJBP winters from southern Ontario and Michigan to Mississippi, Alabama, Georgia, and South Carolina (Figure 7). The estimated number of breeding SJBP geese in spring 2012 was 77,500 (57,800–97,200), similar to ($P = 0.485$) the 2011 estimate of 86,900 (69,400–104,400). The total population index of 94,900 (72,500–117,400) was similar to ($P = 0.787$) last year's index of 98,900 (80,600–117,300; Figure 10). Neither of these indices of SJBP geese showed a trend over the 2003–2012 time series ($P \geq 0.787$). Transect level analyses of this year's breeding pair estimates were similar to those of the previous five years for both Akimiski Island and the mainland. Spring phenology was earlier on the mainland in 2012 compared to the short-term (5-year) average, but Akimiski Island was closer to its average. There was an average to above-average snow pack on the SJBP range last winter and March, but April and May were characterized by warmer than average temperatures. Overall, the snowmelt date approached the record early melt of 2010. However, a blizzard hit the Moosonee area in April, and set back the local chronology somewhat. Snow and ice satellite maps provided confirmatory evidence that the phenology on Akimiski Island lagged behind that of the mainland, and that this disparity was larger than is typically observed. An average fall flight is expected.

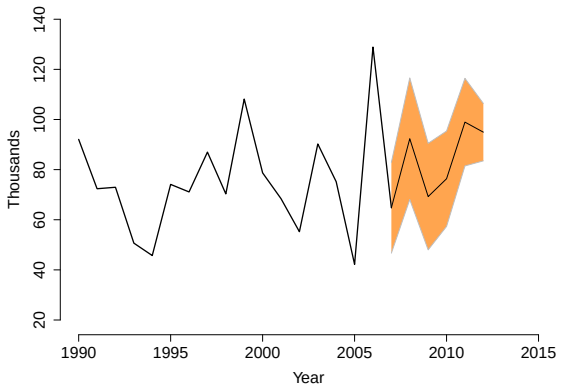
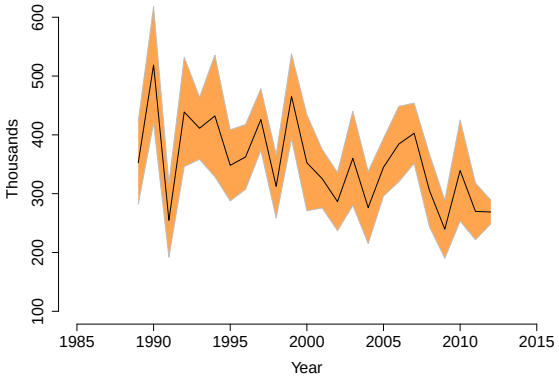


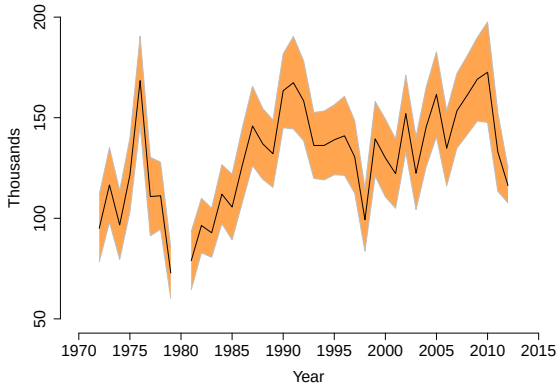
Figure 10: Estimated numbers (and 95% confidence intervals) of Southern James Bay Population (breeding adults) Canada geese.

Mississippi Valley Population (MVP)

The nesting range of this population is in northern Ontario, principally in the Hudson Bay Lowlands, west of Hudson and James bays. MVP Canada geese primarily concentrate during fall and winter in Wisconsin, Illinois, and Michigan (Figure 7). Breeding ground surveys conducted in 2012 produced an estimate of 268,900 (229,300–308,400) MVP breeding adults, similar to the 269,800 (221,600–318,000) counted in 2011 ($P = 0.976$; Figure 11.1). Estimates of breeding adults declined by 3% per year during 2003–2012, but this decrease was not statistically significant ($P = 0.159$). Similarly, 2012 transect level breeding pair counts were statistically similar to the 2007–2012 average ($P = 0.07$). Surveys indicated a total population of 402,800 (332,300–473,400), which, though below average, was an increase over the 2011 estimate of 300,200 (248,200–352,200). Considerably more flocked birds, indicative of yearlings and non-breeding adults in the population, were observed than in recent years. Spring phenology in 2012 was similar to the 5-year average. The timing of snowmelt and river breakups was also near average. At a field camp east of Peawanuck, conditions were dry with almost no snow as of 1 June, and biologists predicted a peak hatch of about 14 June. More extensive studies conducted later in the month found an average breeding effort and levels of nest depredation that were somewhat lower than in the



11.1: Mississippi Valley Population



11.2: Eastern Prairie Population

Figure 11: Estimated numbers (and 95% confidence intervals) of Mississippi Valley Population (breeding adults) Canada geese and Eastern Prairie Population (indicated pairs) Canada geese.

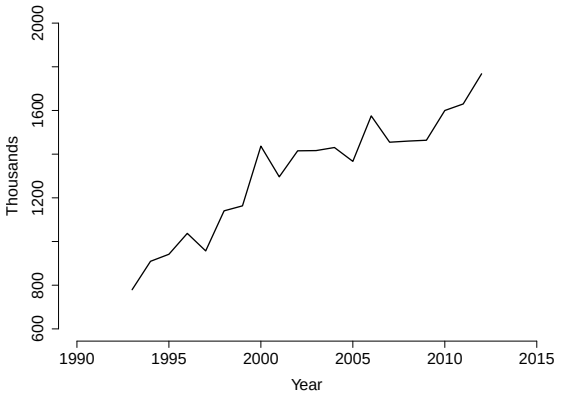
previous two years. The average breeding effort, coupled with a similar breeding adult population, suggests a fall flight similar to 2011.

Eastern Prairie Population (EPP)

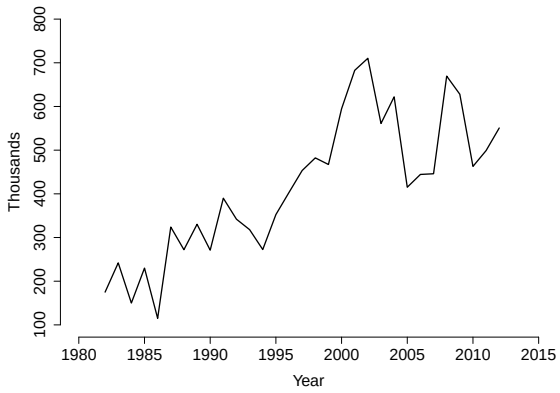
These geese nest in the Hudson Bay Lowlands of Manitoba and concentrate primarily in Manitoba, Minnesota, and Missouri during winter (Figure 7). The 2012 survey estimate of single and paired EPP geese was 116,300 (99,300–133,300), 13% lower than last year's estimate of 133,100 (113,500–152,700, $P = 0.205$; Figure 11.2). The 2012 spring estimate of 262,500 (227,400–297,600) total geese was 36% higher than the 192,900 (168,600–217,200) estimated in 2011 ($P = 0.001$). Neither of these estimates showed a trend over the 2003–2012 time series ($P \geq 0.916$). The estimate of productive geese ($50,300 \pm 8,200$) was unchanged from the 2011 estimate ($57,600 \pm 10,300$). For the second consecutive year, range-wide conditions were characterized by below-normal snowfall and drier than normal conditions. The mean May temperature and number of degree heating days were similar to their 1970–2011 averages. However, moisture conditions in the extreme southern part of the survey area likely improved after the survey, as a record snowfall (approx. 20 cm) occurred in the area on 11 June. Despite extremely early snow-free dates in southern Manitoba (i.e., late March), in the north, the landscape was snow-free only slightly earlier than normal. Biologists sampled nests near Churchill and predicted a median hatch date of 13 June, one week earlier than last year, which suggests an EPP fall flight larger than in 2011.

Mississippi Flyway Giant Population (MFGP)

Giant Canada geese have been reestablished or introduced in all Mississippi Flyway states. This subspecies now represents a large proportion of all Canada geese in the Mississippi Flyway (Figure 7). Biologists estimated a record-high 1,767,900 MFGP geese during the spring of 2012 (using new indices that incorporate new estimation procedures for ON and MB), 8% higher than the revised 2011 estimate of 1,629,800 (Figure 12.1). This is considered an over-abundant population, currently managed with the goal of reducing it. The long-term average estimate of population growth suggests the population has grown at an average annual rate of 4.8%. However, population growth has slowed in recent years as the estimate of growth during the period 1993–2000 suggests 7.2% annual growth, while the estimate for the period 2001–2012 indicates a growth rate of 3.0% annually. An early spring coupled with relatively dry conditions in 2012 likely resulted in above average goose productivity in Michigan, Minnesota, and Wisconsin.



12.1: Mississippi Flyway Giant Population



12.2: Western Prairie/Great Plains Population

Figure 12: Numbers of Mississippi Flyway Giant Population (breeding adults) Canada geese and Western Prairie/Great Plains Population Canada geese (winter geese).

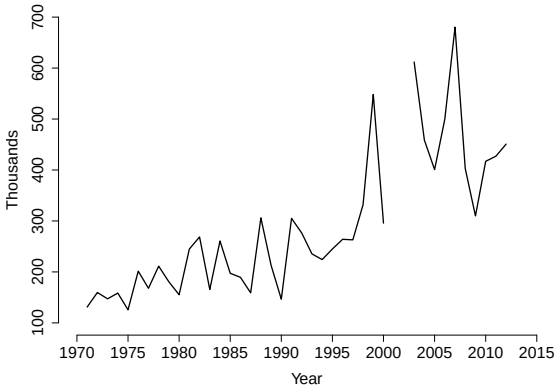
Canada goose productivity in the remainder of the Mississippi Flyways states and provinces was likely near average. Variable goose abundance and nesting conditions across the Flyway make it difficult to generalize about MFGP Canada goose fall abundance; however, Canada geese remain abundant across the flyway and hunters may not perceive significant changes in abundance in 2012 compared to 2011.

Western Prairie and Great Plains Populations (WPP/GPP)

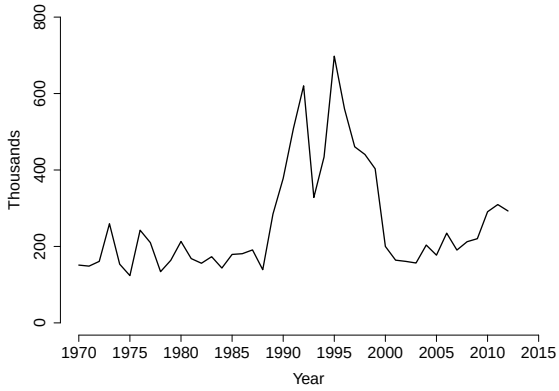
The WPP is composed of mid-sized and large Canada geese that nest in eastern Saskatchewan and western Manitoba. The GPP is composed of large Canada geese resulting from restoration efforts in Saskatchewan, North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, and Texas. Geese from these breeding populations commingle during migration with other Canada geese along the Missouri River in the Dakotas and on reservoirs from southwestern Kansas to Texas (Figure 7). These two populations are managed jointly and surveyed during winter. During the 2012 MWS, 550,800 WPP/GPP geese were counted, 10% more than the 499,000 recorded in 2011 (Figure 12.2). Midwinter indices have shown no trend from 2003–2012 ($P = 0.994$). In 2012, the estimated spring population in the portion of WPP/GPP range included in the WBPHS (Strata 21–25, 30–40, 43–49) was 1,800,500 (1,555,000–2,046,100) geese, 54% higher than last year's estimate of 1,171,700 (997,200–1,346,200, $P < 0.001$). The WBPHS estimates have increased an average of 10% per year since 2003 ($P < 0.001$). The northern WPP range experienced average spring phenology in 2012, and spring was 1–2 weeks early in the south. Throughout the survey area, water conditions were much drier than in 2011, but early nesting should contribute to good survival. Coupled with a record-high breeding population, a very high fall flight seems probable.

Tall Grass Prairie Population (TGPP)

These small Canada geese nest on Baffin (particularly on the Great Plain of the Koukdjuak), Southampton, and King William Islands; north of the Maguse and McConnell Rivers on the Hudson Bay coast; and in the eastern Queen Maud Gulf region. TGPP Canada geese winter mainly in Oklahoma, Texas, and northeastern Mexico (Figure 7). These geese mix with other Canada geese on wintering areas, making it difficult to estimate the size of the winter population. During the 2012 MWS in the Central Flyway, 450,800 TGPP geese were counted, 6% more than the 427,100 index of 2011 (Figure 13.1). Over the past 10 years, the TGP population has not exhibited a significant trend



13.1: Tall Grass Prairie Population



13.2: Short Grass Prairie Population

Figure 13: Estimated numbers of Tall Grass Prairie and Short Grass Prairie Population Canada geese estimated during winter surveys.

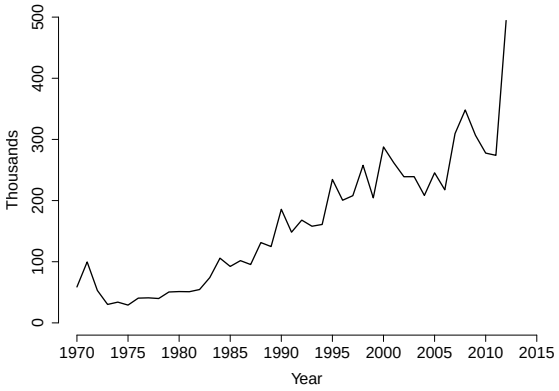
($P = 0.237$). Biologists reported early goose nesting phenology on Southampton and Baffin Islands but expect poor production from TGP geese 2012 because of widespread flooding on Southampton Island. In contrast, ice breakup was 4 days earlier than average, and 6 days earlier than last year at Karrak Lake. Biologists working in the Queen Maud Gulf Sanctuary reported that goose nesting phenology was 2 days earlier than average. Overall, available information suggests that the production of TGPP Canada geese will be similar to that of 2011.

Short Grass Prairie Population (SGPP)

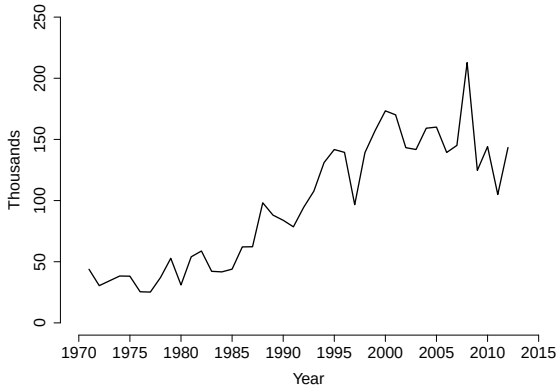
These small Canada geese nest on Victoria and Jenny Lind Islands and on the mainland from the Queen Maud Gulf west and south to the Mackenzie River and northern Alberta. These geese winter in southeastern Colorado, northeastern New Mexico, and the Oklahoma and Texas panhandles (Figure 7). The MWS index of SGPP Canada geese in 2012 was 292,800, −5% lower than the 2011 estimate of 309,600 (Figure 13.2). These indices have increased an average of 7% per year since 2003 ($P < 0.001$). In 2012, the estimated spring population of SGPP geese in the Northwest Territories (WBPHS strata 13–18) was 207,600 (131,200–283,900, $P = 0.780$), similar to last year's estimate of 225,100 (128,500–321,800). WBPHS estimates have increased an average of 11% per year since 2003 ($P = 0.002$). Nesting phenology in the Queen Maud Gulf Sanctuary was approximately four days earlier than average. Wetland conditions in boreal forest SGPP nesting areas were assessed as good. Production of SGPP geese in 2012 is expected to be above average.

Hi-line Population (HLP)

These large Canada geese nest in southeastern Alberta, southwestern Saskatchewan, eastern Montana and Wyoming, and in Colorado. They winter in these states and central New Mexico (Figure 7). A newly adopted primary index of this population is based on WBPHS surveys in Alberta, Saskatchewan, and Montana, and state surveys in Wyoming. In 2012, these surveys yielded an estimate of 494,400 geese, 80% higher than last year's value of 274,000 (Figure 14.1), and a record high. The breeding population survey estimates have increased an average of 6% per year during 2003–2012 ($P = 0.015$). The mid-winter survey index for 2012 was 344,000, up 26% from last year's estimate of 273,000. Over the past 10 years, mid-winter indices for this population have increased by an average of 4% per year ($P = 0.021$). Wetland conditions in the HLP range deteriorated dramatically from 2011 to 2012. However, an early spring likely boosted production, and com-



14.1: Hi-line Population



14.2: Rocky Mountain Population

Figure 14: Estimated numbers of Hi-line Population (breeding adults) and Rocky Mountain Population (breeding adults) Canada geese.

bined with the record-high breeding population, the 2012 fall flight of HLP geese will likely be higher than that of 2011.

Rocky Mountain Population (RMP)

These large Canada geese nest in southern Alberta and western Montana, and the inter-mountain regions of Utah, Idaho, eastern Nevada, Wyoming, and Colorado. They winter mainly in central and southern California, Arizona, Nevada, Utah, Idaho, and Montana (Figure 7). The spring population index for RMP states and provinces in 2012 was 143,400 geese, 37% higher than the index from 2011, which totaled 105,000 (Figure 14.2). Data for some states and years have been reanalyzed, and thus the RMP time series presented in this report is not directly comparable to those previously published. The revised indices exhibited no trend over the 2003–2012 time series ($P = 0.347$). Population indices in 2012 increased in Alberta and Montana, but in 2011, 3 of 7 Montana survey segments had been missed owing to weather. Indices increased in Utah, decreased in Colorado, and were similar to 2011 in Wyoming, Idaho, Nevada, and Arizona. The fall flight of RMP geese is expected to be average.

Pacific Population (PP)

These large Canada geese nest and winter west of the Rocky Mountains from northern Alberta and British Columbia south through the Pacific Northwest to California (Figure 7). The total PP goose index in 2012 was 221,600, 11% higher than the prior year's count of 200,000. In 2006, British Columbia initiated a different survey design. Data since the implementation of the new survey has been reanalyzed for this report, and thus, the total PP indices are not comparable to indices published in prior reports. There was no trend ($P = 0.548$) in the total PP index from 2006 to 2012. Most PP geese are surveyed in Alberta (WBPHS strata 76–77) where 114,100 (72,300–155,900) were estimated in 2012, similar ($P = 0.915$) to the 2011 estimate of 111,200 (59,600–162,700). Over the past 10 years, PP geese counted in the WBPHS strata have increased 7% per year ($P = 0.087$). Conditions in Alberta remained dry, and many wetlands were recessed. Gosling production in 2012 may be lower than average, but a fall flight similar to last year's is expected.

Dusky Canada Geese (DCG)

These mid-sized Canada geese predominantly nest on the Copper River Delta of southeastern Alaska, and winter principally in the Willamette and Lower Columbia River Valleys

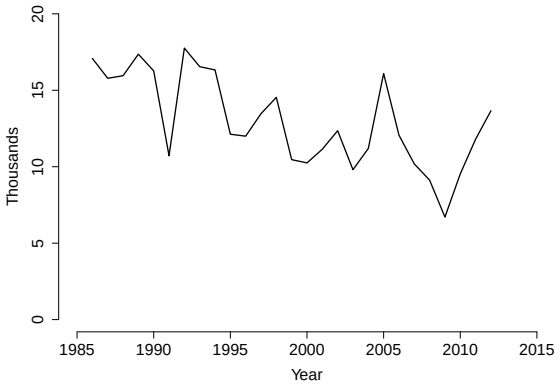


Figure 15: Estimated numbers of breeding adult Dusky Canada geese.

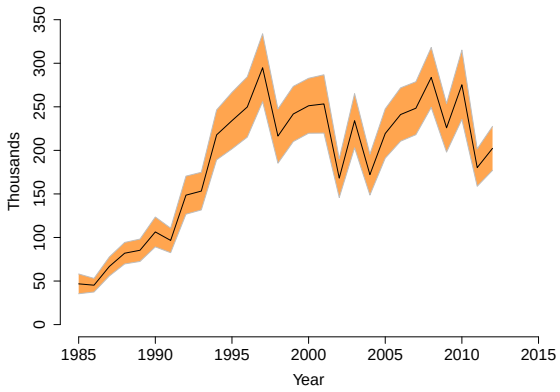


Figure 16: Estimated numbers of Cackling Canada geese (predicted fall goose population, with 95% confidence intervals).

of Oregon and Washington (Figure 7). Dusky Canada geese are surveyed near the Copper River Delta and Middleton Island, Alaska. As specified in the Pacific Flyway Management Plan, the Copper River Delta Breeding Pair Survey is the management index for dusky Canada geese. The management index is based on the sum of indicated pairs (corrected for detection rate and re-nesting), indicated flocked birds, and the indicated adult birds from Middleton Island. The 2012 population index is 13,700 birds and the most recent 3-year (2010–2012) running average is 11,700 birds (Figure 15). The 2012 population index and 3-year average are 15.8% and 25% higher, respectively than the 2011 population index (11,800) and former 3-year (2009–2011) average (9,300). The 2012 indicated breeding bird and indicated total bird indices are the highest recorded since 2005. These increases could be due in part to four consecutive years of high production on the Copper River Delta.

Cackling Canada Geese

Cackling Canada geese nest on the Yukon–Kuskokwim Delta (YKD) of western Alaska. They primarily winter in the Willamette and Lower Columbia River Valleys of Oregon and Washington (Figure 7). The analyses used to calculate the primary index of this population were changed in 2011. From 1998 to 2010 an estimated fall population was derived based on the historical relationship between spring surveys of adults on the YKD and direct counts conducted in the fall. Now, estimates of adults on the YKD are adjusted by the ratio of fall estimates based on observations of neck-banded birds and spring YKD estimates. Thus, we present the revised time series (Appendix D.1). The estimate for 2012 is 202,300 (177,100–227,600) geese, similar to last year's estimate of 180,200 (158,777–201,649). However, the difference between estimates may reflect factors other than true population size. Over the 2003–2012 time series, there has been no trend overall for the revised estimates ($P = 0.997$; Figure 16). Relative to recent years, phenology on the YKD was late, owing to cold spring temperatures and a large snow pack. During the survey, some of the habitat appeared to be flooded by snowmelt held by ice clogged sloughs and rivers. By 14 June 2012, some greening up of the tundra had occurred and only about 15% of the lakes in the northern areas had ice. Overall, lower production and a fall flight similar to that of last year are expected.

Lesser and Taverner's Canada Geese

These populations nest throughout Alaska and winter in Washington, Oregon, and California (Figure 7). Taverner's geese are more strongly associated with tundra areas of the North Slope and western Alaska, while lesser Canada geese tend to nest in Alaska's interior. However, these geese mix with other

Canada geese throughout the year and estimates of separate populations have not been presented in the past. We present the total combined estimate first, followed by the population-specific ones that have recently been developed. The 2012 estimate of Canada geese within WBPHS strata predominantly occupied by these subspecies (strata 1–6, 8, 10–12) was 63,000 (40,200–85,700), 33% higher than the 2011 estimate of 47,500 (27,400–67,600, $P = 0.317$). These estimates have not shown a trend over the period between 2003 and 2012 ($P = 0.416$).

Population indices for Taverner's Canada goose in Alaska are based on expanded counts of from three breeding pair survey efforts: the Arctic Coastal Plain Breeding Pair Survey, the Yukon Delta Coastal Zone Breeding Pair Survey, and stratum 10 (Seward Peninsula), stratum 11 (Kotzebue Sound), and stratum 9 (inland portions of the Yukon–Kuskokwim Delta) of the Waterfowl Breeding Populations and Habitat Survey Lines have been established to categorize Canada goose observations to identify Taverner's for inclusion in population indices. The indicated total birds from all three of the above 2012 surveys is 47,400 birds and the 3-year (2010–2012) average is 47,600 birds. The average growth rate from 1986 to 2012 for indicated total Taverner's Canada geese did not show a significant trend.

Within the Alaska–Yukon region, lesser Canada geese are found in boreal forest habitat. Population indices for the Alaska–Yukon region are based on the expanded counts of Canada geese in stratum 1 (Kenai–Susitna), stratum 2 (Nelchina), stratum 3 (Tanana–Kuskokwim), stratum 4 (Yukon Flats), and stratum 12 (Old Crow Flats) of the Waterfowl Breeding Population and Habitat Survey. Indicated breeding birds and total bird indices for 2012 were 1,400 and 3,800, respectively. The 3-year (2010–2012) average of the indicated breeding birds index was 2,657 and the 3-year average of indicated total birds index was 4,700. The average growth rate from 1986 to 2012 for indicated total lesser Canada geese showed no trend.

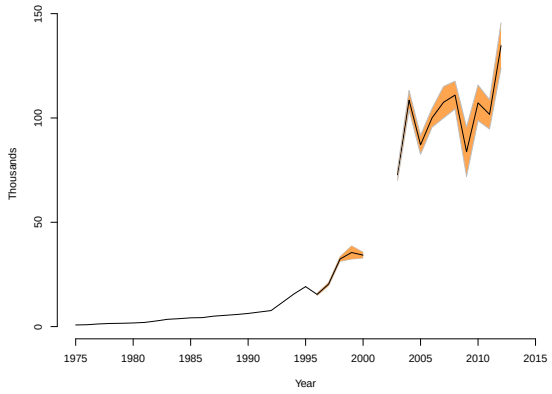


Figure 17: Estimated numbers of Aleutian Canada geese (winter geese, with 95% confidence intervals).

Aleutian Canada Geese (ACG)

The Aleutian Canada goose was listed as endangered in 1967 (the population numbered approximately 800 birds in 1974) and was delisted in 2001. These geese now nest primarily on the Aleutian Islands, although historically they nested from near Kodiak Island, Alaska to the Kuril Islands in Asia. They now winter along the Pacific Coast to central California (Figure 7). Aleutian goose population estimates since 1996 are based on mark-resight analysis of observations of neck-banded geese in California, and thus this time series is revised annually. The preliminary population estimate during the winter of 2012 was 134,700 (113,400–156,000), 32% higher than the revised 2011 estimate of 101,700 (87,900–115,600; Figure 17). These estimates have increased an average of 3% per year since 2003, and the latest is well above the 1996 revised estimate of 15,400 (14,300–16,500). A fall flight slightly higher than that of last year is expected.

Status of Light Geese

The term light geese refers to both snow geese and Ross's geese (including both white and blue color phases), and the lesser (*C. c. caerulescens*) and greater (*C. c. atlantica*) snow goose subspecies. Another collective term, mid-continent light geese, includes lesser snow and Ross's geese

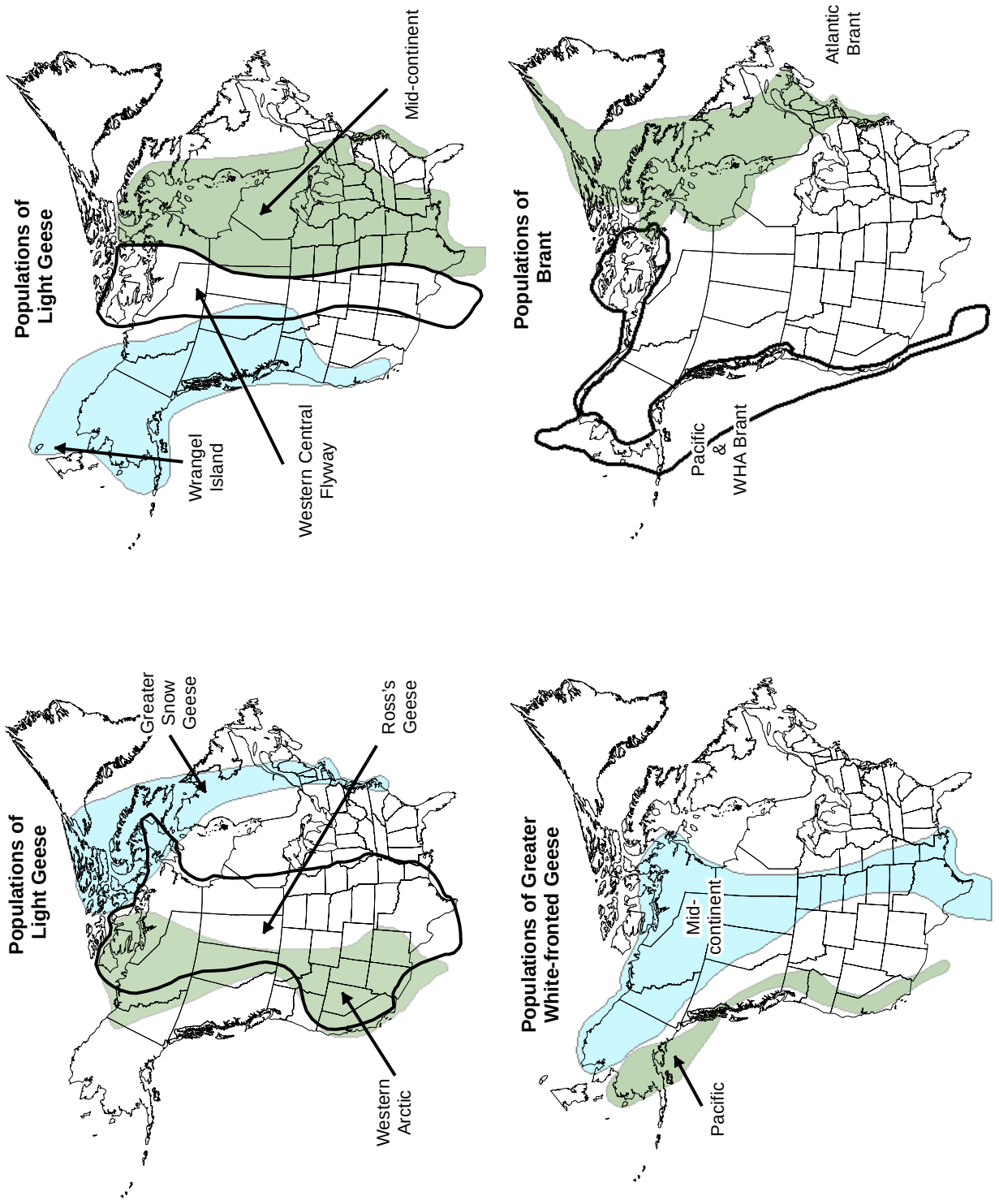


Figure 18: Approximate ranges of brant and snow, Ross's, and white-fronted goose populations in North America.

of two populations: the Mid-continent Population and the Western Central Flyway Population.

Ross's Geese

Most Ross's geese nest in the Queen Maud Gulf region, but increasing numbers nest on Southampton, Baffin, and Banks Islands, and along the western coast of Hudson Bay. Ross's geese are present in the range of three different populations of light geese and primarily winter in California, New Mexico, Texas, and Mexico, with increasing numbers in Louisiana and Arkansas (Figure 18). Ross's geese are annually surveyed at only one of their numerous nesting colonies. More comprehensive aerial photography inventories and groundwork (to identify proportions of snow and Ross's geese within colonies) are conducted periodically. Since 1993, the proportion of Ross's geese has been growing, and they have outnumbered snow geese there since 2007. The largest Ross's goose colonies are in the Queen Maud Gulf Sanctuary. Biologists at the Karrak Lake colony estimated that 682,000 (629,000–735,000) adult Ross's geese nested there in 2011, 3% fewer than in 2010 (Figure 19). Overall, these estimates have remained stable at about 700,000 from 2007 to 2011, but nonetheless have increased an average of 6% per year during 2002–2011 ($P = 0.001$). Colony 10, about 60 miles to the east of Karrak Lake, includes similar or higher numbers of Ross's geese. In 2012, conditions near the Queen Maud Gulf were approximately 4 days earlier than average, following 5 years of later than average timing. Nesting activities at the Karrak Lake colony were 2 days earlier compared to the long-term (1991–2012) average. Biologists expect Ross's goose production in 2012 to be above average, a turnaround after several consecutive years of below-average production.

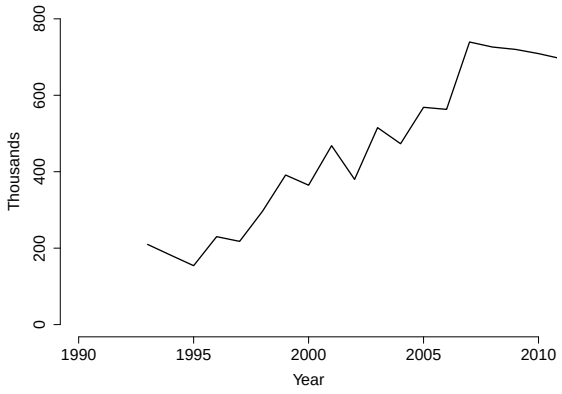


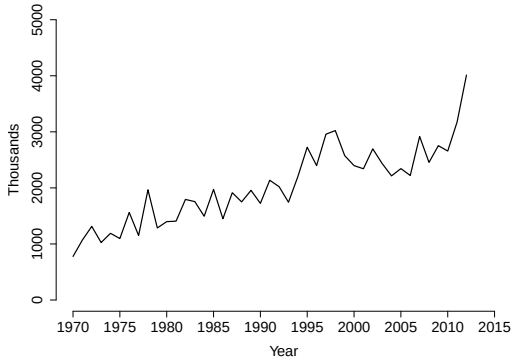
Figure 19: Estimated numbers of nesting adult Ross's geese at the Karrak Lake colony, Nunavut.

Mid-continent Population Light Geese (MCP)

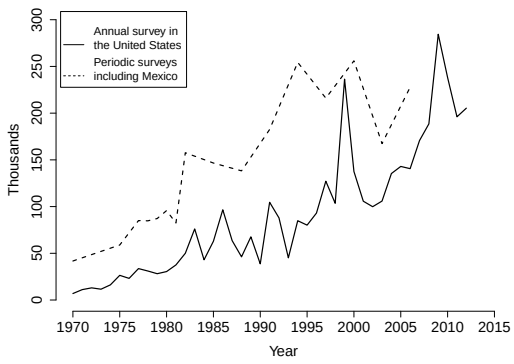
This population includes lesser snow geese and increasing numbers of Ross's geese. Geese of the MCP nest on Baffin and Southampton Islands, with smaller numbers nesting along the west coast of Hudson Bay (Figure 18). These geese winter primarily in eastern Texas, Louisiana, and Arkansas. During the 2012 MWS, biologists counted 4,021,200 light geese, a 27% increase relative to the 2011 index of 3,175,200, and a record high for the second year in a row. (Figure 20.1). Winter indices during 2003–2012 increased an average of 5% per year ($P = 0.005$). Biologists on Southampton and Baffin Islands reported that snow goose nesting there will likely result in complete breeding failure in 2012 because of widespread flooding. In addition, geese arrived early, but were met with heavy snow cover, making for a very short nesting window. The western portion of the Hudson Bay was ice-free early. Estimated hatch date at Cape Churchill was about one week earlier than in 2011. Spring phenology was earlier on the mainland in 2012 compared to the short-term (5-year) average, but Akimiski Island was close to its average. Overall, information suggests a below average fall flight of MCP snow geese containing a low proportion of young.

Western Central Flyway Population (WCFP)

Historically, this population included predominantly snow geese, but Ross's geese continue to increase and now represent nearly one third of all WCFP geese. Geese of the WCFP nest in the central and western Canadian Arctic, with large nesting colonies near the Queen Maud Gulf and on Banks Island. These geese



20.1: Mid-continent Population Light Geese



20.2: Western Central Flyway Light Geese

Figure 20: Estimated numbers of Mid-continent Population and Western Central Flyway Population snow and Ross's geese (winter geese).

stage during fall in eastern Alberta and western Saskatchewan and concentrate during winter in southeastern Colorado, New Mexico, the Texas Panhandle, and the northern highlands of Mexico (Figure 18). WCFP geese wintering in the U.S. portion of their range are surveyed annually, but their entire winter range that includes Mexico is usually surveyed once every three years. However, surveys in Mexico have not been conducted since 2009 due to sociopolitical unrest in that country. During the 2012 surveys in the U.S. portion of WCFP range, 205,300 geese were counted, 5% more than the 196,100 geese than were counted 2011 (Figure 20.2). These population indices increased 8% per year from 2003 to 2012 ($P = 0.003$). In 2012, spring phenology near the Queen Maud Gulf was approximately 4 days earlier than average, following 5 years of later than average timing. Nesting activities at the Karrak Lake colony were 2 days earlier compared to the long-term average (1991–2012) and 1 day earlier than 2011. Biologists expect WCFP snow goose production in 2012 to be above average, a turnaround after several consecutive years of below-average production.

Western Arctic/Wrangel Island Population (WAWI)

Most of the snow geese in the Pacific Flyway originate from nesting colonies in the western and central Arctic (WA: Banks Island, the Anderson and Mackenzie River Deltas, and the western Queen Maud Gulf region) or Wrangel Island (WI), located off the northern coast of Russia. The WA segment of the population winters in central and southern California, New Mexico, and Mexico; the WI segment winters in the Puget Sound area of Washington and in northern and central California (Figure 18). In winter, WA and WI segments commingle with light geese from other populations in California, complicating surveys. Due to the departure of long-time researcher Vasiliy Baranyuk from the Wrangel Island Nature Reserve, no information on breeding chronology and nesting on Wrangel Island is available for 2012. However, the fall 2011 estimate of WAWI snow geese was 1,097,900, 27% higher than the 863,800 counted in 2010 (Figure 21). Additional monitoring data will be reported for this population if it becomes available.

Greater Snow Geese (GSG)

This subspecies principally nests on Bylot, Axel Heiberg, Ellesmere, and Baffin Islands, and on Greenland, and winters along the Atlantic coast from New Jersey to North Carolina (Figure 18). This population is monitored on their spring staging areas near the St. Lawrence Valley in Quebec. Beginning in 2008, estimates

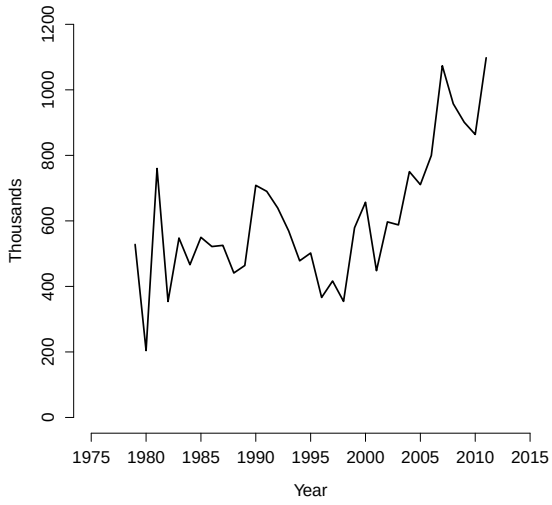


Figure 21: Estimated numbers of Western Arctic/Wrangel Island population snow geese (fall geese).

have been calculated using a revised sampling methodology. The preliminary estimate from spring surveys in 2012 was 1,005,000 (920,000–1,090,000) geese, 10% more than the 917,000 (880,700–953,300) estimated last year ($P = 0.062$; Figure 22). Spring estimates of greater snow geese have increased an average of 2% per year since 2003 ($P = 0.314$), despite the introduction of special seasons, and biologists remain concerned about their high numbers. The number of snow geese counted during the 2012 MWS in the Atlantic Flyway was 331,600, 22% higher the 271,100 counted during the 2011 survey. The largest known greater snow goose nesting colony is on Bylot Island, where breeding conditions for greater snow geese were relatively good this year. Snow pack was slightly above average in May but snowmelt in early June was near normal. Geese nonetheless arrived early in June and nest initiation was rapid and slightly earlier than normal. The breeding effort was fairly high and similar to last year.

However, following two years of high lemming abundance, lemming populations crashed over the winter. Consequently nest predation, especially by arctic foxes, was high. Mean initiation date, clutch size, and mean nest survival to late incubation were slightly better than their 20-year averages. However, because of the high predation rate on goose nests, biologists expect a moderately good fall flight for greater snow geese.

Status of Greater White-fronted Geese

Pacific Population White-fronted Geese (PP)

These geese primarily nest on the Yukon–Kuskokwim Delta (YKD) of Alaska and winter in the Central Valley of California (Figure 18). The index for this population since 1999 has been a predicted fall population estimate derived from spring surveys of adults on the YKD and Bristol Bay. The 2012 fall estimate is 429,800, 29% lower than the 2011 estimate of 604,300 (Figure 23). Over the past 10 years however, these estimates have increased an average of 3% per year ($P = 0.116$). The 2012 YKD spring survey reported a Pacific population indicated total birds index of $181,500 \pm 15,500$ and an indicated breeding birds index of $97,700 \pm 8,400$. The indicated total birds and the indicated breeding birds indices are 8% and 15% higher than those of 2011 ($168,900 \pm 16,100$ and $84,600 \pm 8,100$, respectively). The 2012 estimates of both indicated total birds and indicated breeding birds were the highest on record. Annual growth rates for indicated total birds and indicated breeding birds measured 1.096 ± 0.006 and 1.102 ± 0.005, respectively and were the highest growth rates of the five goose species on the Yukon-Kuskokwim Delta. The annual growth rate for indicated total birds from 1985 to 1995 measured 1.159 ± 0.022 as compared to 1.056 ± 0.005 during 1996–2012.

Mid-continent Population White-fronted Geese (MCP)

These white-fronted geese nest across a broad region from central and northwestern Alaska to the central Arctic and the Foxe Basin. They concentrate in southern Saskatchewan during the fall and in Texas, Louisiana, Arkansas, and Mexico during winter (Figure 18). During the fall 2011 survey in Saskatchewan and Alberta, biologists counted 681,700 MCP geese, 4% fewer than the 709,800 counted during the

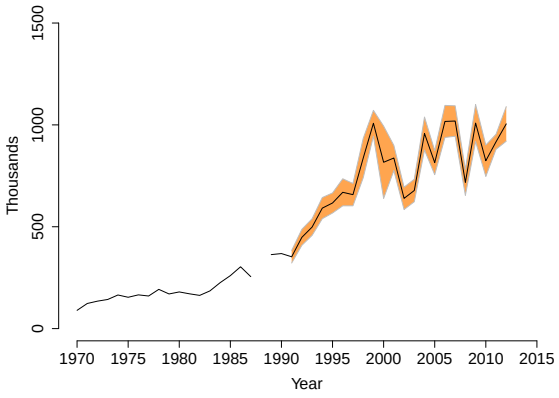


Figure 22: Estimated numbers of greater snow geese (spring staging geese, with 95% confidence intervals), 1970–2012.

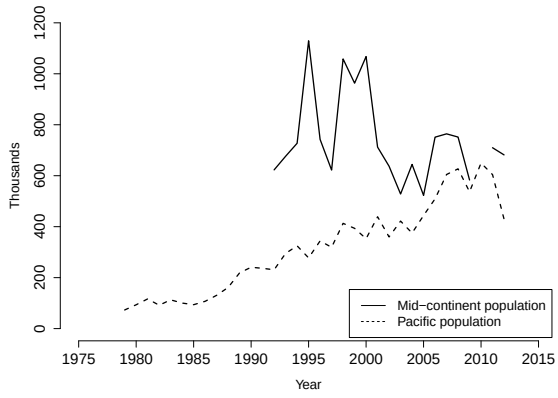


Figure 23: Estimated numbers of mid-continent population and Pacific population white-fronted geese (fall geese).

previous year's survey (Figure 23). During 2003–2012, these estimates increased by an average of 2% per year ($P = 0.221$). Eastern portions (e.g., Queen Maud Gulf, Rasmussen Lowlands) of MCP white-fronted goose range experienced earlier than average ice break-ups and nesting activities began earlier than average. Nesting phenology near Karrak Lake was 4 days earlier than the long-term average. White-fronted goose production is expected to be above average in 2012. Nesting near the Mackenzie River Delta may have been affected by flooding.

Status of Brant

Atlantic Brant (ATLB)

Most of this population nests on islands of the eastern Canadian Arctic. These brant winter along the Atlantic Coast from Massachusetts to North Carolina (Figure 18). The 2012 MWS index for brant in the Atlantic Flyway was 149,200, similar to the 2011 estimate of 148,900 (Figure 24). These estimates have shown no trend over the 2003–2012 time period ($P = 0.617$). Winter snowfall and spring temperatures were both average, as was the timing of snowmelt near James Bay staging areas. Biologists reported widespread flooding on Southampton Island and expect little or no brant production there in 2012.

Pacific Brant (PACB)

These brant nest across Alaska's Yukon-Kuskokwim Delta (YKD) and North Slope, Banks Island, other islands of the western and central Arctic, the Queen Maud Gulf, and Wrangel Island. They winter as far south as Baja California and the west coast of Mexico (Figure 18). The 2012 MWS estimate of brant in the Pacific Flyway and Mexico was 157,400, 6% higher than the 2011 estimate of 147,900 (Figure 24). Estimates increased an average of 3% per year from 2003 to 2012 ($P = 0.038$). Although the Yukon Delta Coastal Breeding Waterfowl Survey was not specifically designed to assess populations of colonial nesting species, the survey data are useful in helping to better understand population trends and distribution. The 2012 indicated total birds index from this survey ($21,900 \pm 3,200$) is 36% higher than the 2011 index ($16,200 \pm 2,000$) and the 2012 indicated breeding birds index ($17,500 \pm 2,700$) is 42% higher than the 2011 index ($12,400 \pm 1,700$). The indicated total birds and indicated breeding birds annual growth rates are 1.008 ± 0.009 and 1.059 ± 0.008, respectively.

Western High Arctic Brant (WHA)

This population of brant nests on the Parry Islands of the Northwest Territories (Figure 18). The population stages in fall at Izembek Lagoon,

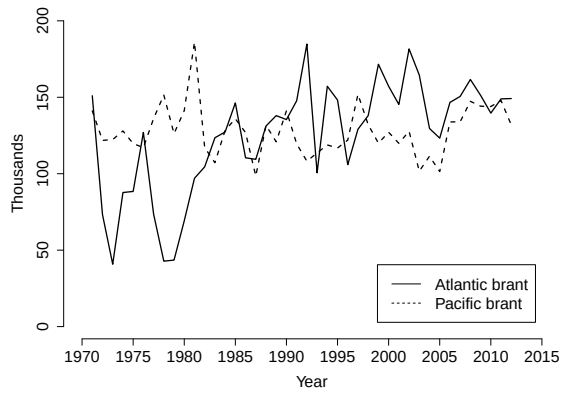


Figure 24: Numbers of Atlantic and Pacific brant estimated during winter surveys.

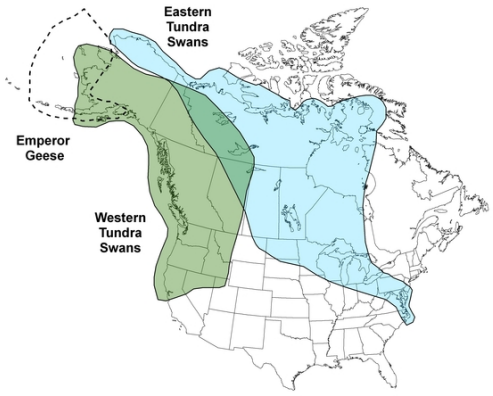


Figure 25: Approximate ranges of emperor geese, and Eastern and Western Populations of tundra swans in North America.

Alaska. They predominantly winter in Padilla, Samish, and Fidalgo Bays of Washington and near Boundary Bay, British Columbia, although some individuals have been observed as far south as Mexico. This population is monitored during the MWS in three Washington state counties. Last year, biologists recorded 50% juveniles for WHA brant in Puget Sound ($n = 791$). The 2012 MWS recorded 6,700 WHA birds, 21% fewer than the 8,500 brant counted in 2011. These estimates have increased an average of 2% per year during 2002–2011 ($P = 0.538$). Satellite imagery for the breeding area in the Parry Islands suggests 2012 will be an excellent year for breeding, with the smallest snow pack in 12 years.

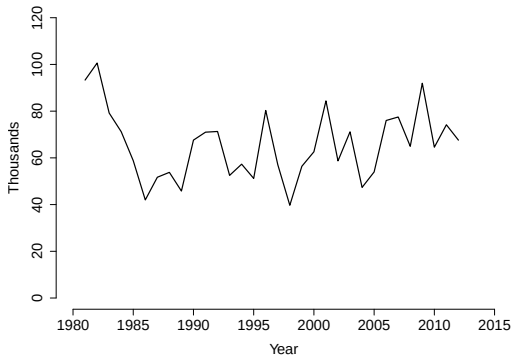
Status of Emperor Geese

The breeding range of emperor geese is restricted to coastal areas of the Bering Sea, with the largest concentration on the Yukon-Kuskokwim Delta (YKD) in Alaska. Emperor geese migrate relatively short distances and primarily winter in the Aleutian Islands (Figure 25). Since 1981, emperor geese have been surveyed annually on spring staging areas in southwestern Alaska. As specified in the management plan for emperor geese, the Pacific Flyway Council recognizes the management index as the 3-year average of estimates derived from the spring population survey on the Alaska Peninsula. The 2012 estimate derived from the spring emperor goose survey was 68,800 emperor geese. This represented a 7% decrease from the 2011 estimate (74,200). The current 3-year (2010–2012) average of 68,800 is down 11% from the previous 3-year average of 76,900 (Figure 26.1). These estimates have increased an average of 2% per year during 2003–2012 ($P = 0.250$). In 2012, the emperor goose indices on the Yukon-Kuskokwim Delta for indicated total birds ($20,400 \pm 1,600$) and indicated breeding birds ($17,200 \pm 1,300$) were 4% lower and 17% higher, than the respective 2011 indices ($21,200 \pm 1,300$) and ($14,700 \pm 800$). From 1985–2012, the population growth rates for indicated total birds (1.015 ± 0.003) and indicated breeding birds (1.025 ± 0.003) were positive. In comparison to recent years, 2012 spring phenology on the Yukon-Kuskokwim Delta was late due to cold spring temperatures and a large snow pack. Below-average production is expected.

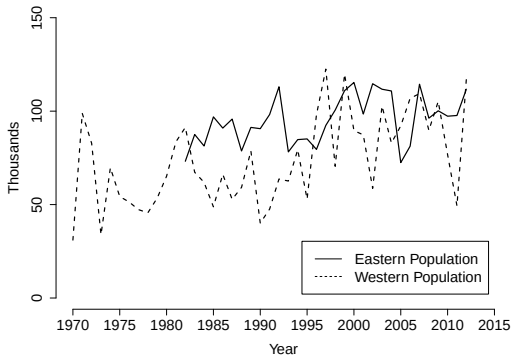
Status of Tundra Swans

Western Population Tundra Swans

These swans nest along the coastal lowlands of western Alaska, particularly between the Yukon and Kuskokwim Rivers. They winter primarily in California, Utah, and the Pacific Northwest (Figure 25). The 2012 MWS estimate of western population swans was 117,200, 138% higher than last year's estimate of 49,300 (Figure 26.2). In 2010 and 2011, major swan areas in California could not be covered. The return to full survey coverage this year likely accounted



26.1: Emperor geese



26.2: Tundra swans

Figure 26: Estimated numbers of emperor geese (spring staging geese), and Eastern and Western populations of tundra swans (winter swans).

for the dramatic difference between this year's and last year's counts. Despite variation in survey coverage, MWS estimates are have shown no trend over the last 10 years ($P = 0.463$). The Yukon-Kuskokwim Delta is the core breeding area for this population of tundra swans in Alaska. The indicated total birds index in 2012 ($39,300 \pm 5,700$) was 18% higher as compared 2011 ($33,500 \pm 4,400$).

Eastern Population Tundra Swans

Eastern Population tundra swans (EP) nest from the Seward Peninsula of Alaska to the northeast shore of Hudson Bay and Baffin Island. The Mackenzie Delta and adjacent areas are of particular importance. These birds winter in coastal areas from Maryland to North Carolina (Figure 25). The primary index for EP tundra swans includes swans counted during winter in Ontario and the Atlantic and Mississippi Flyways. During the 2012 MWS, 111,700 EP tundra swans were observed, 14% higher than the 2011 count of 97,700 (Figure 26.2). These estimates have exhibited no trend during the 2003–2012 ten-year time frame ($P = 0.723$). Spring phenology was average in the central Arctic and North Slope portions of EP tundra swan range in 2012. Swan production in 2012 is expected to be near average.

A Individuals who supplied information for the generation of this report

A.1: Individuals who supplied information on the status of ducks.

Alaska, Yukon Territory, and Old Crow Flats (Strata 1–12)

Air E. Mallek and D. Groves

Northern Alberta, Northeastern British Columbia, and Northwest Territories (Strata 13–18, 20, and 77)

Air W. Rhodes and C. Spiegel

Northern Saskatchewan and Northern Manitoba (Strata 21–23, 24, 25)

Air K. Fox and M. Rabe[b]

Air stratum 24 R. Spangler and J. Bredy

Air stratum 25 R. Spangler and D. Benning[e]

Southern and Central Alberta (Strata 26–29, 75, and 76)

Air J. Bredy and J. Hitchcock

Ground G. Raven[a], M. Watmough[a], R. Wiacek[a], J. Caswell[b], M. Gillespie[c], K. Jones[a], and L. Smith[a]

Southern Saskatchewan (Strata 30–33)

Air P. Thorpe and S. Yates

Ground J.-M. DeVink[a], K. Dufour[a], K. Warner[a], P. Bergen[c], S. Leach[a], B. Tether[a], and S. Heap[a]

Southern Manitoba (Strata 34-40)

Air R. Spangler and D. Benning[e]

Ground M. Schuster[a], J. Asmundson[a], G. Ball[c], J. Leafloor[a], J. Ingram[a], K. Renwick[a], R. Buss[c], and D. Walker[c]

Montana and Western Dakotas (Strata 41–44)

Air S. Bayless and J. Klimstra

Ground A. Mohler and G. Suleiman

Eastern Dakotas (Strata 45–49)

Air T. Liddick and D. Fronczak

Ground K. Kruse, S. Olson, V. Morgan, and J. Dowler

Western Ontario and Central Quebec (Strata 50, 55,57, 69–70)

Air J. Wortham and G. Boomer

Eastern Ontario and Southern Quebec (Strata 51-54, 56, 68)

Air S. Earsom and B. Berg

Maine and Maritimes (Strata 62–67)

Air M. Koneff and H. Obrecht[e]

Canadian Wildlife Service helicopter plot survey

Quebec	D. Bordage[a], C. Lepage[a], C. Marcotte[a], and S. Orichefsky[a]
Ontario	S. Meyer[a], C. Sharp[a], S. Badzinski[a], and A. Harasym[d]
New Brunswick & Nova Scotia	R. Hicks[a] and B. Pollard[a]
Labrador & Newfoundland	S. Gilliland[a], P. Ryan[a], and R. Wells[a]

California

Air	M. Weaver[b] and S. Oldenburger[b]

Michigan

Air	B. Barlow[b], B. Dybas-Berger[b], S. Chadwick[b], J. Darling[b], N. Kalejs[b], T. Maples[b], T. McFadden[b], M. Mills[b], J. Niewoonder[b], J. Robison[b], R. Soulard[b], B. Sova[b], V. Weigold[b]

Minnesota

Air	T. Pfingsten[b] and S. Cordts[b]
Ground	S. Kelly, W. Brininger, D. Hertel, F. Oslund, P. Richert, K. Bousquet, G. Dehmer, S. Zodrow, J. Govan, K. Halver, L. Deede, G. Kemper, B. Anderson, P. Soler, J. Braun, K. Norton, B. Nylin[d], T. Moser[e], J. Kelley and T. Cooper

Nebraska

M. Vrtiska

Northeastern U.S.

Data Analysis	J. Klimstra
Connecticut	M. Huang[b] and K. Kubik[b]
Delaware	M. Dibona[b] and J. Baird[b]
Maryland	Maryland Department of Natural Resources personnel and cooperators
Massachusetts	Massachusetts Division of Fisheries and Wildlife personnel and cooperators
New Hampshire	J. Robinson[b], P. Tate[b], T. Walski[b], K. Bordeau[b], K. Rines[b], E. Robinson[b], A. Timmins[b], W. Staats[b], and J. Kilborn[b]
New Jersey	T. Nichols[b], A. Burnett[b], J. Garris[b], B. Kirkpatrick[d], S. Petzinger[b], J. Powers[b], S. Predl[b], L. Widjeskog[b], R. Somes[b], P. Winkler[b], K. Tinnes[b], P. Woerner[b], O. Jones[b], D. Faith[b], P. Castelli, and J. Heisse
New York	New York State Department of Environmental Conservation personnel and cooperators
Pennslyvania	D. Brauning[b], M. Casalena[b], R. Coup[b], J. Dunn[b], B. Ellis[b], J. Gilbert[b], M. Giles[b], I. Gregg[b], D. Gross[b], T. Hardisky[b], T. Hoppe[b], K. Jacobs[b], M. Lovallo[b], J. Morgan[b], M. Ternent[b], S. Trusso[b], M. Weaver[b], and K. Wenner[b]
Rhode Island	P. Ricard[b], C. Brown[b], J. Beuth[b], and B. Tefft[b]

Vermont	B. Crenshaw[b], J. Buck[b], J. Austin[b], D. Blodgett[b], J. Gobeille[b], T. Appleton[b], D. Sausville[b], J. Mlcuch[b], A. Alfieri[b], F. Hammond[b], J. Flewelling[b], and R. Smith[b]
Virginia	G. Costanzo[b], B. Lewis[b], M. DeLeeuw[b], A. Proctor[b], M. Dye[b], T. Engelmeyer[b], P. West[b], C. Dobyns[b], J. Rohm[b], D. Ellinghausen[b], G. Sours[b], A. Bourgeois[b], T. Willingham[b], J. Ferdinansen[b], M. Frank[b], M. Gautier[b], T. Moss[b], D. Johnson[b], D. Lovelace[b], B. Stinson[b], F. Frenzel[b], B. Bassinger[b], J. Watson[b] B. Moyer[b], D. Kocka[b], J. Bowman[b], D. Mohler[b], and K. Martin[b]

Nevada

Air	K. Neill[b], C. Nicolai, N. Saake[d], and M. Dobel[d]

Oregon

Air	B. Bales[b], B. Reishus[b], C. Sponseller[b], T. Collom[b], M. St. Louis[b], J. Journey[b], J. Thompson[b], R. Klus[b], K. Martin[b], D. Marvin[b], E. Miguez[b], P. Perrine[b], and Timberland Helicopters[d]

Washington

Air	M. Moore[b], J. Evenson[b], D. Blodgett[d], T. Cyra[b], R. Finger[b], M. Livingston[b], B. Murphie[b], J. Shepherd[b], N. Ludwig[d], and P. Regggli[d]

Wisconsin

Air	L. Waskow[b], P. Berringer[b], C. Cold[b], C. Milestone[b], and R. Lichtie[b]
Ground	R. Anderson[b], R. Brathal[b], J. Carstens[b], N. Christel[b], J. Christian[b], J. Christopoulos[b], C. Cole[b], G. Dunsmoor[b], S. Fisher[b], J. Huff[b], L. Kardash[b], J. Leith[b], D. Matheys[b], R. McDonough[b], D. Miller[b], C. Mogen[b], K. Morgan[b], J. Pritzl[b], J. Robaidek[b], M. Schmidt[b], M. Soergel[b], K. Van Horn[b], J. Wanner[b], R. Weide[b], D. Weidert[b], L. Wienke[b], B. Axt, P. Charland, G. Hamilton, J. Lutes, S. Otto, M. Pfost, R. Samerdyke, G. Van Vreede, and T. Walters[d]

[a] Canadian Wildlife Service
[b] State, Provincial or Tribal Conservation Agency
[c] Ducks Unlimited Canada
[d] Other Organization
[e] U.S. Fish & Wildlife Service Retired
All others—U.S. Fish & Wildlife Service

A.2: Individuals that supplied information on the status of geese and swans.

Flyway-wide and Regional Survey Reports

R. Bergeron[a], K. Bollinger, L. Denlinger, J. Fischer, D. Fronczak, D. Groves, J. Kelley, J. Klimstra, K. Kruse, J. Leafloor[a], S. Olson, P. Padding, J. Dubovsky, and E. Taylor

Information from the Breeding Population and Habitat Survey

See Appendix A.1

North Atlantic Population of Canada Geese

S. Gilliland[a], M. Koneff, H. Obrecht[d], and G. Zimmerman

Atlantic Population of Canada Geese

R. Cotter[a], W. Harvey[b], M. Koneff, and E. Reed[a]

Atlantic Flyway Resident Population of Canada Geese

T. Nichols[b], G. Costanzo[b], W. Crenshaw[b], J. Dunn[b], H. Heusmann[b], L. Hindman[b], R. Hossler[b], M. Huang[b], K. Jacobs[b], J. Osenkowski[b], and E. Robinson[b].

Southern James Bay Population of Canada Geese

K. Abraham[b], R. Brook[b], J. Hughes[a]

Mississippi Valley Population of Canada Geese

K. Abraham[b], R. Brook[b], J. Hughes[a]

Mississippi Flyway Population Giant Canada Geese

K. Abraham[b], F. Baldwin[b], J. Hughes[a], D. Luukkonen[b], R. Marshalla[b], L. Naylor[b], A. Phelps[b], R. Pritchert[b], A. Radeke[b], D. Rave[b], L. Reynolds[b], D. Scott[b], K. Van Horn[b], T. White[b], and G. Zenner[b]

Eastern Prairie Population of Canada Geese

F. Baldwin[b], B. Lubinski, A. Raedeke[b], M. Reiter[d], and J. Wollenberg[b]

Western Prairie and Great Plains Populations of Canada Geese

S. Bayless, D. Benning[d], J. Bredy, K. Fox, D. Fronczak, J. Klimstra, T Liddick, M. Rabe[b], W. Rhodes, P. Thorpe, and S. Yates

Tall Grass Prairie Population of Canada Geese

R. Alisauskas[a], K. Kruse

Short Grass Prairie Population of Canada Geese

R. Alisauskas[a], W. Rhodes, C. Spiegel

Hi-Line Population of Canada Geese

S. Bayless, J. Bredy, J. Hitchcock, J. Klimstra, L. Roberts[b], E. Silverman, P. Thorpe, and S. Yates

Rocky Mountain Population of Canada Geese

S. Bayless, J. Bredy, J. Hitchcock, D. Kraege[b], S. Olson, L. Roberts[b], T. Sanders, E. Silverman, and R. Woolstenhulme[b]

Pacific Population of Canada Geese

A. Breault[b], B. Bales[b], J. Bredy, J. Hitchcock, D. Kraege[b], S. Olson, B. Reishus[b], W. Rhodes, T. Sanders, C. Spiegel, M. Weaver[b], and R. Woolstenhulme[b]

Dusky Canada Geese

W. Eldridge, B. Larned, M. Petrula, J. Hodges, and R. Stehn

Lesser and Taverner's Canada Geese

K. Bollinger, D. Groves, E. Mallek, R. Platte, R. Stehn, and B. Stone

Cackling Canada Geese

K. Bollinger, R. Platte, R. Stehn, and B. Stone

Aleutian Canada Geese

V. Byrd, T. Sanders, and L. Spitler

Greater Snow Geese

J. Lefebvre[a], G. Gauthier[c], J. Ingram[a], and B. Lubinski

Mid-continent Population Light Geese

R. Alisauskas[a], G. Gilchrist[a], J. Ingram[a] and B. Lubinski

Western Central Flyway Population Light Geese

R. Alisauskas[a]

Western Arctic/Wrangel Island Population of Lesser Snow Geese

P. Cherny[b], R. Corcoran, J. Hailine, J. Isola, E. King, D. Kraege[b], S. Olson, S. Oldenburger[b] M. Weaver[b], and M. Wolder

Ross's Geese

R. Alisauskas[a]

Pacific Population White-fronted Geese

K. Bollinger, L. Denlinger, R. Platte, and B. Stone

Mid-continent Population White-fronted Geese

R. Alisauskas[a], D. Groves, K. Kraii[b], B. Larned, E. Mallek, M. Spindler, and K. Warner[a]

Pacific Brant

K. Bollinger, R. Platte, and B. Stone

Atlantic Brant

K. Abraham[a], G. Gilchrist[a], and J. Klimstra

Western High Arctic Brant

D. Kraege[b]

Emperor Geese

K. Bollinger, L. Denlinger, R. Platte, and B. Stone

Western Population of Tundra Swans

K. Bollinger, R. Platte, R. Stehn, and B. Stone

Eastern Population of Tundra Swans

K. Abraham[a], D. Fronzcak, and J. Klimstra

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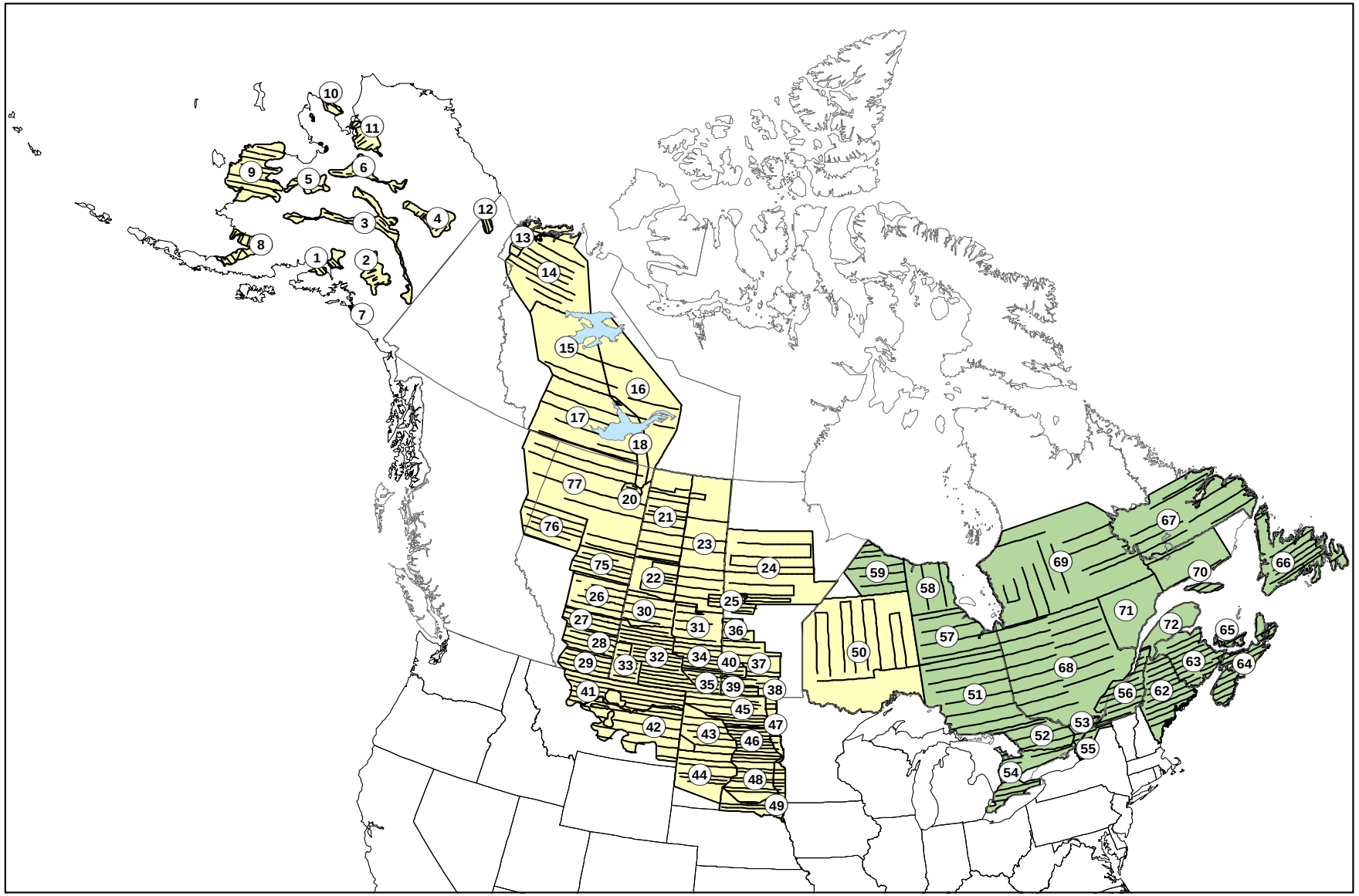
[a] Canadian Wildlife Service
[b] State, Provincial or Tribal Conservation Agency
[c] Other Organization
[d] U.S. Fish & Wildlife Service Retired
All others–U.S. Fish and Wildlife Service

B Waterfowl Breeding Population and Habitat Survey map



Strata and transects of the Waterfowl Breeding Population and Habitat Survey (yellow = traditional survey area, green = eastern survey area).

C Historical estimates of May ponds and regional waterfowl populations

Table C.1: Estimated number of May ponds and standard errors (in thousands) in portions of Prairie Canada and the north-central U.S.

	Prairie Canada		North-central U.S.[a]		Total	
Year	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$
1961	1,977.20	165.40				
1962	2,369.10	184.60				
1963	2,482.00	129.30				
1964	3,370.70	173.00				
1965	4,378.80	212.20				
1966	4,554.50	229.30				
1967	4,691.20	272.10				
1968	1,985.70	120.20				
1969	3,547.60	221.90				
1970	4,875.00	251.20				
1971	4,053.40	200.40				
1972	4,009.20	250.90				
1973	2,949.50	197.60				
1974	6,390.10	308.30	1,840.80	197.20	8,230.90	366.00
1975	5,320.10	271.30	1,910.80	116.10	7,230.90	295.10
1976	4,598.80	197.10	1,391.50	99.20	5,990.30	220.70
1977	2,277.90	120.70	771.10	51.10	3,049.10	131.10
1978	3,622.10	158.00	1,590.40	81.70	5,212.40	177.90
1979	4,858.90	252.00	1,522.20	70.90	6,381.10	261.80
1980	2,140.90	107.70	761.40	35.80	2,902.30	113.50
1981	1,443.00	75.30	682.80	34.00	2,125.80	82.60
1982	3,184.90	178.60	1,458.00	86.40	4,642.80	198.40
1983	3,905.70	208.20	1,259.20	68.70	5,164.90	219.20
1984	2,473.10	196.60	1,766.20	90.80	4,239.30	216.50
1985	4,283.10	244.10	1,326.90	74.00	5,610.00	255.10
1986	4,024.70	174.40	1,734.80	74.40	5,759.50	189.60
1987	2,523.70	131.00	1,347.80	46.80	3,871.50	139.10
1988	2,110.10	132.40	790.70	39.40	2,900.80	138.10
1989	1,692.70	89.10	1,289.90	61.70	2,982.70	108.40
1990	2,817.30	138.30	691.20	45.90	3,508.50	145.70
1991	2,493.90	110.20	706.10	33.60	3,200.00	115.20
1992	2,783.90	141.60	825.00	30.80	3,608.90	144.90
1993	2,261.10	94.00	1,350.60	57.10	3,611.70	110.00
1994	3,769.10	173.90	2,215.60	88.80	5,984.80	195.30
1995	3,892.50	223.80	2,442.90	106.80	6,335.40	248.00

Table C.1: Continued.

	Prairie Canada		North-central U.S.[a]		Total	
Year	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$
1996	5,002.60	184.90	2,479.70	135.30	7,482.20	229.10
1997	5,061.00	180.30	2,397.20	94.40	7,458.20	203.50
1998	2,521.70	133.80	2,065.30	89.20	4,586.90	160.80
1999	3,862.00	157.20	2,842.20	256.80	6,704.30	301.20
2000	2,422.50	96.10	1,524.50	99.90	3,946.90	138.60
2001	2,747.20	115.60	1,893.20	91.50	4,640.40	147.40
2002	1,439.00	105.00	1,281.00	63.40	2,720.00	122.70
2003	3,522.30	151.80	1,667.80	67.40	5,190.10	166.10
2004	2,512.60	131.00	1,407.00	101.70	3,919.60	165.80
2005	3,920.50	196.70	1,460.70	79.70	5,381.20	212.20
2006	4,449.50	221.50	1,644.40	85.40	6,093.90	237.40
2007	5,040.20	261.80	1,962.50	102.50	7,002.70	281.20
2008	3,054.80	147.60	1,376.60	71.90	4,431.40	164.20
2009	3,568.10	148.00	2,866.00	123.10	6,434.00	192.50
2010	3,728.70	203.40	2,936.30	142.30	6,665.00	248.20
2011	4,892.70	197.50	3,239.50	127.40	8,132.20	235.00
2012	3,885.10	146.50	1,658.90	52.70	5,544.00	155.60

[a] No comparable survey data available for the north-central U.S. during 1961–73.

Table C.2: Breeding population estimates (in thousands) for total ducks[a] and mallards for states, provinces, or regions that conduct spring surveys.

	British Columbia		California		Michigan		Minnesota		Nebraska	
Year	Total ducks	Mallards	Total ducks	Mallards	Total ducks	Mallards	Total ducks	Mallards	Total ducks	Mallards
1955									101.5	32.0
1956									94.9	25.8
1957									154.8	26.8
1958									176.4	28.1
1959									99.7	12.1
1960									143.6	21.6
1961									141.8	43.3
1962									68.9	35.8
1963									114.9	37.4
1964									124.8	66.8
1965									52.9	20.8
1966									118.8	36.0
1967									96.2	27.6
1968							321.0	83.7	96.5	24.1
1969							323.2	88.8	100.6	26.7
1970							324.2	113.9	112.4	24.5
1971							277.1	78.5	96.0	22.3
1972							217.2	62.2	91.7	15.2
1973							389.5	99.8	85.5	19.0
1974							281.6	72.8	67.4	19.5
1975							471.6	175.8	62.6	14.8
1976							684.1	117.8	87.2	20.1
1977							501.1	134.2	152.4	24.1
1978							462.5	146.8	126.0	29.0
1979							552.4	158.7	143.8	33.6
1980							690.6	172.0	133.4	37.3
1981							439.8	154.8	66.2	19.4
1982							465.2	120.5	73.2	22.3
1983							367.1	155.8	141.6	32.2
1984							529.7	188.1	154.1	36.1
1985							562.9	216.9	75.4	28.4
1986							520.8	233.6	69.5	15.1
1987							589.0	192.3	120.5	41.7
1988							725.2	271.7	126.5	27.8
1989							813.6	273.0	136.7	18.7
1990							807.9	232.1	81.4	14.7
1991					408.4	289.3	753.7	225.0	126.3	26.0
1992			497.4	375.8	867.5	385.8	973.3	360.9	63.4	24.4
1993			666.7	359.0	742.8	437.2	837.2	305.8	92.8	23.8
1994			483.2	311.7	683.1	420.5	1,115.6	426.5	118.9	17.5
1995			589.7	368.5	791.9	524.1	797.1	319.4	142.9	42.0
1996			843.7	536.7	680.5	378.2	889.1	314.8	132.3	38.9
1997			824.3	511.3	784.0	489.3	868.1	407.4	128.3	26.1
1998			706.8	353.9	1,068.5	523.0	693.1	368.5	155.7	43.4
1999			851.0	560.1	744.6	466.1	680.5	316.4	251.2	81.1

Table C.2: Continued.

	British Columbia		California		Michigan		Minnesota		Nebraska	
Year	Total ducks	Mallards	Total ducks	Mallards	Total ducks	Mallards	Total ducks	Mallards	Total ducks	Mallards
2000			562.4	347.6	793.9	427.2	747.8	318.1	178.8	54.3
2001			413.5	302.2	497.8	324.2	716.4	320.6	225.3	69.2
2002			392.0	265.3	742.5	323.2	1,171.5	366.6	141.8	50.6
2003			533.7	337.1	535.4	298.9	721.8	280.5	96.7	32.9
2004			412.8	262.4	624.5	342.0	1,008.3	375.3	69.9	23.2
2005			615.2	317.9	468.3	258.1	632.0	238.5	117.1	29.3
2006	394.4	102.1	649.4	399.4	412.2	244.6	521.1	160.7		
2007	369.0	98.5	627.6	388.3	641.9	337.7	488.5	242.5		
2008	345.6	73.7	554.3	297.1	437.5	200.5	739.6	297.6		
2009	314.6	67.0	510.8	302.0	493.6	258.9	541.3	236.4		
2010	300.1	72.4	541.3	367.9	595.3	338.3	530.7	241.9		
2011	253.2	68.3	558.6	314.7	471.4	258.6	687.5	283.3		
2012	296.2	78.7	524.5	381.9	773.0	439.3	468.6	225.0		

[a] Species composition for the total duck estimate varies by region.

Table C.2: Continued.

	Nevada[c]		Northeast U.S.[b]		Oregon		Washington		Wisconsin	
Year	Total ducks	Mallards	Total ducks	Mallards	Total ducks	Mallards	Total ducks	Mallards	Total ducks	Mallards
1955										
1956										
1957										
1958										
1959	14.2	2.1								
1960	14.1	2.1								
1961	13.5	2.0								
1962	13.8	1.7								
1963	23.8	2.2								
1964	23.5	3.0								
1965	29.3	3.5								
1966	25.7	3.4								
1967	11.4	1.5								
1968	10.5	1.2								
1969	18.2	1.4								
1970	19.6	1.5								
1971	18.3	1.1								
1972	19.0	0.9								
1973	20.7	0.7							412.7	107.0
1974	17.1	0.7							435.2	94.3
1975	14.5	0.6							426.9	120.5
1976	13.6	0.6							379.5	109.9
1977	16.5	1.0							323.3	91.7
1978	11.1	0.6							271.3	61.6
1979	12.8	0.6					98.6	32.1	265.7	78.6
1980	16.6	0.9					113.7	34.1	248.1	116.5
1981	26.9	1.6					148.3	41.8	505.0	142.8
1982	21.0	1.1					146.4	49.8	218.7	89.5
1983	24.3	1.5					149.5	47.6	202.3	119.5
1984	24.0	1.4					196.3	59.3	210.0	104.8
1985	24.9	1.5					216.2	63.1	192.8	73.9
1986	26.4	1.3					203.8	60.8	262.0	110.8
1987	33.4	1.5					183.6	58.3	389.8	136.9
1988	31.7	1.3					241.8	67.2	287.1	148.9
1989	18.8	1.3					162.3	49.8	462.5	180.7
1990	22.2	1.3					168.9	56.9	328.6	151.4
1991	14.6	1.4					140.8	43.7	435.8	172.4
1992	12.4	0.9					116.3	41.0	683.8	249.7
1993	14.1	1.2	1,158.1	686.6			149.8	55.0	379.4	174.5
1994	19.2	1.4	1,297.3	856.3	336.7	125.0	123.9	52.7	571.2	283.4
1995	17.9	1.0	1,408.5	864.1	227.5	85.6	147.3	58.9	592.4	242.2
1996	26.4	1.7	1,430.9	848.6	298.9	108.3	163.3	61.6	536.3	314.4
1997	25.3	2.5	1,423.5	795.2	370.9	127.7	172.8	67.0	409.3	181.0
1998	27.9	2.1	1,444.0	775.2	358.0	132.9	185.3	79.0	412.8	186.9
1999	29.9	2.3	1,522.7	880.0	334.3	133.6	200.2	86.2	476.6	248.4

Table C.2: Continued.

	Nevada[c]		Northeast U.S.[b]		Oregon		Washington		Wisconsin	
Year	Total ducks	Mallards	Total ducks	Mallards	Total ducks	Mallards	Total ducks	Mallards	Total ducks	Mallards
2000	26.1	2.1	1,933.5	762.6	324.4	116.3	143.6	47.7	744.4	454.0
2001	22.2	2.0	1,397.4	809.4			146.4	50.5	440.1	183.5
2002	11.7	0.7	1,466.2	833.7	276.2	112.2	133.3	44.7	740.8	378.5
2003	21.1	1.7	1,266.2	731.9	258.7	96.9	127.8	39.8	533.5	261.3
2004	12.0	1.7	1,416.9	805.9	245.6	92.3	114.9	40.0	651.5	229.2
2005	10.7	0.7	1,416.2	753.6	226.1	83.5	111.5	40.8	724.3	317.2
2006	37.4	1.8	1,384.2	725.2	263.5	88.4	135.4	45.5	522.6	219.5
2007	11.4	2.1	1,500.1	687.6	336.5	101.7	128.3	46.1	470.6	210.0
2008	11.5	1.9	1,197.1	619.1	239.9	84.3	120.9	50.6	626.9	188.4
2009	105.5	12.7	1,271.1	666.8	198.3	79.5	116.5	47.5	502.4	200.5
2010	68.9	8.9	1,302.0	651.7	219.8	75.1	105.0	49.2	386.5	199.1
2011	11.7	2.3	1,265.0	586.1	168.9	67.9	137.6	62.5	513.7	187.9
2012	23.9	4.1	1,309.9	612.6	276.0	96.3	172.7	91.2	521.1	197.0

[b] Includes all or portions of Connecticut, Delaware, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, and Virginia.

[c] Survey redesigned in 2009, and not comparable with previous years.

Table C.3: Breeding population estimates and standard errors (in thousands) for 10 species of ducks from the traditional survey area (strata 1–18, 20–50, 75–77).

	Mallard		Gadwall		American wigeon		Green-winged teal		Blue-winged teal	
Year	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$
1955	8,777.3	457.1	651.5	149.5	3,216.8	297.8	1,807.2	291.5	5,305.2	567.6
1956	10,452.7	461.8	772.6	142.4	3,145.0	227.8	1,525.3	236.2	4,997.6	527.6
1957	9,296.9	443.5	666.8	148.2	2,919.8	291.5	1,102.9	161.2	4,299.5	467.3
1958	11,234.2	555.6	502.0	89.6	2,551.7	177.9	1,347.4	212.2	5,456.6	483.7
1959	9,024.3	466.6	590.0	72.7	3,787.7	339.2	2,653.4	459.3	5,099.3	332.7
1960	7,371.7	354.1	784.1	68.4	2,987.6	407.0	1,426.9	311.0	4,293.0	294.3
1961	7,330.0	510.5	654.8	77.5	3,048.3	319.9	1,729.3	251.5	3,655.3	298.7
1962	5,535.9	426.9	905.1	87.0	1,958.7	145.4	722.9	117.6	3,011.1	209.8
1963	6,748.8	326.8	1,055.3	89.5	1,830.8	169.9	1,242.3	226.9	3,723.6	323.0
1964	6,063.9	385.3	873.4	73.7	2,589.6	259.7	1,561.3	244.7	4,020.6	320.4
1965	5,131.7	274.8	1,260.3	114.8	2,301.1	189.4	1,282.0	151.0	3,594.5	270.4
1966	6,731.9	311.4	1,680.4	132.4	2,318.4	139.2	1,617.3	173.6	3,733.2	233.6
1967	7,509.5	338.2	1,384.6	97.8	2,325.5	136.2	1,593.7	165.7	4,491.5	305.7
1968	7,089.2	340.8	1,949.0	213.9	2,298.6	156.1	1,430.9	146.6	3,462.5	389.1
1969	7,531.6	280.2	1,573.4	100.2	2,941.4	168.6	1,491.0	103.5	4,138.6	239.5
1970	9,985.9	617.2	1,608.1	123.5	3,469.9	318.5	2,182.5	137.7	4,861.8	372.3
1971	9,416.4	459.5	1,605.6	123.0	3,272.9	186.2	1,889.3	132.9	4,610.2	322.8
1972	9,265.5	363.9	1,622.9	120.1	3,200.1	194.1	1,948.2	185.8	4,278.5	230.5
1973	8,079.2	377.5	1,245.6	90.3	2,877.9	197.4	1,949.2	131.9	3,332.5	220.3
1974	6,880.2	351.8	1,592.4	128.2	2,672.0	159.3	1,864.5	131.2	4,976.2	394.6
1975	7,726.9	344.1	1,643.9	109.0	2,778.3	192.0	1,664.8	148.1	5,885.4	337.4
1976	7,933.6	337.4	1,244.8	85.7	2,505.2	152.7	1,547.5	134.0	4,744.7	294.5
1977	7,397.1	381.8	1,299.0	126.4	2,575.1	185.9	1,285.8	87.9	4,462.8	328.4
1978	7,425.0	307.0	1,558.0	92.2	3,282.4	208.0	2,174.2	219.1	4,498.6	293.3
1979	7,883.4	327.0	1,757.9	121.0	3,106.5	198.2	2,071.7	198.5	4,875.9	297.6
1980	7,706.5	307.2	1,392.9	98.8	3,595.5	213.2	2,049.9	140.7	4,895.1	295.6
1981	6,409.7	308.4	1,395.4	120.0	2,946.0	173.0	1,910.5	141.7	3,720.6	242.1
1982	6,408.5	302.2	1,633.8	126.2	2,458.7	167.3	1,535.7	140.2	3,657.6	203.7
1983	6,456.0	286.9	1,519.2	144.3	2,636.2	181.4	1,875.0	148.0	3,366.5	197.2
1984	5,415.3	258.4	1,515.0	125.0	3,002.2	174.2	1,408.2	91.5	3,979.3	267.6
1985	4,960.9	234.7	1,303.0	98.2	2,050.7	143.7	1,475.4	100.3	3,502.4	246.3
1986	6,124.2	241.6	1,547.1	107.5	1,736.5	109.9	1,674.9	136.1	4,478.8	237.1
1987	5,789.8	217.9	1,305.6	97.1	2,012.5	134.3	2,006.2	180.4	3,528.7	220.2
1988	6,369.3	310.3	1,349.9	121.1	2,211.1	139.1	2,060.8	188.3	4,011.1	290.4
1989	5,645.4	244.1	1,414.6	106.6	1,972.9	106.0	1,841.7	166.4	3,125.3	229.8
1990	5,452.4	238.6	1,672.1	135.8	1,860.1	108.3	1,789.5	172.7	2,776.4	178.7
1991	5,444.6	205.6	1,583.7	111.8	2,254.0	139.5	1,557.8	111.3	3,763.7	270.8
1992	5,976.1	241.0	2,032.8	143.4	2,208.4	131.9	1,773.1	123.7	4,333.1	263.2
1993	5,708.3	208.9	1,755.2	107.9	2,053.0	109.3	1,694.5	112.7	3,192.9	205.6
1994	6,980.1	282.8	2,318.3	145.2	2,382.2	130.3	2,108.4	152.2	4,616.2	259.2
1995	8,269.4	287.5	2,835.7	187.5	2,614.5	136.3	2,300.6	140.3	5,140.0	253.3
1996	7,941.3	262.9	2,984.0	152.5	2,271.7	125.4	2,499.5	153.4	6,407.4	353.9
1997	9,939.7	308.5	3,897.2	264.9	3,117.6	161.6	2,506.6	142.5	6,124.3	330.7

Continued.

	Mallard		Gadwall		American wigeon		Green-winged teal		Blue-winged teal	
Year	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$
1998	9,640.4	301.6	3,742.2	205.6	2,857.7	145.3	2,087.3	138.9	6,398.8	332.3
1999	10,805.7	344.5	3,235.5	163.8	2,920.1	185.5	2,631.0	174.6	7,149.5	364.5
2000	9,470.2	290.2	3,158.4	200.7	2,733.1	138.8	3,193.5	200.1	7,431.4	425.0
2001	7,904.0	226.9	2,679.2	136.1	2,493.5	149.6	2,508.7	156.4	5,757.0	288.8
2002	7,503.7	246.5	2,235.4	135.4	2,334.4	137.9	2,333.5	143.8	4,206.5	227.9
2003	7,949.7	267.3	2,549.0	169.9	2,551.4	156.9	2,678.5	199.7	5,518.2	312.7
2004	7,425.3	282.0	2,589.6	165.6	1,981.3	114.9	2,460.8	145.2	4,073.0	238.0
2005	6,755.3	280.8	2,179.1	131.0	2,225.1	139.2	2,156.9	125.8	4,585.5	236.3
2006	7,276.5	223.7	2,824.7	174.2	2,171.2	115.7	2,587.2	155.3	5,859.6	303.5
2007	8,307.3	285.8	3,355.9	206.2	2,806.8	152.0	2,890.3	196.1	6,707.6	362.2
2008	7,723.8	256.8	2,727.7	158.9	2,486.6	151.3	2,979.7	194.4	6,640.1	337.3
2009	8,512.4	248.3	3,053.5	166.3	2,468.6	135.4	3,443.6	219.9	7,383.8	396.8
2010	8,430.1	284.9	2,976.7	161.6	2,424.6	131.5	3,475.9	207.2	6,328.5	382.6
2011	9,182.6	267.8	3,256.9	196.9	2,084.0	110.1	2,900.1	170.7	8,948.5	418.2
2012	10,601.5	324.0	3,585.6	208.7	2,145.0	145.6	3,471.2	207.9	9,242.3	425.1

Continued.

	Northern shoveler		Northern pintail		Redhead		Canvasback		Scaup	
Year	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$
1955	1,642.8	218.7	9,775.1	656.1	539.9	98.9	589.3	87.8	5,620.1	582.1
1956	1,781.4	196.4	10,372.8	694.4	757.3	119.3	698.5	93.3	5,994.1	434.0
1957	1,476.1	181.8	6,606.9	493.4	509.1	95.7	626.1	94.7	5,766.9	411.7
1958	1,383.8	185.1	6,037.9	447.9	457.1	66.2	746.8	96.1	5,350.4	355.1
1959	1,577.6	301.1	5,872.7	371.6	498.8	55.5	488.7	50.6	7,037.6	492.3
1960	1,824.5	130.1	5,722.2	323.2	497.8	67.0	605.7	82.4	4,868.6	362.5
1961	1,383.0	166.5	4,218.2	496.2	323.3	38.8	435.3	65.7	5,380.0	442.2
1962	1,269.0	113.9	3,623.5	243.1	507.5	60.0	360.2	43.8	5,286.1	426.4
1963	1,398.4	143.8	3,846.0	255.6	413.4	61.9	506.2	74.9	5,438.4	357.9
1964	1,718.3	240.3	3,291.2	239.4	528.1	67.3	643.6	126.9	5,131.8	386.1
1965	1,423.7	114.1	3,591.9	221.9	599.3	77.7	522.1	52.8	4,640.0	411.2
1966	2,147.0	163.9	4,811.9	265.6	713.1	77.6	663.1	78.0	4,439.2	356.2
1967	2,314.7	154.6	5,277.7	341.9	735.7	79.0	502.6	45.4	4,927.7	456.1
1968	1,684.5	176.8	3,489.4	244.6	499.4	53.6	563.7	101.3	4,412.7	351.8
1969	2,156.8	117.2	5,903.9	296.2	633.2	53.6	503.5	53.7	5,139.8	378.5
1970	2,230.4	117.4	6,392.0	396.7	622.3	64.3	580.1	90.4	5,662.5	391.4
1971	2,011.4	122.7	5,847.2	368.1	534.4	57.0	450.7	55.2	5,143.3	333.8
1972	2,466.5	182.8	6,979.0	364.5	550.9	49.4	425.9	46.0	7,997.0	718.0
1973	1,619.0	112.2	4,356.2	267.0	500.8	57.7	620.5	89.1	6,257.4	523.1
1974	2,011.3	129.9	6,598.2	345.8	626.3	70.8	512.8	56.8	5,780.5	409.8
1975	1,980.8	106.7	5,900.4	267.3	831.9	93.5	595.1	56.1	6,460.0	486.0
1976	1,748.1	106.9	5,475.6	299.2	665.9	66.3	614.4	70.1	5,818.7	348.7
1977	1,451.8	82.1	3,926.1	246.8	634.0	79.9	664.0	74.9	6,260.2	362.8
1978	1,975.3	115.6	5,108.2	267.8	724.6	62.2	373.2	41.5	5,984.4	403.0
1979	2,406.5	135.6	5,376.1	274.4	697.5	63.8	582.0	59.8	7,657.9	548.6
1980	1,908.2	119.9	4,508.1	228.6	728.4	116.7	734.6	83.8	6,381.7	421.2
1981	2,333.6	177.4	3,479.5	260.5	594.9	62.0	620.8	59.1	5,990.9	414.2
1982	2,147.6	121.7	3,708.8	226.6	616.9	74.2	513.3	50.9	5,532.0	380.9
1983	1,875.7	105.3	3,510.6	178.1	711.9	83.3	526.6	58.9	7,173.8	494.9
1984	1,618.2	91.9	2,964.8	166.8	671.3	72.0	530.1	60.1	7,024.3	484.7
1985	1,702.1	125.7	2,515.5	143.0	578.2	67.1	375.9	42.9	5,098.0	333.1
1986	2,128.2	112.0	2,739.7	152.1	559.6	60.5	438.3	41.5	5,235.3	355.5
1987	1,950.2	118.4	2,628.3	159.4	502.4	54.9	450.1	77.9	4,862.7	303.8
1988	1,680.9	210.4	2,005.5	164.0	441.9	66.2	435.0	40.2	4,671.4	309.5
1989	1,538.3	95.9	2,111.9	181.3	510.7	58.5	477.4	48.4	4,342.1	291.3
1990	1,759.3	118.6	2,256.6	183.3	480.9	48.2	539.3	60.3	4,293.1	264.9
1991	1,716.2	104.6	1,803.4	131.3	445.6	42.1	491.2	66.4	5,254.9	364.9
1992	1,954.4	132.1	2,098.1	161.0	595.6	69.7	481.5	97.3	4,639.2	291.9
1993	2,046.5	114.3	2,053.4	124.2	485.4	53.1	472.1	67.6	4,080.1	249.4
1994	2,912.0	141.4	2,972.3	188.0	653.5	66.7	525.6	71.1	4,529.0	253.6
1995	2,854.9	150.3	2,757.9	177.6	888.5	90.6	770.6	92.2	4,446.4	277.6
1996	3,449.0	165.7	2,735.9	147.5	834.2	83.1	848.5	118.3	4,217.4	234.5
1997	4,120.4	194.0	3,558.0	194.2	918.3	77.2	688.8	57.2	4,112.3	224.2
1998	3,183.2	156.5	2,520.6	136.8	1,005.1	122.9	685.9	63.8	3,471.9	191.2

Continued.

	Northern shoveler		Northern pintail		Redhead		Canvasback		Scaup	
Year	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$
1999	3,889.5	202.1	3,057.9	230.5	973.4	69.5	716.0	79.1	4,411.7	227.9
2000	3,520.7	197.9	2,907.6	170.5	926.3	78.1	706.8	81.0	4,026.3	205.3
2001	3,313.5	166.8	3,296.0	266.6	712.0	70.2	579.8	52.7	3,694.0	214.9
2002	2,318.2	125.6	1,789.7	125.2	564.8	69.0	486.6	43.8	3,524.1	210.3
2003	3,619.6	221.4	2,558.2	174.8	636.8	56.6	557.6	48.0	3,734.4	225.5
2004	2,810.4	163.9	2,184.6	155.2	605.3	51.5	617.2	64.6	3,807.2	202.3
2005	3,591.5	178.6	2,560.5	146.8	592.3	51.7	520.6	52.9	3,386.9	196.4
2006	3,680.2	236.5	3,386.4	198.7	916.3	86.1	691.0	69.6	3,246.7	166.9
2007	4,552.8	247.5	3,335.3	160.4	1,009.0	84.7	864.9	86.2	3,452.2	195.3
2008	3,507.8	168.4	2,612.8	143.0	1,056.0	120.4	488.7	45.4	3,738.3	220.1
2009	4,376.3	224.1	3,225.0	166.9	1,044.1	106.3	662.1	57.4	4,172.1	232.3
2010	4,057.4	198.4	3,508.6	216.4	1,064.2	99.5	585.2	50.8	4,244.4	247.9
2011	4,641.0	232.8	4,428.6	267.9	1,356.1	128.3	691.6	46.0	4,319.3	261.1
2012	5,017.6	254.2	3,473.1	192.4	1,269.9	99.2	759.9	68.5	5,238.6	296.8

Table C.4: Total breeding duck estimates for the traditional survey area, in thousands.

	Traditional Survey Area[a]	
Year	$\widehat{N}$	$\widehat{SE}$
1955	39,603.6	1,264.0
1956	42,035.2	1,177.3
1957	34,197.1	1,016.6
1958	36,528.1	1,013.6
1959	40,089.9	1,103.6
1960	32,080.5	876.8
1961	29,829.0	1,009.0
1962	25,038.9	740.6
1963	27,609.5	736.6
1964	27,768.8	827.5
1965	25,903.1	694.4
1966	30,574.2	689.5
1967	32,688.6	796.1
1968	28,971.2	789.4
1969	33,760.9	674.6
1970	39,676.3	1,008.1
1971	36,905.1	821.8
1972	40,748.0	987.1
1973	32,573.9	805.3
1974	35,422.5	819.5
1975	37,792.8	836.2
1976	34,342.3	707.8
1977	32,049.0	743.8
1978	35,505.6	745.4
1979	38,622.0	843.4
1980	36,224.4	737.9
1981	32,267.3	734.9
1982	30,784.0	678.8
1983	32,635.2	725.8
1984	31,004.9	716.5
1985	25,638.3	574.9
1986	29,092.8	609.3
1987	27,412.1	562.1
1988	27,361.7	660.8
1989	25,112.8	555.4
1990	25,079.2	539.9
1991	26,605.6	588.7
1992	29,417.9	605.6
1993	26,312.4	493.9
1994	32,523.5	598.2
1995	35,869.6	629.4
1996	37,753.0	779.6

Table C.4: Continued.

	Traditional Survey Area[a]	
Year	$\widehat{N}$	$\widehat{SE}$
1997	42,556.3	718.9
1998	39,081.9	652.0
1999	43,435.8	733.9
2000	41,838.3	740.2
2001	36,177.5	633.1
2002	31,181.1	547.8
2003	36,225.1	664.7
2004	32,164.0	579.8
2005	31,734.9	555.2
2006	36,160.3	614.4
2007	41,172.2	724.8
2008	37,276.5	638.3
2009	42,004.8	701.9
2010	40,893.8	718.4
2011	45,554.3	766.5
2012	48,575.3	796.8

[a] Total ducks in the traditional survey area include species in Appendix C.3 plus American black ducks, ring-necked duck, goldeneyes, bufflehead, and ruddy duck.

Table C.5: Breeding population estimates and 90% credible intervals (in thousands) for the 6 most abundant species of ducks in the eastern survey area, 1990–2012[a].

	Mallard		American black duck		Green-winged teal		Ring-necked duck		Goldeneyes[b]		Mergansers[c]	
Year	$\widehat{N}$	90% CI	$\widehat{N}$	90% CI	$\widehat{N}$	90% CI	$\widehat{N}$	90% CI	$\widehat{N}$	90% CI	$\widehat{N}$	90% CI
1990	312.5	(207.6, 507.3)	597.0	(532.7, 674.2)	249.3	(195.7, 323.6)	496.9	(395.9, 638.6)	368.0	(289.6, 482.8)	380.5	(320.6, 456.6)
1991	359.1	(238.4, 575.9)	600.1	(530.0, 687.3)	242.0	(189.2, 317.8)	443.4	(356.2, 565.8)	386.1	(303.3, 507.8)	455.9	(382.7, 552.3)
1992	356.9	(235.2, 577.2)	568.7	(504.7, 646.5)	230.4	(178.8, 303.1)	455.2	(363.6, 585.3)	399.3	(312.3, 524.9)	453.1	(374.1, 561.9)
1993	362.5	(240.1, 583.0)	551.2	(484.8, 630.2)	210.5	(161.4, 278.5)	425.3	(337.5, 550.1)	385.8	(302.2, 510.4)	431.3	(356.5, 530.9)
1994	376.9	(246.8, 608.9)	509.8	(449.7, 581.6)	220.2	(170.1, 293.1)	422.2	(335.2, 544.4)	397.4	(309.3, 523.9)	430.1	(350.0, 549.7)
1995	309.9	(203.1, 504.4)	591.4	(522.0, 675.1)	225.4	(173.7, 299.0)	435.7	(345.9, 559.3)	346.8	(269.8, 458.8)	465.3	(382.8, 577.2)
1996	339.1	(223.6, 549.2)	715.5	(639.6, 807.8)	296.3	(235.1, 385.4)	555.3	(444.9, 712.7)	420.6	(328.1, 552.5)	418.6	(353.8, 500.9)
1997	361.7	(238.8, 588.1)	596.8	(535.6, 669.0)	232.0	(182.3, 300.8)	491.5	(393.4, 626.3)	422.3	(331.0, 555.1)	427.9	(361.5, 513.1)
1998	403.4	(266.9, 642.9)	632.5	(568.9, 707.4)	220.6	(174.1, 284.6)	429.5	(344.9, 550.0)	371.0	(290.8, 488.3)	348.6	(295.0, 416.3)
1999	409.9	(273.1, 653.0)	719.8	(646.7, 806.3)	256.7	(201.6, 335.0)	511.8	(411.2, 653.9)	457.0	(353.2, 608.5)	412.4	(347.9, 496.0)
2000	365.5	(246.7, 585.4)	652.5	(588.8, 726.8)	277.2	(222.0, 353.4)	533.1	(427.7, 681.3)	438.5	(341.0, 579.4)	424.3	(360.4, 504.9)
2001	397.6	(268.4, 633.4)	612.5	(551.2, 684.7)	233.8	(185.1, 300.7)	486.6	(392.7, 619.5)	506.7	(392.3, 674.8)	402.9	(342.5, 480.3)
2002	391.1	(264.6, 618.4)	710.3	(639.0, 794.9)	279.4	(220.9, 364.6)	490.5	(391.9, 634.3)	569.4	(428.5, 784.3)	557.6	(469.4, 669.0)
2003	407.0	(271.1, 648.9)	649.0	(581.9, 727.6)	270.7	(213.8, 352.4)	500.3	(403.2, 637.5)	430.4	(336.5, 565.8)	475.9	(401.5, 572.5)
2004	429.0	(288.3, 681.9)	642.4	(577.3, 722.5)	311.9	(245.6, 409.4)	539.6	(436.8, 688.8)	422.1	(333.9, 549.9)	505.5	(428.6, 603.0)
2005	416.6	(277.4, 668.5)	617.8	(553.0, 696.3)	248.0	(196.3, 320.7)	507.1	(411.1, 642.2)	387.0	(306.1, 505.4)	471.2	(398.0, 566.7)
2006	386.8	(260.3, 614.0)	636.0	(570.1, 714.2)	251.7	(198.6, 326.5)	517.3	(417.4, 654.7)	386.1	(304.6, 503.0)	427.1	(362.0, 509.4)
2007	428.8	(288.1, 683.4)	744.3	(665.0, 842.0)	280.5	(221.9, 361.3)	636.8	(511.0, 815.9)	459.6	(358.8, 606.6)	457.2	(385.1, 549.3)
2008	423.5	(284.9, 671.7)	642.2	(575.8, 721.6)	298.4	(228.3, 411.2)	514.9	(416.0, 654.1)	433.8	(339.4, 568.5)	435.9	(370.1, 519.2)
2009	447.7	(301.5, 708.4)	594.9	(534.2, 667.9)	289.4	(226.3, 384.0)	516.0	(414.9, 658.4)	404.1	(315.9, 530.3)	458.7	(388.1, 550.1)
2010	367.4	(247.2, 585.2)	564.6	(505.3, 633.8)	273.4	(217.4, 354.4)	516.9	(416.6, 656.6)	398.1	(311.2, 523.4)	377.2	(319.0, 450.8)
2011	410.1	(273.8, 657.8)	544.2	(488.8, 609.6)	255.5	(201.5, 332.3)	491.7	(396.2, 623.7)	401.3	(315.9, 526.8)	399.9	(338.1, 480.0)
2012	395.4	(266.2, 630.1)	603.1	(539.4, 677.2)	259.3	(205.7, 333.6)	487.8	(393.3, 621.8)	394.0	(310.2, 513.8)	420.9	(357.2, 502.7)

[a] Estimates from Bayesian hierarchical analysis using FWS and CWS data from strata 51, 52, 63, 64, 66–68, 70–72.

[b] Common and Barrow's, combined.

[c] Common, red-breasted, and hooded, combined.

D Historical estimates of goose and swan populations

Table D.1: Abundance indices (in thousands) for North American Canada goose populations, 1969–2012.

Year	North Atlantic[a,b]	Atlantic[a,b]	Atlantic Flyway Resident[a]	Southern James Bay[a]	Miss. Valley[a]	Miss. Flyway Giant[a]	Eastern Prairie[a]
1969/70							
1970/71							
1971/72							95.0
1972/73							116.6
1973/74							96.7
1974/75							121.5
1975/76							168.4
1976/77							110.8
1977/78							111.2
1978/79							72.8
1979/80							
1980/81							78.9
1981/82							96.4
1982/83							92.8
1983/84							112.0
1984/85							105.6
1985/86							126.4
1986/87							145.9
1987/88		118.2					137.0
1988/89					352.5		132.1
1989/90				92.1	518.8		163.4
1990/91				72.4	254.8		167.4
1991/92				73.0	438.9		158.4
1992/93		93.0		50.7	411.2	779.4	136.2
1993/94		43.2		45.7	432.2	909.4	136.2
1994/95		34.0		74.1	348.2	941.6	139.0
1995/96	99.6	51.5		71.1	362.4	1,037.3	141.0
1996/97	64.4	72.1		87.0	426.0	957.0	130.5
1997/98	53.9	48.6		70.3	312.5	1,140.5	99.3
1998/99	96.8	83.7		108.1	465.5	1,163.3	139.5
1999/00	58.0	95.8		78.7	352.6	1,436.7	130.0
2000/01	57.8	135.2		68.4	325.4	1,296.3	122.2
2001/02	62.0	182.4		55.2	286.5	1,415.2	152.0
2002/03	60.8	174.9	1,126.7	90.2	360.1	1,416.3	122.4
2003/04	67.8	191.8	1,073.1	75.2	276.3	1,430.4	145.5
2004/05	51.3	175.7	1,167.1	42.2	344.9	1,367.0	161.6
2005/06	49.2	186.1	1,144.0	128.9	384.4	1,575.2	134.8
2006/07	69.9	207.3	1,128.0	64.8	402.6	1,454.7	153.4
2007/08	41.9	174.0	1,024.9	92.3	305.2	1,459.8	161.1
2008/09	53.7	186.8	1,006.1	69.2	239.6	1,463.7	169.2
2009/10	54.6	165.1	977.1	76.4	339.3	1,599.9	172.6
2010/11	48.5	216.0	1,015.1	86.9	269.8	1,629.8	133.1
2011/12	71.6	190.3	879.8	94.9	268.9	1,767.9	116.3

Table D.1: Continued

Year	W. Prairie & Great Plains[b]	Tall Grass Prairie[b,c]	Short Grass Prairie[d]	Hi-line[a]	Rocky Mountain[a]	Dusky[e]	Cackling[f]	Aleutian[e]
1969/70			151.2	58.8				
1970/71		131.1	148.5	99.6	46.9			
1971/72		159.6	160.9	53.0	33.8			
1972/73		147.2	259.4	30.1	37.9			
1973/74		158.5	153.6	33.9	42.7			
1974/75		125.6	123.7	29.1	42.3			0.8
1975/76		201.5	242.5	40.5	30.2			0.9
1976/77		167.9	210.0	40.9	29.5			1.3
1977/78		211.3	134.0	39.8	43.1			1.5
1978/79		180.5	163.7	50.5	58.6		64.1	1.6
1979/80		155.2	213.0	51.2	36.3		127.4	1.7
1980/81		244.9	168.2	51.0	60.3		87.1	2.0
1981/82	175.0	268.6	156.0	54.5	65.9		54.1	2.7
1982/83	242.0	165.5	173.2	74.1	49.7		26.2	3.5
1983/84	150.0	260.7	143.5	105.8	48.3		25.8	3.8
1984/85	230.0	197.3	179.1	92.3	49.9		46.8	4.2
1985/86	115.0	189.4	181.0	101.8	68.4	17.1	45.2	4.3
1986/87	324.0	159.0	190.9	95.4	70.4	15.8	66.7	5.0
1987/88	272.1	306.1	139.1	131.3	107.0	16.0	82.0	5.4
1988/89	330.3	213.0	284.8	124.8	95.0	17.4	85.3	5.8
1989/90	271.0	146.5	378.1	185.8	91.5	16.3	106.4	6.3
1990/91	390.0	305.1	508.5	148.3	85.6	10.7	96.6	7.0
1991/92	341.9	276.3	620.2	168.0	102.1	17.8	148.6	7.7
1992/93	318.0	235.3	328.2	158.0	116.4	16.5	153.2	11.7
1993/94	272.5	224.2	434.1	160.9	138.5	16.3	217.8	15.7
1994/95	352.5	245.0	697.8	234.6	148.2	12.1	234.1	19.2
1995/96	403.3	264.0	561.2	200.5	145.7	12.0	249.8	15.4
1996/97	453.4	262.9	460.7	208.0	103.5	13.5	294.8	20.4
1997/98	482.3	331.8	440.6	257.7	146.7	14.5	216.4	32.4
1998/99	467.2	548.2	403.2	204.5	164.6	10.5	241.8	35.5
1999/00	594.7	295.7	200.0	287.7	180.8	10.3	251.2	34.3
2000/01	682.7	149.1	164.1	261.9	177.3	11.1	253.3	
2001/02	710.3	504.7	160.9	239.0	150.9	12.4	168.1	
2002/03	561.0	611.9	156.7	239.1	148.7	9.8	234.0	72.8
2003/04	622.1	458.7	203.6	208.4	165.4	11.2	172.1	108.5
2004/05	415.1	400.8	177.2	245.4	167.0	16.1	219.4	87.1
2005/06	444.4	499.8	234.7	217.6	148.4	12.1	241.1	100.1
2006/07	446.0	680.3	190.5	309.5	153.6	10.2	248.4	107.5
2007/08	669.5	402.7	212.4	348.2	221.3	9.1	283.7	111.0
2008/09	628.0	309.9	220.3	306.7	131.5	6.7	225.9	83.8
2009/10	462.8	417.0	290.7	277.6	150.1	9.5	275.3	107.2
2010/11	499.0	427.1	309.6	274.0	111.7	11.8	180.2	101.7
2011/12	550.8	450.8	292.8	494.4		13.7	202.3	134.7

[a] Surveys conducted in spring.
[b] Surveys conducted in December until 1998; in 1999 a January survey replaced the December count.
[c] Only Tall Grass Prairie Population geese counted in Central Flyway range are included.
[d] Surveys conducted in January.
[e] Indirect or preliminary estimate.
[f] Surveys conducted in fall through 1998; from 1999 to present a fall index is predicted from breeding ground surveys (total indicated birds).

Table D.2: Abundance indices for snow, Ross's, white-fronted, and emperor goose populations, 1969–2012.

	Snow and Ross's geese				White-fronted geese		
Year	Greater snow geese[a]	Mid-continent[b]	Western Central Flyway[c]	Western Arctic & Wrangel Isl.[d]	Mid-continent[d]	Pacific[e]	Emperor geese[a]
1969/70	89.6	777.0	6.9				
1970/71	123.3	1,070.2	11.1				
1971/72	134.8	1,313.4	13.0				
1972/73	143.0	1,025.3	11.6				
1973/74	165.0	1,189.8	16.2				
1974/75	153.8	1,096.6	26.4				
1975/76	165.6	1,562.4	23.2				
1976/77	160.0	1,150.3	33.6				
1977/78	192.6	1,966.4	31.1				
1978/79	170.1	1,285.7	28.2			73.1	
1979/80	180.0	1,398.1	30.4	528.1		93.5	
1980/81	170.8	1,406.7	37.6	204.2		116.5	93.3
1981/82	163.0	1,794.1	50.0	759.9		91.7	100.6
1982/83	185.0	1,755.5	76.1	354.1		112.9	79.2
1983/84	225.4	1,494.5	43.0	547.6		100.2	71.2
1984/85	260.0	1,973.0	62.9	466.3		93.8	58.8
1985/86	303.5	1,449.4	96.6	549.8		107.1	42.0
1986/87	255.0	1,913.8	63.5	521.7		130.6	51.7
1987/88		1,750.7	46.2	525.3		161.5	53.8
1988/89	363.2	1,956.2	67.6	441.0		218.8	45.8
1989/90	368.3	1,724.3	38.7	463.9		240.8	67.6
1990/91	352.6	2,135.8	104.6	708.5		236.5	71.0
1991/92	448.1	2,021.9	87.9	690.1		230.9	71.3
1992/93	498.4	1,744.1	45.1	639.3	622.9	295.1	52.5
1993/94	591.4	2,200.8	84.9	569.2	676.3	324.8	57.3
1994/95	616.6	2,725.1	80.1	478.2	727.3	277.5	51.2
1995/96	669.1	2,398.1	93.1	501.9	1,129.4	344.1	80.3
1996/97	657.5	2,957.7	127.2	366.3	742.5	319.0	57.1
1997/98	836.6	3,022.2	103.5	416.4	622.2	413.1	39.7
1998/99	803.4	2,575.7	236.4	354.3	1,058.3	393.4	54.6
1999/00	813.9	2,397.3	137.5	579.0	963.1	352.7	62.6
2000/01	837.4	2,341.3	105.8	656.8	1,067.6	438.9	84.4
2001/02	639.3	2,696.1	99.9	448.1	712.3	359.7	58.7
2002/03	678.0	2,435.0	105.9	596.9	637.2	422.0	71.2
2003/04	957.6	2,214.3	135.4	587.8	528.2	374.9	47.4
2004/05	814.6	2,344.2	143.0	750.3	644.3	443.9	54.0
2005/06	1,017.0	2,221.7	140.6	710.7	522.8	509.3	76.0
2006/07	1,019.0	2,917.1	170.6	799.7	751.3	604.7	77.5
2007/08	718.0	2,455.1	188.5	1073.5	764.3	627.0	64.9
2008/09	1,009.0	2,753.4	284.4	957.4	751.7	536.7	91.9
2009/10	824.0	2,657.5	238.1	901.0	583.2	649.8	64.6
2010/11	917.0	3,175.2	196.1	863.8	709.8	604.3	74.2
2011/12	1,005.0[f]	4,021.2	205.3		681.7	429.8	67.6

[a] Surveys conducted in spring.
[b] Surveys conducted in December until 1997/98; surveys since 1998/99 were conducted in January.
[c] Surveys conducted in January.
[d] Surveys conducted in autumn.
[e] Surveys conducted in fall through 1998; from 1999 to present a fall index is predicted from breeding ground surveys (total indicated birds).
[f] Incomplete or preliminary.

Table D.3: Abundance indices of North American brant and swan populations from January surveys, 1969–2012.

	Brant			Tundra swans	
Year	Atlantic	Pacific[a]	Western High Arctic	Western	Eastern
1969/70		136.6	5.1	31.0	
1970/71	151.0	141.1	8.1	98.8	
1971/72	73.2	121.8	3.0	82.8	
1972/73	40.8	122.4	2.7	33.9	
1973/74	87.7	128.0	2.7	69.7	
1974/75	88.4	119.7	3.7	54.3	
1975/76	127.0	117.1	5.0	51.4	
1976/77	73.6	136.1	10.9	47.3	
1977/78	42.8	151.5	11.4	45.6	
1978/79	43.5	126.2	3.2	53.5	
1979/80	69.2	141.3	5.1	65.2	
1980/81	97.0	186.1	8.1	83.6	
1981/82	104.5	117.1	4.0	91.3	73.2
1982/83	123.5	107.2	2.1	67.3	87.5
1983/84	127.3	128.4	5.1	61.9	81.4
1984/85	146.3	136.0	8.8	48.8	96.9
1985/86	110.4	126.9	9.4	66.2	90.9
1986/87	109.4	98.5	10.4	52.8	95.8
1987/88	131.2	131.6	15.3	59.2	78.7
1988/89	138.0	120.9	14.3	78.7	91.3
1989/90	135.4	141.1	10.5	40.1	90.6
1990/91	147.7	119.5	12.2	47.6	98.2
1991/92	184.8	108.2	9.5	63.7	113.0
1992/93	100.6	113.6	10.8	62.2	78.2
1993/94	157.2	118.8	11.2	79.4	84.8
1994/95	148.2	116.8	16.9	52.9	85.1
1995/96	105.9	122.0	4.9	98.1	79.5
1996/97	129.1	151.9	6.0	122.5	92.4
1997/98	138.0	132.1	6.3	70.5	100.6
1998/99	171.6	120.0	9.2	119.8	111.0
1999/00	157.2	127.1	7.9	89.6	115.3
2000/01	145.3	119.9	4.9	87.3	98.4
2001/02	181.6	127.8	9.0	58.7	114.7
2002/03	164.5	101.7	4.9	102.7	111.7
2003/04	129.6	111.5	7.7	83.0[b]	110.8
2004/05	123.2	101.4	10.0	92.1	72.5
2005/06	146.6	133.9	9.5	106.9	81.3
2006/07	150.6	133.9	6.1	109.4	114.4
2007/08	161.6	147.4	9.2	89.7	96.2
2008/09	151.3		16.2	105.2	100.2
2009/10	139.7	143.9	6.0	76.7	97.3
2010/11	148.9	147.9	8.5	49.3[b]	97.7
2011/12	149.2	131.9	6.7	117.2	111.7

[a] Beginning in 1986, counts of Pacific brant in Alaska were included with the Pacific flyway.

[b] Incomplete or preliminary.

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