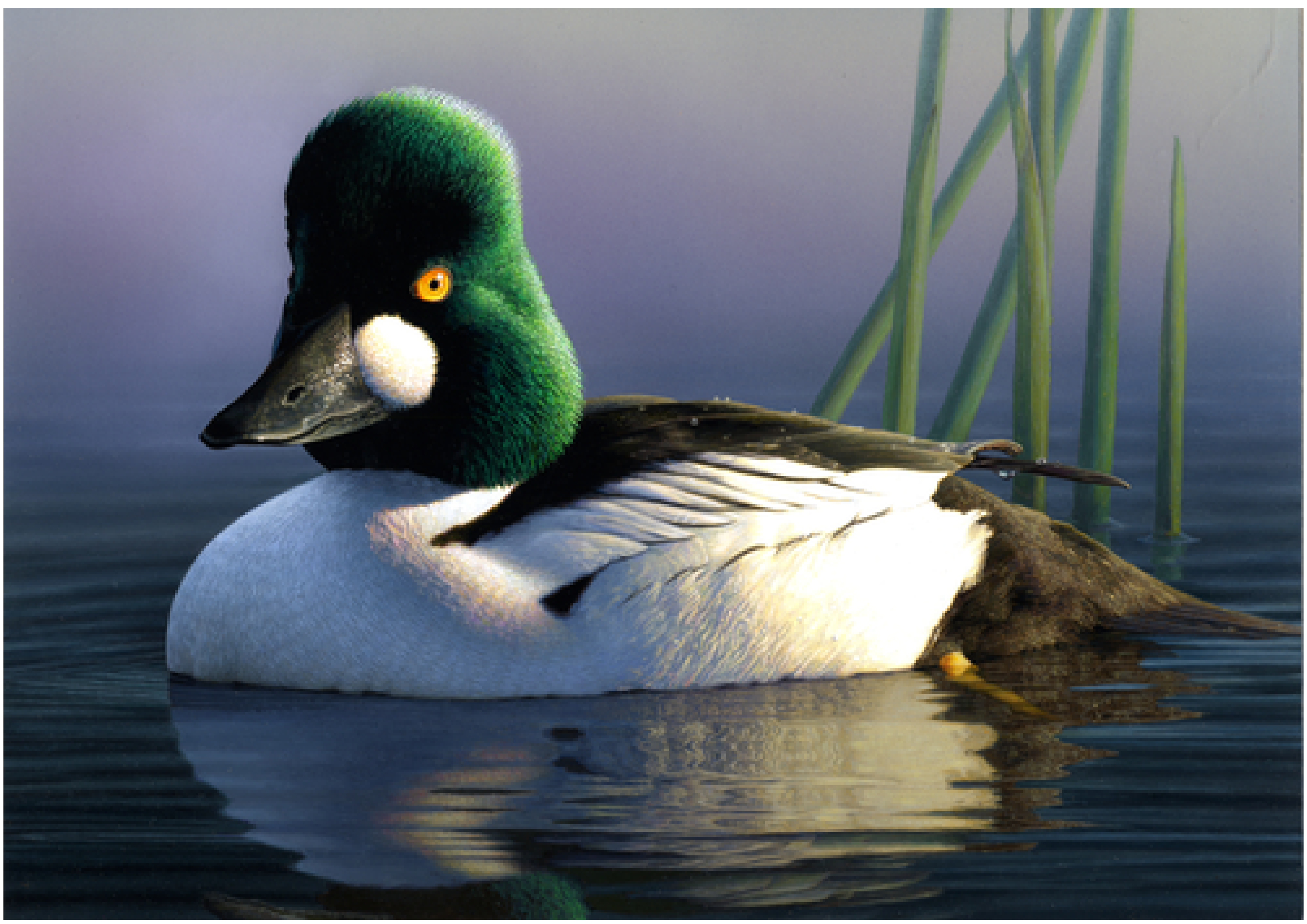
U.S. Fish & Wildlife Service

Waterfowl

Population Status, 2013



Waterfowl Population Status, 2013

July 24, 2013

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 and 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 2013–2014 hunting season.

Cover: 2013–2014 Duck stamp, which features a common goldeneye (*Bucephala clangula*) painted by Robert Steiner of San Francisco, winner of the 2012 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 and 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. In particular, we would like to acknowledge many of the pilot-biologists and observers who flew additional strata, utilized replacement survey aircraft, and made an extra effort to complete this year's Waterfowl Breeding Population and Habitat Survey.

Authors: This report was prepared by the U.S. Fish and 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. Jim Bredy, Steve Earsom, Mark Koneff, Terry Liddick, Fred Roetker, Rob Spangler, Phil Thorpe, Walt Rhodes, Sarah Yates, 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 and Phil Thorpe provided the maps.

This report should be cited as: U.S. Fish and Wildlife Service. 2013. Waterfowl population status, 2013. 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).

Table of Contents

List of Tables

List of Figures

Status of Ducks

Abstract: In the traditional survey area, which includes strata 1–18, 20–50, and 75–77, the total duck population estimate (excluding scoters [*Melanitta* spp.], eiders [*Somateria* spp. and *Polysticta stelleri*], long-tailed ducks [*Clangula hyemalis*], mergansers [*Mergus* spp. and *Lophodytes cucullatus*], and wood ducks [*Aix sponsa*]) was 45.6 ± 0.7 [SE] million birds. This represents a 6% decrease from last year's estimate of 48.6 ± 0.8 million, but is still 33% higher than the long-term average (1955–2012). Estimated mallard (*Anas platyrhynchos*) abundance was 10.4 ± 0.4 million, which was similar to the 2012 estimate, and 36% above the long-term average of 7.6 ± 0.04 million. Estimated abundance of gadwall (*A. strepera*; 3.3 ± 0.2 million) was similar to the 2012 estimate and 80% above the long-term average (1.9 ± 0.02 million). The estimate for American wigeon (*A. americana*; 2.6 ± 0.2 million) was 23% above the 2012 estimate of 2.1 ± 0.1 million and similar to the long-term average of 2.6 ± 0.02 million. The estimated abundance of green-winged teal (*A. crecca*) was 3.1 ± 0.2 million, which was similar to the 2012 estimate and 51% above the long-term average (2.0 ± 0.02 million). The estimate for blue-winged teal (*A. discors*; 7.7 ± 0.4 million) was 16% below the 2012 estimate and 60% above the long-term average of 4.8 ± 0.04 million. The estimate for northern shoveler (*A. clypeata*; 4.8 ± 0.2 million) was similar to the 2012 estimate and 96% above the long-term average of 2.4 ± 0.02 million. The northern pintail estimate (*A. acuta*; 3.3 ± 0.2 million) was similar to the 2012 estimate and was 17% below the long-term average of 4.0 ± 0.04 million. Abundance estimates of redheads (*Aythya americana*; 1.2 ± 0.09 million) and canvasbacks (*A. valisineria*; 0.8 ± 0.06 million) were similar to their 2012 estimates and were 76% and 37% above their long-term averages of 0.7 ± 0.01 million and 0.6 ± 0.01 million, respectively. Estimated abundance of scaup (*A. affinis* and *A. marila* combined; 4.2 ± 0.3 million) was 20% below the 2012 estimate and 17% below the long-term average of 5.0 ± 0.05 million. Despite a delayed spring over most of the survey area, habitat conditions during the 2013 Waterfowl Breeding Population and Habitat Survey were improved or similar to last year in many areas due to average or above-average annual precipitation, with the exceptions of southeastern Canada, the northeast U.S., and portions of Montana and the Dakotas. The total pond estimate (Prairie Canada and U.S. combined) was 6.9 ± 0.2 million, which was 24% above the 2012 estimate of 5.5 ± 0.2 million and 35% above the long-term average of 5.1 ± 0.03 million. The 2013 estimate of ponds in Prairie Canada was 4.6 ± 0.2 million. This estimate was 17% above the 2012 estimate (3.9 ± 0.1 million) and 32% above the 1961–2012 average (3.5 ± 0.03 million). The 2013 pond estimate for the northcentral U.S. was 2.3 ± 0.1 million, which was 41% above the 2012 estimate (1.7 ± 0.1 million) and 42% above the 1974–2012 average (1.7 ± 0.02 million). The projected mallard fall flight index is 13.0 ± 1.2 million birds. In the eastern survey area, estimated abundance of American black ducks (*Anas rubripes*) was 0.6 ± 0.04 million, which was similar to the 2012 estimate and the 1990–2012 average. The estimated abundance of mallards was 0.5 ± 0.2 million, which was similar to the 2012 estimate and 25% above the 1990–2012 average. Abundance estimates of ring-necked ducks (*Aythya collaris*,0.6 ± 0.1 million) and goldeneyes (common and Barrow's [*Bucephala islandica*]; 0.5 ± 0.1 million) were 24% and 17% above 2012 estimates and 25% and 10% above the long-term averages, respectively. Abundance estimates for green-winged teal and mergansers were similar to last year's estimates and their 1990–2012 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 northcentral 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 northcentral U.S., aerial waterfowl counts are corrected annually for visibility bias by conducting ground counts along a subsample 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 northcentral 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 and 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, 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. Survey-wide composite estimates for the eastern survey area 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 with results from previous reports.

Survey Coverage and Estimation Methods for 2013

Immediately preceding the 2013 survey a material failure of the exhaust system on USFWS Kodiak planes developed that could have compromised air-crew safety. The decision was made not to utilize these aircraft, which are typically operated in more northern survey strata, and complete the survey with other USFWS fleet aircraft. Three strata in the traditional survey area and most of the eastern survey area were not flown by airplane. In the traditional survey area, population estimates were imputed from the historical time series for western Ontario and a portion of Alaska which were not flown. The hierarchical modeling framework used to integrate CWS and USFWS data in the eastern survey area can produce population estimates provided at least one survey is conducted within a stratum.

In the traditional survey area, estimates were imputed using locally-weighted linear regression (loess) for the three missing strata (Stratum 1, Kenai-Susitna; Stratum 6, Koyukuk River; and Stratum 50, Western Ontario Mixed Forest) using the stats package in R (R Core Team 2013). This method has been previously employed to impute missing values in the survey time series. For each species, the loess smoothing procedure was fit to estimated duck densities from 1974 to 2012 in Strata 1 and 6, and from 1985 to 2012 in Stratum 50. We chose 1974 as the start date, because the survey took on its current design and protocols that year, following a survey review (Bowden 1973); 1985 was used for Stratum 50, because the stratum was not surveyed from 1974 to 1984. The smoothing parameter values for the loess fit for each species and missing strata were determined by the following procedure. For crew areas that contained missing strata (Alaska crew area [strata 1–11] and western Ontario crew area [Strata 21–25, 50]), we determined the smoothing parameter that minimized the predicted mean squared error by sequentially dropping each year from the time series (including 2013 when available), predicting the missing year's density from the resulting loess function, and selecting the smoothing parameter that gave the lowest mean squared prediction error for each stratum in the crew area. Smoothing parameters were averaged across strata within crew area to fit the loess prediction functions for Strata 1, 6, and 50. The 2013 estimated density and its standard error were imputed from each loess fit, and an overall estimate of the standard error was calculated by summing the prediction variance and the average sampling variance for the time series. The imputed density estimate and variance were then substituted into the regular formulae used to compute the breeding population and its standard error. If there were fewer than two records of a species in the stratum over the past five years, we assumed the species was not present in the stratum.

In the eastern survey area, USFWS fleet aircraft were not available in time to complete airplane surveys in any strata except Maine (stratum 62); however, the CWS successfully completed their helicopter surveys. Therefore, we were able to estimate waterfowl population sizes for the 10 eastern strata covered in this report (51, 52, 63, 64, 66, 67, 68, 70, 71, and 72) based on the CWS data for 2013. Although the hierarchical modeling approach can provide population estimates for a stratum based solely on either the CWS or USFWS survey, the two surveys provide different information and estimates based on the combined data provide broader inferences. Further, estimates could not be derived for portions of the survey not covered by the CWS, including northern Quebec (stratum 69), southern Quebec (stratum 56), Prince Edward Island (stratum 65), and southern Ontario (strata 52–54).

Total Duck Species Composition

In the traditional survey area, our estimate of total ducks excludes scoters, eiders, long-tailed ducks, mergansers, and wood ducks, 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 2013).

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

2012 in Review

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 experienced average moisture and temperatures. The 2012 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 the 2011 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 northcentral U.S. was 1.7 ± 0.1 million, which was 49% below the 2011 estimate (3.2 ± 0.1 million) and similar to the long-term (1974–2011) average.

In the traditional survey area, which includes strata 1–18, 20–50, and 75–77, the 2012 total duck population estimate was 48.6 ± 0.8 million birds. This estimate represented a 7% increase over the 2011 estimate of 45.6 ± 0.8 million birds and was 43% above the long-term average (1955–2011). Estimated mallard abundance in 2012 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 in 2012 (3.6 ± 0.2 million) was similar to the 2011 estimate and 96% above the long-term average. Estimated abundance of American wigeon in 2012 (2.1 ± 0.1 million) was similar to the 2011 estimate and 17% below the long-term average. The 2012 estimated abundance of green-winged teal was 3.5 ± 0.2 million, which was 20% above the 2011 estimate and 74% above their long-term average. The 2012 estimate of blue-winged teal abundance 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 in 2012 (3.5 ± 0.2 million) was 22% below the 2011 estimate, and 14% below the long-term average. The 2012 northern shoveler estimate was 5.0 ± 0.3 million, which was similar to the 2011 estimate and 111% above the long-term average. Redhead abundance in 2012 (1.3 ± 0.1 million) was similar to the 2011 estimate and 89% above the long-term average. The 2012 canvasback estimate (0.8 ± 0.07 million) was similar to the 2011 estimate and 33% above the long-term average. Estimated abundance of scaup in 2012 (5.2 ± 0.3 million) was 21% above the 2011 estimate and similar to the long-term average.

Most of the eastern survey area had mild winter temperatures with below-average precipitation in 2011–2012, although northern survey areas in Labrador, Newfoundland and eastern Quebec experienced more normal conditions, with some areas receiving heavy snowfall. In the eastern survey area, the 2012 American black duck 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 in 2012 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, goldeneyes, and mergansers in 2012 were all similar to their 2011 estimates and long-term averages.

2013 Breeding Populations and Habitat Conditions

Overall Habitat and Population Status

Despite a delayed spring, habitat conditions during the 2013 Waterfowl Breeding Population and Habitat Survey were improved or similar to last year in many areas due to average or above-average annual precipitation, with the exceptions of southeastern Canada, the northeast U.S., and portions of Montana and the Dakotas. The total pond estimate (Prairie Canada and U.S. combined) was 6.9 ± 0.2 million, which was 24% above the 2012 estimate of 5.5 ± 0.2 million and 35% above the long-term average of 5.1 ± 0.03 million (Table 1, Figure 1, Appendix C.1).

The delayed spring was evident across the traditional survey area. The majority of the Canadian prairies had average to below-average winter temperatures and above-average precipitation; however, a poor frost seal resulted in little runoff to recharge wetlands. Extreme southern Saskatchewan and southern Manitoba received abundant spring rainfall but most of this moisture came too late for the majority of waterfowl breeding this year. The 2013 estimate of ponds in Prairie Canada was 4.6 ± 0.2 million. This estimate was 17% above the 2012 estimate (3.9 ± 0.1 million) and 32% above the 1961–2012 average (3.5 ± 0.03 million). The Parklands have improved from 2012 and the western boreal forest received average annual precipitation. Most of the Canadian portion of the traditional survey area was rated as good or excellent this year, in contrast to the dry conditions last year across northern Saskatchewan and Alberta. Much of the U.S. prairies had average winter precipitation and received record-breaking snowfall in April. Despite the moisture most of the habitat was fair to poor, which was unchanged from 2012. The 2013 pond estimate for the northcentral U.S. was 2.3 ± 0.1 million, which was 41% above the 2012 estimate (1.7 ± 0.1 million) and 42% above the 1974–2012 average (1.7 ± 0.02 million). Most of the increase in pond numbers resulted from 10 days of rain in May during the survey, and post-survey reconnaissance revealed numerous wetlands, with many unoccupied by waterfowl.

Winter and spring temperatures in the eastern survey area were closer to normal than in the traditional survey area. Portions of northern Quebec experienced above-average winter temperatures. Most of the eastern survey area had average annual precipitation but southern Ontario and western Quebec experienced near-record-low winter precipitation, with improvement to the north and east into the Maritimes. Abundant late-spring rains dominated much of eastern Canada, which may have inhibited waterfowl production. Habitat conditions ranged from fair in Maine and the southern Maritimes to good in Newfoundland and Labrador.

In the traditional survey area, which includes strata 1–18, 20–50, and 75–77, the total duck population estimate was 45.6 ± 0.7 million birds. This represents a 6% decrease from last year's estimate of 48.6 ± 0.8 million, but is still 33% higher than the long-term average (1955–2012; Table 2, Appendix C.4). In the eastern Dakotas, total duck numbers were 14% lower than the 2012 estimate but 119% above the long-term average. The total duck estimate in southern Alberta was similar to last year's estimate and the long-term average. The total duck estimate was 8% higher than last year in southern Saskatchewan, and 61% 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 similar to last year's estimate and 16% above the long-term average. The estimate in the northern Saskatchewan–northern Manitoba–western Ontario survey area was 25% higher than the 2012 estimate and similar to the long-term average. The total duck estimate in the Montana–western Dakotas area was 35% below the 2012 estimate and similar to the long-term average. In the Alaska–Yukon Territory–Old Crow Flats region the total duck estimate was 26% lower than last year, and 11% below the long-term

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

			Change from 2012			Change from LTA	
Region	2013	2012	%	*P*	LTA[a]	%	*P*
Prairie & Parkland Canada							
S. Alberta	1,127	807	+40	0.001	747	+51	<0.001
S. Saskatchewan	2,846	2,678	+6	0.426	2,046	+39	<0.001
S. Manitoba	578	401	+44	<0.001	664	−13	0.013
Subtotal	4,551	3,885	+17	0.005	3,457	+32	<0.001
Northcentral U.S.							
Montana & western Dakotas	383	428	−11	0.170	559	−32	<0.001
Eastern Dakotas	1,958	1,231	+59	<0.001	1,092	+79	<0.001
Subtotal	2,341	1,659	+41	<0.001	1,651	+42	<0.001
Total	6,892	5,544	+24	<0.001	5,099	+35	<0.001

[a] Long-term average. Prairie and Parkland Canada, 1961–2012; northcentral U.S. and total, 1974–2012.

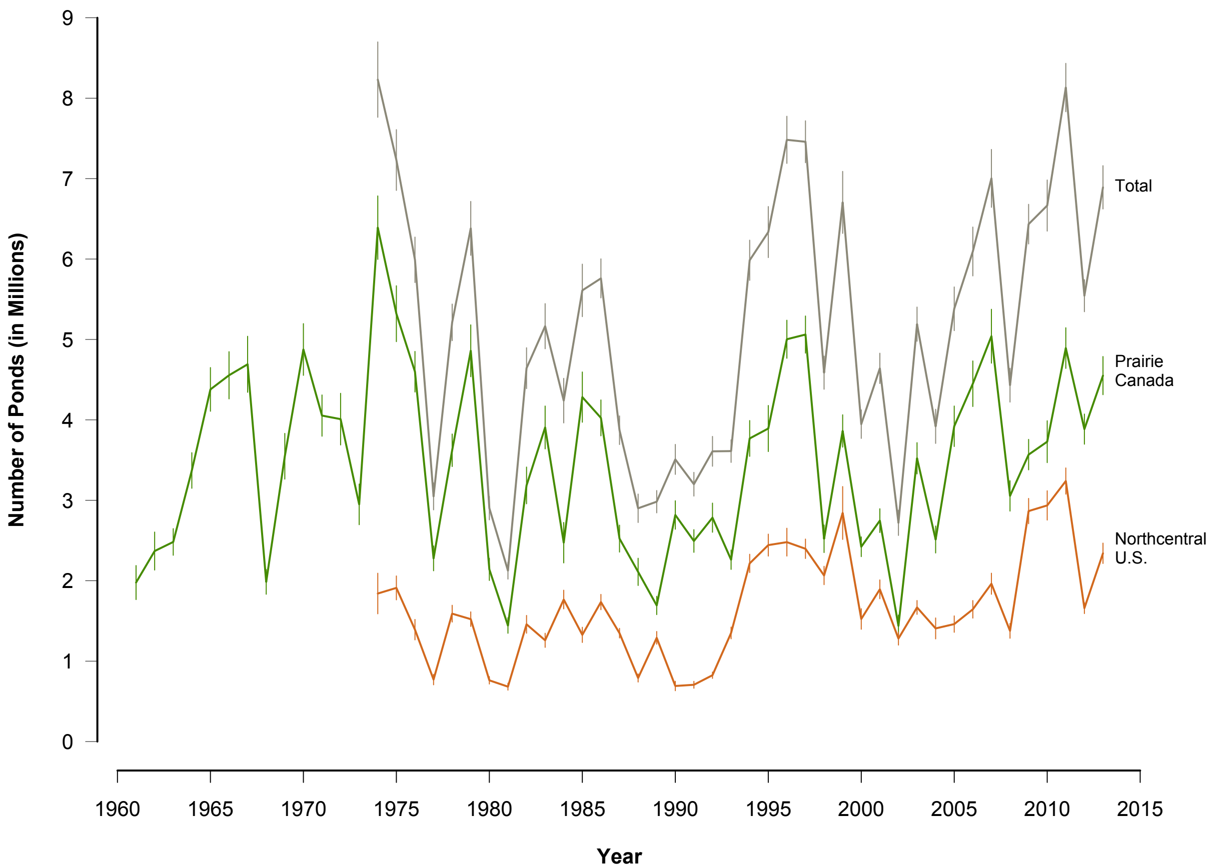


Figure 1. Number of ponds in May and 90% confidence intervals in Prairie Canada, the northcentral U.S., and both areas combined (total ponds).

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

Region	2013	2012	Change from 2012 %	Change from 2012 P	LTA[b]	Change from LTA %	Change from LTA P
Alaska–Yukon Territory–Old Crow Flats	3,296	4,455	-26	<0.001	3,703	-11	0.022
C. & N. Alberta–N.E. British Columbia–NWT	8,323	8,799	-5	0.358	7,148	+16	0.001
N. Saskatchewan–N. Manitoba–W. Ontario	3,441	2,754	+25	0.048	3,477	-1	0.900
S. Alberta	4,471	4,845	-8	0.163	4,253	+5	0.219
S. Saskatchewan	12,258	11,318	+8	0.066	7,616	+61	<0.001
S. Manitoba	1,575	1,538	+2	0.764	1,529	+3	0.570
Montana & Western Dakotas	1,599	2,467	-35	<0.001	1,673	-4	0.525
Eastern Dakotas	10,643	12,400	-14	0.003	4,869	+119	<0.001
Total	45,607	48,575	-6	0.007	34,266	+33	<0.001
Other regions							
California	451	530	−15	0.338	589	−23	0.022
Northeast U.S.[c]	1,282	1,310	−2	0.805	1,391	−8	0.158
Oregon	267	276	−3	0.797	276	−3	0.706
Wisconsin	527	521	+1	0.934	442	+19	0.127

[a] Includes 10 species in Appendix C.3 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, 1955–2012; 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.

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, Michigan, and Wisconsin, measures of precision for estimates of total duck numbers are available (Table 2). In Oregon, the total duck estimate was similar to 2012, and the long-term average (1994–2012). The total duck estimate in California was similar to the 2012 estimate and 23% lower than the long-term average. Wisconsin's total duck estimate was similar to the 2012 estimate and its long-term average. In Michigan, the total duck estimate was similar to 2012 and the long-term average. The total breeding duck estimate in the northeast U.S. was similar to 2012 and the long-term average. Of the states without measures of precision for total duck numbers, the 2013 estimate of total ducks in Minnesota was higher than the 2012 estimate. Total duck estimates decreased in Washington from 2012, and increased in Nevada (see Regional Habitat and Population Status 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 10.4 ± 0.4 million birds, which was similar to the 2012 estimate of 10.6 ± 0.3 million birds and 36% above the long-term average (Table 3). In the eastern

Table 3. Mallard breeding population estimates (in thousands) for regions in the traditional survey area.

			Change from 2012			Change from LTA	
Region	2013	2012	%	*P*	LTA[a]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	338	506	−33	0.009	377	−10	0.314
C. & N. Alberta–N.E. British Columbia–NWT	1,020	1,547	−34	0.001	1,085	−6	0.517
N. Saskatchewan–N. Manitoba–W. Ontario	1,427	1,039	+37	0.188	1,125	+27	0.212
S. Alberta	1,141	1,261	−9	0.307	1,072	+6	0.386
S. Saskatchewan	2,576	2,502	+3	0.704	2,064	+25	<0.001
S. Manitoba	448	401	+12	0.396	384	+17	0.049
Montana & Western Dakotas	794	793	0	0.992	511	+55	0.003
Eastern Dakotas	2,627	2,554	+3	0.743	1,007	+161	<0.001
Total	10,372	10,602	−2	0.636	7,626	+36	<0.001
Eastern survey area	500	405	+22	——[b]	394	+25	——[b]
Other regions							
California	299	387	−23	0.242	365	−18	0.217
Michigan	288	439	−34	0.385	362	−20	0.096
Minnesota	293	225	+30	0.355	226	+30	0.253
Northeast U.S.[c]	604	613	−1	0.893	747	−19	<0.001
Oregon	93	96	−3	0.770	100	−7	0.301
Wisconsin	181	197	−8	0.655	183	−1	0.936

[a] Long-term average. Traditional survey area 1955–2012; eastern survey area 1990–2012; 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.

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 similar to last year's and the long-term average. In the Montana–western Dakotas survey area, the mallard count was similar to the 2012 estimate and 55% above the long-term average. In the central and northern Alberta–northeastern British Columbia–Northwest Territories region the mallard estimate was 34% lower than 2012 and similar to the long-term average. In the northern Saskatchewan–northern Manitoba–western Ontario survey area, the mallard estimate was similar to that of 2012 and the long-term average. Mallard numbers were 33% lower than the 2012 estimate and similar to their long-term average in the Alaska–Yukon Territory–Old Crow Flats region. In the southern Manitoba survey area, the mallard estimate was similar to last year and 17% above the long-term average. In southern Saskatchewan, mallard numbers were similar to last year and 25% above the long-term average.

In the eastern survey area, estimated abundance of mallards was 0.5 ± 0.2 million, which was similar to the 2012 estimate and 25% above 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 is not comparable to the eastern mallard estimate used for AHM (U.S. Fish and Wildlife Service 2013), which

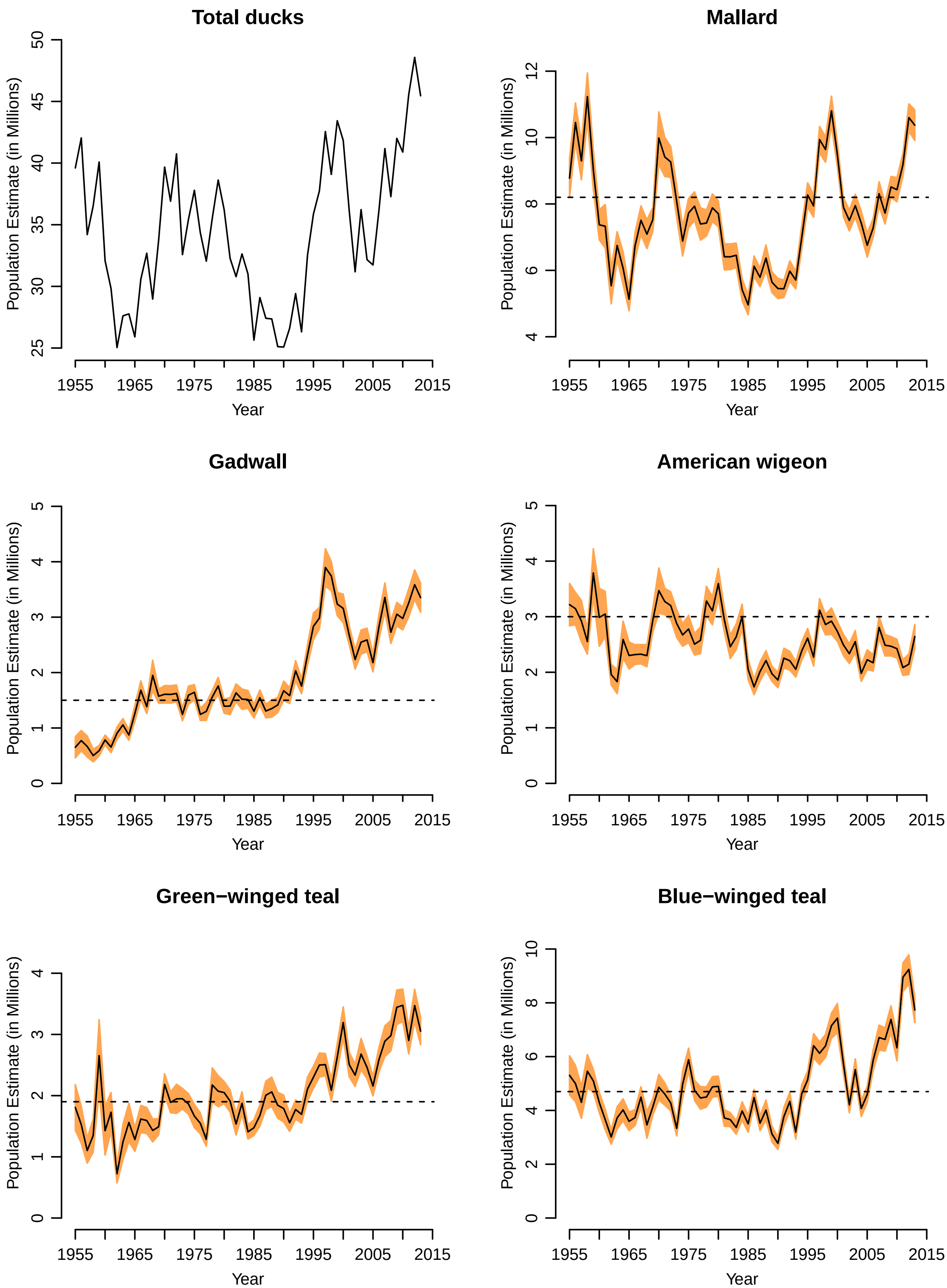


Figure 2. Breeding population estimates, 90% confidence intervals, and North American Waterfowl Management Plan population goals (dashed line) for selected species in the traditional survey area (strata 1–18, 20–50, 75–77).

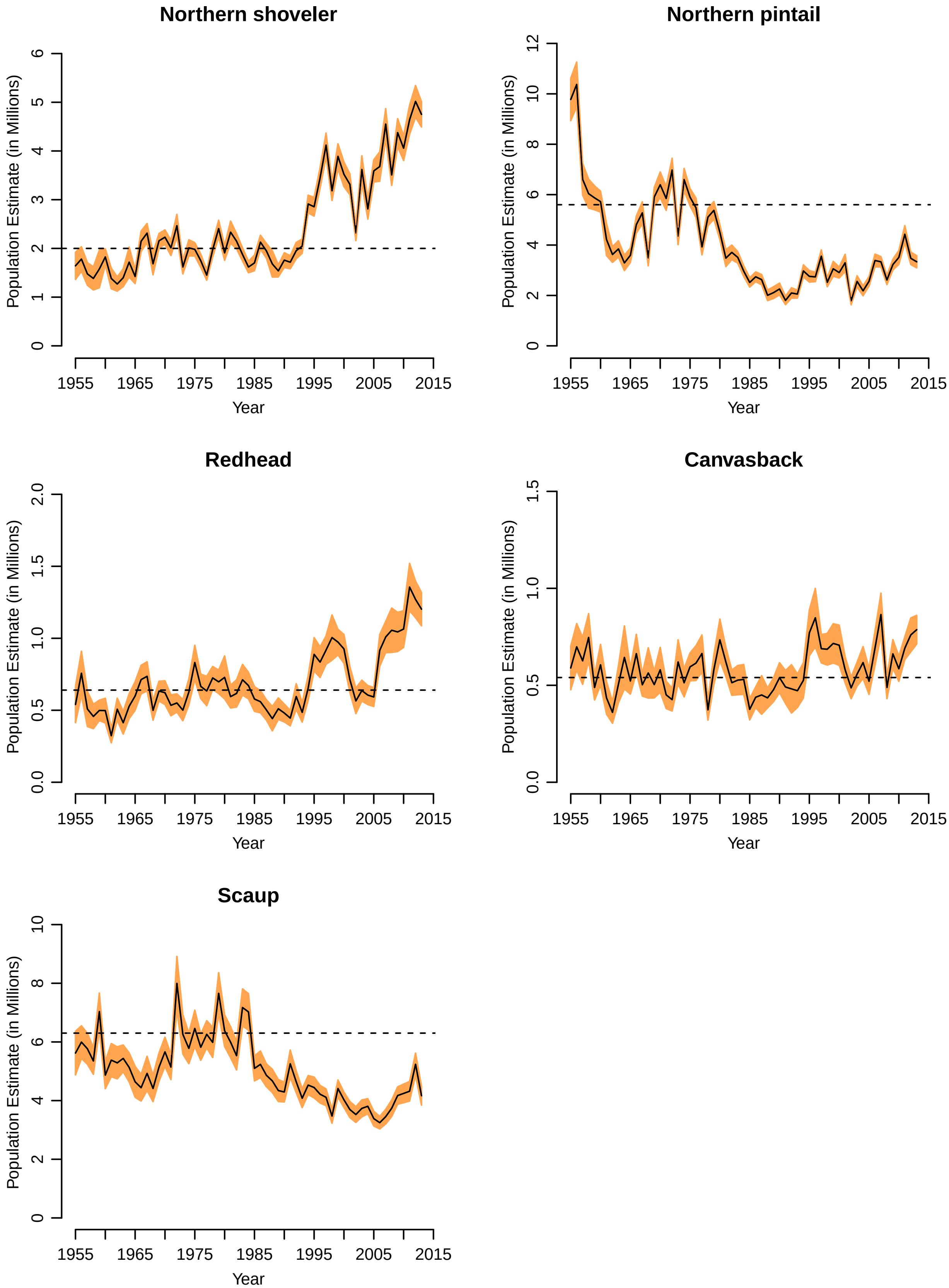


Figure 2. Continued.

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

			Change from 2012			Change from LTA	
Region	2013	2012	%	*P*	LTA[a]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	2	1	+159	0.374	2	−15	0.771
C. & N. Alberta–N.E. British Columbia–NWT	33	56	−40	0.106	51	−34	0.021
N. Saskatchewan–N. Manitoba–W. Ontario	13	31	−59	0.038	26	−52	0.021
S. Alberta	340	378	−10	0.583	317	+7	0.640
S. Saskatchewan	1,300	1,144	+14	0.316	621	+109	<0.001
S. Manitoba	133	113	+18	0.542	72	+85	0.002
Montana & Western Dakotas	217	254	−14	0.511	207	+5	0.780
Eastern Dakotas	1,314	1,609	−18	0.194	567	+132	<0.001
Total	3,351	3,586	−7	0.423	1,864	+80	<0.001

[a] Long-term average, 1955–2012.

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

			Change from 2012			Change from LTA	
Region	2013	2012	%	*P*	LTA[a]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	577	686	−16	0.162	553	+4	0.636
C. & N. Alberta–N.E. British Columbia–NWT	1,100	680	+62	0.023	887	+24	0.142
N. Saskatchewan–N. Manitoba–W. Ontario	230	130	+77	0.069	236	−3	0.896
S. Alberta	197	234	−16	0.434	282	−30	0.004
S. Saskatchewan	369	243	+52	0.012	407	−9	0.317
S. Manitoba	10	5	+101	0.025	55	−82	<0.001
Montana & Western Dakotas	43	85	−49	0.037	111	−61	<0.001
Eastern Dakotas	117	81	+44	0.311	55	+114	0.050
Total	2,644	2,145	+23	0.025	2,587	+2	0.736

[a] Long-term average, 1955–2012.

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

Region	2013	2012	Change from 2012 %	Change from 2012 *P*	LTA[a]	Change from LTA %	Change from LTA *P*
Alaska–Yukon Territory–Old Crow Flats	452	705	−36	0.003	404	+12	0.336
C. & N. Alberta–N.E. British Columbia–NWT	1,229	1,567	−22	0.117	803	+53	0.001
N. Saskatchewan–N. Manitoba–W. Ontario	358	136	+164	<0.001	202	+77	0.001
S. Alberta	195	274	−29	0.158	198	−1	0.935
S. Saskatchewan	575	497	+16	0.395	261	+121	<0.001
S. Manitoba	60	157	−62	0.001	53	+13	0.568
Montana & Western Dakotas	23	19	+18	0.766	42	−46	0.038
Eastern Dakotas	161	117	+38	0.507	54	+200	0.082
Total	3,053	3,471	−12	0.123	2,017	+51	<0.001

[a] Long-term average, 1955–2012.

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

Region	2013	2012	Change from 2012 %	Change from 2012 *P*	LTA[a]	Change from LTA %	Change from LTA *P*
Alaska–Yukon Territory–Old Crow Flats	0	0	0	1.000	1	−100	<0.001
C. & N. Alberta–N.E. British Columbia–NWT	386	147	+163	0.002	270	+43	0.120
N. Saskatchewan–N. Manitoba–W. Ontario	40	51	−22	0.720	242	−84	<0.001
S. Alberta	752	596	+26	0.205	607	+24	0.107
S. Saskatchewan	2,759	2,608	+6	0.632	1,332	+107	<0.001
S. Manitoba	345	327	+5	0.813	374	−8	0.603
Montana & Western Dakotas	226	661	−66	0.001	284	−21	0.127
Eastern Dakotas	3,225	4,853	−34	<0.001	1,728	+87	<0.001
Total	7,732	9,242	−16	0.007	4,839	+60	<0.001

[a] Long-term average, 1955–2012.

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

			Change from 2012			Change from LTA	
Region	2013	2012	%	*P*	LTA[a]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	226	377	−40	0.005	290	−22	0.034
C. & N. Alberta–N.E. British Columbia–NWT	348	275	+27	0.434	220	+59	0.042
N. Saskatchewan–N. Manitoba–W. Ontario	35	11	+218	0.076	40	−11	0.724
S. Alberta	853	915	−7	0.662	404	+111	<0.001
S. Saskatchewan	1,706	1,858	−8	0.424	733	+133	<0.001
S. Manitoba	149	138	+8	0.725	110	+36	0.036
Montana & Western Dakotas	170	341	−50	0.103	163	+4	0.844
Eastern Dakotas	1,263	1,104	+14	0.317	468	+170	<0.001
Total	4,751	5,018	−5	0.412	2,429	+96	<0.001

[a] Long-term average, 1955–2012.

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

			Change from 2012			Change from LTA	
Region	2013	2012	%	*P*	LTA[a]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	995	1,176	−15	0.338	931	+7	0.658
C. & N. Alberta–N.E. British Columbia–NWT	235	79	+199	<0.001	358	−34	0.003
N. Saskatchewan–N. Manitoba–W. Ontario	10	16	−40	0.444	37	−74	<0.001
S. Alberta	368	357	+3	0.868	679	−46	<0.001
S. Saskatchewan	825	605	+36	0.022	1,156	−29	<0.001
S. Manitoba	36	22	+61	0.176	103	−65	<0.001
Montana & Western Dakotas	88	244	−64	<0.001	263	−66	<0.001
Eastern Dakotas	779	974	−20	0.163	503	+55	0.001
Total	3,335	3,473	−4	0.608	4,029	−17	<0.001

[a] Long-term average, 1955–2012.

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

			Change from 2012			Change from LTA	
Region	2013	2012	%	*P*	LTA[a]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	1	0	+100	0.037	2	−32	0.390
C. & N. Alberta–N.E. British Columbia–NWT	22	16	+35	0.454	40	−44	0.009
N. Saskatchewan–N. Manitoba–W. Ontario	5	19	−76	0.015	26	−82	<0.001
S. Alberta	204	183	+11	0.681	124	+65	0.029
S. Saskatchewan	437	383	+14	0.458	213	+105	<0.001
S. Manitoba	71	99	−28	0.261	73	−3	0.892
Montana & Western Dakotas	7	20	−64	0.170	11	−34	0.327
Eastern Dakotas	455	549	−17	0.331	194	+134	<0.001
Total	1,202	1,270	−5	0.614	682	+76	<0.001

[a] Long-term average, 1955–2012.

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

			Change from 2012			Change from LTA	
Region	2013	2012	%	*P*	LTA[a]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	35	35	−1	0.976	87	−60	<0.001
C. & N. Alberta–N.E. British Columbia–NWT	92	93	0	0.995	75	+23	0.514
N. Saskatchewan–N. Manitoba–W. Ontario	30	27	+12	0.819	52	−42	0.069
S. Alberta	54	146	−63	0.002	65	−17	0.221
S. Saskatchewan	381	313	+22	0.288	193	+97	<0.001
S. Manitoba	62	52	+18	0.472	56	+11	0.545
Montana & Western Dakotas	13	10	+29	0.630	9	+48	0.264
Eastern Dakotas	119	84	+42	0.228	38	+212	<0.001
Total	787	760	+4	0.763	576	+37	<0.001

[a] Long-term average, 1955–2012.

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

Region	2013	2012	Change from 2012 %	Change from 2012 P	LTA[a]	Change from LTA %	Change from LTA P
Alaska–Yukon Territory–Old Crow Flats	548	849	−36	0.003	918	−40	<0.001
C. & N. Alberta–N.E. British Columbia–NWT	2,343	2,839	−17	0.143	2,536	−8	0.390
N. Saskatchewan–N. Manitoba–W. Ontario	315	338	−7	0.773	561	−44	<0.001
S. Alberta	150	294	−49	0.003	337	−55	<0.001
S. Saskatchewan	475	521	−9	0.660	407	+17	0.309
S. Manitoba	38	102	−63	0.075	128	−70	<0.001
Montana & Western Dakotas	14	18	−23	0.405	50	−73	<0.001
Eastern Dakotas	282	277	+2	0.943	111	+154	0.002
Total	4,166	5,239	−20	0.006	5,048	−17	0.001

[a] Long-term average, 1955–2012.

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 2012. In Wisconsin and Oregon, mallard estimates were similar to last year and their long-term averages. The mallard estimate was similar to the 2012 estimate in the northeast U.S., but was 19% below the long-term average. In Michigan, the 2013 mallard estimate was similar to the 2012 estimate and 20% below the long-term average. In Minnesota, the 2013 mallard estimate was similar to last year's estimate and the long-term average. In Washington, mallard numbers were similar to 2012.

In the traditional survey area the estimate of blue-winged teal (7.7 ± 0.4 million) was 16% below the 2012 estimate and 60% above the long-term average of 4.8 ± 0.04 million (Table 7). The estimated abundance of gadwall (3.3 ± 0.2 million) was similar to the 2012 estimate and 80% above the long-term average (1.9 ± 0.02 million; Table 4). The estimate for American wigeon (2.6 ± 0.2 million) was 23% above the 2012 estimate of 2.1 ± 0.1 million and similar to the long-term average of 2.6 ± 0.02 million (Table 5). The estimated abundance of green-winged teal was 3.1 ± 0.2 million, which was similar to the 2012 estimate and 51% above the long-term average (2.0 ± 0.02 million; Table 6). The northern shoveler estimate (4.8 ± 0.2 million) was similar to the 2012 estimate and 96% above the long-term average of 2.4 ± 0.02 million (Table 8). The estimate for northern pintails (3.3 ± 0.2 million) was similar to the 2012 estimate of 3.5 ± 0.2 million and 17% below the long-term average of 4.0 ± 0.04 million (Table 9). The estimated abundance of redheads (1.2 ± 0.09 million) and canvasbacks (0.8 ± 0.06 million) were similar to their 2012 estimates and were 76% and 37% above their long-term averages of 0.7 ± 0.01 million and 0.6 ± 0.01 million, respectively (Table 10 and 11). Estimated abundance of scaup (4.2 ± 0.3 million) was 20% below the 2012 estimate and 17% below the long-term average of 5.0 ± 0.05 million (Table 12). In the eastern survey area, abundance estimates for ring-necked ducks (0.6 ± 0.1 million) and goldeneyes (0.5 ± 0.1 million) were 24% and

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

Species	2013	2012	% Change from 2012	Average[b]	% Change from Average
Mallard	500	405	+22	394	+25[c]
American black duck	622	602	+3	621	0
Green-winged teal	292	260	+12	258	+12
Ring-necked duck	630	506	+24[c]	501	+25[c]
Goldeneyes (common and Barrow's)	472	402	+17[c]	428	+10[c]
Mergansers (common, red-breasted, and hooded)	465	420	+11	435	+7

[a] Estimates from hierarchical analysis using FWS and CWS data from strata 51, 52, 63, 64, 66–68, 70–72.
[b] Average for 1990–2012.
[c] Indicates Significant Change. Significance ($P \leq 0.10$) determined by non-overlap of Bayesian credibility intervals.

17% above 2012 estimates and 25% and 10% above the long-term averages. Abundance estimates for green-winged teal and mergansers were similar to last year's estimates and their 1990–2012 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 in January in states of the Atlantic and Mississippi flyways. Measures of precision are not available for the midwinter surveys. In 2013, the total midwinter count of American black ducks in both flyways combined was 225,000, which was slightly above the most recent 10-year average (2003–2012) of 223,700. In the Atlantic Flyway, the 2013 black duck midwinter index was 208,200, which was above the flyway's 10-year average of 202,600. In the Mississippi Flyway, the black duck midwinter index in 2013 was 16,800, which was 20% below the 10-year flyway average of 21,100. 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 622,000, similar to the 2012 estimate of 602,000 and the 1990–2012 average of 621,000. 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 2013 survey (49,700) was 73% higher than the 2012 estimate (28,600) and was 19% below the 1993–2012 average (61,900).

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, in addition to the trend estimates (average % per year) and associated 95% credible intervals (LCL, UCL in parentheses following trend estimates) presented here. In the Atlantic and Mississippi flyways combined, the BBS wood duck index increased by an average of 1.6% (1.0%, 2.1%) per year over the entire survey period (1966–2012), 2.0% (1.2%, 2.7%) over the past 20 years (1993–2012), and 2.4% (1.1%, 3.7%) over the most recent (2003–2012) 10-year period. The Atlantic Flyway wood duck index increased by

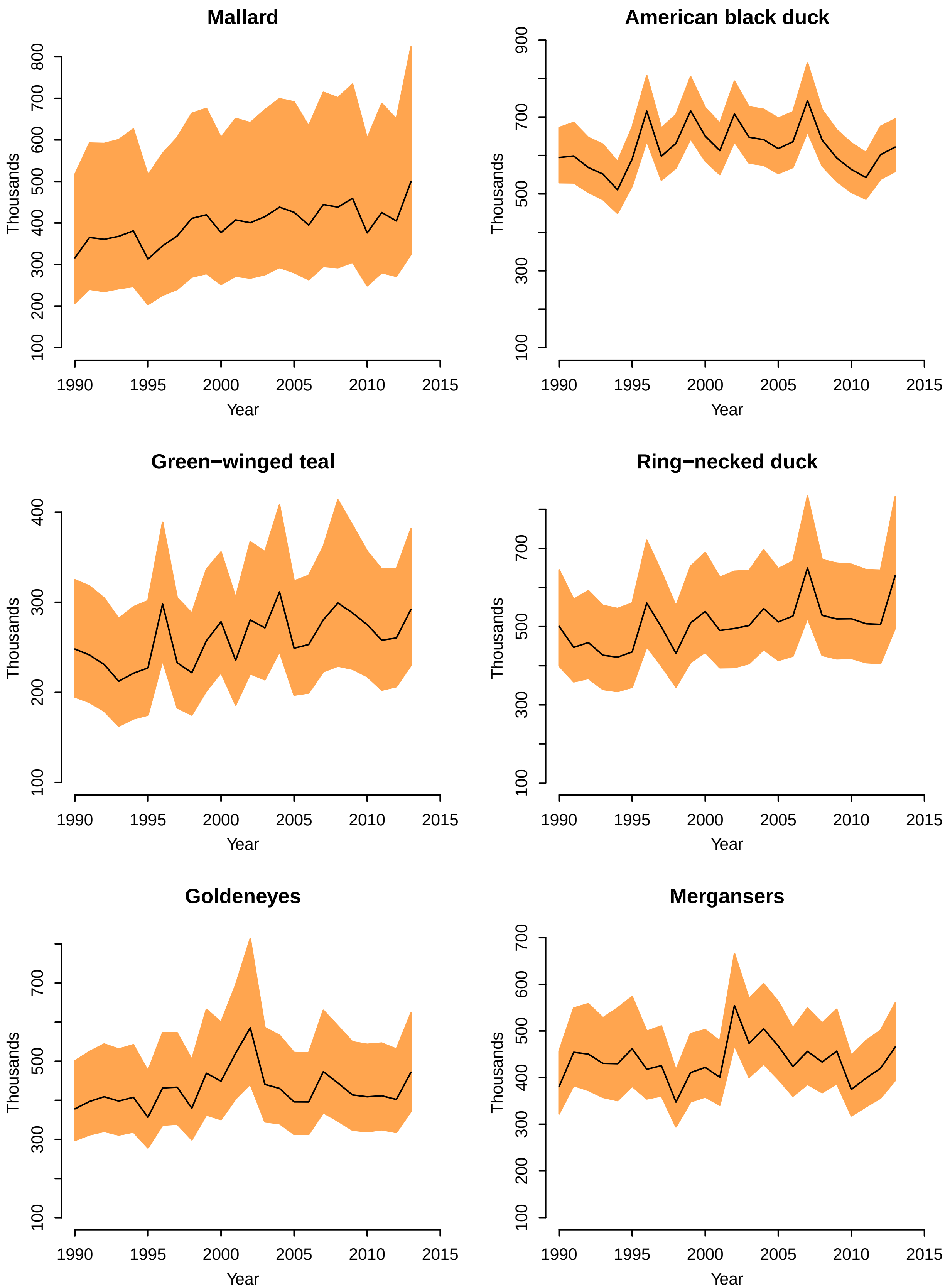


Figure 3. Breeding population estimates and 90% credible intervals from Bayesian hierarchical models for species in the eastern survey area (strata 51, 52, 63, 64, 66–68, 70–72).

an average of 1.2% (0.5%, 2.0%) annually over the entire time series (1966–2012), by 1.7% (0.3%, 2.9%) over the past 20 years (1993–2012), and by 2.6% (0.5%, 4.6%) from 2003 to 2012. In the Mississippi Flyway, the corresponding BBS wood duck indices increased by 1.7% (1.0%, 2.4%, 1966–2012), 2.0% (1.1%, 2.9%, 1993–2012), and 2.4% (0.7%, 3.9%, 2003–2012; 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 2013 survey (361,200) was 13% below the 2012 estimate (418,900) and 5% below the 1993–2012 average (380,200).

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 website on the Publications page (http://www.fws.gov/migratorybirds/NewReportsPublications/PopulationStatus.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)

Late spring and early summer precipitation last year was normal to well-above normal. This precipitation assisted with the replenishment of water in many wetland basins, improving waterfowl brood-rearing habitat. Late summer/fall precipitation in 2012 was below normal. Winter precipitation was normal or above normal for the Nov 2012–early March 2013 period. The long winter of 2012–13 slowly came to an end during the month of April, despite a severe winter storm during the last few days of the month. Two slow-moving low-pressure storm systems brought significant moisture to the province in late May-early June. These storms helped maintain the quality of seasonal wetland basins. There was some flooding of local rivers and low-lying areas that may have negatively affected nesting waterfowl. The dry conditions of northern Manitoba extended into portions of the very southernmost part of Alberta between Medicine Hat and Lethbridge. However, farther to the north, the wetlands between Calgary and Edmonton and eastward to the Saskatchewan border had some of the best conditions seen in two decades. Although the number of wetlands has increased dramatically in some areas, the quality of adjacent upland habitat, also a critical element in nest success, has decreased the last few years in this region due to several long, cold winters. The "Peace Country" between Slave Lake, Grande Prairie and the Peace River remains drier than the aspen parklands to the southeast. The central portion of the Peace Country has heavy agriculture use, while the northern and eastern portions remain wetter with much better upland habitat.

Smaller wetlands in the shortgrass prairie and aspen-parkland regions have the ability to recover more quickly from drought than deeper, larger wetlands. For example, Beaverhill Lake, approximately 10 miles long by 5 miles wide, is located approximately 30 miles east of Edmonton, Alberta, and was once a mecca for waterfowl. Prolonged drought turned this once extensive marsh into a dry lake bed. Recent moisture helped to bring some water back to the lake; however, it will take a prolonged period of significant moisture before this once great marsh returns to the glory years of its past.

Overall, in southern Alberta May ponds were 40% higher than the 2012 estimate and 51% above the long-term average. The total duck estimate was similar to 2012 and the long-term average. The mallard estimate was also similar to 2012 and the long-term average. Blue-winged teal, green-winged teal, and gadwall were all similar to their 2012 estimates and their long-term averages. The American wigeon estimate was similar to last year but 30% below the long-term average. The northern shoveler estimate was similar to 2012 and 111% above the long-term average. Northern pintails were similar to 2012 and 46% below the long-term average. Redheads were similar to 2012 and 65% higher than their long-term average. Canvasbacks were 63% lower than 2012 and similar to their long-term average. Scaup estimates were 49% lower than last year and 55% below their long-term average.

Southern Saskatchewan (strata 30–33)

In this crew area, the late summer and early fall of 2012 were characterized by below-average precipitation and above-average temperatures. The province then entered a record-breaking winter for snowfall; from October to March Saskatchewan received well-above-average snowfall, breaking records for winter precipitation in many areas, including Regina. Temperatures were below average at the end of the fall and into early winter, then moderated in January and February to normal or slightly above normal. March and April temperatures were well-below normal. Precipitation in April and May was below normal for most of the survey area except along the U.S. border, where above-normal rainfall was received (Agriculture and Agri-Food Canada 2013).

The hydrological picture for the southern Saskatchewan survey area this spring was set up in the fall by the drier-than-normal summer and early snowfall in October. The above-normal snowfall throughout winter insulated the ground until mid-April, preventing a solid frost seal from forming. Once the snow melted, the water was absorbed directly into the dry ground instead of pooling on top of the frozen ground and forming ephemeral and temporary wetlands, normally present in years with above-normal precipitation. Wetlands with undamaged basins collected the snowmelt and flooded outside their normal margins. The majority of this crew area had good production potential for waterfowl. Good soil moisture provided abundant upland nesting cover and full wetland basins provided plentiful habitat for broods. Given the higher grassland cover available in the Missouri Coteau and the abundant and full wetlands this year, excellent production and recruitment is predicted from this part of Saskatchewan. The western parklands, which were bordering on poor in 2012, have rebounded and wetlands were full. Good-to-excellent production is predicted from this area of the province. The northeast parklands have improved from 2012 and have a mix of wetland conditions, with excellent habitat near Prince Albert that was wetter this year than in the last 20 years, but only fair conditions in the northeast and southern parts of the survey stratum. Production should be predominantly good in the northeast parklands.

The 2013 May pond estimate in this survey area was similar to 2012, and 39% higher than the long-term average. Total duck numbers were 8% higher than 2012, and 61% above the long-term average. Mallards were similar to 2012 and 25% above the long-term average. Blue-winged teal were similar to last year and 107% above the long-term average. Northern shovelers were similar to 2012 and 133% above the long-term average. The green-winged teal estimate was similar to last year, but still 121% above its long-term average. Gadwall numbers were similar to 2012 and 110% above the long-term average. American wigeon were 52% higher than last year but similar to the long-term average. Northern pintails were 36% higher than in 2012, and 29% below the long-term average. Redheads were similar to 2012 and 105% above their long-term average. The canvasback estimate was similar to 2012 and 98% higher than the long-term average. The scaup estimate was similar to 2012 and the long-term average.

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

Habitat conditions for nesting and brood-rearing waterfowl were observed to be good throughout southern Manitoba and southeastern Saskatchewan in 2013. In general 2013 seems to be improved from 2012 and could be considered an average year for waterfowl production. In most strata, permanent water bodies were full if not flooded, and temporary wetlands and potholes were abundant. However, little to no sheet water was observed this year. There were a few areas, mainly near the Manitoba–Saskatchewan border that were downgraded to fair due to a higher percentage of dry basins, and Stratum 38 generally lacked quality habitat; however these areas are known to be dry even in average years.

Precipitation during the fall of 2012 was well below normal in southern Manitoba but near normal to above normal in the interlake regions (Stratum 36, 37, 40) and northern Manitoba (Agriculture and Agri-Food Canada 2013). Fall soil moisture conditions throughout southern Manitoba were below normal while areas in central and northern Manitoba were normal to above average. Winter season precipitation in the Manitoba region was mixed in 2013. Precipitation in southern and southwestern Manitoba was closer to average (Stratum 39), below average in the southeast (Stratum 38), and above average in the northern part of the crew area (Strata 34, 37, 40). In southeastern Saskatchewan (Stratum 35) winter season precipitation was well-above normal, and spring temperatures were some of the coldest on record in 2013. Snow cover persisted in both southeastern Saskatchewan and southern Manitoba until the end of April, with some snow remaining until early May. While the above-average winter precipitation seems to have increased runoff in major rivers and basins in 2013 compared to 2012, dry soils have absorbed most of the runoff, leaving some temporary wetlands drier than last year. However, conditions appeared to improve, especially in the very southern portion of the survey area near the U.S. border, with increased precipitation from the numerous low-pressure systems that moved across the northern U.S. throughout the month of May. Precipitation at the time of the survey was 115–200% above average throughout southern Manitoba and Saskatchewan from May 5 to June 3, 2013. With increased precipitation and favorable spring temperatures improving soil and wetland conditions, it should be an average to above-average year for waterfowl recruitment in both southeastern Saskatchewan and southern Manitoba.

The 2013 May pond estimate in this crew area was 44% higher than the 2012 estimate and 13% lower than the long-term average. The total duck estimate was similar to 2012 and the long-term average. Mallard numbers were similar to 2012 and 17% higher than the long-term average. The gadwall estimate was similar to last year and 85% above the long-term average. American wigeon were 101% above last year and 82% below the long-term average. The blue-winged teal estimate was similar to last year and the long-term average. Green-winged teal were 62% lower than last year but similar to the long-term average. The northern shoveler estimate was similar to last year's estimate and 36% higher than the long-term average. Northern pintails were similar to the 2012 estimate, and 65% lower than the long-term average. Redhead and canvasback estimates were similar to last year's estimates and their long-term averages. The scaup estimate was 63% lower than last year and 70% lower than the long-term average in this survey area.

Montana and Western Dakotas (strata 41–44)

Habitat conditions in early May were dry across the crew area and somewhat similar to last year. The exception was northeast Montana, where late winter snows provided additional water. A series of high-moisture, low-pressure systems starting in mid-May led to localized flooding in eastern Montana and western North Dakota, dramatically increasing available water. In many places this led to an increase of over 200% in precipitation for the year. However, the rain came after most of the survey was completed, and was too late for many waterfowl that had already moved to other areas for the breeding season.

Wetland conditions in western South Dakota (stratum 44) were fair to poor with many wetlands, dugouts and reservoirs averaging 10–50% capacity. In western North Dakota (stratum 43), conditions were improved, with wetlands at 40–60% of capacity. Habitat in this area was considered fair, although the number of ponds decreased from 2012. Habitat conditions deteriorated in eastcentral Montana (Stratum 42), with many dry wetlands, small streams, and reservoirs at only at 20–50% of their capacity. Habitat was classified as poor to fair, with pond counts below the already low counts from last year. Conditions improved in northeastern Montana near the Canadian border where habitat was rated as good with ponds and reservoirs averaging 70% of capacity. The pond count in stratum 41 increased from 2012 but this count was due partially to the recent rains in late May.

Overall, the 2013 May pond count in this crew area was similar to last year, and 32% lower than the long-term average. Total duck numbers decreased by 35% from 2012, but were similar to the long-term average. The mallard estimate was similar to 2012 and 55% above the long-term average. The gadwall estimate was similar to 2012 and the long-term average. The American wigeon estimate was 49% lower than 2012 and 61% lower than the long-term average. Green-winged teal were similar to last year but 46% lower than the long-term average. Blue-winged teal were 66% lower than last year but similar to the long-term average. Northern shovelers were similar to last year and the long-term average. The northern pintail estimate was 64% lower than 2012 and 66% lower than the long-term average. Redhead and canvasback estimates were similar to 2012 and their long-term averages. The scaup estimate was similar to last year and 73% lower than the long-term average.

Eastern Dakotas (strata 45–49)

Habitat conditions in this crew area changed dramatically as the survey progressed. The South Dakota portion of the survey area was drier than in 2012 despite average snow during the winter and record snow in April. The dry trend from 2012 continued throughout much of the winter in southeastern South Dakota but northeastern South Dakota saw record snowfall and well below-average temperatures. Despite the snow, most of South Dakota was extremely dry at the beginning of the survey. With an abnormally cool and snowy spring, upland vegetation remained dormant and trees were early in the bud stage. Spring phenology was well behind average and considerably behind the abnormally early spring of 2012. In strata 48 and 49 in South Dakota, conditions ranged from fair in the prairies to good on the coteau. Permanent wetland basins contained water but vegetation margins were present in nearly all of them. Very few wetlands were more than 50% full, and most semi-permanent and seasonal wetlands were dry. All streams and rivers were well within their banks and some streams were dry. With the near average amount of winter and spring moisture and the record precipitation in April, farming activity was on schedule. Waterfowl production was predicted to be good in the coteau regions of the state but only fair in the drift plain region, with conditions improving slightly to the north, particularly near Aberdeen.

Wetland habitats in stratum 45 and 46 in North Dakota were good due to extensive rainfall in mid-May, which dramatically changed the landscape. After 6 inches of rain in five days, seasonal wetlands were recharging and sheet water was observed for the first time during the survey. Virtually all of the permanent wetland basins in the coteau regions were at least 60% full but vegetation margins were still present. Semi-permanent and seasonal wetlands ranged from puddles to 50% full. An additional five days of rain near the end of the survey continued to improve wetland conditions. It was noteworthy that many seasonal wetlands held water but were unoccupied by ducks. Stratum 45 appeared good in nearly all areas, with recharged wetlands and abundant sheet water. However, the Souris River was well within its banks and Devil's Lake and Lake Sakakawea had exposed beach areas, something not seen in recent years until 2012. Stratum 47 (eastern North Dakota) was particularly wet despite extensive draining and tiling, but this was due mostly to sheet water, since there are few intact wetlands remaining in this stratum.

On the whole, conditions in the eastern Dakotas were fair, with good conditions in the coteau. Waterfowl production in the crew area should be average this year. The cold spring delayed breeding and nesting, but the ratio of pairs to lone drakes observed throughout the survey suggested that survey timing was appropriate. Some regions, particularly Stratum 47, were in poor condition. It should be noted that the recent rain was widespread over most of the crew area, which vastly improved conditions and should be good news for 2014.

In the eastern Dakotas, the 2013 May pond estimate was 59% higher than 2012, and 79% higher than the long-term average. The total duck estimate was 14% below last year and 119% above the long-term average. Mallard numbers were similar to 2012 and 161% higher than the long-term average. The gadwall estimate was similar to 2012 and 132% above the long-term average. The American wigeon estimate was similar to 2012, and was 114% above the long-term average. Green-winged teal were similar to 2012, but were 200% higher than the long-term average. Blue-winged teal were 34% lower than last year and 87% higher than their long-term average. Northern shovelers were similar to last year and 170% above their long-term average. The northern pintail estimate was similar to the 2012 estimate, and 55% higher than their long-term average. The redhead estimate was similar to last year and 134% above the long-term average. The canvasback estimate was similar to 2012 and 212% above their long-term average. Scaup numbers were similar to last year and 154% above their long-term average in this survey area.

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

The survey area received primarily average to above-average annual precipitation, with temperatures that ranged from near normal to below average since June 2012. Precipitation ranged from 60% to as much as 150% above average, with above-average moisture stretched across the lower half of the survey area from Fort McMurray, through Prince Albert, and over to Giliam. The abundant moisture fell as both rain and snow during the summer of 2012 and winter 2012-13, with the northern areas below average during the same period. The entire crew area received mainly below-average to much-below-average precipitation from March to June 2013 (Agriculture and Agri-Food Canada 2013).

Temperatures during summer 2012 were average to only slightly above average across the entire survey area. Mean monthly temperatures from October through December 2012, however, were below average, particularly in northern Saskatchewan during November 2012. January and February 2013 temperatures were average to above average, with western areas from Meadow Lake north to Cree Lake and over to Fort McMurray the warmest as temperatures were as much as 4°C above normal. The entire crew area experienced a very late and cold spring, with temperatures running as much as 5°C below normal through April 2013. In western Ontario, many lakes did not thaw until well into the third week of May. Conversely, temperatures rebounded in May 2013 to above average. Despite one of the latest starting dates for the survey due to the late spring, habitat conditions responded positively very quickly towards the end of May 2013. Only the largest water bodies contained ice on the main lakes proper and birds were paired and distributed nicely across the crew area. No large flocks were encountered. The abundant annual precipitation resulted in good-to-excellent habitat conditions for spring 2013. In western Ontario, where many water bodies are permanent or semipermanent, any changes to nesting waterfowl habitat primarily result from either extreme weather or fluctuations in beaver populations. This year, the beaver population responded to the abundant spring rains, ensuring an abundance of nesting cover was available in more ephemeral wetlands.

The 2013 total duck estimate in this survey area was 25% higher than last year and similar to the long-term average. The mallard estimate was similar to last year and to the long-term average. Gadwall numbers were 59% lower than 2012 and 52% lower than the long-term average. The American wigeon estimate was 77% higher than 2012, and similar to the long-term average. Green-winged teal were 164% higher than last year and 77% higher than the long-term average. Blue-winged teal estimates were similar to 2012 but 84% lower than the long-term average. Northern shovelers were 218% higher than last year but similar to the long-term average. Northern pintails were similar to last year and 74% lower than the long-term average. The redhead estimate was 76% lower than 2012 and 82% lower than the long-term average. Canvasback were similar to 2012 and 42% lower than the long-term average. The scaup estimate was similar to 2012 but 44% lower than the long-term average.

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

After a prolonged winter and one of the latest break-ups in recent years, spring returned quickly in the north. Smaller wetlands thawed quickly and waterfowl appeared to occupy these desirable habitats immediately. As usual, larger lakes were slower to thaw; however, birds were also observed in good numbers along open shoreline habitat. Wetland conditions were good throughout the region. In the Mackenzie River Delta, spring flooding may have impacted early nesters. In this crew area, the total duck estimate for 2013 was similar to the 2012 estimate and 16% higher than the long-term average. Mallard numbers were 34% lower than 2012 and similar to the long-term average. The American wigeon estimate was 62% higher than the 2012 estimate and similar to the long-term average. Gadwall were similar to last year and 34% lower than the long-term average. Green-winged teal were similar to 2012 and 53% above the long-term average. Blue-winged teal were 163% above the 2012 estimate and similar to the long-term average. Northern shovelers were similar to the 2012 estimate and 59% above the long-term average. Northern pintails were 199% higher than 2012 and 34% below the long-term average. Redheads were similar to 2012 and 44% below the long-term average. The canvasback and scaup estimates were both similar to last year and to the long-term average.

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

The delayed spring in Alaska was among the latest recorded in the history of the waterfowl survey there. Habitat conditions in the Kotzebue Sound and Bristol Bay were in good condition, similar to last year; however, habitats in the interior of Alaska have declined since 2012, and were only in fair condition. The 2013 total duck estimate in this survey area was 27% lower than in 2012 and 12% lower than the long-term average. Mallard numbers were 33% lower than last year and similar to the long-term average. Gadwall and American wigeon were both similar to last year and to their long-term average. Green-winged teal were 36% lower than last year's estimate and similar to their long-term average. Blue-winged teal were not counted in this crew area in 2013 or 2012. The northern shoveler estimate was 40% lower than last year and 22% below the long-term average. Northern pintails were similar to 2012 and their long-term average. The redhead estimate was 100% higher than 2012, when none were counted, and similar to the long-term average. The canvasback estimate was similar to 2012 but 60% lower than the long-term average. The scaup estimate was 36% lower than 2012 and 40% lower than the long-term average.

Eastern survey area (strata 51–72)

Much of southern Ontario experienced below-average winter precipitation. Some areas in southern Ontario experienced a near-record dry winter. Quebec east of the St. Lawrence River was generally 60–85% of normal precipitation for the winter, and conditions were near normal in the province west of the St. Lawrence (Agriculture and Agri-Food Canada 2013). The dry trend began to reverse itself in April, and in the two months following some parts of southern Ontario saw record rainfall. Agricultural areas near the St. Lawrence were in fair to poor condition, while areas further east in stratum 56 were considered to be good. Conditions were generally good in stratum 51, though some rivers were out of their banks west of Timmins, resulting in fair to poor conditions. Many spring rains arrived too late to benefit nesting waterfowl and only served to swell rivers and small tributaries. Spring arrived on time in the areas bordering the Great Lakes, but many marshes and agricultural areas were considered slightly drier than normal. Further north, closer to the James Bay Lowlands, slightly drier conditions persisted from winter to spring and warm temperatures and thawing occurred about 1 to 2 weeks later than average. Overall, conditions for breeding waterfowl were considered fair in northeast and southeastern Ontario and good along the border of Quebec.

Southern Quebec experienced near normal winter precipitation with more eastern areas receiving an abundance of late spring rains associated with a series of low pressure systems affecting the Great Lakes and New England states. Spring came normally to the area and most lakes were ice free by the second week of May. Overall habitat conditions for nesting waterfowl were considered good across all of southern Quebec. Spring was slightly later in northern Quebec, 1–2 weeks behind average conditions. Water bodies were much more permanent across these areas and were charged with abundant spring rain; however, man-made reservoirs associated with hydroelectric development in the area were maintained at low levels throughout the winter and spring due to maintenance requirements. Conditions for nesting waterfowl were considered to be good across northern Quebec.

Across the Maine and Atlantic Canada crew area it was a fairly normal winter with an average or just-below-average snowpack. Spring phenology was delayed until an extended period of warm, dry weather in late April and early May. This advanced the spring phenology and waterfowl breeding efforts in the southern portions of the crew area, and the timing of the survey appeared to be appropriate. Spring phenology was somewhat more advanced in northern New Brunswick, near normal in Prince Edward Island, and somewhat delayed in Nova Scotia at the time of the survey. Conditions in Cape Breton were on par with the long-term average with ice cover present on some higher elevation lakes. A lack of late winter and early spring precipitation across Maine and the Maritimes resulted in lower-than-normal water levels in lakes and wetlands; habitat conditions in these areas were assessed as fair. Heavy rains after the survey recharged wetlands and caused local flooding that may have destroyed some nests. Habitat conditions throughout Newfoundland and Labrador were generally good. Spring phenology was average to early, but prolonged periods of rain and snow, especially in western Newfoundland and Labrador, may have taken a toll on early nesting efforts.

Estimated abundance of mallards in the eastern survey area was similar to the 2012 estimate and 25% higher than the long-term average (1990–2012). The estimated abundance of American black ducks was similar to the 2012 estimate and the long-term average. Green-winged teal abundance was similar to 2012 and the long-term average. The abundance of ring-necked ducks was 24% higher than 2012 and 25% higher than the long-term average. Goldeneyes increased 17% from 2012 and were 10% above the long-term average. Mergansers were similar to last year's estimate and their 1990–2012 average.

Other areas

In the Pacific Flyway, below-normal winter precipitation and snowpack led to a decline in habitat conditions in many areas. In California, winter and spring precipitation were below average. Poor waterfowl production is expected in 2013 as poor habitat conditions prevailed in the state. In California, the total duck estimate in 2013 was 451,300, which was similar to last year's estimate and 23% below their long-term average of 588,800. The mallard estimate in 2013 was 298,600, also similar to the 2012 estimate and their long-term average (365,000). In Nevada, winter precipitation and run-off was well below normal. Most wetlands in northern Nevada including the Carson Sink area (Stillwater NWR, Carson Lake WMA) had only 40–50% coverage. Reservoir storage for this area was at only 37% of capacity so little additional water was forthcoming. Eastern Nevada wetlands were only slightly better, with 60–70% coverage and reservoir storage at 30% capacity. The total duck estimate for Nevada was 40,000, which was higher than 2012. The Nevada mallard estimate was 8,900, which was also higher than 2012. In Oregon, winter precipitation was well below normal throughout much of the state, which reduced available habitat for waterfowl compared to the last few years. Modest precipitation in May improved habitat conditions in some areas, especially in northeastern Oregon, but waterfowl production was likely below average statewide. In Oregon, the total duck estimate in 2013 was 267,100, which was similar to 2012 and the long-term average of 275,600. The 2013 mallard count was 93,500, which was similar to last year and the long-term average (100,400). In eastern Washington, the survey area was drier this year than in the last two years. Many of the ponds present during the 2012 survey were dry. The combined precipitation accumulation from March and April 2013 was 0.49–0.86 inches below normal within all of the survey strata. In western Washington, the survey area appeared to be wetter than 2012, with higher April precipitation than in either of the previous two years. The estimate for total ducks in Washington (156,500) was similar to the 2012 estimate. The mallard estimate in Washington was 74,100, which was similar to last year's estimate. In British Columbia, snowfall and snowpack were average for the interior during the 2012–2013 winter. The cooler and wetter conditions experienced in mid- and late April resulted in continued snow accumulation in most interior B.C. areas up to the end of April. Typically, snow packs transition from accumulating snow to melting snow around the middle of April, but this transition was delayed by one to two weeks in April 2013. Wetland water levels were marginally lower than last year in most of the B.C. interior and were expected to have negative effects on waterfowl populations. In British Columbia, the total duck estimate was 305,300, which was similar to last year (298,000) and the long-term average (330,500). The 2013 mallard estimate was 77,200, which was similar to last year's estimate of 78,700 and the long-term average (80,100).

In the Midwest, spring precipitation improved habitat conditions from last year, although a late spring delayed nesting in some areas. In Minnesota, ice-out on many lakes was the latest or almost latest on record. Spring temperatures were 3–4°C below normal in March and April. Wetland conditions were extremely dry in early April, but above-normal precipitation in April and May dramatically improved habitat for waterfowl by late May. The number of permanent or semi-permanent wetlands increased 13% from 2012 and was close to the 10-year and long-term averages. The estimate of total duck abundance, excluding scaup, was 683,000, which was higher than last year's estimate (469,000) and the long-term average of 620,000 ducks. The estimated mallard breeding population was 293,000, which was similar to last year's estimate of 225,000 mallards and the long-term average. In Michigan, the wet spring resulted in the highest wetland counts recorded since 2006. The number of wetlands was 7.6% above the 1991–2012 average. The estimate for total ducks was 678,600, which was similar to last year and the 1991–2012 average. In Wisconsin, a late, cold spring delayed waterfowl migration into northern regions of the state. Above-average fall and winter precipitation, combined with abundant spring precipitation, contributed to good wetland conditions in key breeding areas. Wetland numbers increased from 2012 in all areas of the state except for parts of northeast Wisconsin. The total Wisconsin breeding duck population estimate was 527,300, which was similar to 2012 (521,100) and 19% above the long-term average. The 2013 total mallard population estimate of 181,200 was similar to the 2012 estimate of 197,000 and the long-term average. In Nebraska, habitat conditions in the Sandhills were considered fair. Precipitation occurred over most of the area in March, April and May, but nesting likely was delayed given colder than normal temperatures during that same period. Upland conditions are still recovering from the drought in 2012. Overall, production was expected to be poor to fair in 2013. Nebraska has not conducted a spring waterfowl survey in recent years.

In the northeast U.S., cool spring temperatures contrasted with the early spring of 2012. Wetland habitats were generally good, with drier conditions along the northeast coast (Connecticut, Massachusetts and Rhode Island). In Vermont, water levels on marshes and lakes were slightly below normal but late spring precipitation resulted in habitat conditions ranging from good to excellent. Unseasonably cool wet weather during a one-week period raised concerns about broods but casual observations suggested good brood survival. Habitat conditions in New

Hampshire were excellent this spring, with optimal water levels in ponds and marshes. Similar to Vermont, a week of rain in mid-May had the potential to impact late nesters and broods in northern areas of the state. In Massachusetts, spring conditions were dry despite substantial snowfall in January. Precipitation levels were approximately 4 inches below normal at the time of the survey. Fairly dry conditions in Connecticut as well left many wetlands low or with almost no water. Consequently, breeding habitat conditions were average to poor in Connecticut in 2013. Rhode Island experienced a dry and cool early spring, but the weather turned cooler and wetter by the time of the survey. Waterfowl numbers were much lower in 2013 than in previous years. In New York, spring temperatures varied widely from low 20s to the low 80s; mid-April temperatures were below normal across the entire state with frequent frosts and freezes, but were followed by above normal daytime temperatures leading to warm and dry conditions during the final week of the survey. Habitat conditions in Pennsylvania were average across most of the state in early spring, despite cooler than average March temperatures. Vegetation growth during the survey period was average. Precipitation was below average in May, which may have resulted in below-average habitat for broods and renesting waterfowl. Production in Pennsylvania in 2013 is expected to be average from the birds that attempted to nest. In Maryland and Delaware, habitat conditions were very good due to above-normal precipitation. Spring rains filled most wetland basins and created excellent brood cover, in contrast to habitat conditions in 2012, which were among the warmest and driest in Delaware since 1895. In New Jersey, water levels were also higher than average in the southern areas of the state, but lower than average in the north. Spring phenology was noticeably later than usual, but the timing of duck and Canada goose broods appeared to be normal. Total duck numbers from the 2013 Atlantic Flyway Breeding Waterfowl survey were 1.28 million, which was similar to the 2012 estimate and the long-term (1993–2012) average of 1.39 million. Mallard numbers (604,200) were similar to the 2012 estimate of 612,600 and 19% below the long-term average of 747,400.

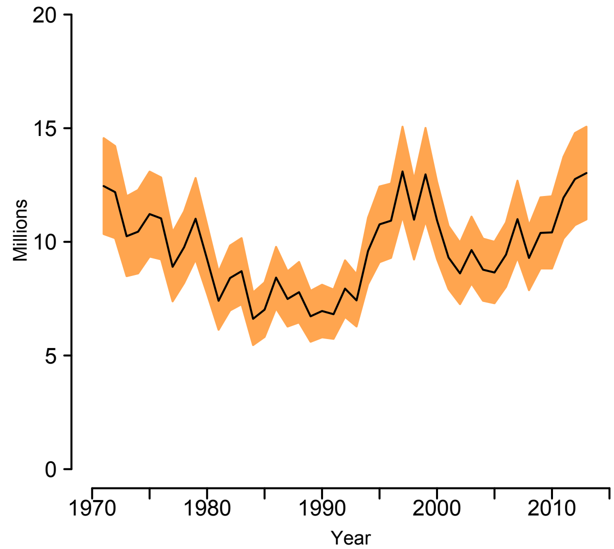


Figure 4. Estimates and 90% confidence intervals for the predicted size of the mallard population in the fall.

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 13.0 ± 1.2 million birds in 2013 (Figure 4). This is similar to the 2012 estimate of 12.8 ± 1.2 million.

References

Agriculture and Agri-Food Canada. 2013. Current Conditions. Accessed May–June 2013. URL http://www4.agr.gc.ca/DW-GS/current-actuelles.jspx?lang=eng&jsEnabled=true.

Bowden, D. C. 1973. Review and evaluation of the May waterfowl breeding ground survey, Unpublished report.

Link, W. A., and J. R. Sauer. 2002. A hierarchical analysis of population change with application to Cerulean warblers. Ecology 83:2832–2840.

Martin, T. G., B. A. Wintle, J. R. Rhodes, P. M. Kuhnert, S. A. Field, S. J. Low-Choy, A. J. Tyre, H. P. Possingham, and M. Anderson. 2005. Zero tolerance ecology: improving ecological inference by modeling the source of zero observations. Ecology Letters 8:1235–1246.

R Core Team. 2013. R: A Language and Environment for Statistical Computing. R Foundation for Statistical Computing, Vienna, Austria. URL http://www.R-project.org/.

Sauer, J. R., and S. Droege. 1990. Wood duck population trends from the North American Breeding Bird Survey. Pages 159–165 *in* L. H. Fredrickson, G. V. Burger, S. P. Havera, D. A. Graber, R. E. Kirby, and T. S. Taylor, editors. Proceedings of the 1988 North American Wood Duck Symposium, 20–22 February 1988. St. Louis, MO.

Smith, G. W. 1995. A critical review of the aerial and ground surveys of breeding waterfowl in North America. U.S. Department of Interior Biological Science Report 5, Washington, D.C.

U.S. Fish and Wildlife Service. 2013. Adaptive Harvest Management: 2013 Hunting Season. U.S. Department of Interior Technical report, Washington, D.C. URL http://www.fws.gov/migratorybirds/CurrentBirdIssues/Management/AHM/AHM-intro.htm.

Zimmerman, G. S., J. R. Sauer, W. A. Link, and M. Otto. 2012. Composite analysis of black duck breeding population surveys in eastern North America. Journal of Wildlife Management 76:1165–1176. URL http://onlinelibrary.wiley.com/doi/10.1002/jwmg.351/abstract.

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 2013, many arctic and boreal areas important for geese were characterized by a cold, late spring, followed by higher than average temperatures that in many cases produced an average timing of breeding. Biologists cautioned that the effect of a late spring combined with rapid warm-up was uncertain, but in many areas they reported average peak hatch dates and clutch sizes. A major exception to the generally average nesting conditions in the north-country was Alaska's Yukon–Kuskokwim Delta (YKD), where ice break-up was the latest since 1964. Predicted production on the YKD was then downgraded to poor after a storm surge/high tide event at peak hatch in late June destroyed numerous nests and goslings. Emperor geese, cackling Canada geese, and white-fronted geese were the species most affected. Spring was also later than average in Alaska's interior, and the area extending along the Beaufort Sea from Alaska's eastern coast through Tuktut Nogait National Park (Northwest Territories) remained ice-covered longer than normal. In contrast, in the central Arctic, phenology was earlier than average and earlier than last year, so above-average production of snow, Ross's geese, and Mid-continent white-fronted geese nesting in the Queen Maud Gulf Sanctuary was expected. Brant, and Canada geese nesting in the central Arctic should benefit as well. Gosling production of Canada goose populations that migrate to the Atlantic and Mississippi Flyways should generally be average in 2013. Production by the Southern James Bay Canada goose population has been low and that population continued to decline. Indices of wetland abundance in the Canadian and U.S. prairies in 2013 improved dramatically over last year's, with the exception of the western Dakotas and Eastern Montana. Although early spring was cold and wet in many goose nesting areas of the U.S., the outlook for production was generally average. Breeding populations of most temperate-nesting geese remained high in 2013, despite efforts to reduce or stabilize them. Production of temperate-nesting Canada geese from most of their North American range is expected to be average in 2013.

Primary abundance indices increased for 11 goose populations and decreased for 11 goose populations in 2013 compared to 2012. Primary abundance indices for both populations of tundra swans decreased in 2013 from 2012 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, Western Central Flyway, and Western Arctic Wrangel Island light geese, Ross's geese, Pacific brant, and the Pacific population of white-fronted geese. Only the Atlantic Flyway Resident Population showed a significantly negative 10-year trend. The forecast for the production of geese and swans in North America is generally favorable in 2013.

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

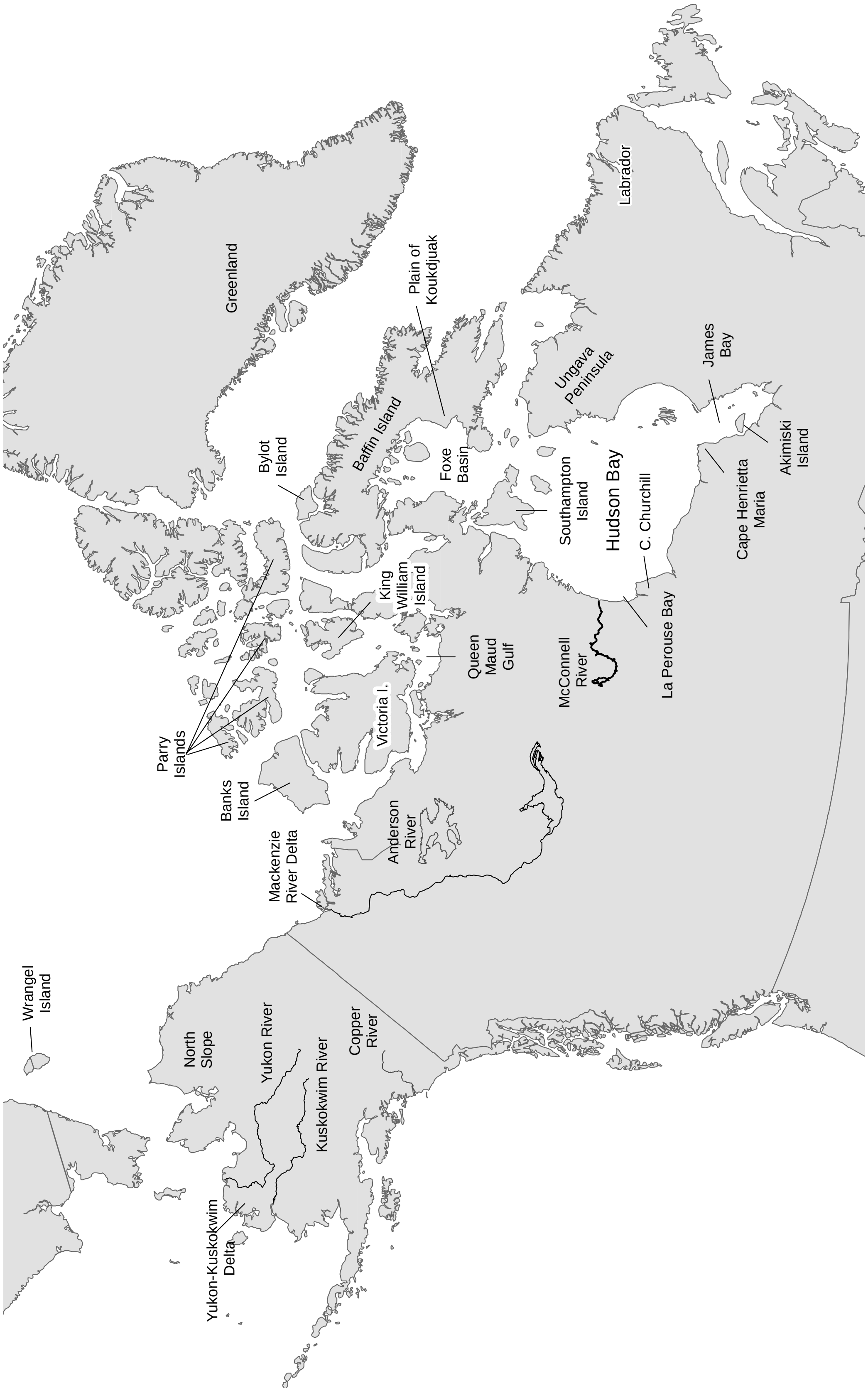


Figure 5. Important goose and swan nesting areas in Arctic and subarctic North America.

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.

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). 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 year 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 2013, snowmelt timing was average or later than average throughout most of the important goose breeding areas. A very late ice breakup and a coastal flood at peak hatch on the Yukon–Kuskokwim Delta meant that the outlook for production there was poor, and emperor geese, cackling Canada geese, and white-fronted geese were the species most affected. 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 2013 was more extensive than on the same date in 2012, as areas along the coast of the Beaufort Sea along the northeastern coast of Alaska to the border between the Northwest Territories and Nunavut remained ice covered. Spring was also later than average in Alaska's interior.

In the central Arctic, phenology was earlier than average and earlier than last year, so above-average production of snow, Ross's, and Mid-continent white-fronted geese nesting in the Queen Maud Gulf Sanctuary was expected. Brant and Canada geese nesting in the central Arctic should benefit as well.

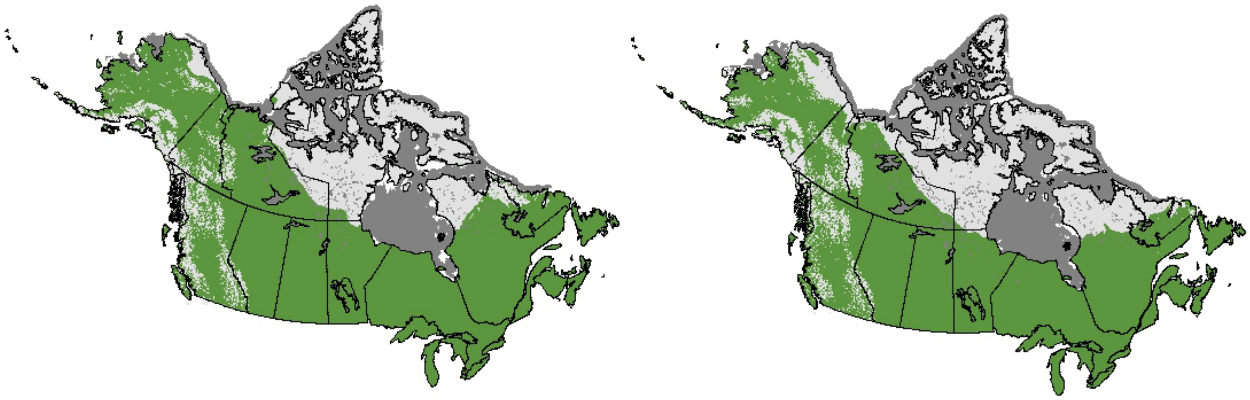


Figure 6. The extent of snow (light gray) and ice (dark gray) cover in North America on 2 June 2012 and 2 June 2013 (National Ice Center 2012).

Gosling production of Canada goose populations that migrate to the Atlantic and Mississippi Flyways should generally be average in 2013. Production by the Southern James Bay Canada goose population has been low and that population and prospects for production are poor again in 2013.

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 2013 improved dramatically over last year, with the exception of the western Dakotas and Eastern Montana. Although early spring was cold and wet in many goose nesting areas of the U.S., the outlook for production was generally average. Breeding populations of most temperate-nesting geese remained high in 2013, despite efforts to reduce or stabilize them. Production of temperate-nesting Canada geese from most of their North American range is expected to be average in 2013.

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). Typically, the NAP goose estimate (Figure 8.1) is calculated using data from the Waterfowl Breeding and Habitat Survey (WBPHS) in Newfoundland and Labrador (Strata 66–67). Because of mechanical problems with the USFWS Kodiak aircraft typically used to fly strata 66 and 67, these areas were not surveyed in 2013 by the USFWS. These strata were surveyed by CWS using helicopters. For several years, biologists have been considering revising the index used to monitor this population to one that combines both the WBPHS transect and Canadian Wildlife Service (CWS) helicopter plot survey data, but that new index has not yet been adopted. The density of NAP geese estimated from the Newfoundland and Labrador CWS plot survey was similar to the 2006–2012 average, and was above the 1990–2012 average. CWS helicopter crews reported that spring was mild and cool, snow melt was early, and breeding phenology was earlier than normal over most of the survey area. During the survey, lakes and ponds were largely ice-free, and water levels high. In addition, many groups of non-breeders were

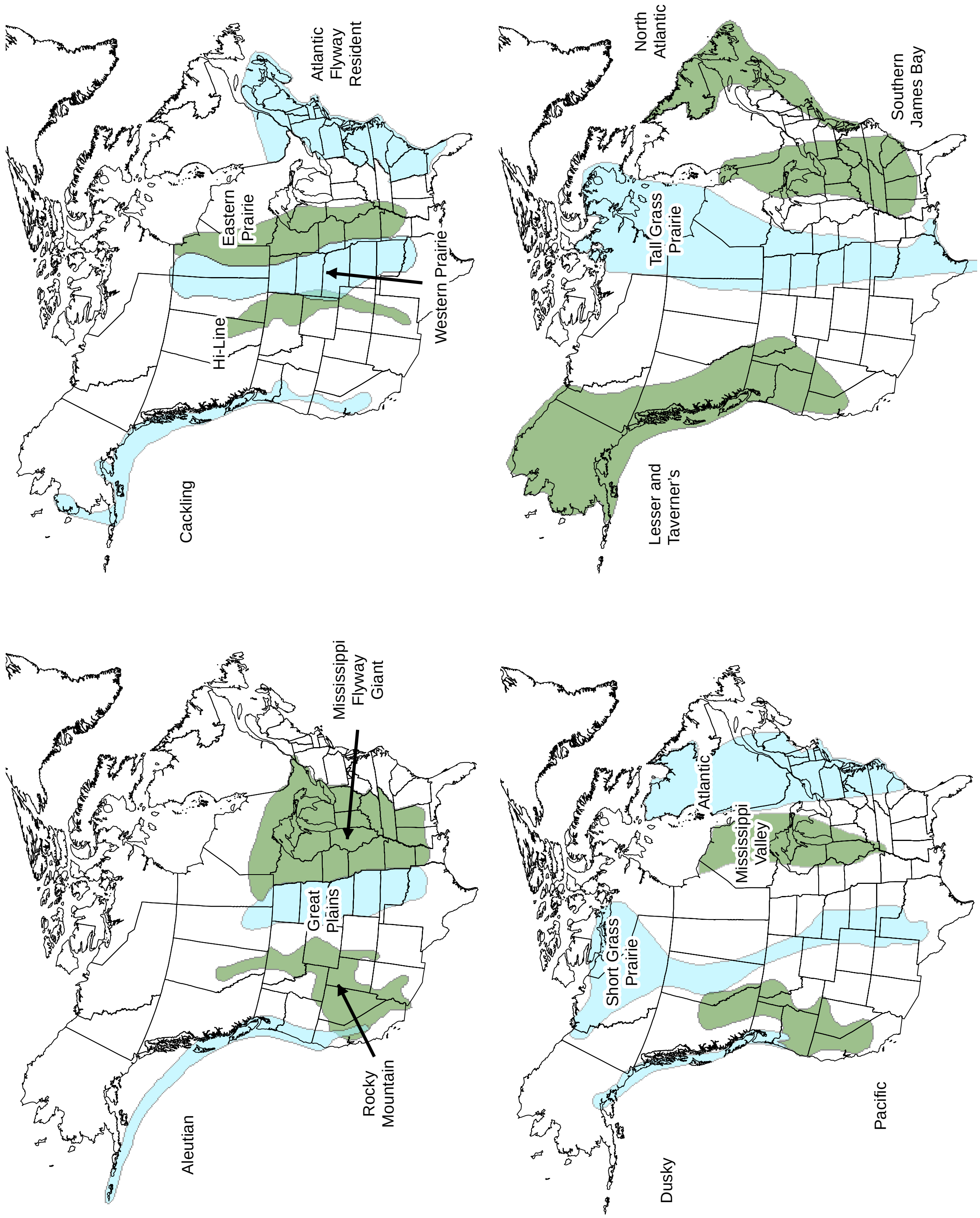
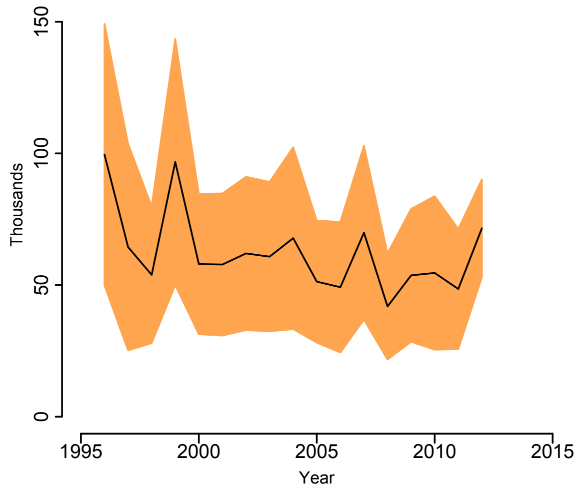
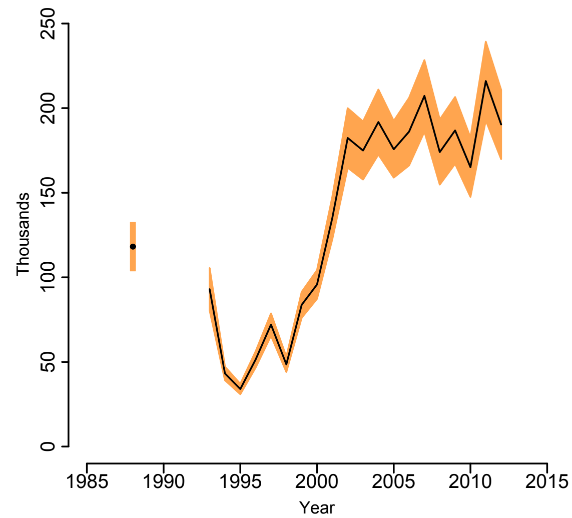


Figure 7. Approximate ranges of Canada goose populations in North America.



8.1: North Atlantic Population



8.2: Atlantic Population

Figure 8. Estimated numbers (and 95% confidence intervals) of North Atlantic Population (indicated pairs; 1996–2012), and Atlantic Population (breeding pairs; 1988–2012) Canada geese.

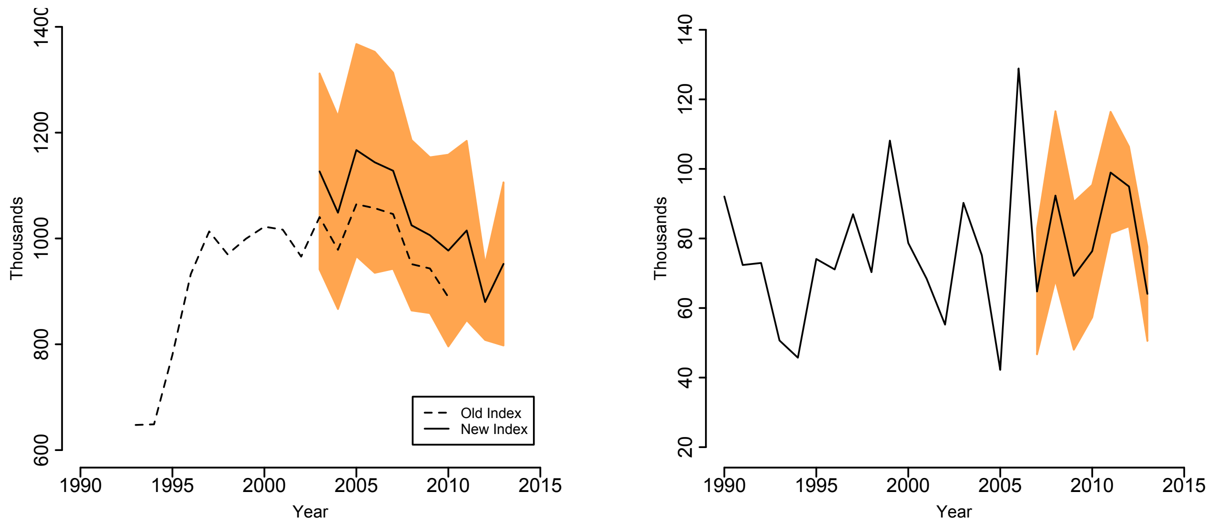
observed, which may indicate good production last year. The early spring combined with average pair densities suggest an above average fall flight for NAP geese.

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 (Figure 8.2). The AP winters from New England to South Carolina, but the largest concentrations occur on the Delmarva Peninsula (Figure 7). This population is typically monitored using estimates from a spring survey of the Ungava Peninsula. However, in 2013 appropriate aircraft were unavailable so the survey was not conducted. The survey is expected to resume in 2014. As of early June the timing of snow melt was average, and on Big Island a biologist found 15 nests with full clutches. On the Hudson Bay coast spring was cold which suggested that nesting was slightly late. A model that uses mean temperature for three weeks in mid-May (4–24) to predict the timing of mean clutch initiation predicted 6 June for Hudson Bay and 1 June for Ungava Bay. These dates were similar to 2011, and slightly later than for 2012. Another model uses historic banding data and weather data from Kuujjuaq to predict the ratio of immatures/adults. The 2013 predicted age ratio estimate was 1.47, slightly below the long-term mean of 1.53. Biologists predicted below average productivity for AP geese this year.

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 951,900 (797,700–1,107,000) AFRP Canada geese was estimated during the spring of 2013, similar ($P = 0.499$) to the 2012 estimate of 879,800 (739,500–1,020,100; Figure 9.1), and similar to the long-term (2003–2013) average ($P = 0.207$). These indices have declined by an average of 2% per year since 2004 ($P = 0.004$). In the mid-Atlantic states (VA, MD, DE, and NJ) spring was cool, wet, and late, and average production was expected. Pennsylvania and southern New England (CT, RI, and MA) also experienced below-normal temperatures. However, abnormally dry conditions that reduced



9.1: Atlantic Flyway Resident Population

9.2: Southern James Bay Population

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

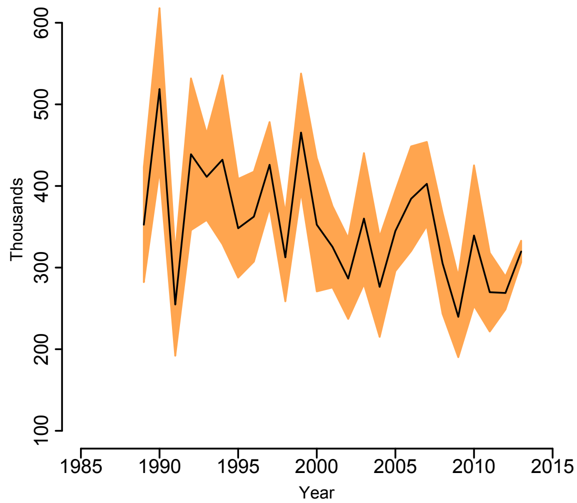
wetland quality and quantity meant that average to poor production was expected in these areas. In Vermont and New Hampshire, good wetland conditions combined with mostly dry, warm days made for excellent nesting conditions. Despite some concerns about a rainy period that could have reduced gosling survival, biologists forecast good production in these states.

Southern James Bay Population (SJBP)

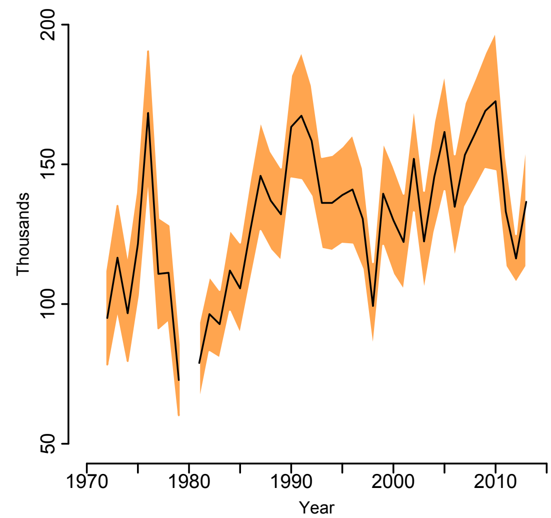
This population nests on Akimiski Island and in the Hudson Bay Lowlands to the west and south of James Bay. The SJBP winters from southern Ontario and Michigan to Mississippi, Alabama, Georgia, and South Carolina (Figure 7). The estimated number of breeding SJBP geese in spring 2013 was 60,900 (47,600–77,100), similar to (P = 0.169) the 2012 estimate of 77,500 (57,800–97,200). The total population index of 64,100 (50,500–77,600) was 33% below ($P = 0.021$) last year's index of 94,900 (72,500–117,400; Figure 9.2). Neither of these indices of SJBP geese showed a trend over the 2003–2012 time series ($P \geq 0.919$). 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 much later in 2013 than in 2012, later than the short-term (5-year) average, but similar to the long-term average. Peak hatch on Akimiski Island occurred from 14–16 June, about a week later than average. There was an above-average snow pack across the SJBP range last winter, and March, April and May were characterized by colder than average temperatures. A below-average fall flight is expected.

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 2013 produced an estimate of 319,700 (241,700–397,700) MVP breeding adults, similar to the 268,900 (229,300–308,400) counted in 2012 (P = 0.257; Figure 10.1). Estimates of breeding adults declined by 2% per year during 2004–2013, but this decrease was not statistically significant ($P = 0.363$). Similarly, 2013 transect level breeding pair counts were statistically similar to the 2008–2012 average ($P = 0.20$), and 10% below the 1982–2012 average. Surveys indicated a total population of



10.1: Mississippi Valley Population



10.2: Eastern Prairie Population

Figure 10. Estimated numbers (and 95% confidence intervals) of Mississippi Valley Population (breeding adults) Canada geese and Eastern Prairie Population (indicated pairs) Canada geese.

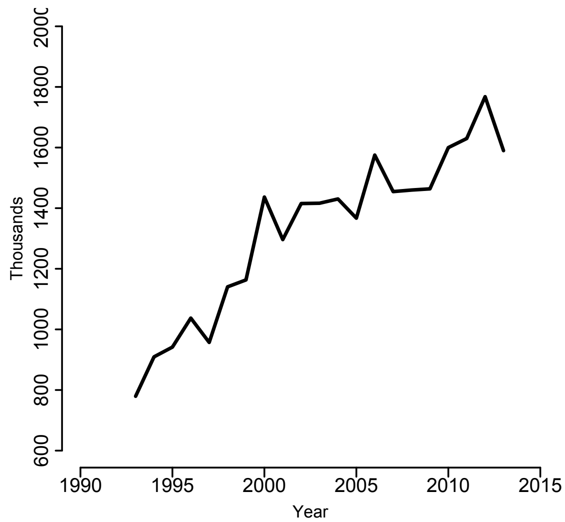
390,700 (278,800–502,600), similar to the 2012 estimate of 402,800 (332,300–473,400). Total population estimates have declined an average of 6% per year over the 2004–2013 timeframe ($P = 0.019$). Spring phenology was later in 2013 than the 5-year average, and similar to the long-term average. There was an above average snowpack on the MVP range last winter and March–May were characterized by average to below average temperatures. Snow melt and river breakups were later than in 2012, similar to the long-term average, and late May–early July was very dry. At the Burnpoint Creek camp east of Peawanuck, dry conditions and almost no snow were observed on 5 June. Peak hatch was estimated at 19–20 June. Above-average breeding effort and predation on nests (15%) that was lower than in the past few years were also reported. Therefore the outlook for productivity of MVP geese was predicted as good.

Eastern Prairie Population (EPP)

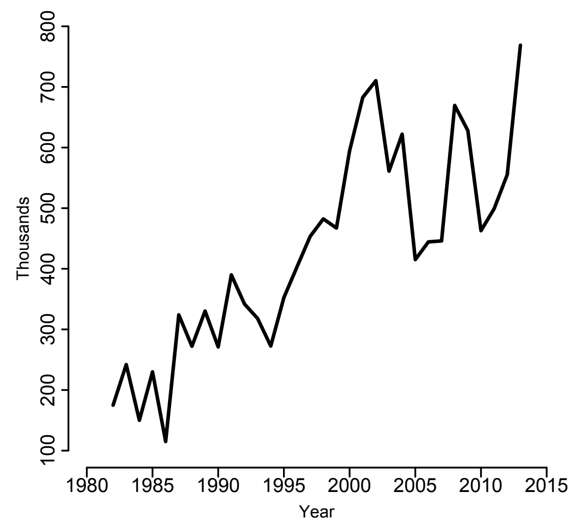
These geese nest in the Hudson Bay Lowlands of Manitoba and concentrate primarily in Manitoba, Minnesota, and Missouri during winter (Figure 7), and they are surveyed annually on their breeding grounds. Because of the variable influence of molt migrants, EPP geese are monitored using the estimate of geese counted as singles and pairs, as they represent geese nesting in the current year and those likely to nest in the near future. The 2013 estimate of single and paired EPP geese was 136,600 (113,500–159,700), similar to last year's estimate of 116,300 (99,300–133,300; $P = 0.107$; Figure 10.2). The 2013 spring estimate of 176,900 (154,700–199,100) total geese was 33% lower than the 262,500 (227,400–297,600) estimated in 2012 ($P < 0.001$). Neither of these estimates exhibited a trend over the 2004–2013 time series ($P \geq 0.294$). The estimate of productive geese in 2013 ($73,800 \pm 14,000$) increased relative to the 2012 estimate ($50,300 \pm 8,200$). The timing of spring was near average throughout the EPP Canada goose range. The mean May temperature was warmer than 2012 as well as the 1970–2012 average. Biologists sampled nests near the town of Churchill and predicted a median hatch date of 19 June, with EPP production close to average this year.

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



11.1: Mississippi Flyway Giant Population



11.2: Western Prairie/Great Plains Population

Figure 11. Numbers of Mississippi Flyway Giant Population (breeding adults) Canada geese and Western Prairie/Great Plains Population Canada geese (winter geese).

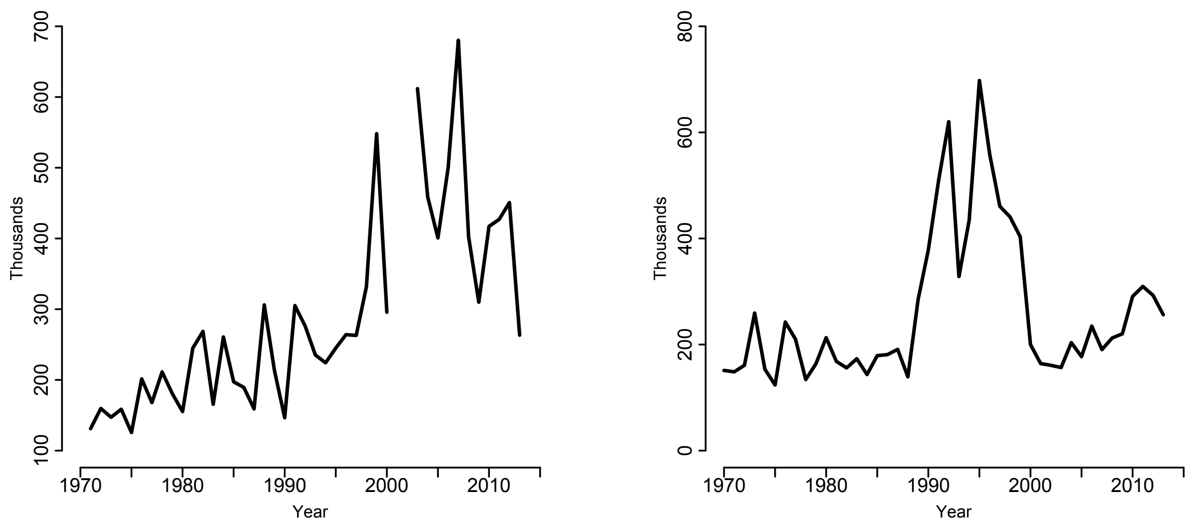
(Figure 7). Biologists estimated 1,589,800 MFGP geese during the spring of 2013, 10% lower than the revised 2012 estimate of 1,767,900 (Figure 11.1). Over the past 10 years, this population has increased by an average of 2% per year ($P = 0.010$). This is considered an over-abundant population, currently managed with the goal of reducing it. 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 2013 compared to 2012.

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 2013 Midwinter Survey, 768,800 WPP/GPP geese were counted, 38% more than the 555,400 recorded in 2012 (Figure 11.2). Midwinter indices have shown no trend from 2004–2013 ($P = 0.254$). 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 1,551,500 (1,406,600–1,696,300) geese, similar to last year's estimate of 1,800,500 (1,555,000–2,046,100; $P = 0.087$). The WBPHS estimates have increased an average of 11% per year since 2004 ($P < 0.001$). Conditions were rated as good over most of the WPP/GPP range, even though spring was about 1 week later than normal. The exception was South Dakota, where drought conditions continued through May. Coupled with a 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



12.1: Tall Grass Prairie Population

12.2: Short Grass Prairie Population

Figure 12. Estimated numbers of Tall Grass Prairie and Short Grass Prairie Population Canada geese estimated during winter surveys.

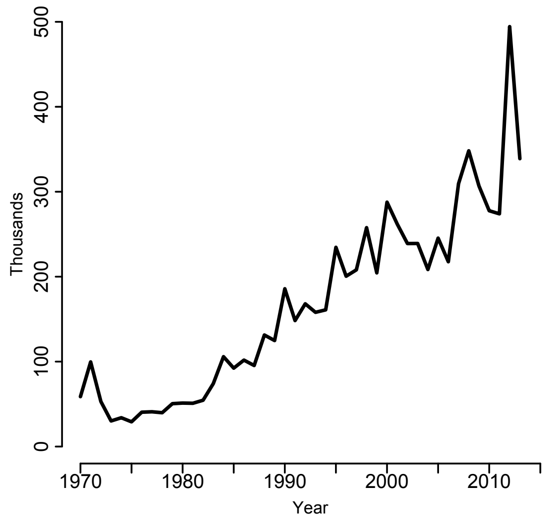
Mexico (Figure 7). These geese mix with other Canada geese on wintering areas, making it difficult to estimate the size of the winter population. During the 2013 Midwinter Survey in the Central Flyway, 263,300 TGPP geese were counted, 42% fewer than the 2012 index of 450,800 (Figure 12.1). Over the past 10 years, the TGP population has not exhibited a significant trend ($P = 0.161$). Biologists reported average nesting phenology on Southampton Island. Ice breakup was 9 days earlier than average, and the first gosling was seen 2 days earlier than average at Karrak Lake in the Queen Maud Gulf Sanctuary. Overall, available information suggests that the production of TGPP Canada geese will be higher than that of 2012.

Short Grass Prairie Population (SGPP)

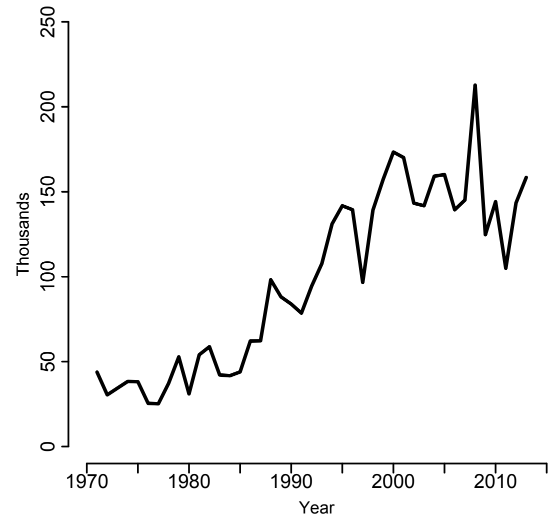
These small Canada geese nest on Victoria and Jenny Lind Islands and on the mainland from the Queen Maud Gulf west and south to the Mackenzie River and northern Alberta. These geese winter in southeastern Colorado, northeastern New Mexico, and the Oklahoma and Texas panhandles (Figure 7). The MWS index of SGPP Canada geese in 2013 was 256,300, 12% lower than the 2012 estimate of 292,800 (Figure 12.2). These indices have increased an average of 5% per year since 2004 ($P = 0.007$). In 2012, the estimated spring population of SGPP geese in the Northwest Territories (WBPHS strata 13–18) was 176,700 (123,600–229,800), similar to last year's estimate of 207,600 (131,200–283,900, $P = 0.516$). WBPHS estimates have increased an average of 9% per year since 2004 ($P = 0.010$). Nesting phenology in the Queen Maud Gulf Sanctuary was very early, approximately 9 days earlier than average at Karrak Lake. Wetland conditions in boreal forest SGPP nesting areas were assessed as good, except that flooding on the Mackenzie River Delta may have destroyed early nests. Production of SGPP geese in 2013 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). The primary index of this population is based on the WBPHS estimates from portions of Alberta (strata 26–29), Saskatchewan (strata 30–33), and Montana (strata 41–42), and state surveys in Wyoming. In 2013, these surveys yielded an estimate of 338,900 geese, a 31% drop from last year's record high value of 494,400



13.1: Hi-line Population



13.2: Rocky Mountain Population

Figure 13. Estimated numbers of Hi-line Population (breeding adults) and Rocky Mountain Population (breeding adults) Canada geese.

(Figure 13.1). These breeding population survey indices have increased an average of 6% per year over the 2004–2013 time frame ($P = 0.018$). The midwinter survey index for 2013 was 341,300, similar to last year's count of 339,400. Over the past 10 years, midwinter indices for this population have increased by an average of 5% per year ($P = 0.008$). Wetland conditions remained poor to fair over most of the HLP range. However, late rains might have likely boosted production, so the the 2013 fall flight of HLP geese will likely be average.

Rocky Mountain Population (RMP)

These large Canada geese nest in southern Alberta and western Montana, and the intermountain 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 is calculated based on WBPHS estimates from portions of Alberta (Strata 26–29) and Montana (Strata 41–42), plus state surveys in Arizona, Colorado, Idaho, Nevada, Utah, and Wyoming. The index for 2013 was 158,400 geese, 11% higher than the index from 2012, which totaled 143,400 (Figure 13.2). RMP indices exhibited no trend over the 2004–2013 time series ($P = 0.434$). Wetland conditions were rated as good in Aberta, and fair to poor in Montana, where drought conditions prevailed. Indices increased in Utah and Nevada and were similar to 2012 in Colorado, Wyoming, Idaho, and Arizona. The fall flight of RMP geese was 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 PP goose index is based on breeding ground surveys in Alberta, British Columbia, Washington, Oregon, California, Nevada, Idaho, and Montana. The total PP goose index in 2013 was 220,000, similar to the 221,300 counted in 2012. There was no trend ($P = 0.406$) in the total PP index from 2006 to 2013. Most PP geese are surveyed in Alberta (WBPHS strata 76–77) where 128,100 (94,300–194,000) were estimated in 2013, similar ($P = 0.741$) to the 2012 estimate of 114,100 (72,300–155,900). Over the past 10 years, PP geese counted in the WBPHS strata have increased 9% per year ($P = 0.035$).

Figure 14. Estimated numbers of breeding adult Dusky Canada geese, 1986–2012.

Conditions in Alberta improved relative to 2012, and most of the PP range in that province was rated as good. Gosling production in 2013 should be higher than average, and a fall flight similar to last year's is expected.

Dusky Canada Geese

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 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 (Figure 14). 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. However, in 2013, the lack of aircraft availability and significant weather delays meant that the breeding ground survey for dusky Canada geese could not be accomplished. The USFWS fully plans to resume the survey in 2014.

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 of predicted fall populations (Appendix D.1). The estimate for 2013 was 312,200 (268,200–356,200) geese, 54% higher than last year's estimate of 202,300 (177,100–227,600). Over the 2004–2013 time series, there has been no trend overall for the revised estimates ($P = 0.363$; Figure 15). As in 2012, spring phenology on the YKD was late. Poor production was expected on the YKD in 2013 owing to the late spring, compounded by a storm surge at high tide (29 June) that caused widespread coastal flooding. The worst flooding occurred in high density goose nesting areas during peak hatch, and biologists reported high losses of nests and goslings. Overall, below-average production and a fall flight lower than last year are expected.

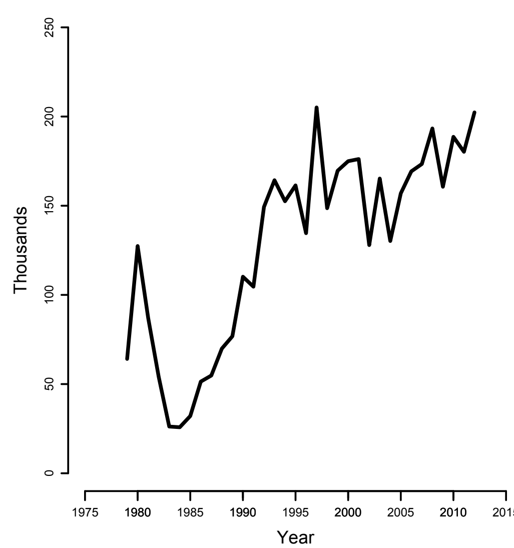


Figure 15. Estimated numbers of Cackling Canada geese (predicted fall goose population, with 95% confidence intervals).

Lesser and Taverner's Canada Geese

These populations nest throughout Alaska and winter in Washington, Oregon, and California (Figure 7). Nesting 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 estimate for the two populations combined first, followed by the population-specific ones that have recently been developed. The 2013 estimate of Canada geese within WBPHS strata predominantly occupied by these populations was 40,300 (22,500–58,100). Lesser and Tavener's estimates have not shown a trend over the period between 2004 and 2013 ($P = 0.259$). The WBPHS estimate is usually based on counts in strata 1–6, 8, and 10–12. However, in 2013, strata 1 and 6 were not flown, so the 2013 estimate is not directly comparable with those from previous years.

Population indices for Taverner's Canada goose in Alaska are based on expanded counts 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 WBPHS. As of the publication of this report, these indices were not yet available.

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 WBPHS. Indicated breeding birds and total bird indices for 2013 were 2,000 and 4,100, respectively. The 3-year (2011–2013) averages of the indicated breeding bird and indicated total bird indices were 2,000 and 3,800, respectively. The average growth rate from 1964–2013 and from 2003–2013 for indicated total lesser Canada geese showed no trend.

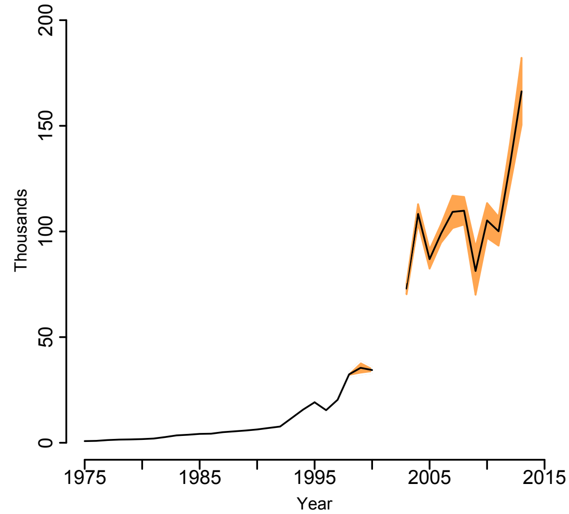


Figure 16. Estimated numbers of Aleutian Canada geese (winter geese, with 95% confidence intervals).

Aleutian Canada Geese

The Aleutian Canada goose was listed as an endangered population in 1967 (the population numbered approximately 800 birds in 1974), was downgraded to threatened in 1990, and was removed from protection under the Endangered Species Act 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 a 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 2013 was 166,300 (135,200–197,500), similar to the revised 2012 estimate of 131,800 (112,100–151,400; $P = 0.070$; Figure 16). These estimates have increased an average of 4% per year since 2004, and the latest is well above the 1996 revised estimate of 15,400 (14,300–16,500).

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*)

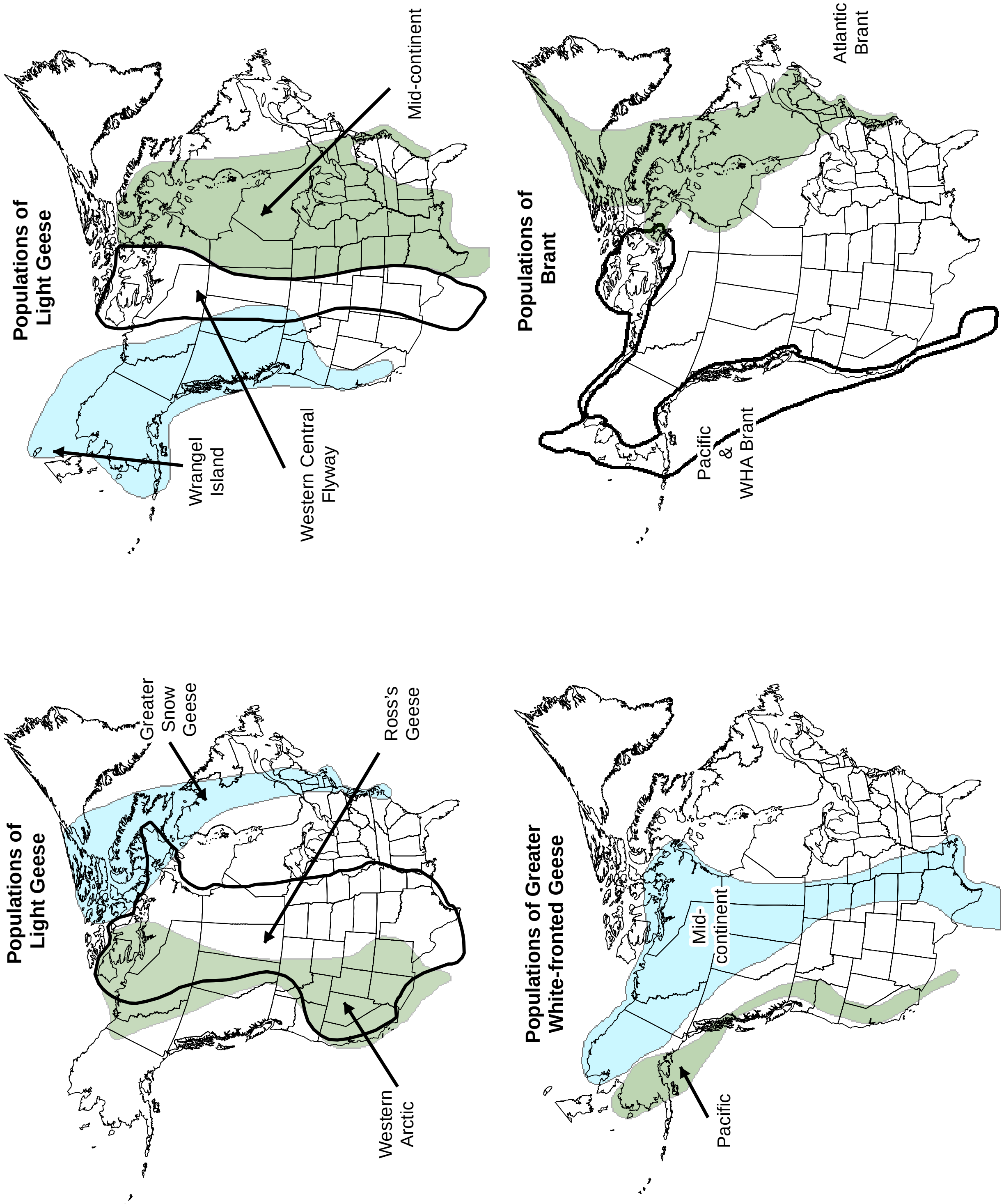


Figure 17. Approximate ranges of brant and snow, Ross's, and white-fronted goose populations in North America.

and greater (*C. c. atlantica*) snow goose subspecies. Another collective term, mid-continent light geese, includes lesser snow and Ross's geese 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 are nesting on Southampton, Baffin, and Banks Islands, and along the western coast of Hudson Bay. Ross's geese are present in the winter ranges 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 17). 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 at Karrak Lake there since 2007. The largest Ross's goose colonies are in the Queen Maud Gulf Sanctuary, and estimates of their abundance are not available until after the current year's breeding season and the publication of this report, so we present the previous year's estimate. Biologists at the Karrak Lake colony estimated that 766,000 (719,000–813,000) adult Ross's geese nested there in 2012, 12% more than the 682,000 (629,000–735,000) estimated in 2011 (Figure 18). These estimates have increased an average of 5% per year from 2003 to 2012 ($P = 0.002$). In 2013, ice breakup at the Karrak Lake colony was 9 days earlier than the long-term (1991–2013) average, and the earliest on record. In addition, the first goslings were seen 2 days earlier than average. This suggested that after several years of late nesting, production of goslings in 2013 was expected to be higher than average for geese from the Queen Maud Gulf Sanctuary, and similar to 2012.

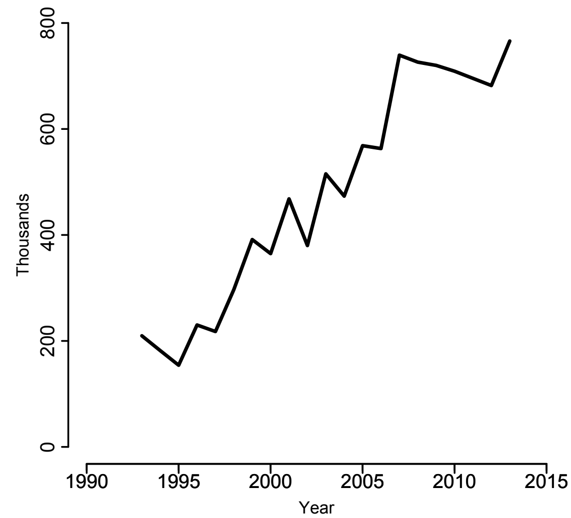


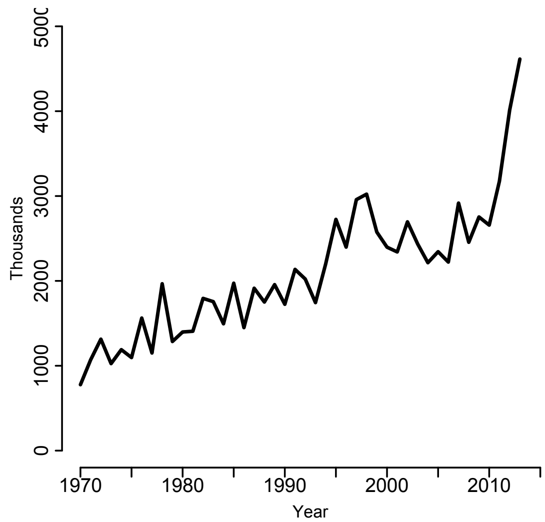
Figure 18. Estimated numbers of nesting adult Ross's geese at the Karrak Lake colony, Nunavut.

Mid-continent Population Light Geese (MCP)

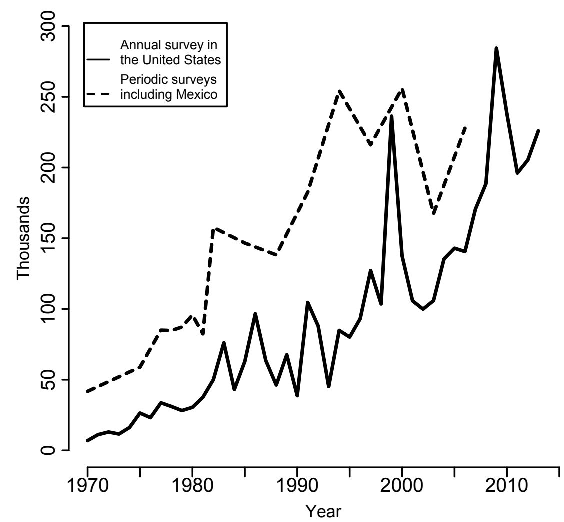
This population includes lesser snow geese and increasing numbers of Ross's geese. Geese of the MCP nest on Baffin and Southampton Islands, with smaller numbers nesting along the west coast of Hudson Bay (Figure 17). These geese winter primarily in eastern Texas, Louisiana, and Arkansas. During the 2013 Midwinter Survey, biologists counted 4,614,000 light geese, a 15% increase relative to the 2012 index of 4,021,200, and a record high for the third year in a row. (Figure 19.1). Winter indices during 2004–2013 increased an average of 7% per year ($P < 0.001$). Phenology on Southampton Island, on the western portion of Hudson Bay, and at Cape Churchill were all average. Overall, information suggests an 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 stage during



19.1: Mid-continent Population Light Geese



19.2: Western Central Flyway Light Geese

Figure 19. Estimated numbers of Mid-continent Population and Western Central Flyway Population snow and Ross's geese (winter geese).

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 17). WCFP geese wintering in the U.S. portion of their range are surveyed annually, but their entire winter range, including Mexico, is usually surveyed once every three years. However, surveys in Mexico have not been conducted since 2009 due to socio-political unrest in that country. During the 2013 surveys in the U.S. portion of WCFP range, 225,900 geese were counted, 10% more than the 205,300 geese that were counted in 2012 (Figure 19.2). These population indices increased 6% per year from 2004 to 2013 ($P = 0.011$). In 2013, ice breakup at the Karrak Lake was 9 days earlier than the long-term (1991–2013) average, and the earliest on record. In addition, the first goslings were seen 2 days earlier than average. This suggested that after several years of late nesting, production of goslings, as in 2012, was expected to be higher than average for snow geese in the Queen Maud Gulf Sanctuary in 2013. Phenology on Banks Island was average. Biologists expected WCFP snow goose production in 2013 to be above average.

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 17). In winter, WA and WI segments commingle with light geese from other populations in California, complicating surveys. Thus, a fall index based on a special white goose survey in California and the Skagit/Fraser midwinter survey is calculated. The fall 2012 estimate of WAWI snow geese was 881,400, 20% lower than the 1,097,900 counted in 2011 (Figure 20). These indices have increased an average of 5% per year from 2003 to 2012 ($P = 0.018$). Due to recent staffing changes at the Wrangel Island Nature Reserve, no information on breeding chronology or nesting of Wrangel Island geese is available for 2013. Additional monitoring data will be reported for this population if it becomes available.

Figure 20. Estimated numbers of Western Arctic/Wrangel Island population snow geese (fall geese).

Greater Snow Geese

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 17). This population is typically monitored on their spring staging areas near the St. Lawrence Valley in Quebec, where the Canadian Wildlife Service (CWS) conducts an annual aerial photographic survey. Since 2008, estimates have been calculated using a revised sampling methodology. The preliminary estimate from spring surveys in 2013 was 921,000 (858,000–984,000) geese, similar to the 1,005,000 (920,000–1,090,000) estimated last year ($P = 0.122$; Figure 21). Spring estimates of greater snow geese have shown no trend over the past 10 years ($P = 0.897$), which provides some evidence that this over-abundant population is stabilizing. However, biologists remain concerned about their high numbers. The number of snow geese counted during the 2013 Mid-winter Survey in the Atlantic Flyway was 366,500, 11% higher than the 331,600 counted during the 2012 survey. The largest known greater snow goose nesting colony is on Bylot Island, where breeding effort was relatively good this year, and slightly higher than last year. Cold weather caused an initial delay in goose arrival, but mild June temperatures melted snow quickly, and the median laying date was 12 June, right at the long-term average. CWS biologists also reported that although the average clutch size was slightly below normal, nest success was above normal. Lemming populations were low for the second year in a row. Lemmings provide an alternate source of prey for arctic foxes and other predators, and typically, when lemming numbers are low, predation on nests tends to be high, which was the case in 2012. However multiple years of low lemming populations likely reduced fox survival and reproduction, and reduced overall predation on goose nests. Thus, near average production is expected in 2013.

Status of Greater White-fronted Geese

Pacific Population White-fronted Geese

These geese primarily nest on the Yukon–Kuskokwim Delta (YKD) of Alaska and winter in the Central Valley of California (Figure 17). The fall population index for Pacific White-fronted geese is based on the correlation between indicated total birds from June breeding pair surveys (the Yukon–Kuskokwim Delta Coastal Zone Survey and the Alaska–Yukon Breeding Population and Habitat Survey) and fall counts when both fall and June surveys were conducted between 1985 and 1998. This predicted fall population has been used since 1999. The 2013 predicted fall estimate is 579,900, 13% lower than the 2012 estimate of 664,200 (Figure 22). Over the past 10 years these estimates have increased an average of 5% per year ($P = 0.009$). The 2012 YKD Coastal Zone survey reported a Pacific population indicated total birds index of $164,400 \pm 18,300$ and an indicated breeding birds index of $93,800 \pm 12,700$. The indicated total bird and the indicated breeding bird indices were 18% and 4% lower respectively than those of 2012, but confidence intervals overlapped, indicating no significant change. On the YKD, annual growth rates for indicated total birds measured 1.105 for the first 22 years of the survey (1985–2006) and 1.005 over the past 7 years of the survey (2007–2013). The annual growth rate for indicated breeding birds from 1985 to 2013 measured 1.100,

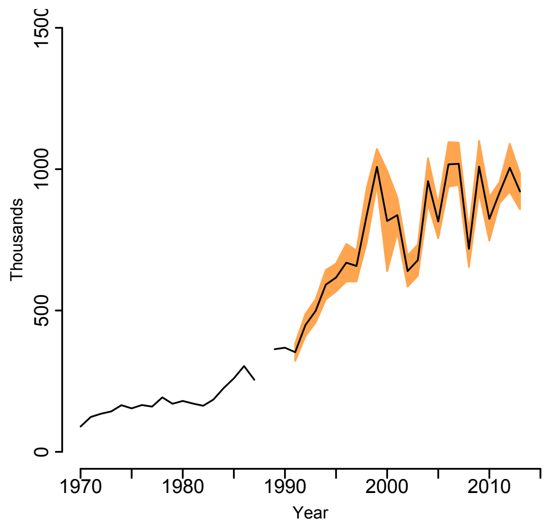


Figure 21. Estimated numbers of greater snow geese (spring staging geese, with 95% confidence intervals), 1970–2013.

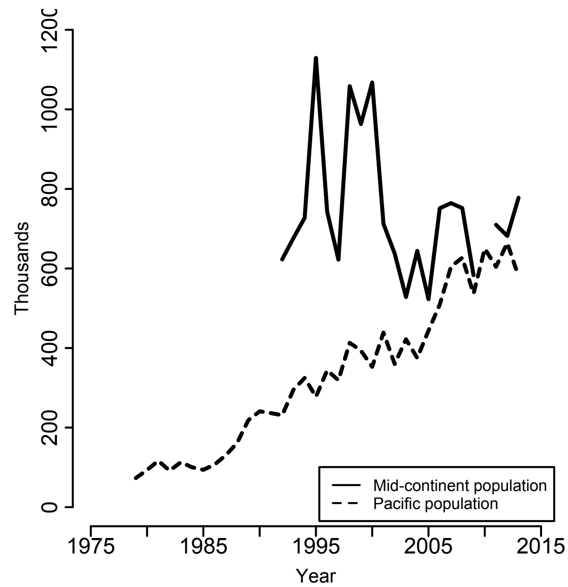


Figure 22. Estimated numbers of mid-continent population and Pacific population white-fronted geese (fall geese).

and has not exhibited the same level of stabilization that the indicated total bird index has. Relatively few PP white-fronted geese were counted in the YKD interior strata; the addition of these gave combined indicated total bird (199,500) and breeding bird (109,400) indices lower than those of 2012. On the coast, poor production was expected in 2013 owing to the late spring and a storm surge at high tide (29 June) that caused widespread coastal flooding. The worst flooding occurred in high density goose nesting areas during peak hatch, and biologists reported high losses of nests and goslings. Fair production was expected in the interior strata. Overall, below-average production and a fall flight lower than last year are expected.

Mid-continent Population White-fronted Geese

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 17). During the fall 2012 survey in Saskatchewan and Alberta, biologists counted 777,900 MCP geese, a 14% increase over the 681,700 counted during the previous year's survey (Figure 22). During 2004–2013, these estimates did not exhibit a significant trend ($P = 0.093$). As in 2012, 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. At Karrak Lake, ice breakup was 9 days earlier than the long-term average. White-fronted goose production is expected to be above average in 2013. However, once again, flooding reported near the Mackenzie River Delta had the potential to reduce productivity there.

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 17). The 2013 MWS index for brant in the Atlantic Flyway was 111,800, 25% lower than the 2012 estimate of 149,200 (Figure 23). These estimates have shown no trend over the 2004–2013 time period ($P = 0.928$). The productivity of the previous year is estimated by the percentage of juveniles counted during November and December. In the fall of 2012, juvenile birds comprised 7.4% of the population, well below the long-term average of

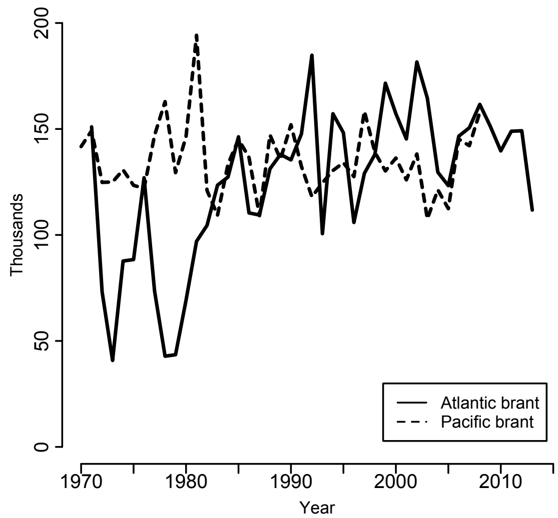


Figure 23. Numbers of Atlantic and Pacific brant estimated during winter surveys.

18%. Average spring phenology was reported near James Bay staging areas and on Southampton Island. Average brant production is expected in 2013.

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 17). There have been several changes to the method for calculating the wintering Pacific Brant index. Western High Arctic brant are now included in the total, British Columbia winter counts are now included, and no index is given for years during which brant were not surveyed in Mexico (2009, 2011–12). Therefore, the time series we present is not comparable to those previously reported. The 2013 MWS estimate of brant in the Pacific Flyway and Mexico was 162,900, slightly higher than the last complete estimate (in 2010) of 161,700 (Figure 23). Winter estimates increased an average of 4% per year from 2004 to 2013 ($P = 0.022$). Although the Yukon Delta Coastal Breeding Waterfowl Survey was not specifically designed to assess populations of colonial nesting species, the survey data may be useful in helping to better understand population trends and distribution. The 2013 indicated total birds index from this survey (24,000) was 10% higher than the 2012 index (21,900) and the 2013 indicated breeding birds index (13,100) was 26% lower than the 2012 index (17,500). The indicated total birds and indicated breeding birds annual growth rates were 1.008 and 1.058, respectively. Poor brant production was expected on the YKD in 2013 owing to a late spring compounded by a storm surge at high tide (29 June) that caused widespread coastal flooding. The worst flooding occurred in high density goose nesting areas during peak hatch, and biologists reported high losses of nests and goslings.

Western High Arctic Brant (WHAB)

This population of brant nests on the Parry Islands of the Northwest Territories (Figure 17). The population stages in fall at Izembek Lagoon, 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 no longer monitored separately, as there is considerable mixing with other Pacific Brant during the midwinter survey. Satellite imagery for the breeding area in the Parry Islands suggests 2013 will be a poor year for breeding, with extensive snow cover as of late June.

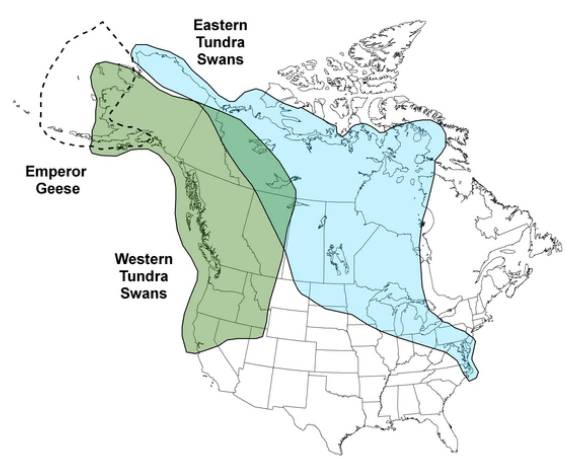
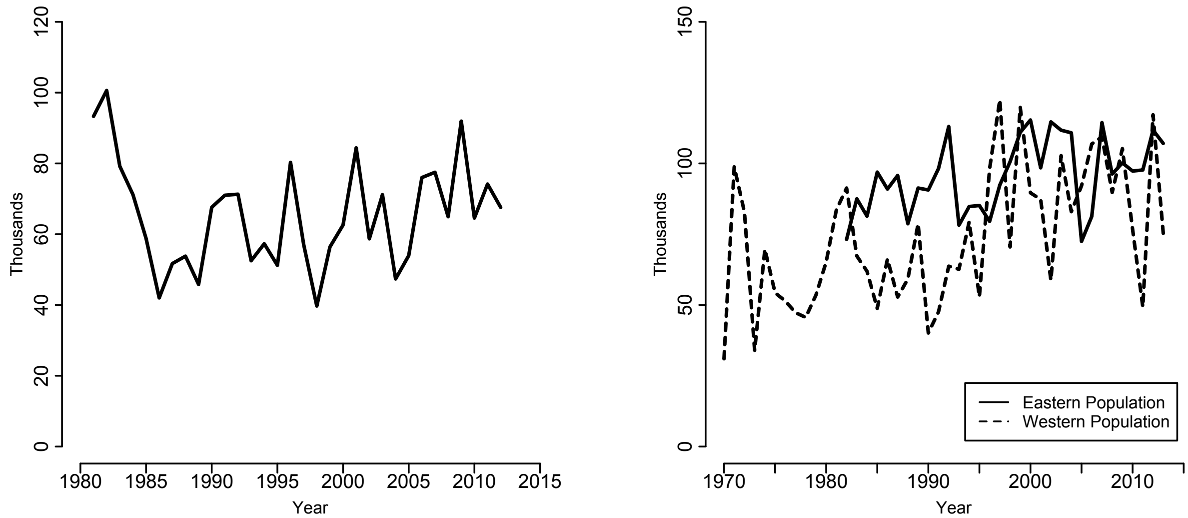


Figure 24. Approximate ranges of emperor geese, and Eastern and Western Populations of tundra swans in North America.



25.1: Emperor geese 25.2: Tundra swans

Figure 25. Estimated numbers of emperor geese (spring staging geese; 1986–2012), and Eastern and Western populations of tundra swans (winter swans).

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 24). 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 (Figure 25.1). However, in 2013, mechanical difficulties with aircraft prevented the survey from being done. Additional estimates for emperor geese are available from the Yukon Delta Coastal Survey. In 2013, the emperor goose indices on the Yukon–Kuskokwim Delta for indicated total birds ($29,800 \pm 2,200$) and indicated breeding birds ($19,400 \pm 1,300$) were 46% higher and 13% higher than the respective 2012 indices ($20,400 \pm 1,600$ and $17,200 \pm 1300$). However, the confidence intervals for indicated breeding birds overlapped, so those indices did not differ statistically between years. While both indices were the highest recorded in the YKD coastal survey, the 2013 confidence limits encompass population indices for 2001 and 2006. From 1985–2013, the population growth rates for indicated total birds (1.017) and indicated breeding birds (1.026) were positive. In 2013 spring phenology on the Yukon–Kuskokwim Delta was late, and ice break-up was among the latest recorded. 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 24). However, MWS survey effort has been variable. The 2013 Midwinter Survey estimate of western population swans was 75,300, 36% lower than last year's estimate of 117,200 (Figure 25.2). MWS estimates have shown no trend over the last 10 years ($P = 0.424$).The Yukon–Kuskokwim Delta (YKD) is the core breeding area for this population of tundra swans in Alaska. The indicated total bird index from the 2013 YKD Coastal Zone survey (19,600) was 51% lower than the 2012 index (39,300). However, the average annual

(1985–2013) growth rate for swans nesting on the YKD is positive (1.09, $R^2 = 0.124$). Spring phenology on the YKD was late for the second year in a row, so below-average production is expected.

Eastern Population Tundra Swans

Eastern Population tundra swans 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 24). The primary index for these tundra swans includes swans counted during winter in Ontario and the Atlantic and Mississippi Flyways. During the 2013 Midwinter Survey, 107,100 swans were observed, 4% fewer than the 111,700 counted in 2012 (Figure 25.2). These estimates have exhibited no trend during the 2004–2013 ten-year time frame ($P = 0.249$). The productivity of the previous year is estimated by the percentage of juveniles counted during November and December. In the fall of 2012, juveniles comprised 10.3% of the population, slightly below the long-term average of 13.7%. Spring phenology was earlier than average in the central Arctic and later than last year on the North Slope in 2013. However, flooding on the Mackenzie River Delta may have impacted nesting efforts. Overall, swan production in 2013 is expected to be 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 2–5, 7–12)

Air	E. Mallek and D. Groves
Air	F. Roetker and M. Koneff (stratum 12)

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

Air	F. Roetker and M. Koneff
Air	J. Bredy and D. Fronczak (strata 17[partial], 18[partial], 20, and 77)

Northern Saskatchewan and Northern Manitoba (Strata 21–25)

Air	W. Rhodes and B. Lubinski
Air	F. Roetker and M. Koneff (stratum 24)

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

Air	J. Bredy and J. Hitchcock
Ground	G. Raven[a], M. Gillespie[c], J. Caswell[b], K. Zimmer[a], M. Ives[d], and M. Chupik[d]

Southern Saskatchewan (Strata 30–33)

Air	P. Thorpe and S. Chandler
Ground	J.-M. DeVink[a], K. Dufour[a], K. Warner[a], P. Bergen[c], S. Leach[a], T. Knackstedt[a], and S. Heap[a]

Southern Manitoba (Strata 34–40)

Air	S. Yates and J. Bidwell[e]
Air	P. Thorpe and S. Chandler (stratum 36)
Ground	M. Schuster[a], J. Ingram[a], R. Bazin[a], J. Leafloor[a], D. Walker[c], M. Ross[a], G. Ball[c], and R. Buss[c]

Montana and Western Dakotas (Strata 41–44)

Air	R. Spangler and J. Klimstra
Ground	P. Garrettson and B. West

Eastern Dakotas (Strata 45–49)

Air	T. Liddick and D. Fronczak
Ground	K. Kruse, J. Hoskins, T. Quesinberry, and J. Sands

Maine and Maritimes (Stratum 62)

Air	M. Koneff and S. Yates

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], and S. Badzinski[a]
New Brunswick & Nova Scotia	R. Hicks[a] and B. Pollard[a]
Newfoundland & Labrador	S. Gilliland[a], P. Ryan[a], R. Wells[a], A. Hicks[a], R. Hicks[a], and B. Pollard[a]

California

Air	M. Weaver[b] and R. Carrothers[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], H. Singer[b], B. Sova[b], V. Weigold[b]

Minnesota

Air	T. Buker[b] and S. Cordts[b]
Ground	S. Kelly, W. Brininger, D. Hertel, F. Oslund, P. Richert, K. Bousquet, G. Dehmer, S. Zodrow, K. Fritz, J. Berens, L. Deede, G. Kemper, C. Okeson, P. Soler, T. Hewitt, M. Oehler, T. Zimmerman, A. Forbes, J. Kelley and T. Cooper

Nebraska

M. Vrtiska

Northeastern U.S.

Data Analysis	J. Klimstra
Connecticut	M. Huang[b] and K. Kubik[b]
Delaware	Delware Division of Fish and Wildlife personnel and cooperators
Maryland	D. Heilmeier[b], D. Brinker[b], B. Evans[b], D. Webster[b], R. Hill[b], D. Price[b], J. Homyack[b], G. Timko[b], C. Harris[b], R. Norris[b], J. Bennett[b], N. Sagwitz[b], P. Bendel[b], T .Decker[b], and L. Hindman[b]
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], J. Powers[b], L. Widjeskog[b], K. Tinnes[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], E. Kibe[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], B. Tefft[b], S. Vito, B. Kowal, W.Shean, and S. O'Donnell

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

Nevada

Air	K. Neill[b], and B. Sedinger[d]

Oregon

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

Washington

Air	J. Evenson[b], D. Blodgett[d], T. Cyra[b], R. Finger[b], B. Murphie[b], J. Shepherd[b], E. Wehland[b] and K. Clard[d]

Wisconsin

Air	L. Waskow[b], P. Berringer[b], C. Cold[b], C. Milestone[b], and R. Lichtie[b]
Ground	G. Albers[b], G. Bedient[b], M. Carlisle[b], J. Carstens[b], N. Christel[b], J. Christopoulos[b], C. Cole[b], B. Dart[b], G. Dunsmoor[b], E. Eilert[b], S. Fisher[b], E. Grossman[b], B. Groth[b], D. Hawley[b], J. Hopp[b], J. Huff[b], E. Kroening[b], D. Matheys[b], R. McDonough[b], C. Mogen[b], J. Pritzl[b], J. Robaidek[b], M. Schmidt[b], M. Sparrow[b], J. Wanner[b], R. Weide[b], D. Weidert[b], L. Wienke[b], and M. Woodford[b], M. Engel, G. Hamilton, J. Lutes, S. Otto, and K. VanBeek

[a]Canadian Wildlife Service
[b]State, Provincial or Tribal Conservation Agency
[c]Ducks Unlimited Canada
[d]Other Organization
[e]U.S. Fish and Wildlife Service Retired
All others—U.S. Fish and 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. Dubovsky, J. Fischer, D. Fronczak, D. Groves, J. Kelley, J. Klimstra, K. Kruse, J. Leafloor[a], S. Olson, P. Padding, M. Robertson[a], and E. Taylor

Information from the Breeding Population and Habitat Survey

See Appendix A.1

North Atlantic Population of Canada Geese

S. Gilliland[a], A. Hicks[a], R. Hicks[a], P. Ryan[a], B. Pollard[a], and R. Wells[a]

Atlantic Population of Canada Geese

R. Cotter[a], L. Hindman[b], E. Reed[a], P. May[c], and A. Tulugak[b]

Atlantic Flyway Resident Population of Canada Geese

T. Nichols[b], G. Costanzo[b], W. Crenshaw[b], M. DiBona[b], I. Gregg[b], B. Harvey[b], H. Heusmann[b], L. Hindman[b], R. Hossler[b], M. Huang[b], K. Jacobs[b], K. Kubik[b], P. Ricard[b], E. Robinson[b] and J. Robinson[b], D. Sausville[b], G. Somogie[b], and B. Swift[b]

Southern James Bay Population of Canada Geese

K. Bennett[b], R. Brook[b], J. Hughes[a], and B. Rizzuto[b]

Mississippi Valley Population of Canada Geese

K. Bennett[b], R. Brook[b], and B. Rizzuto[b]

Mississippi Flyway Population Giant Canada Geese

K. Abraham[b], G. Anderson[b], F. Baldwin[b], S. Cordts[b], J. Easterwood[b], M. Ervin[b], H. Havens[b], J. Hughes[a], O. Jones[b], J. Leafloor[a], D. Luukkonen[b], L. Naylor[b], A. Phelps[b], R. Pritchert[b], A. Radeke[b], D. Rave[b], L. Reynolds[b], R. Smith[b], and K. Van Horn[b]

Eastern Prairie Population of Canada Geese

F. Baldwin[b], B. Lubinski, and J. Wollenberg[b]

Western Prairie and Great Plains Populations of Canada Geese

J. Bidwell[d], S. Chandler, D. Fronczak, J. Klimstra, M. Koneff, T Liddick, B. Lubinski, W. Rhodes, F. Roetker, R. Spangler, P. Thorpe, and S. Yates

Tall Grass Prairie Population of Canada Geese

R. Alisauskas[a] and K. Kruse

Short Grass Prairie Population of Canada Geese

R. Alisauskas[a], J. Bredy, D. Fronczak, M. Koneff, and F. Roetker

Hi-Line Population of Canada Geese

J. Bredy, S. Chandler, J. Hitchcock, J. Klimstra, P. Thorpe, E. Silverman, and R. Spangler

Rocky Mountain Population of Canada Geese

J. Bredy, J. Hitchcock, J. Klimstra, R. Spangler, and R. Woolstenhulme[b]

Pacific Population of Canada Geese

A. Breault[b], J. Bredy, D. Fronczak, J. Hitchcock, D. Kraege[b], S. Olson, B. Reishus[b], T. Sanders, M. Weaver[b], and R. Woolstenhulme[b]

Dusky Canada Geese

D. Groves

Lesser and Taverner's Canada Geese

D. Groves and E. Mallek

Cackling Canada Geese

K. Bollinger[d], W. Eldridge[d], J. Fischer, J. Hodges[d], D. Groves, and R. Stehn

Aleutian Canada Geese

D. Giggs, R. Lowe, E. Nelson, S. Oldenburger[b], S. Olson, B. Reishus[b], T. Sanders, S. Stephensen, M. Weaver[b], and D. Woolington

Greater Snow Geese

F. Baldwin[a], S. Bourbeau[a], M. Cadieux[a], B. Campbell[a], R. Cotter[a], S. Gagnon[a], G. Gauthier[c], J. Hughes[a], M. Labonte[c], J. Lefebvre[a], J. Rodrigue[a], and F. St.-Pierre[c]

Mid-continent Population Light Geese

R. Alisauskas[a] and G. Gilchrist[a]

Western Central Flyway Population Light Geese

R. Alisauskas[a], B. Lubinski, and M. Robertson

Western Arctic/Wrangel Island Population of Lesser Snow Geese

T. Anderson, R. Corcoran, M. Creegen, J. Hailine, J. Isola, C. Langner[b], B. Lubinski, T. Keldsen, M. Robertson[a], M. Weaver[b], M. Wolder, and D. Woolington

Ross's Geese

R. Alisauskas[a]

Pacific Population White-fronted Geese

K. Bollinger[d], L. Denlinger, W. Eldridge[d], D. Groves, J. Hodges[d], and E. Mallek

Mid-continent Population White-fronted Geese

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

Pacific Brant

K. Bollinger[d], J. Hodges[d], and W. Eldridge[d]

Atlantic Brant

S. Earsom, S. Campbell, M. DiBona[b], D. Faith, M. Fisher, J. Fuller[b], G. Gilchrist[a], I. Gregg[b], W. Harper, J. Heise, L. Hindman[b], M. Hoff, D. Howell[b], P. Jayne, O. Jones[b], J. Klimstra, S. Meyer, T. Nichols[b], P. Padding, W. Stanton, J. Stanton, D. Stewart, B. Swift[b], H. Walbridge, D. Webster, M. Whitbeck, and T. Willis

Western High Arctic Brant

D. Kraege[b]

Emperor Geese

K. Bollinger[d], W. Eldridge[d], and J. Hodges[d]

Western Population of Tundra Swans

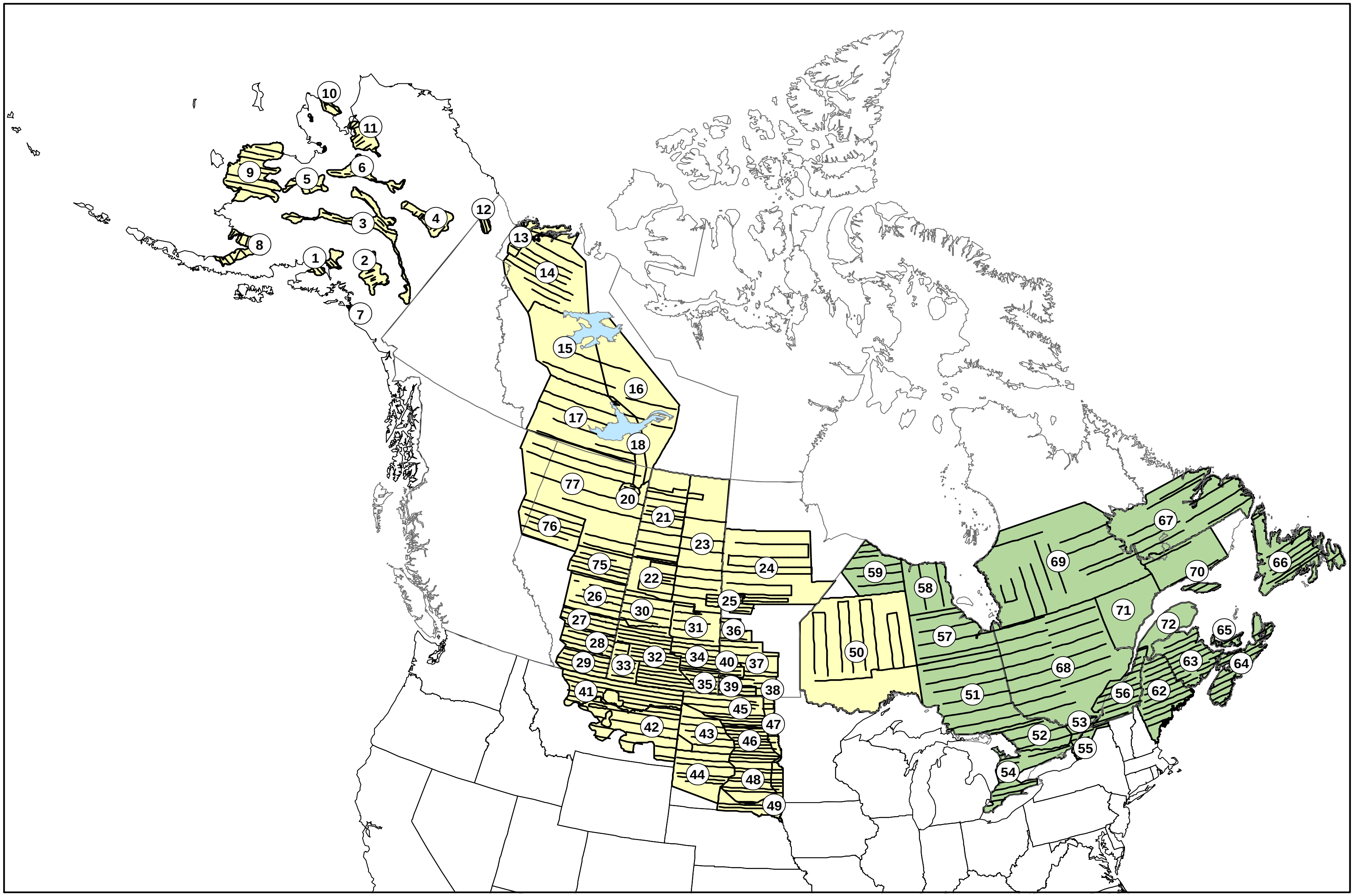
K. Bollinger[d], W. Eldridge[d], J. Hodges[d], and S. Olson

Eastern Population of Tundra Swans

S. Earsom, S. Campbell, M. DiBona[b], D. Faith, M. Fisher, D. Fronzcak, J. Fuller[b], I. Gregg[b], W. Harper, J. Heise, L. Hindman[b], M. Hoff, D. Howell[b], P. Jayne, O. Jones[b], J. Klimstra, B. Lubinski, S. Meyer, T. Nichols[b], P. Padding, M. Robertson[a], W. Stanton, J. Stanton, D. Stewart, B. Swift[b], H. Walbridge, D. Webster, M. Whitbeck, and T. Willis

[a]Canadian Wildlife Service
[b]State, Provincial or Tribal Conservation Agency
[c]Other Organization
[d]U.S. Fish and 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 northcentral U.S.

	Prairie Canada		Northcentral 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	2215.60	88.80	5,984.80	195.30
1995	3,892.50	223.80	2442.90	106.80	6,335.40	248.00

Table C.1. Continued.

Year	Prairie Canada $\widehat{N}$	Prairie Canada $\widehat{SE}$	Northcentral U.S.[a] $\widehat{N}$	Northcentral U.S.[a] $\widehat{SE}$	Total $\widehat{N}$	Total $\widehat{SE}$
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
2013	4,550.50	185.50	2,341.20	99.00	6,891.70	210.20

[a] No comparable survey data available for the northcentral 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.

Year	British Columbia		California		Michigan		Minnesota		Nebraska	
	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	401.8	102.1	649.4	399.4	412.2	244.6	521.1	160.7		
2007	374.8	98.5	627.6	388.3	641.9	337.7	488.5	242.5		
2008	348.7	73.7	554.3	297.1	437.5	200.5	739.6	297.6		
2009	321.6	67.0	510.8	302.0	493.6	258.9	541.3	236.4		
2010	307.8	72.4	541.3	367.9	595.3	338.3	530.7	241.9		
2011	260.7	68.3	558.6	314.7	471.4	258.6	687.5	283.3		
2012	298.0	78.7	529.7	387.1	860.1	439.3	468.6	225.0		
2013	305.3	77.2	451.3	298.6	678.6	288.4	682.9	293.2		

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

Table C.2. Continued.

	Nevada[b]		Northeast U.S.[c]		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[b]		Northeast U.S.[c]		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	176.0	81.2	386.5	199.1
2011	11.7	2.3	1,265.0	586.1	168.9	67.9	141.5	62.6	513.7	187.9
2012	23.9	4.1	1,309.9	612.6	276.0	96.3	168.9	89.4	521.1	197.0
2013	40.1	8.8	1,281.8	604.2	267.1	93.5	156.5	74.1	527.3	181.2

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

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

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

Continued.

	Mallard		Gadwall		American wigeon		Green-winged teal		Blue-winged teal	
Year	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$
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
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
2013	10,371.9	360.6	3,351.4	204.5	2,644.3	169.2	3,053.4	173.7	7,731.7	363.2

Continued.

Year	Northern shoveler $\widehat{N}$	Northern shoveler $\widehat{SE}$	Northern pintail $\widehat{N}$	Northern pintail $\widehat{SE}$	Redhead $\widehat{N}$	Redhead $\widehat{SE}$	Canvasback $\widehat{N}$	Canvasback $\widehat{SE}$	Scaup $\widehat{N}$	Scaup $\widehat{SE}$
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

Continued.

Year	Northern shoveler		Northern pintail		Redhead		Canvasback		Scaup	
	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$
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
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
2013	4,751.0	202.3	3,335.0	188.4	1,202.2	90.5	787.0	57.6	4,165.7	250.8

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.

Year	Traditional Survey Area[a]	
	$\widehat{N}$	$\widehat{SE}$
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
2013	45,607.3	749.8

[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% credibility intervals (in thousands) for the 6 most abundant species of ducks in the eastern survey area, 1990–2013[a].

	Mallard		American black duck		Green-winged teal		Ring-necked duck		Goldeneyes[b]		Mergansers[c]	
Year	$\hat{N}$	90% CI	$\hat{N}$	90% CI	$\hat{N}$	90% CI	$\hat{N}$	90% CI	$\hat{N}$	90% CI	$\hat{N}$	90% CI
1990	316.2	(207.2, 516.8)	594.6	(529.2, 672.4)	248.1	(194.9, 324.9)	500.8	(399.4, 645.1)	378.1	(297.4, 500.8)	380.8	(322.1, 456.9)
1991	365.1	(240.5, 592.2)	598.7	(528.7, 685.8)	241.5	(188.9, 318.0)	446.8	(358.8, 569.5)	397.0	(311.8, 524.6)	454.3	(383.0, 549.0)
1992	360.6	(235.1, 591.4)	568.6	(504.2, 646.6)	231.0	(179.3, 304.7)	459.2	(367.3, 592.0)	409.2	(320.6, 543.9)	450.4	(372.7, 558.4)
1993	367.9	(242.0, 600.5)	551.6	(485.2, 629.2)	212.3	(162.5, 281.9)	426.8	(339.3, 554.2)	398.0	(311.3, 531.0)	430.5	(357.7, 528.0)
1994	381.1	(247.1, 626.2)	510.6	(449.5, 584.0)	221.2	(170.6, 294.9)	421.8	(334.0, 546.2)	407.8	(318.9, 542.0)	429.8	(350.8, 549.1)
1995	313.2	(203.7, 515.2)	590.9	(520.6, 673.7)	227.1	(174.8, 301.7)	435.2	(344.9, 559.9)	356.6	(278.2, 475.6)	461.8	(381.4, 573.6)
1996	345.0	(226.1, 567.3)	715.5	(637.7, 807.7)	298.0	(235.4, 388.7)	560.2	(448.6, 720.7)	431.7	(336.6, 572.6)	417.9	(354.4, 499.3)
1997	368.7	(240.2, 605.5)	598.1	(535.7, 671.1)	232.9	(182.9, 304.9)	498.8	(399.4, 640.3)	433.5	(339.2, 572.5)	425.7	(360.7, 510.6)
1998	411.0	(269.9, 663.9)	631.6	(567.2, 706.5)	221.8	(174.9, 288.0)	431.7	(345.3, 552.3)	380.0	(299.0, 504.3)	347.5	(294.3, 416.0)
1999	419.7	(278.3, 675.8)	716.2	(643.0, 805.0)	257.3	(201.6, 336.6)	509.5	(408.6, 654.2)	469.3	(362.7, 632.6)	410.8	(348.1, 494.2)
2000	376.8	(252.0, 605.7)	650.3	(585.8, 724.5)	278.4	(221.9, 355.8)	538.8	(434.2, 689.4)	449.0	(350.8, 599.8)	421.8	(358.5, 502.7)
2001	407.3	(272.0, 651.6)	612.5	(550.3, 684.0)	235.6	(186.0, 305.3)	490.0	(394.8, 626.1)	520.6	(403.7, 695.0)	400.8	(340.9, 478.5)
2002	400.5	(267.4, 641.4)	708.0	(635.6, 793.2)	280.4	(220.7, 367.2)	495.2	(395.3, 641.4)	585.4	(441.3, 813.2)	554.5	(468.9, 665.8)
2003	415.2	(275.6, 672.4)	647.5	(580.4, 726.5)	271.6	(214.0, 356.1)	502.7	(405.4, 643.4)	440.7	(345.0, 585.9)	473.6	(400.5, 569.3)
2004	438.1	(292.9, 699.0)	641.1	(574.7, 720.1)	311.5	(245.2, 408.0)	546.2	(441.2, 696.4)	430.5	(340.4, 566.2)	504.6	(428.9, 601.5)
2005	425.7	(280.7, 691.5)	617.9	(553.0, 697.2)	249.0	(197.0, 323.6)	511.9	(413.4, 648.3)	396.0	(313.0, 522.2)	467.6	(396.4, 562.8)
2006	394.9	(263.6, 633.6)	635.7	(568.9, 713.5)	253.1	(199.4, 329.8)	526.9	(424.5, 667.1)	395.8	(313.0, 521.1)	424.0	(360.3, 506.7)
2007	444.5	(295.3, 714.6)	742.3	(661.2, 840.7)	280.6	(223.0, 361.9)	649.8	(521.5, 833.4)	473.3	(368.4, 630.2)	456.3	(385.6, 549.1)
2008	438.1	(292.5, 701.5)	640.1	(572.9, 718.9)	299.2	(229.2, 413.6)	528.7	(426.5, 671.0)	444.2	(347.0, 590.0)	433.4	(367.9, 517.0)
2009	459.4	(305.4, 734.3)	593.5	(532.5, 666.6)	288.2	(225.8, 385.6)	519.6	(417.6, 662.2)	413.8	(323.7, 549.5)	456.8	(387.1, 546.5)
2010	376.1	(248.9, 603.5)	563.6	(504.1, 632.5)	275.1	(217.6, 356.7)	520.1	(418.7, 659.4)	409.1	(319.8, 543.2)	374.6	(318.1, 447.6)
2011	425.3	(280.5, 687.4)	542.5	(486.4, 607.7)	257.9	(202.5, 336.8)	507.3	(407.9, 645.5)	411.6	(324.8, 546.3)	398.7	(337.4, 479.3)
2012	404.9	(271.6, 650.5)	602.0	(538.2, 675.7)	260.4	(206.4, 337.0)	505.6	(405.7, 644.2)	402.2	(317.8, 531.1)	420.1	(356.1, 501.3)
2013	499.8	(324.7, 823.8)	621.8	(558.3, 694.9)	292.2	(230.0, 381.5)	630.0	(495.7, 831.9)	472.0	(371.7, 623.1)	465.4	(393.9, 559.8)

[a] Estimates from Bayesian hierarchical analysis using USFWS and CWS data from strata 51, 52, 63, 64, 66–68, 70–72.
[b] Common and Barrow's.
[c] Common, red-breasted, and hooded.

D Historical estimates of goose and swan populations

Table D.1. Abundance indices (in thousands) for North American Canada goose populations, 1969–2013.

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	1037.3	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	1140.5	99.3
1998/99	96.8	83.7		108.1	465.5	1163.3	139.5
1999/00	58.0	95.8		78.7	352.6	1436.7	130.0
2000/01	57.8	135.2		68.4	325.4	1296.3	122.2
2001/02	62.0	182.4		55.2	286.5	1415.2	152.0
2002/03	60.8	174.9	1126.7	90.2	360.1	1416.3	122.4
2003/04	67.8	191.8	1073.1	75.2	276.3	1430.4	145.5
2004/05	51.3	175.7	1167.1	42.2	344.9	1367.0	161.6
2005/06	49.2	186.1	1144.0	128.9	384.4	1575.2	134.8
2006/07	69.9	207.3	1128.0	64.8	402.6	1454.7	153.4
2007/08	41.9	174.0	1024.9	92.3	305.2	1459.8	161.1
2008/09	53.7	186.8	1006.1	69.2	239.6	1463.7	169.2
2009/10	54.6	165.1	977.1	76.4	339.3	1599.9	172.6
2010/11	48.5	216.0	1015.1	86.9	269.8	1629.8	133.1
2011/12	71.6	190.3	879.8	94.9	268.9	1767.9	116.3
2012/13			951.9	64.1	319.7	1589.8	136.6

Table D.1. Continued

Year	W. Prairie & Great Plains[c]	Tall Grass Prairie[c,d]	Short Grass Prairie[e]	Hi-line[a]	Rocky Mountain[a]	Dusky[f]	Cackling[g]	Aleutian[f]
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	20.3
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	34.4
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	73.0
2003/04	622.1	458.7	203.6	208.4	165.4	11.2	172.1	108.3
2004/05	415.1	400.8	177.2	245.4	167.0	16.1	219.4	86.9
2005/06	444.4	499.8	234.7	217.6	148.4	12.1	241.1	99.0
2006/07	446.0	680.3	190.5	309.5	153.6	10.2	248.4	109.3
2007/08	669.5	402.7	212.4	348.2	221.3	9.1	283.7	109.8
2008/09	628.0	309.9	220.3	306.7	131.5	6.7	225.9	81.3
2009/10	462.8	417.0	290.7	277.6	150.1	9.5	275.3	105.2
2010/11	499.0	427.1	309.6	274.0	111.7	11.8	180.2	100.1
2011/12	555.4	450.8	292.8	494.4	143.4	13.7	202.3	131.8
2012/13	768.8	263.3	256.3	338.9	158.4		312.2	166.3

[a] Surveys conducted in spring.
[b] Breeding pairs
[c] Surveys conducted in December until 1998; in 1999 a January survey replaced the December count.
[d] Only Tall Grass Prairie Population geese counted in Central Flyway range are included.
[e] Surveys conducted in January.
[f] Indirect or preliminary estimate.
[g] 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, 1969–2013.

Year	Snow and Ross's geese: Greater snow geese[a]	Mid-continent[b]	Western Central Flyway[c]	Western Arctic & Wrangel Isl.[d]	White-fronted geese: Mid-continent[d]	Pacific[e]	Emperor geese[a]
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	1,073.5	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	4,021.2	205.3	1,097.9	681.7	664.2	67.6
2012/13	921.0	4,614.0	225.9	881.4	777.9	579.9	

[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).

Table D.3. Abundance indices of North American brant and swan populations from January surveys, 1969–2013.

Year	Brant		Tundra swans	
	Atlantic	Pacific[a]	Western	Eastern
1969/70		141.7	31.0	
1970/71	151.0	149.2	98.8	
1971/72	73.2	124.8	82.8	
1972/73	40.8	125.0	33.9	
1973/74	87.7	130.7	69.7	
1974/75	88.4	123.4	54.3	
1975/76	127.0	122.0	51.4	
1976/77	73.6	147.0	47.3	
1977/78	42.8	162.9	45.6	
1978/79	43.5	129.4	53.5	
1979/80	69.2	146.4	65.2	
1980/81	97.0	194.2	83.6	
1981/82	104.5	121.0	91.3	73.2
1982/83	123.5	109.3	67.3	87.5
1983/84	127.3	133.4	61.9	81.4
1984/85	146.3	145.1	48.8	96.9
1985/86	110.4	136.6	66.2	90.9
1986/87	109.4	109.1	52.8	95.8
1987/88	131.2	147.2	59.2	78.7
1988/89	138.0	135.7	78.7	91.3
1989/90	135.4	152.0	40.1	90.6
1990/91	147.7	132.3	47.6	98.2
1991/92	184.8	118.0	63.7	113.0
1992/93	100.6	124.6	62.2	78.2
1993/94	157.2	130.4	79.4	84.8
1994/95	148.2	134.1	52.9	85.1
1995/96	105.9	127.5	98.1	79.5
1996/97	129.1	158.4	122.5	92.4
1997/98	138.0	139.0	70.5	100.6
1998/99	171.6	130.2	119.8	111.0
1999/00	157.2	136.3	89.6	115.3
2000/01	145.3	126.0	87.3	98.4
2001/02	181.6	138.2	58.7	114.7
2002/03	164.5	107.6	102.7	111.7
2003/04	129.6	121.3	82.95[b]	110.8
2004/05	123.2	112.4	92.1	72.5
2005/06	146.6	145.2	106.9	81.3
2006/07	150.6	142.1	109.4	114.4
2007/08	161.6	157.9	89.7	96.2
2008/09	151.3		105.2	100.2
2009/10	139.7	161.7	76.7	97.3
2010/11	148.9		49.3[b]	97.7
2011/12	149.2		117.2	111.7
2012/13	111.8	162.9	75.3	107.1

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

Division of Migratory Bird Management
11510 American Holly Dr.
Laurel, MD 20708-4016

U.S. Fish & Wildlife Service
http://www.fws.gov

For state transfer relay service
TTY/Voice: 711