U.S. Fish & Wildlife Service

Waterfowl

Population Status, 2015

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July 23, 2015

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 2015–2016 hunting season.

Cover: 2015–2016 Duck stamp, which features a pair of ruddy ducks (*Oxyura jamaicensis*) painted by Jennifer Miller, from Olean, N.Y., winner of the 2014 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 pilot-biologist Jim Bredy who flew additional strata in Alaska, making an extra effort to complete this year's Waterfowl Breeding Population and Habitat Survey.

This report was compiled by the U.S. Fish and Wildlife Service, Division of Migratory Bird Management, Population and Habitat Assessment Branch. The principal authors are Joshua Dooley, Kathy Fleming, Pamela Garrettson, Walt Rhodes, and Nathan Zimpfer. 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. 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. 2015. Waterfowl population status, 2015. 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/birds/surveys-and-data/reports-and-publications.php).

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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 49.5 ± 0.8 [SE] million birds. This estimate is similar to the 2014 estimate of 49.2 ± 0.8 million, and is 43% higher than the long-term average (1955–2014). This year also marks the highest estimates in the time series for mallards (*Anas platyrhynchos*) and green-winged teal (*A. crecca*). Estimated mallard abundance was 11.6 ± 0.4 million, which was similar to the 2014 estimate of 10.9 ± 0.3 million, and 51% above the long-term average of 7.7 ± 0.04 million. Estimated abundance of gadwall (*A. strepera*; 3.8 ± 0.2 million) and American wigeon (*A. americana*; 3.0 ± 0.2 million) were similar to last year's estimates, and were 100% and 17% above their long-term averages of 1.9 ± 0.02 million and 2.6 ± 0.02 million, respectively. The estimated abundance of green-winged teal was 4.1 ± 0.3 million, which was 19% above the 2014 estimate of 3.4 ± 0.2 million and 98% above the long-term average (2.1 ± 0.02 million). Estimated blue-winged teal (*A. discors*; 8.5 ± 0.4 million) abundance was similar to the 2014 estimate, and 73% above the long-term average of 4.9 ± 0.04 million. Estimated abundance of northern shovelers (*A. clypeata*; 4.4 ± 0.2 million) was 17% below the 2014 estimate but 75% above the long-term average of 2.5 ± 0.02 million. Northern pintail abundance (*A. acuta*; 3.0 ± 0.2 million) was similar to the 2014 estimate and 24% below the long-term average of 4.0 ± 0.04 million. Abundance estimates for redheads (*Aythya americana*; 1.2 ± 0.1 million) and canvasbacks (*Aythya valisineria*; 0.8 ± 0.06 million) were similar to their 2014 estimates and were 71% and 30% 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; 4.4 ± 0.3 million) was similar to the 2014 estimate and 13% below the long-term average of 5.0 ± 0.05 million. Despite an early spring over most of the survey area, habitat conditions during the 2015 Waterfowl Breeding Population and Habitat Survey (WBPHS) were similar to or poorer than last year. With the exception of portions of southern Saskatchewan and central latitudes of eastern Canada, in many areas the decline in habitat conditions was due to average to below-average annual precipitation. The total pond estimate (Prairie Canada and U.S. combined) was 6.3 ± 0.2 million, which was 12% below the 2014 estimate of 7.2 ± 0.2 million but 21% above the long-term average of 5.2 ± 0.03 million. The 2015 estimate of ponds in Prairie Canada was 4.2 ± 0.1 million. This estimate was 10% below the 2014 estimate of 4.6 ± 0.2 million but 19% above the long-term average (3.5 ± 0.02 million). The 2015 pond estimate for the northcentral U.S. was 2.2 ± 0.09 million, which was 16% below the 2014 estimate of 2.6 ± 0.1 million and 28% above the long-term average (1.7 ± 0.02 million). The projected mallard fall flight index is 13.8 ± 1.4 million birds. In the eastern survey area, estimated abundance of American black ducks (*Anas rubripes*) was 0.5 ± 0.04 million, which was 11% below last year's estimate of 0.6 ± 0.04 million, and 13% below the 1990–2014 average of 0.6 ± 0.04 million. The estimated abundance of mallards (0.4 ± 0.1 million) and mergansers (0.4 ± 0.04 million) were similar to the 2014 estimates and their 1990–2014 averages. Abundance estimates of green-winged teal (0.2 ± 0.04 million) and goldeneyes (common and Barrow's [*Bucephala clangula* and *B. islandica*], 0.4 ± 0.4 million) were similar to their 2014 estimates, and were 14% and 15% below their 1990–2014 averages of 0.3 ± 0.04 million and 0.4 ± 0.07 million, respectively. The abundance estimate of ring-necked ducks (*Aythya collaris*, 0.5 ± 0.07 million) was similar to the 2014 estimate and the 1990–2014 average.

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 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 the eastern survey area, 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 by visibility-correction factors derived from 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 of 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.

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 2015).

Review of Estimation Procedures

Since the inception of the Waterfowl Breeding Population and Habitat Survey (WBPHS) 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 almost 20 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

2014 in Review

In 2014, spring was delayed even later than 2013 across most of the WBPHS area. Habitat conditions during the survey were mostly improved or similar to 2013, due to average to above-average annual precipitation. The exceptions were west-central Alberta and east of James Bay in Quebec. Alaska was the only region that experienced an early spring. The total pond estimate (Prairie Canada and U.S. combined) was 7.2 ± 0.2 million which was similar to the 2013 estimate of 6.9 ± 0.2 million and 40% above the long-term average (1974–2013) of 5.1 ± 0.03 million. In the traditional survey area, the majority of the Canadian prairies had below to well-below-average winter temperatures and average precipitation. Southern Manitoba benefitted from the summer and fall precipitation of 2013, whereas southern Saskatchewan and most of Alberta were aided by spring 2014 precipitation. The 2014 estimate of ponds in Prairie Canada was 4.6 ± 0.2 million. This estimate was similar to the 2013 estimate (4.6 ± 0.2 million) and 33% above the 1961–2013 average (3.5 ± 0.03 million). The parklands remained in good condition from previous years' carry-over water and the boreal region benefitted from above-average annual precipitation. Most of the Canadian portion of the traditional survey area was rated as good or excellent in 2014 and the region continued to receive additional precipitation after the survey. Much of the U.S. prairies had average winter precipitation and well-below-average winter temperatures that continued into spring. Habitat conditions improved in the western Dakotas and Montana from 2013 but remained similar in the eastern Dakotas. The 2014 pond estimate for the northcentral U.S. was 2.6 ± 0.1 million which was similar to the 2013 estimate (2.3 ± 0.1 million) and 53% above the 1974–2013 average (1.7 ± 0.02 million). Waterfowl habitat in North Dakota remained under pressure from wetland drainage, loss of CRP grasses, and energy development.

In the traditional survey area, which included strata 1–18, 20–50, and 75–77, the 2014 total duck population estimate was 49.2 ± 0.8 million

birds. This represented an 8% increase over the 2013 estimate of 45.6 ± 0.7 million, and was 43% higher than the long-term average (1955–2013). Estimated mallard abundance was 10.9 ± 0.3 million, which was similar to the 2013 estimate, and 42% above the long-term average of 7.7 ± 0.04 million. Estimated abundance of gadwall (3.8 ± 0.2 million) was similar to the 2013 estimate and 102% above the long-term average (1.9 ± 0.02 million). The estimate for American wigeon (3.1 ± 0.2 million) was 18% above the 2013 estimate of 2.6 ± 0.2 million and 20% above the long-term average of 2.6 ± 0.02 million. The estimated abundance of green-winged teal was 3.4 ± 0.2 million, which was similar to the 2013 estimate and 69% above the long-term average (2.0 ± 0.02 million). The estimate for blue-winged teal 8.5 ± 0.5 million) was similar to the 2013 estimate and 75% above the long-term average of 4.9 ± 0.04 million. Estimates of northern shovelers (5.3 ± 0.3 million) and northern pintails (3.2 ± 0.2 million) were similar to the 2013 estimates and were 114% above and 20% below their long-term averages of 2.5 ± 0.02 million and 4.0 ± 0.04 million, respectively. Abundance estimates for redheads (1.3 ± 0.1 million) and canvasbacks (0.7 ± 0.05 million) were similar to their 2013 estimates and were 85% and 18% above their long-term averages of 0.7 ± 0.01 million and 0.6 ± 0.01 million, respectively. Estimated abundance of scaup (4.6 ± 0.3 million) was similar to the 2013 estimate and similar to the long-term average of 5.0 ± 0.05 million.

In 2014, winter and spring temperatures in the eastern survey area were also well below normal with most areas receiving average to above-average precipitation. Habitat conditions were similar to 2013 or improved, particularly in the northeastern U.S. An exception was the area east of James Bay in Quebec which experienced dry conditions and extensive wildfires. Less flooding was noted across the eastern survey area in 2014, in contrast to some years, and continued cool, damp spring conditions in the Maritimes may have limited waterfowl production. The 2014 estimated abundance of American black ducks in the eastern survey area was 0.6 ± 0.04 million, which was similar to 2013 and the 1990–2013 average. The estimated abundance of mallards was 0.4 ± 0.1 million, which was similar to the 2013 estimate and the 1990–2013 average. Abundance estimates of green-winged teal (0.2 ± 0.04 million) and ring-necked ducks (0.5 ± 0.1 million) were 19% and 22% below their 2013 estimates, and similar to their 1990–2013 averages, respectively. Abundance estimates for goldeneyes and mergansers were similar to the 2013 estimates and their 1990–2013 averages.

2015 Overall Habitat Conditions and Population Status

Despite an early spring over most of the survey area, habitat conditions during the 2015 WBPHS were similar to or poorer than last year. In many areas, the decline in habitat conditions was due to average to below-average annual precipitation, with the exception of portions of southern Saskatchewan and central latitudes of eastern Canada where good conditions persisted from last year. The total pond estimate (Prairie Canada and U.S. combined) was 6.3 ± 0.2 million, which was 12% below the 2014 estimate of 7.2 ± 0.2 million but 21% above the long-term average of 5.2 ± 0.03 million (Table 1, Figure 1). The 2015 estimate of ponds in Prairie Canada was 4.2 ± 0.1 million. This estimate was 10% below the 2014 estimate of 4.6 ± 0.2 million but 19% above the long-term average (3.5 ± 0.02 million). The 2015 pond estimate for the northcentral U.S. was 2.2 ± 0.09 million, which was 16% below the 2014 estimate of 2.6 ± 0.1 million and 28% above the long-term average (1.7 ± 0.02 million). Spring phenology was early across the traditional survey area, particularly in relation to 2013 and 2014. Much of the Canadian prairies had average to below-average winter precipitation and above-average temperatures. Nearly all of Prairie Canada experienced below-normal spring precipitation, with the best moisture conditions centered in southern Saskatchewan. Annual winter precipitation was lower in the northern part of the survey area; the parklands, however, continued to benefit from precipitation received in 2013 and 2014. The boreal region and Alaska exhibited drier conditions, but an early spring and the absence

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

			Change from 2014			Change from LTA	
Region	2015	2014	%	*P*	LTA[a]	%	*P*
Prairie & Parkland Canada							
S. Alberta	1,023	1,218	−16	0.051	762	+34	<0.001
S. Saskatchewan	2,571	2,744	−6	0.362	2,074	+24	<0.001
S. Manitoba	557	668	−17	0.080	663	−16	0.009
Subtotal	4,151	4,630	−10	0.032	3,499	+19	<0.001
Northcentral U.S.							
Montana & western Dakotas	910	966	−6	0.466	565	+61	<0.001
Eastern Dakotas	1,247	1,586	−21	0.003	1,125	+11	0.092
Subtotal	2,157	2,551	−15	0.004	1,690	+28	<0.001
Total	6,308	7,181	−12	0.001	5,194	+21	<0.001

[a] Long-term average. Prairie and Parkland Canada, 1961–2014; northcentral U.S. and total, 1974–2014.

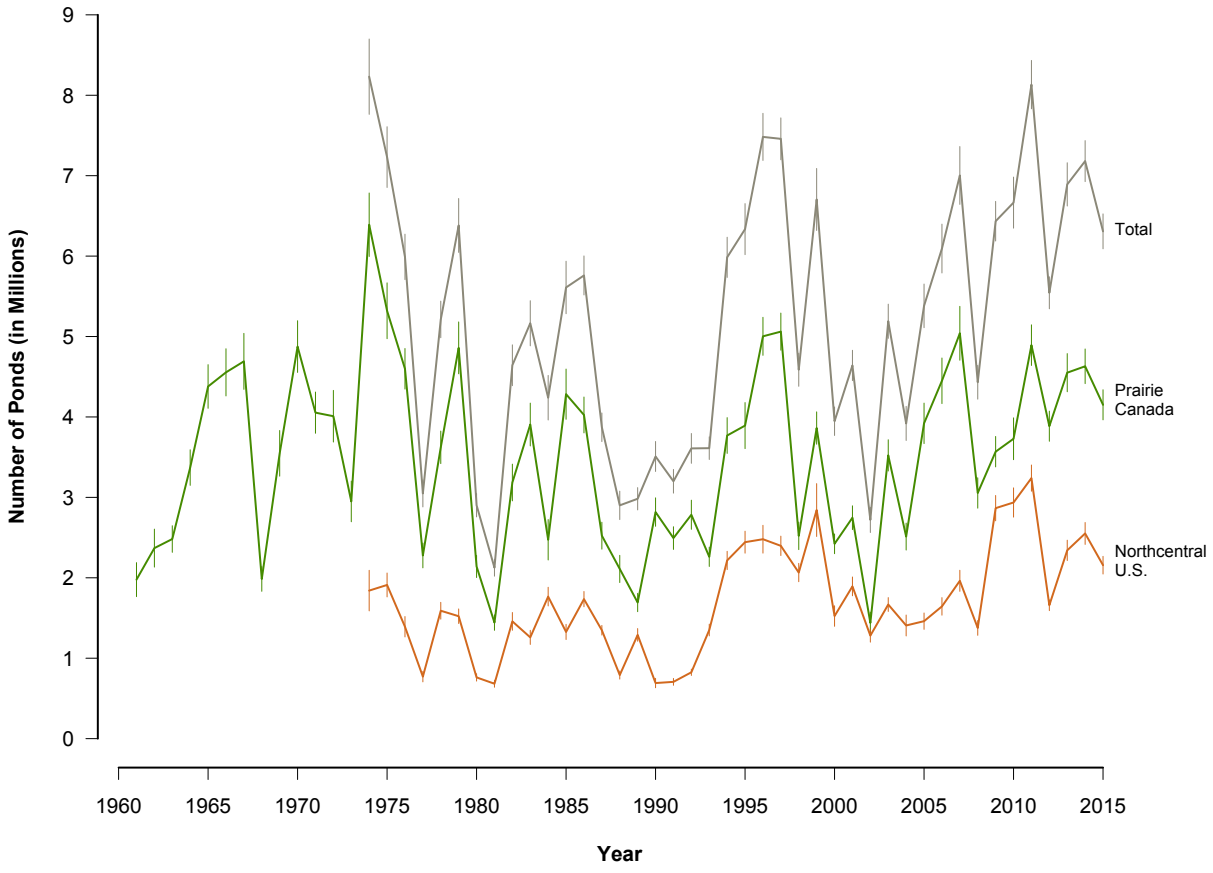

Figure 1. Number of ponds in May and 90% confidence intervals in Prairie Canada, the northcentral U.S., and both areas combined (total ponds).

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

			Change from 2014			Change from LTA	
Region	2015	2014	%	*P*	LTA[b]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	3,389	3,510	−3	0.592	3,693	−8	0.053
C. & N. Alberta–N.E. British Columbia–NWT	11,546	9,946	+16	0.007	7,214	+60	<0.001
N. Saskatchewan–N. Manitoba–W. Ontario	3,527	2,566	+37	0.002	3,461	+2	0.772
S. Alberta	5,678	5,644	+1	0.918	4,279	+33	<0.001
S. Saskatchewan	13,542	12,893	+5	0.258	7,781	+74	<0.001
S. Manitoba	1,988	2,193	−9	0.182	1,540	+29	<0.001
Montana & Western Dakotas	2,730	3,660	−25	0.002	1,704	+60	<0.001
Eastern Dakotas	7,121	8,740	−19	0.003	5,030	+42	<0.001
Total	49,522	49,152	+1	0.751	34,703	+43	<0.001
Other regions							
California	316	449	−30	0.101	577	−45	<0.001
Michigan	431	395	+9	0.587	642	−33	<0.001
Northeast U.S.[c]	1197	1344	−11	0.280	1383	−14	0.045
Oregon	280	315	−11	0.580	265	+6	0.644
Washington	193	177	+9	<0.001	164	+18	0.375
Wisconsin	373	395	−6	0.684	443	−16	0.080

[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, 1955–2014; 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.

of flooding in important nesting areas should aid waterfowl production. Habitats in most of the Canadian portion of the traditional survey area were rated as fair or good this year; however, some areas received greater annual precipitation which resulted in excellent conditions. Following a relatively mild winter, the U.S. prairies also recorded an early spring, although precipitation since last summer was average to mostly below average. Habitat conditions declined relative to 2014 in Montana and the Dakotas despite significant rainfall in May, which came too late to benefit most early nesting waterfowl.

In the traditional survey area, which includes strata 1–18, 20–50, and 75–77, the total duck population estimate was 49.5 ± 0.8 million birds. This estimate is similar to the 2014 estimate of 49.2 ± 0.8 million, and is 43% higher than the long-term average (1955–2014). In the eastern Dakotas, total duck numbers were 19% lower than the 2014 estimate, but 42% above the long-term average. The total duck estimate in southern Alberta was similar to last year's estimate and 33% above the long-term average. The total duck estimate was similar to last year in southern Saskatchewan, and 74% above the long-term average. In southern Manitoba, the total duck population estimate was similar to last year's estimate and 29% above the long-term average. The total duck estimate in central and northern Alberta–northeastern British Columbia–Northwest Territories was 16% higher than last year's estimate and 60% above the long-term average. The estimate in the north-

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

			Change from 2014			Change from LTA	
Region	2015	2014	%	*P*	LTA[a]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	471	501	−6	0.696	379	+24	0.071
C. & N. Alberta–N.E. British Columbia–NWT	1,981	1,757	+13	0.328	1,095	+81	<0.001
N. Saskatchewan–N. Manitoba–W. Ontario	1,728	1,126	+53	0.028	1,130	+53	0.003
S. Alberta	1,392	1,444	−4	0.715	1,080	+29	0.005
S. Saskatchewan	3,068	2,553	+20	0.012	2,081	+47	<0.001
S. Manitoba	538	602	−11	0.488	388	+39	0.057
Montana & Western Dakotas	767	1,014	−24	0.044	525	+46	0.001
Eastern Dakotas	1,698	1,903	−11	0.256	1,049	+62	<0.001
Total	11,643	10,900	+7	0.138	7,726	+51	<0.001
Eastern survey area	406	432	−6	−−[b]	392	+2	−−[b]
Other regions							
California	174	239	−27	0.292	357	−51	<0.001
Michigan	238	230	+3	0.857	353	−33	<0.001
Minnesota	206	257	−20	0.448	228	+10	0.562
Northeast U.S.[c]	540	635	−15	0.158	736	−27	<0.001
Oregon	87	85	+2	0.863	92	−5	0.610
Washington	86	86	0	0.995	79	10	0.677
Wisconsin	176	159	−11	0.584	182	−3	0.797

[a] Long-term average. Traditional survey area 1955–2014; eastern survey area 1990–2014; 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.

ern Saskatchewan–northern Manitoba–western Ontario survey area was 37% above the 2014 estimate and similar to the long-term average. The total duck estimate in the Montana–western Dakotas area was 25% lower than the 2014 estimate and 60% above the long-term average. In the Alaska–Yukon Territory–Old Crow Flats region the total duck estimate was similar to last year and 8% lower than the long-term average.

Several states and provinces conduct breeding waterfowl surveys in areas outside the geographic extent of the WBPHS of the USFWS and CWS (Appendix C.2). In California, Oregon, Washington, Wisconsin, Michigan, and the northeast U.S., measures of precision for estimates of total duck numbers are available (Table 2). The total duck estimate in California was similar to the 2014 estimate and 45% below the long-term average. In Washington the total duck estimate was 9% higher than 2014 and similar to the long-term average (2010–2014). Wisconsin's total duck estimate was similar to the 2014 estimate and 16% lower than the long-term average. In Michigan, the total duck estimate was similar to 2014 and 33% lower than the long-term average. The total breeding duck estimate in the northeast U.S. was similar to 2014 but 14% below the long-term average. Of the states without measures of precision for total duck numbers, the 2015 estimate of total ducks in Minnesota was higher

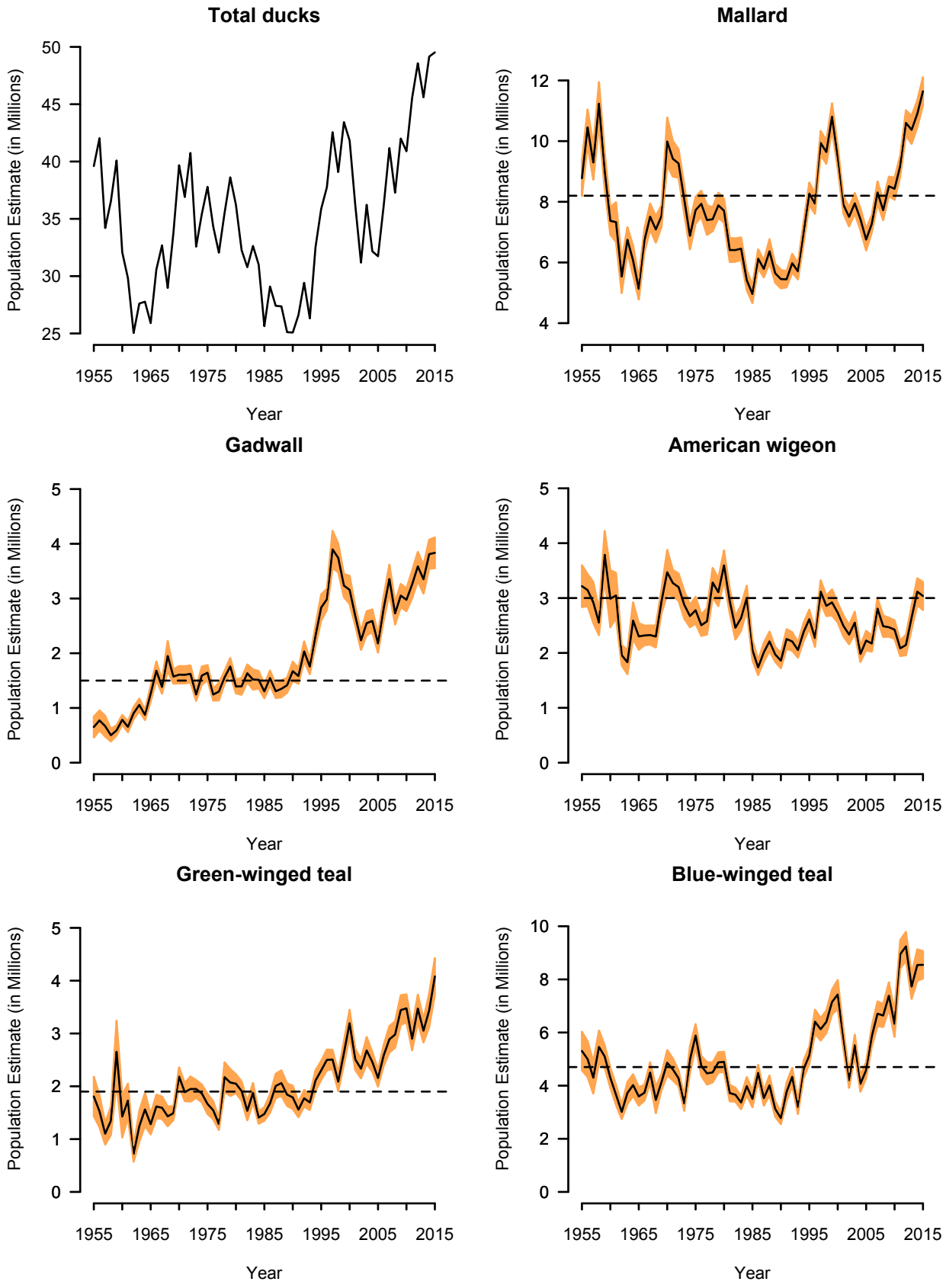

Figure 2. Breeding population estimates, 90% confidence intervals, and North American Waterfowl Management Plan population goals (dashed line) for selected species in the traditional survey area (strata 1–18, 20–50, 75–77).

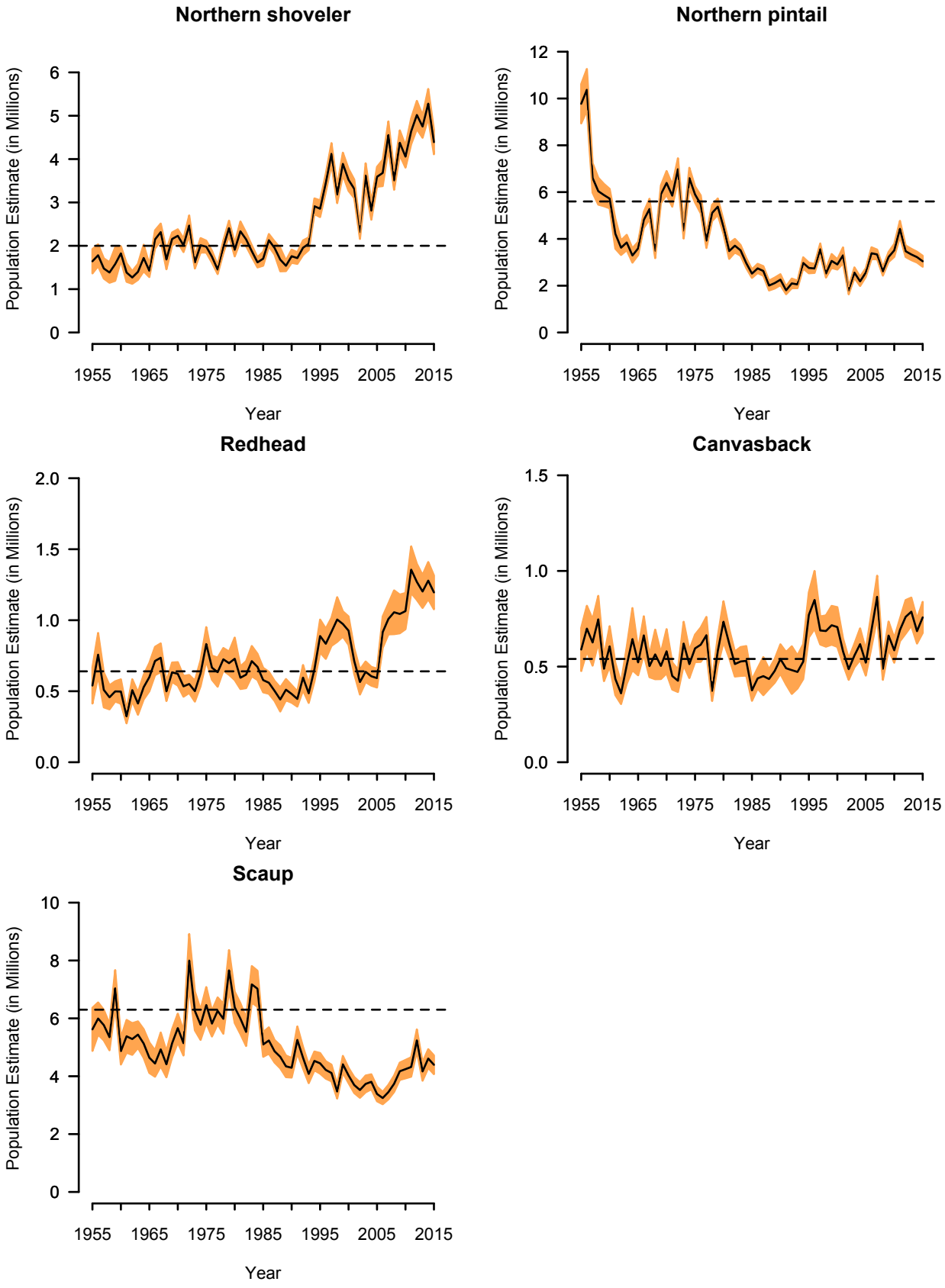

Figure 2. Continued.

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

			Change from 2014			Change from LTA	
Region	2015	2014	%	*P*	LTA[a]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	2	0	+200	0.321	2	+6	0.956
C. & N. Alberta–N.E. British Columbia–NWT	34	43	−20	0.364	51	−32	0.008
N. Saskatchewan–N. Manitoba–W. Ontario	7	36	−81	0.005	26	−75	<0.001
S. Alberta	564	565	0	0.996	322	+75	0.003
S. Saskatchewan	1,463	1,455	+1	0.958	646	+126	<0.001
S. Manitoba	205	236	−13	0.455	76	+171	<0.001
Montana & Western Dakotas	528	426	+24	0.415	211	+150	0.001
Eastern Dakotas	1,031	1,051	−2	0.915	588	+75	0.001
Total	3,834	3,811	+1	0.939	1,921	+100	<0.001

[a] Long-term average, 1955–2014.

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

			Change from 2014			Change from LTA	
Region	2015	2014	%	*P*	LTA[a]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	541	734	−26	0.043	557	−3	0.756
C. & N. Alberta–N.E. British Columbia–NWT	1,506	1,562	−4	0.814	902	+67	0.001
N. Saskatchewan–N. Manitoba–W. Ontario	99	74	+34	0.256	233	−57	<0.001
S. Alberta	305	224	+36	0.143	279	+9	0.544
S. Saskatchewan	251	273	−8	0.645	404	−38	<0.001
S. Manitoba	8	14	−39	0.076	54	−85	<0.001
Montana & Western Dakotas	195	129	+51	0.115	110	+77	0.014
Eastern Dakotas	131	106	+23	0.639	57	+131	0.073
Total	3,037	3,117	−3	0.773	2,596	+17	0.028

[a] Long-term average, 1955–2014.

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

			Change from 2014			Change from LTA	
Region	2015	2014	%	*P*	LTA[a]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	566	475	+19	0.227	406	+39	0.003
C. & N. Alberta–N.E. British Columbia–NWT	2,333	1,716	+36	0.066	825	+183	<0.001
N. Saskatchewan–N. Manitoba–W. Ontario	140	118	+20	0.381	203	−31	0.001
S. Alberta	327	368	−11	0.637	201	+63	0.027
S. Saskatchewan	452	466	−3	0.829	269	+68	<0.001
S. Manitoba	99	76	+30	0.219	54	+84	0.005
Montana & Western Dakotas	56	12	+382	<0.001	41	+39	0.189
Eastern Dakotas	107	209	−49	0.052	58	+84	0.062
Total	4,081	3,440	+19	0.080	2,058	+98	<0.001

[a] Long-term average, 1955–2014.

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

			Change from 2014			Change from LTA	
Region	2015	2014	%	*P*	LTA[a]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	0	0	0	1.000	1	−100	<0.001
C. & N. Alberta–N.E. British Columbia–NWT	360	377	−5	0.874	274	+31	0.234
N. Saskatchewan–N. Manitoba–W. Ontario	94	46	+105	0.146	235	−60	<0.001
S. Alberta	1,169	834	+40	0.071	614	+91	<0.001
S. Saskatchewan	3,567	3,109	+15	0.199	1,385	+158	<0.001
S. Manitoba	522	474	+10	0.578	375	+39	0.056
Montana & Western Dakotas	618	1,178	−48	0.004	298	+107	<0.001
Eastern Dakotas	2,217	2,523	−12	0.437	1,766	+25	0.063
Total	8,547	8,542	0	0.992	4,949	+73	<0.001

[a] Long-term average, 1955–2014.

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

			Change from 2014			Change from LTA	
Region	2015	2014	%	*P*	LTA[a]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	397	372	+7	0.752	291	+36	0.043
C. & N. Alberta–N.E. British Columbia–NWT	454	372	+22	0.291	224	+103	<0.001
N. Saskatchewan–N. Manitoba–W. Ontario	20	24	−17	0.668	39	−50	0.001
S. Alberta	887	914	−3	0.818	420	+111	<0.001
S. Saskatchewan	1,692	1,711	−1	0.931	766	+121	<0.001
S. Manitoba	131	255	−49	0.001	113	+16	0.421
Montana & Western Dakotas	297	521	−43	0.056	170	+75	0.033
Eastern Dakotas	513	1,110	−54	0.001	492	+4	0.756
Total	4,391	5,279	−17	0.010	2,515	+75	<0.001

[a] Long-term average, 1955–2014.

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

			Change from 2014			Change from LTA	
Region	2015	2014	%	*P*	LTA[a]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	668	701	−5	0.778	928	−28	0.002
C. & N. Alberta–N.E. British Columbia–NWT	639	318	+101	0.008	355	+80	0.006
N. Saskatchewan–N. Manitoba–W. Ontario	52	5	+910	<0.001	36	+45	0.195
S. Alberta	260	461	−44	0.015	670	−61	<0.001
S. Saskatchewan	720	739	−3	0.861	1,143	−37	<0.001
S. Manitoba	41	49	−17	0.465	101	−60	<0.001
Montana & Western Dakotas	197	252	−22	0.269	260	−24	0.068
Eastern Dakotas	466	695	−33	0.069	510	−9	0.577
Total	3,043	3,220	−6	0.489	4,003	−24	<0.001

[a] Long-term average, 1955–2014.

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

			Change from 2014			Change from LTA	
Region	2015	2014	%	*P*	LTA[a]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	0	0	0	1.000	1	−100	<0.001
C. & N. Alberta–N.E. British Columbia–NWT	47	59	−20	0.530	40	+19	0.599
N. Saskatchewan–N. Manitoba–W. Ontario	20	2	+1,114	0.015	25	−21	0.493
S. Alberta	167	263	−36	0.111	127	+31	0.314
S. Saskatchewan	603	542	+11	0.565	222	+171	<0.001
S. Manitoba	102	95	+7	0.766	73	+40	0.102
Montana & Western Dakotas	8	17	−52	0.252	11	−29	0.343
Eastern Dakotas	248	301	−18	0.354	200	+24	0.164
Total	1,196	1,279	−6	0.549	701	+71	<0.001

[a] Long-term average, 1955–2014.

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

			Change from 2014			Change from LTA	
Region	2015	2014	%	*P*	LTA[a]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	41	21	+96	0.443	85	−52	0.063
C. & N. Alberta–N.E. British Columbia–NWT	109	62	+77	0.182	75	+46	0.279
N. Saskatchewan–N. Manitoba–W. Ontario	35	23	+54	0.352	51	−31	0.064
S. Alberta	114	71	+60	0.121	65	+75	0.028
S. Saskatchewan	270	325	−17	0.197	198	+36	0.007
S. Manitoba	38	59	−37	0.029	56	−33	0.008
Montana & Western Dakotas	18	15	+17	0.769	9	+95	0.183
Eastern Dakotas	132	108	+21	0.575	41	+224	0.007
Total	757	685	+11	0.374	581	+30	0.006

[a] Long-term average, 1955–2014.

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

			Change from 2014			Change from LTA	
Region	2015	2014	%	*P*	LTA[a]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	587	578	+2	0.924	907	−35	<0.001
C. & N. Alberta–N.E. British Columbia–NWT	2,215	2,127	+4	0.734	2,526	−12	0.130
N. Saskatchewan–N. Manitoba–W. Ontario	345	201	+72	0.004	551	−37	<0.001
S. Alberta	262	247	+6	0.782	332	−21	0.096
S. Saskatchewan	471	850	−45	0.024	416	+13	0.372
S. Manitoba	112	164	−31	0.295	127	−12	0.503
Montana & Western Dakotas	10	22	−54	0.190	49	−79	<0.001
Eastern Dakotas	393	422	−7	0.813	119	+229	0.005
Total	4,395	4,611	−5	0.546	5,026	−13	0.014

[a] Long-term average, 1955–2014.

than the 2014 estimate (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. Estimated mallard abundance was 11.6 ± 0.4 million, which was similar to the 2014 estimate of 10.9 ± 0.3 million, and 51% above the long-term average of 7.7 ± 0.04 million (Table 3). In the eastern Dakotas, the mallard estimate was similar to last year's count, and 62% above the long-term average. The mallard estimate in southern Alberta was similar to last year's estimate and 29% above the long-term average. In the Montana–western Dakotas survey area, the mallard count was 24% lower than the 2014 estimate and 46% above the long-term average. In the central and northern Alberta–northeastern British Columbia–Northwest Territories region the mallard estimate was similar to 2014 and 81% above the long-term average. In the northern Saskatchewan–northern Manitoba–western Ontario survey area, the mallard estimate was 53% above both the 2014 estimate and the long-term average. Mallard numbers were similar to the 2014 estimate and 24% above 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 39% above the long-term average. In southern Saskatchewan, mallard numbers were 20% higher than last year and 48% above the long-term average.

In the eastern survey area, the estimated abundance of mallards was 0.4 ± 0.1 million, which was similar to the 2014 estimate and the 1990–2014 average. The 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 2015), which is based on data from northeast 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, Washington, Oregon, Wisconsin, the northeast U.S., as well as Michigan and Minnesota). Mallard numbers in California were similar to last year, but 51% lower than the long-term average. In Washington, mallard numbers were similar to 2014 and the

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

Species	2015	2014	% Change from 2014	Average[b]	% Change from average
Mallard	406	432	−6	392	+2
American black duck	541	610	−11[c]	618	−13[c]
Green-winged teal	221	229	−3	256	−14[c]
Ring-necked duck	505	490	+3	513	−2
Goldeneyes (common and Barrow's)	358	390	−8	422	−15[c]
Mergansers (common, red-breasted, and hooded)	409	416	−2	441	−7

[a] Estimates derived using FWS and CWS data from strata 51, 52, 63, 64, 66–68, 70–72.
[b] Average for 1990–2014.
[c] Indicates significant change. Significance ($P \leq 0.10$) determined by non-overlap of Bayesian credibility intervals.

long-term average. The mallard estimate in Nevada was higher than in 2014. In Wisconsin and Oregon, mallard estimates were similar to last year and their long-term averages. The mallard estimate was similar to the 2014 estimate in the northeast U.S., but was 27% below the long-term average. In Michigan, the 2015 mallard estimate was similar to the 2014 estimate and 33% below the long-term average. In Minnesota, the 2015 mallard estimate was similar to last year's estimate and the long-term average.

In the traditional survey area the 2015 estimate for blue-winged teal (8.5 ± 0.4 million) was similar to the 2014 estimate, and was 73% above the long-term average of 4.9 ± 0.04 million (Table 7). Estimated abundance of gadwall (3.8 ± 0.2 million) and American wigeon (3.0 ± 0.2 million) were similar to last year's estimates, and were 100% and 17% above their long-term averages of 1.9 ± 0.02 million and 2.6 ± 0.02 million, respectively (Table 4 and Table 5). The estimated abundance of green-winged teal was 4.1 ± 0.3 million, which was 19% above the 2014 estimate of 3.4 ± 0.2 million and 98% above the long-term average (2.1 ± 0.02 million (Table 6). Estimated abundance of northern shovelers (4.4 ± 0.2 million) was 17% below the 2014 estimate but 75% above the long-term average of 2.5 ± 0.02 million (Table 8). Northern pintail abundance (3.0 ± 0.2 million) was similar to the 2014 estimate and 24% below the long-term average of 4.0 ± 0.04 million (Table 9). Abundance estimates for redheads (1.2 ± 0.1 million) and canvasbacks (0.8 ± 0.06 million) were similar to their 2014 estimates and were 71% and 30% above their long-term averages of 0.7 ± 0.01 million and 0.6 ± 0.01 million, respectively (Table 10 and Table 11). The combined estimate of scaup (4.4 ± 0.3 million) was similar to the 2014 estimate and was 13% below the long-term average of 5.0 ± 0.05 million (Table 12). In the eastern survey area, the combined abundance estimate of mergansers (0.4 ± 0.04 million) was similar to the 2014 estimate and their 1990–2014 average. Abundance estimates of green-winged teal (0.2 ± 0.04 million) and goldeneyes (4.0 ± 0.4 million) were similar to their 2014 estimates, and were 14% and 15% below their 1990–2014 averages of 0.3 ± 0.04 million and 0.4 ± 0.07 million, respectively. The abundance estimate of ring-necked ducks (0.5 ± 0.07 million) was similar to the 2014 estimate and the 1990–2014 average (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 2015, the total midwinter count of American black ducks in both flyways combined was 291,921, which was 32% higher than the most recent 10-year average (2005–2014) of 221,800. In the Atlantic Flyway, the 2015 black duck midwinter index was 262,466,

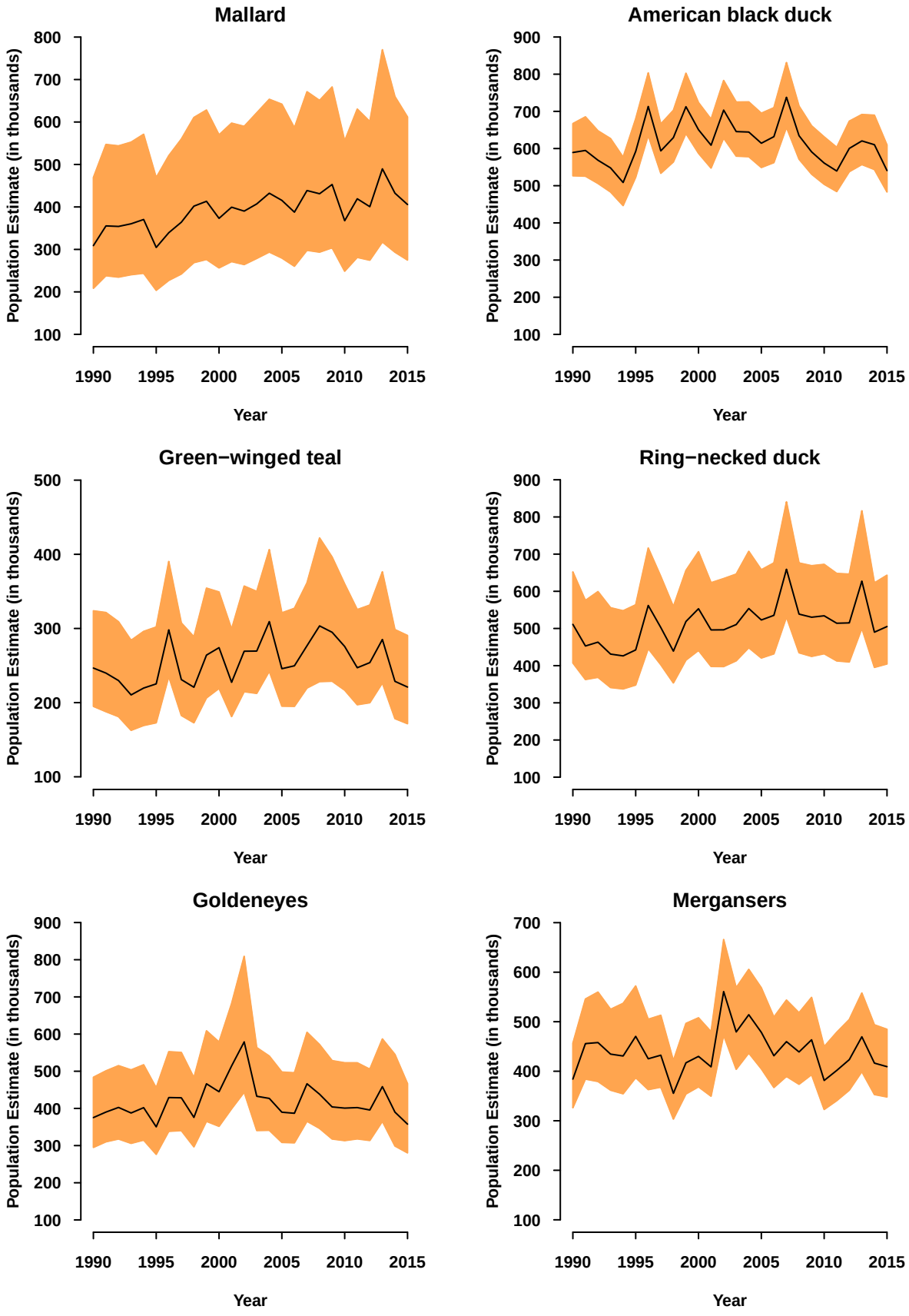

Figure 3. Breeding population estimates and 90% credible intervals from Bayesian hierarchical models for species in the eastern survey area (strata 51, 52, 63, 64, 66–68, 70–72).

about 30% above the flyway's 10-year average of 201,800. In the Mississippi Flyway, the black duck midwinter index in 2015 was 29,455, which was 45% higher than the 10-year flyway average of 20,273. 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 2015 American black duck estimate in the eastern survey area was 541,000, which was 11% lower than the 2014 estimate of 610,000 and 13% lower than the 1990–2014 average of 618,000. Black duck population estimates for northeast states from New Hampshire south to Virginia are also available from the Atlantic Flyway Breeding Waterfowl Survey. The 2015 estimate of 42,429 was 30% lower than the long-term (1993–2014) average of 61,048.

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 % change) 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 1.42% (0.91%, 1.90%) per year over the entire survey period (1966–2014), 1.91% (1.19%, 2.66%) over the past 20 years (1995–2014), and 2.21% (0.9%, 3.52%) over the most recent (2005–2014) 10-year period. The Atlantic Flyway wood duck index increased by an average of 1.25% (0.58%, 1.91%) annually over the entire time series (1966–2014), by 1.97% (0.85%, 3.1%) over the past 20 years (1995–2014), and by 2.6% (0.21%, 4.69%) from 2005 to 2014. In the Mississippi Flyway, the corresponding BBS wood duck indices increased by 1.51% (0.81%, 2.16%, 1966–2014), 1.87% (0.98%, 2.83%, 1995–2014), and 2.03% (0.47%, 3.63%, 2005–2014; 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 2015 survey estimate of 406,178 was similar to the 2014 (421,557) and 1993–2014 average (381,237) estimates.

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. Although these reports are no longer produced, habitat and population status for each region will continue to be summarized in this report. 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)
reported by Jim Bredy

Winter precipitation was normal to slightly-below normal throughout the survey area. In addition, spring precipitation since the first part of March has been below normal. Winter arrived early with cold temperatures; however, there were alternating periods of warm and cold temperatures in early spring. The frost seal was minimal and the snow melted quickly into the ground in much of Alberta, resulting in significantly fewer semi-permanent wetland basins for nesting waterfowl this year as compared to last year. Warm spring temperatures also allowed farmers an early start to their agricultural activities. Upland habitat conditions in the heavy agriculture regions were in the poorest condition. Many of those wetlands that were surrounded

by plowed fields had a small ring of vegetation around the basin or none at all. Much of Alberta between Calgary and Medicine Hat had fair-to-poor wetland conditions, with a majority of the water only in larger wetland basins. Conditions improved significantly between Calgary and Red Deer, and over to Lloydminster. Even though the wetland water levels appeared lower than last year, that area had mostly good wetland conditions. However, Beaverhill Lake, just east of Edmonton, remained mostly dry, a faint glimmer of its past glory as an impressive waterfowl nesting and staging area. The wetland water levels in the rest of the Central Alberta survey area (between Edmonton, Cold Lake, Lesser Slave Lake, Grande Prairie, and Peace River) were lower than last year, and water in many of the basins appeared to be stagnant. As in southern Alberta, the larger wetland basins had the best water levels. Overall, it was a mixed bag in southern and Central Alberta this spring. Most wetland basins had lower water levels than last year, with though some had levels that should have lasted throughout the brood-rearing season. The warm and dry spring negatively affected the quality of upland nesting habitat.

In southern Alberta May ponds were 16% below the 2014 estimate and 34% above the long-term average. The total duck estimate was similar to 2014 and 33% above the long-term average. The mallard estimate was similar to 2014 and 30% above the long-term average. Gadwall were similar to their 2014 estimates and 75% above their long-term average. The American wigeon estimate was similar to last year and the long-term average. Green-winged teal were similar to the 2014 estimate and 63% higher than the long-term average. The blue-winged teal estimate was 40% higher than 2014, and 91% above the long-term average. Northern shovelers were similar to last year and 111% above the long-term average. Northern pintails were 44% below 2014 and 61% below the long-term average. Redheads were similar to 2014 and the long-term average. Canvasbacks were similar to 2014 but 75% above their long-term average. The scaup estimate was similar to last year, but 21% below the long-term average.

Southern Saskatchewan (strata 30–33)
reported by Phil Thorpe

Late summer and fall of 2014 were characterized by normal to above-normal precipitation in the grasslands and well-below normal precipitation in the parklands. Temperatures were normal during the late summer and early fall of 2014. The winter of 2014–2015 was characterized by normal precipitation in the southern grasslands, above-normal precipitation in the northwest grasslands and central parklands, and normal precipitation across the remainder of the survey area. Temperatures were well-above normal for most of the winter, with the exception of February, which was colder than normal. Phenology was normal to slightly ahead of normal during the survey. Precipitation in April, May, and early June was well-below normal across the province, with the driest conditions along the Alberta border (the western third of the province). Although normal to above-normal precipitation was received in the province over the winter, there were very few ephemeral or temporary wetlands observed this year. Seasonal and semi-permanent wetlands contained high water and many were still flooded outside the tree and willow ring, and well outside the cattail ring of vegetation. The majority of the survey area continued to have fair to good production potential for waterfowl. Dry spring conditions may have slowed crop and upland vegetation growth but full wetland basins should have provided abundant habitat for broods. A swath of habitat extending from the southern Missouri Coteau into the northern grasslands had the potential for excellent waterfowl production. Average wetland conditions in the southwest and western grasslands and little sheetwater observed during the survey may have resulted in lower use of the area by waterfowl; as a result, production from this area was expected to be average or fair. The northeast parklands were drier and received less precipitation over the winter and into the spring. Wetlands still remain flooded out of their boundaries, primarily from carry-over water from previous years, and this should support broods into the summer. Average or fair production is expected from the northeast parklands. The northwest

parklands should have good production potential, with conditions degrading to fair closer to the Alberta border. Overall, another good year from southern Saskatchewan, but a drought cycle may be starting to show signs of returning to the prairies.

The 2015 May pond estimate in this survey area was similar to 2014, and 24% higher than the long-term average. Total duck numbers were similar to 2014, and 74% above the long-term average. Mallards were 20% above 2014 and 48% above the long-term average. Green-winged teal and blue-winged teal were similar to last year, and 68% and 158% above their long-term averages, respectively. Northern shovelers were similar to 2014 and 121% above the long-term average. The gadwall estimate was similar to last year, and 126% above the long-term average. American wigeon were similar to last year and 38% lower than the long-term average. Northern pintails were similar to 2014, and 37% below the long-term average. Redheads were similar to 2014 and 171% above their long-term average. The canvasback estimate was similar to 2014 and 36% higher than the long-term average. The scaup estimate was 45% lower than 2014 but similar to the long-term average.

Southern Manitoba (strata 34–40; includes southeast Saskatchewan)
reported by Kevin Fox

Habitat conditions for nesting and brooding waterfowl were good throughout southern Manitoba and southeastern Saskatchewan in 2015. The presence of water on the landscape throughout the survey area was decreased from 2014 due to the lack of heavy flooding. There was a general lack of sheetwater on the landscape; however, conditions remained good and ponds were well within or full to their margins compared with the heavy flooding observed in 2014. As usual, the western segments in strata 39 and 40 were drier than the rest of the survey area. In stratum 39, many of the more shallow wetlands with cattails had low water levels and some drier conditions were also observed in the far eastern transects of the stratum. Conditions in the majority of stratum 40 were excellent and in some areas record numbers of birds were counted. Water levels improved as the survey moved west into southeastern Saskatchewan (strata 34 and 35), with most ponds full to the margins. The lowest quality habitat was once again found in stratum 38 where conditions are typically drier. Similar to previous years, the northern strata (36 and 37) have water levels considered good to excellent due to the increase in more permanent waterbodies to the north.

Precipitation was 40–60mm below normal in southern Manitoba and southeastern Saskatchewan throughout the winter of 2014 and the entire agricultural year (September 2014–May 2015). While the heavy flooding in 2014 provided a buffer for the 2015 breeding season, conditions will need to improve to maintain current water levels. Current precipitation (April–May 2015) is a mixed bag with below-average accumulations in the west and above-average accumulations in the more eastern areas of southern Manitoba. Temperatures during the winter season of 2014–2015 were 2-4^{o}C above normal, except for February which was around 5^{o}C below normal.

The 2014 May pond estimate in this crew area was 17% lower than the 2014 estimate and 16% lower than the long-term average. The total duck estimate was similar to 2014 and 29% above the long-term average. Mallard numbers were similar to 2014 and 39% higher than the long-term average. The gadwall estimate was similar to last year and 171% above the long-term average. American wigeon were 39% lower than last year and 85% below the long-term average. The blue-winged teal estimate was similar to last year and 39% higher than the long-term average. Green-winged teal were similar to last year but 84% above the long-term average. The northern shoveler estimate was 49% lower than last year's estimate but similar to the long-term average. Northern pintails were similar to the 2014 estimate, and 60% lower than the long-term average. The redhead estimate was similar to last year and its long-term average. The canvasback estimate was 37% below last year's and 33% below the long-term average. The scaup estimate was similar to both last year and the long-term average in this survey area.

Montana and Western Dakotas (strata 41–44)
reported by Rob Spangler

Over this past water year, the climate in Montana and the western Dakotas was characterized by average- to below-average precipitation. In the fall, precipitation averaged about 50% of normal in North Dakota and about 75% of normal in South Dakota and Montana. Winter brought better conditions and more precipitation (150% of normal) until February when precipitation dropped off and temperatures increased, drying soil and melting the snow pack. Precipitation increased significantly in May; however, the soil was so dry that much of the runoff was absorbed, leaving little to fill wetlands. Crowding of waterfowl occurred in some areas where pond densities were low, and large amounts of cattle grazing and agriculture across the survey area have impacted nesting.

Wetland conditions in western South Dakota (stratum 44) were mostly poor with many wetlands, dugouts and reservoirs averaging 15–30% of capacity. In western North Dakota (stratum 43), conditions were generally fair with wetlands averaging 40–50% of capacity. Habitat conditions were considered mostly fair with some poor areas in southeastern Montana (stratum 42). The majority of stratum 41 was classified as fair with ponds and reservoirs averaging 40–50% of capacity. However, some habitat was classified as good in the north-central portion of Montana. Overall, mostly fair-to-poor waterfowl production is expected over the Western Dakotas and Montana survey area.

The 2015 May pond count in this crew area was similar to last year, and 61% higher than the long-term average. Total duck numbers decreased by 25% from 2014, and were 60% higher than the long-term average. The mallard estimate was 24% lower than 2014 and 46% above the long-term average. The gadwall estimate was similar to last year and 150% above the long-term average. The American wigeon estimate was similar to 2014 and 77% above the long-term average. Green-winged teal were 382% above last year, but similar to the long-term average. Blue-winged teal were 48% lower than last year and 107% higher than the long-term average. Northern shovelers were 43% lower than last year and 75% above the long-term average. The northern pintail estimate was similar to 2014 and 24% lower than the long-term average. Redhead and canvasback estimates were similar to 2014 and their long-term averages. The scaup estimate was similar to last year, but 79% lower than the long-term average.

Eastern Dakotas (strata 45–49)
reported by Terry Liddick

May 2015 habitat conditions in the survey area changed drastically as the survey progressed. The South Dakota portion of the survey area was dry as or drier than in 2014, resulting from below-average precipitation during the summer-to-spring period of 2014–2015. The dry trend, which began in 2012, has continued through the winter of 2014 in South Dakota. Winter 2014 and spring 2015 precipitation was below average across both states, particularly in southern South Dakota. The northcentral and northeastern portion of South Dakota saw significant precipitation during a week-long period starting on May 13^{th}. Despite that precipitation, most of South Dakota was extremely dry during the survey continued spring and summer precipitation it appears that the region could easily slip back into drought. Upland vegetation was advanced this year and many trees were beginning to leaf out in early May when the survey crew arrived in Mitchell on May 3^{rd}. In stratum 48 and 49 in South Dakota, conditions were fair at best on the coteaus and poor in the prairie areas of the drift plain, particularly in stratum 49 and the southern portion of stratum 48. Many semi-permanent wetland basins were dry as were all of the ephemeral wetlands south of Huron. Few, if any wetlands were more than 50% full, except in the coteau regions. All streams and rivers were well within their banks and most streams were dry. Farming activities were advanced due to the above- or near-average winter and spring temperatures and lack of spring precipitation, with beans being seeded, and approximately 30% of corn planted. Production should be average in the coteau regions of the state but probably well below average in the drift plain

regions. Conditions improved slightly to the north, particularly the northeast region around Aberdeen. Much of that could be attributed to a week-long rain event that occurred from 13 to 18 May. Observed conditions in stratum 45 and 46 in North Dakota were considerably better, with most of the state considered to be fair to good. Although North Dakota conditions seemed better than South Dakota in mid-May, they also benefitted immensely from the same week-long rain event that occurred in South Dakota as the storm moved due north. The drift plain portions of North Dakota were better than South Dakota and the coteau regions were good. Sheet water was observed for the first time during the survey in North Dakota. Virtually all of the permanent wetland basins in the coteau regions were at least 60% full but vegetation margins were present. Semi-permanent and seasonal wetlands were at least 50% full resulting from the recent rains. Many seasonal wetlands held good water but many were void of ducks. Stratum 45 appeared fair to good in nearly all parts, with a few of the coteau segments looking excellent. The Souris and James Rivers were well within their banks and Devil's Lake and Lake Sakakawea had exposed beach areas for the first time since 2011. It was not clear if this was a result of releasing more water to draw them down from record levels experienced the past several years or from a drying trend that was continuing across the survey area. There were few intact wetlands remaining in stratum 47 and most of the segments were again void of wetlands and waterfowl. Observed habitat conditions across North Dakota continued to decline as a result of wetland draining, grass conversion to row crops, and energy development. Many grasslands on the coteaus were also being tilled. Many places with ample nesting habitat had poor wetland densities either naturally or as a result of the continual trend of increased wetland drainage. Most of the coteau regions remained intact and should produce an average number of waterfowl in 2015.

On the whole, just as in 2014, conditions in the eastern Dakotas were fair at best, with much of South Dakota poor. The coteau regions of both states were rated as good and it should be an average year for waterfowl production. The mild spring did not seem to advance breeding for the early nesters, and ratios of pairs to lone drakes were good all the way to survey completion on 25 May. Courtship behavior was still being observed for some of the late-arriving species, such as blue-winged teal and pintails. Several large groups of mallard and blue-winged teal drakes were observed occasionally, presumably from the early dry conditions and therefore the lack of available breeding territories. The regions rated poor in 2014 expanded in 2015, particularly in southern South Dakota. With the benefit of the week-long precipitation event experienced during the survey, where as much as 11 inches of rain fell in some areas, most of North Dakota appeared good. Stratum 47 in eastern North Dakota remained poor and probably always will be with the extensive draining that has occurred there.

In the eastern Dakotas, the 2015 May pond estimate was 21% lower than 2014, but 11% higher than the long-term average. The total duck estimate was 19% below last year and 42% above the long-term average. Mallard numbers were similar to 2014 and 62% higher than the long-term average. The gadwall estimate was similar to 2014 and 75% above the long-term average. The American wigeon estimate was similar to 2014 and 131% above the long-term average. Green-winged teal were 49% lower than 2014, but were 84% higher than the long-term average. Blue-winged teal were similar to last year and 26% higher than their long-term average. Northern shovelers were 54% lower than last year and similar to their long-term average. The northern pintail estimate was 33% lower than the 2014 estimate, and similar to the long-term average. The redhead estimate was similar to last year and the long-term average. The canvasback estimate was similar to 2014 and 224% above the long-term average. Scaup numbers were similar to last year and 229% above their long-term average in this survey area.

Northern Saskatchewan, Northern Manitoba, and Western Ontario (strata 21–25, 50)
reported by Walt Rhodes

The survey area experienced a relatively mild fall and winter period but precipitation was generally below average. Temperatures were as much as 5°C or more above average from October 2014 to May 2015, with the exception of brief spells of below-normal temperatures during November 2014 and February 2015. The overall mild conditions produced an early ice-out across the region, which was in contrast by as much as two weeks or more to the late springs of 2013 and 2014. Upon arriving in Prince Albert, SK, on 14 May 2015, nearby Montreal Lake was entirely thawed as compared to being nearly completely frozen on 22 May 2014. Precipitation from September 2014 through May 2015 was generally below normal (60–85%) across the region. Along the Parklands and southern boreal regions, precipitation tended to be closer to normal (85–115%) during the same period. Fall and winter precipitation ranged from 40% to 150% of normal and generally followed a south-to-north progression towards drier conditions. Spring precipitation followed the same directional progression but the amount of precipitation was scant (<40-85%). For example, one local resident commented during the survey that there had essentially been no measurable snowfall in La Ronge, SK, since early April. There was slightly more spring precipitation in northern Manitoba. Despite the early spring, very little waterfowl activity was noted during the survey but this had rapidly changed by late June, with one of the largest ever evacuations in Saskatchewan history occurring by early July. An overflight of prairie-nesting waterfowl had settled in the crew area but habitat conditions were drier than 2014 and production is expected to be good at best, buoyed more by the early spring than an abundance of moisture.

Western Ontario (stratum 50) suffered a very cold winter but snow accumulation was down from previous years. Spring conditions came slightly early and in time to allow normal settling by nesting waterfowl. Habitat conditions were generally excellent, but the southwest corner of the province north of Lake Superior and along the Manitoba border was much drier than past years. There was less beaver activity than in past years in these areas, and some traditional beaver marshes were abandoned, presumably due to fewer animals or lack of wetland recharge. With the exception of the larger deeper lakes, western Ontario was ice-free by mid-May, which provided adequate habitat for waterfowl.

The 2014 total duck estimate in this survey area was 37% higher than last year and similar to the long-term average. The mallard estimate was 53% higher than both last year and the long-term average. Gadwall numbers were similar to 2014 and 75% lower than the long-term average. The American wigeon estimate was similar to 2014, and 57% lower than the long-term average. Green-winged teal were similar to last year and 31% lower than the long-term average. Blue-winged teal estimates were similar to 2014 but 60% lower than the long-term average. Northern shovelers were similar to last year but 50% lower than the long-term average. Northern pintails were 910% higher than last year but still similar to the long-term average. The redhead estimate was 1,114% higher than 2014 but still similar to the long-term average. Canvasback were similar to 2014 and 31% lower than the long-term average. The scaup estimate was 72% higher than 2014 and 37% lower than the long-term average.

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

Unlike the exceptionally late spring in 2014, spring break-up occurred early in 2015. Waterfowl seemed to be settled across the landscape when we initiated our survey 15 May. Although several larger lakes typically stay ice covered until well into June, we observed less ice in 2015 in any other year since my experience with this area began in 2009. Early open water should bode well for nesting waterfowl, and we saw lots of single and flocked drakes as our survey progressed. Many wetlands in northern Alberta and northeastern British Columbia were very

recessional and lower than normal. However, beaver dams and the availability of wide grassy margins helped mitigate the low-water conditions. Farther north and throughout most of the region water levels appeared normal. No significant spring flooding was observed on the Mackenzie River Delta and this area appeared excellent for nesting waterfowl. Elsewhere, habitat conditions varied from fair in the south to good throughout most of the survey area.

In this survey area, the total duck estimate for 2015 was 16% higher than the 2015 estimate and 60% higher than the long-term average. Mallard numbers were similar to 2014 and 81% above the long-term average. The American wigeon estimate was similar to last year's and 67% higher than the long-term average. Gadwall were similar to last year and 32% lower than the long-term average. Green-winged teal were 36% higher than 2014 and 183% above the long-term average. Blue-winged teal were similar to 2014 and the long-term average. Northern shovelers were similar to the 2014 estimate and 103% above the long-term average. Northern pintails were 101% above last year and 80% higher than the long-term average. Redhead and canvasback estimates were similar to last year and to the long-term average. The scaup estimate was similar to last year and the long-term average.

Alaska, Yukon Territory, and Old Crow Flats (strata 1–12)
reported by Debbie Groves

Alaska experienced an early spring and a mild breakup of river ice with minimal flooding. Water levels in lakes, ponds, streams, and rivers were well below normal across much of the state due to below-average precipitation occurring this past winter and spring. Water remained plentiful, however, so nesting waterfowl were unlikely to be impacted. Overall, the early spring and lack of significant flooding should result in good-to-excellent duck production in the Alaska–Yukon strata in 2015.

The 2015 total duck estimate in this survey area was similar to 2014 and 8% lower than the long-term average. Mallard numbers were similar to last year and 24% higher than the long-term average. Gadwall were similar to 2014 and similar to the long-term average. American wigeon were 26% lower than last year and similar to their long-term average. Green-winged teal were similar to last year and 39% above their long-term average. No blue-winged teal have been counted in this crew area in the last 4 years. The northern shoveler estimate was similar to last year and 37% higher than the long-term average. Northern pintails were similar to 2014 and 28% below their long-term average. No redheads were counted in this crew area in the last 2 years. The canvasback estimate was similar to 2014 but 52% lower than the long-term average. The scaup estimate was similar to 2014 and 35% lower than the long-term average.

Eastern survey area (strata 51–72)
reported by Stephen Earsom, Mark Koneff, and Jim Wortham

Southeastern Ontario and southern Quebec experienced below-average precipitation between 1 November 2014 and 31 March 2015, while precipitation in the rest of the crew area farther north in the two provinces was near normal. This trend continued through April and May 2015. Snow and ice retreated roughly a week earlier than last year, and this combined with the below-average winter left many agricultural ditches, streams, beaver ponds, and string bogs well below capacity during our survey, especially in the southern reaches. Localized areas clearly had more moisture, and some wetlands and beaver ponds were full farther north in the survey area. Permanent lakes were not noticeably different than in other years. Tree leaf-out was well underway when we began surveys on 5 May in Stratum 54. Ice floes were not present on lakes Erie or Ontario, though we did see some on Lake Huron. Many tree species had leaves both in Strata 54 and 53 and in lower elevation areas of 56. We seemed also to note more flocked drake mallards and teal (both blue- and green-winged) than last year. With good survey weather and no mechanical issues, we were able to catch up with the phenology. Timing on strata 52, 51, 68 and northern portions of 56 was appropriate, though phenology varied as always with terrain

and local weather. Throughout the survey all water bodies were melted though a very few patches of snow were noted on north-facing slopes. No broods were observed at any time during the survey. Overall, nearly all of southern Ontario and western Quebec merited a fair or good rating, and we would not expect habitat to be a widespread limiting factor for waterfowl production in 2015.

Winter in northern Quebec (stratum 69) was characterized by colder-than-normal temperatures but normal to below-normal winter precipitation. The timing of spring conditions was average but had been preceded ten days earlier with two days of very warm temperatures, which may have resulted in early emergence of spring plants. Many waterbodies still had remnants of melting ice, and lakes above 2500′ in elevation remained frozen at the time of the survey. Larger man-made reservoirs were completely frozen and inaccessible to settling waterfowl. Eastern areas along the James Bay, which had suffered extensive wildfires in recent years, remained drier than surrounding landscapes and could only be considered fair habitat for nesting waterfowl. Eastward from James Bay to Labrador, habitats were better and considered good from mid-northern Quebec to the Labrador border. Those southern portions of Stratum 70 along the north shore of the St. Lawrence still suffer from ongoing energy development and resource extraction and could only be considered fair due to this disturbance and drier conditions. Habitat conditions improved northward but spring was slightly later than average, which resulted in good conditions for nesting waterfowl along those areas bordering Labrador.

Autumn across Maine and Atlantic Canada was characterized by above-average temperatures in October, below-average temperatures in November, and a return to above- average temperatures in December. Extremely cold temperatures prevailed across the crew area from January through March 2015. February was the coldest month on record in Maine. Substantial snowfall occurred across the region also during the winter of 2015. Some regions of Maine posted record, or near record, snowfall totals. Ice depth on lakes across the region exceeded four feet. Despite the cold and wet winter and deep snow packs, a cool spring led to a protracted thaw and ice-out that minimized flooding. While the spring was cool in Maine, it was relatively dry, and elevated spring water levels resulting from melting were short-lived. This, coupled with relatively dry weather that prevailed in Maine entering the winter of 2015, resulted in dry habitat conditions across Maine during the survey. Habitat conditions across Maine at the time of the survey were characterized as fair. Across the Maritimes and Newfoundland–Labrador, the spring thaw was also protracted; however, Atlantic Canada saw greater spring precipitation than Maine and entered the winter with greater soil moisture. This resulted in generally good habitat conditions across Atlantic Canada. Exceptions were higher elevation areas in Newfoundland-Labrador as well as the highest surveyed latitudes in Labrador, which retained substantial snowpack and ice coverage late into the spring. These conditions likely impacted early nesting activity but may have little impact on later nesters like scaup and scoters. Because of this late phenology, conditions in these higher elevation and higher latitude areas were characterized as fair.

The estimated abundance of mallards in the eastern survey area (0.4 ± 0.1 million) was similar to the 2014 estimates and the 1990–2014 averages. Estimated abundance of American black ducks was 0.5 ± 0.04 million, which was 11% below last year's estimate of 0.6 ± 0.04 million, and 13% below the 1990–2014 average of 0.6 ± 0.04 million. Abundance estimates of green-winged teal (0.2 ± 0.04 million) and goldeneyes were similar to their 2014 estimates, and were 14% and 15% below their 1990–2014 averages of 0.3 ± 0.04 million and 0.4 ± 0.07 million, respectively. The merganser estimate (0.4 ± 0.04 million) was similar to the 2014 estimate and the 1990–2014 average. The estimate of ring-necked ducks (0.5 ± 0.07 million) was similar to the 2014 estimate and the 1990–2014 average.

Other areas

Variable winter precipitation and snowpack in the Pacific Flyway produced wetter condi-

tions in some areas in the north, but lead to continued drought throughout the rest of the flyway. In California, drought conditions remained throughout much of the state during winter and spring, although northeastern California received above-average late spring rains. Central Valley agriculture complementary to waterfowl (mostly rice) and wetland habitats received reduced and delayed surface water allotments from those of 2013–14. Reduced allotments are also anticipated for the 2015–16 season. In California, the total duck estimate in 2015 was 315,600, which was similar to the 2014 estimate of 448,800 but 45% lower than the long-term average (1992–2014) of 576,700. The mallard estimate in 2015 was 173,900, which was similar to the 2014 estimate of 238,700, but 51% lower than the long-term average of 356,700.

In Nevada, winter precipitation and run-off was well below normal for the third consecutive year. Most wetlands in northern Nevada including the Carson Sink area (Stillwater NWR, Carson Lake WMA) had only 20–30% coverage. Northern Nevada Great Basin reservoirs and runoff are similarly below average. Snowpack conditions across the state are non-existent following poor winter precipitation region wide. Marsh conditions survey wide were poor, with many marshes completely dry. The Nevada mallard estimate was 5,500, which was higher than in 2014. In Oregon, conditions for breeding waterfowl were fair to poor in the southeast and southcentral region of the state this May and many wetland basins held very little water. Conditions in northeast Oregon and the Columbia Basin were fair to good because snowpack in the northeast was closer to average. Conditions in western Oregon were good as winter rains were sufficient to recharge wetlands in the Willamette Valley. In Oregon, the total duck estimate in 2015 was 279,700, which was similar to 2014 and the long-term (1994–2014) average. The 2014 mallard count was 87,400, which was similar to last year (85,300) and the long-term average (91,900). In Washington, the warmest and driest conditions were recorded for the winter of 2014–2015 and spring of 2015 since waterfowl surveys began in 2009. These drier conditions were observed in both western and eastern Washington. April precipitation levels were much lower than normal across all regions of the state, with some areas recording no rainfall for the month. Because of the record dry conditions many water features documented during the 2013 and 2014 surveys were either dry or fragmented into smaller water features due to lower water levels. In much of western Washington pond levels appeared noticeably lower than during 2013 and 2014. The estimate for total ducks in Washington (193,100) was 9% higher than the 2014 estimate (177,200) and similar to the long-term average. The mallard estimate in Washington was 86,400, which was similar to last year's estimate and the long-term average. In interior British Columbia, the 2014–2015 winter saw above average precipitation and above normal temperatures. In April, British Columbia interior temperatures remained above average. April precipitation (mostly in the form of rain) was above average in the northern interior and below average in the southern interior. Spring snowmelt occurred earlier than normal throughout the entire province and waterfowl migration appeared to be 1–2 weeks earlier than average for most species. Wetland water levels were generally low in the southern interior and average to high in the northern interior. Habitat conditions during May were poor in the prime waterfowl areas of southern British Columbia and fair to good in the northern portion of the British Columbia Interior. In British Columbia, the 2015 total duck estimate was 364,500, which was similar to last year (324,500) and the long-term average (2006–2014) of 327,000. The 2015 mallard estimate was 82,100, which was similar to last year's estimate of 81,600 and the long-term average (80,000).

In the Midwest, spring started out dry in many areas, but ample precipitation later in the breeding season improved habitat conditions, especially for brood rearing. In Minnesota, wetland conditions in early spring 2015 were extremely dry but improved some by late May. In early May 2015, 40% of the state was classified as severe drought, 54% was moderate drought, 1% was abnormally dry, and 4% of the state was under no drought designation. By early June 2015, none of the state was classified as severe drought, 12% was in moderate drought,

39% was abnormally dry, and 49% of the state was under no drought designation. The number of permanent or semi-permanent wetlands decreased 36% from 2014 and was 13% below the long-term average. The total duck population in Minnesota, excluding scaup, was 524,000, which was above last year's estimate of 474,000 but below the long-term average of 618,200. The 2015 estimated mallard breeding population was 206,000, which was similar to last year's estimate of 257,000, and 10% below the long-term average of 228,000. In Michigan, the 2015 statewide wetland abundance estimate was 522,500 ponds, which was similar to the 2014 estimate and 11% above the long-term average. The estimate for total ducks was 431,100, which was similar to last year and 33% lower than the 1991–2014 average. The Michigan mallard estimate was 237,800, which was similar to last year but 33% lower than the long-term average. In Wisconsin, water conditions were drier than average in early May; however, considerable precipitation later in the month improved wetland conditions for the brood-rearing period. It appeared that the Wisconsin landscape will provide good duck production in 2015, although renesting and late broods are expected in some areas as a result of spring flooding. The 2015 total Wisconsin breeding duck population estimate was 372,800, which was similar to 2014 (395,100) and 16% lower than the long-term average. The 2015 total mallard population estimate of 176,200 was similar to the 2014 estimate of 158,700 and the long-term average. In Nebraska, habitat conditions across the Sandhills were excellent. Precipitation fell across most of the region and record rainfall and precipitation was observed in many locations in May. Cold temperatures may have slowed production, but continued rain into June has provided good to excellent conditions for renesting. Above average production is expected from the Sandhills. Nebraska has not conducted a spring waterfowl survey in recent years.

In the northeast U.S., cold temperatures and high snowfall delayed spring phenology across much of the survey area by 5–10 days. Despite greater snowfall, drier than normal conditions were reported in Massachusetts, New Jersey, Pennsylvania, and Rhode Island. In New Jersey, water levels were generally average to below average with the exception of the southern coastal plain which was much wetter than average. Rainfall was scarce and temperatures above average after mid-April throughout the state, resulting in rapid drying of ephemeral wetlands. Rhode Island experienced a dry spring with water levels at or below normal. In addition, a cold, late winter and relatively dry spring delayed green up and growth of vegetation, which may have delayed nest initiation. In Pennsylvania, waterfowl habitats during the survey period were drier than average in the southern and eastern portions of the Commonwealth but near average in the northern and western portions of the state. The snow/ice thaw was 1–2 weeks later than normal in northern wetlands, and frozen lakes persisted into early April. The relatively late thaw appeared to have delayed nest initiation to the same degree in northern portions of the state. Overall, a typical nesting effort in Pennsylvania was expected for 2015. Total duck numbers from the 2015 Atlantic Flyway Breeding Waterfowl survey were 1.2 million, which was similar to the 2014 estimate of 1.3 million and 14% lower than the long-term (1993–2014) average of 1.4 million. Mallard numbers (540,100) were similar to the 2014 estimate of 634,600 and 27% below the long-term average of 735,800.

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 13.8 ± 1.4 million birds in 2015 (Figure 4). This is similar to the 2014 estimate of 13.4 ± 1.3 million.

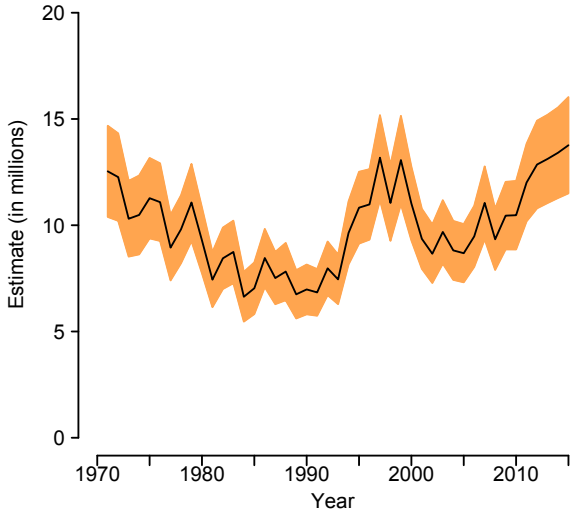

Figure 4. Estimates and 90% confidence intervals for the predicted size of the mallard population in the fall.

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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 2015, conditions in the Arctic and boreal areas important for geese were variable. Compared to last year, snow and ice conditions were less extensive in the western Arctic, more extensive in the central Arctic, and similar in the eastern Arctic. Breeding conditions were good on Bylot Island in the eastern Arctic, and an average to above-average fall flight was expected for greater snow geese. Biologists reported later than average spring phenology at Southampton Island, the northern and western coastal areas of the Hudson Bay, and the southern portion of Baffin Island. Atlantic brant have had three years of low juvenile production, and below-average production was expected again this year. Habitat conditions across Atlantic Canada were generally good, except for a more persistent spring snow pack and ice coverage in higher elevation areas in Newfoundland and Labrador. Nesting conditions were below average on the Ungava Peninsula, and lakes and ponds along the eastern Hudson Bay coast remained frozen in mid-June. North Atlantic Population and Atlantic Population Canada goose numbers were similar to recent averages, and average fall flights were expected. Of the Canada goose populations that migrate through the Mississippi Flyway, Eastern Prairie Population numbers were similar to last year, and average to above-average production was expected; Southern James Bay Population and Mississippi Valley Population breeding numbers were down relative to recent years, with average and below-average fall flights predicted, respectively. Ice breakup and nesting phenology in the Queen Maud Gulf region of the central Arctic were similar to long-term averages, and nesting conditions and habitat were good to above average in the western Arctic and Northwest Territories. Thus, average to above-average production was expected for Ross's, Mid-continent snow, Mid-continent white-fronted, and lesser and Central Flyway Arctic Nesting Canada geese. Alaska experienced an early spring and mild breakup of ice with minimal flooding on the Yukon–Kuskokwim Delta and other interior areas of the state. With less persistent ice and snow cover and favorable breeding conditions in the western Arctic and Alaska, the outlook for goose and swan populations nesting in these areas was good to excellent. With the exception of Cackling Canada geese, indices for geese and swans that breed on the Yukon–Kuskokwim Delta were lower this year compared to last year, though later survey timing relative to the early spring conditions may have contributed to lower counts. Record high counts were observed this year for the Wrangel Island Population of lesser snow geese and Dusky Canada geese, and the spring index for Emperor geese was the highest recorded in over three decades. Across much of the Canadian and U.S. prairies, spring phenology was early. Habitat conditions were generally rated good to fair on the Canadian prairies and fair to poor on the U.S. prairies. Southern and central portions of the western U.S. were exceptionally dry, and habitat conditions there were generally poor. However, production of temperate-nesting Canada geese over most of their North American range is expected to be average, and similar to previous years. Of the 28 goose and swan populations included in this report, 6 had significant positive trends during the most recent 10-year period ($P < 0.05$): Western Prairie and Great Plains Population, Dusky, and Aleutian Canada geese and Mid-continent, Western Central Flyway, and Western Arctic and Wrangel Island light geese. Three populations, Atlantic brant, and the Atlantic and Southern James Bay Populations of Canada geese, showed a significant negative 10-year trend. Of the 13 populations for which primary indices included variance estimates, Ross's geese

significantly increased and 2 populations significantly decreased (Southern James Bay Population and Mississippi Valley Population Canada geese) in 2015 compared to 2014. Of the 15 populations for which primary indices did not include variance estimates, 8 populations were higher than last year, and 7 populations were lower.

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). Arctic-nesting geese rely predominantly on stored reserves for egg production. Thus, persistent snow cover reduces nest site availability, delays nesting activity, and often results in depressed reproductive effort and productivity. In general, goose productivity will be better than average if nesting begins by late May in western and central portions of the Arctic, and by early June in the eastern Arctic. Production usually is poor if nest initiations are delayed much beyond 15 June. For temperate-nesting Canada goose populations, recruitment rates are less variable, but productivity is influenced by localized drought and flood events.

Methods

We have used the most widely accepted nomenclature for various waterfowl populations, but they may differ from other published information. Species nomenclature follows the List of Migratory Birds in Title 50 of the Code of Federal Regulations, Section 10.13, revised 1 March 2010 (79 FR 9282). Some of the goose populations described herein are composed of more than one subspecies and some light goose populations contain two species (i.e., snow and Ross's geese). Population estimates for geese (Appendices D.1, D.2, and D.3) are derived from a variety of surveys conducted by biologists from federal, state, and provincial agencies, or from universities (Appendices A.2). Surveys include the Midwinter Survey (MWS, conducted each January in wintering areas), the Waterfowl Breeding Population and Habitat Survey (WBPHS, see Status of Ducks section of this report), and surveys that are specifically designed for various goose populations. Where survey methodology allowed, 95% confidence intervals are presented in parentheses following population estimates. The 10-year trends of population estimates were calculated by regressing the natural logarithm of survey results on year, and slope coefficients were presented and tested for equality to zero (t-statistic). Changes in population indices between the current and previous 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. 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 over the vast geographic range of waterfowl populations.

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

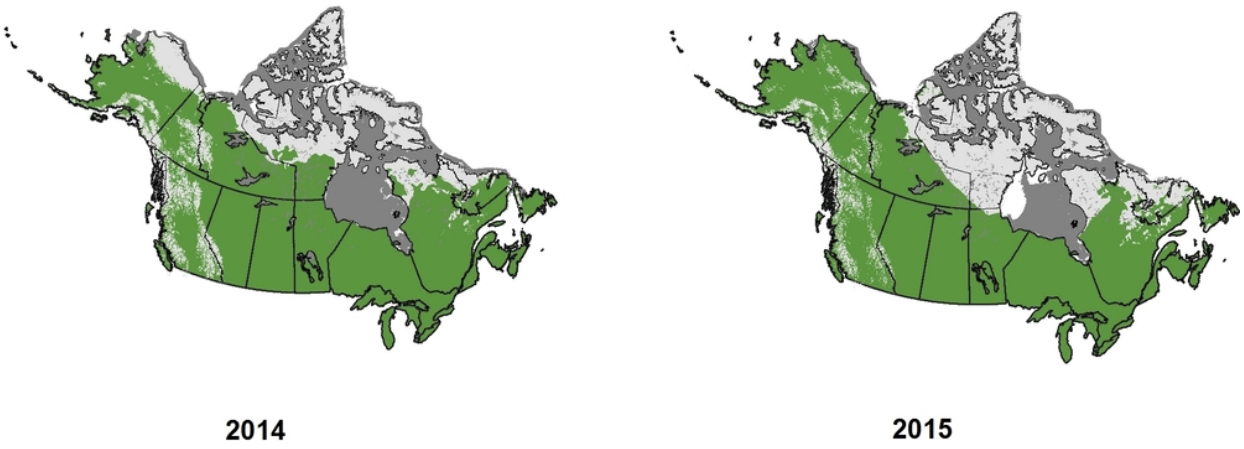


Figure 6. The extent of snow (light gray) and ice (dark gray) cover in North America on 2 June 2014 and 2 June 2015 (National Ice Center 2015).

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 2015, ice and snow melt timing varied among important goose breeding areas and was early in Alaska and the western Arctic, average to late in the north-central and south-central Arctic, and variable in the eastern Arctic. The snow and ice cover graphics (Figure 6) illustrate that the area covered with ice or snow on 2 June 2015 was less extensive in the western Arctic along the northeastern coast of Alaska and Beaufort Sea and more extensive in the central Arctic and western coast of Hudson Bay compared to the same date in 2014. Snow and ice conditions in the eastern Arctic were comparable to last year (National Ice Center 2015). Good to excellent production was expected for goose and swan populations nesting in the western Arctic and Alaska. Variable or average production was expected for goose populations in the central and eastern Arctic, with average to below average production expected in areas such as Southampton Island, along the Hudson Bay, and southern Baffin Island, where late ice and snow melt occurred.

Conditions in Southern Canada and the United States

Conditions that influence the productivity of Canada geese vary less from year to year in temperate regions than in the Arctic and subarctic. Given adequate wetland numbers and the absence of flooding, temperate-nesting Canada geese are reliably productive. Many temperate-nesting goose populations remain above management objective levels, despite efforts aimed to reduce abundance. In 2015, early spring phenology was recorded across much of the Canadian and U.S. prairies. Habitat conditions were generally rated good to fair on the Canadian prairies and fair to poor on the U.S. prairies. Southern and central portions of the western U.S. were exceptionally dry, and habitat conditions were generally poor. Later than normal nest initiation was noted in many Atlantic Flyway states and provinces, but average production was expected. Central Flyway biologists reported average or above-production despite higher than normal precipitation in May in some states, although below average production was reported in South Dakota. Nesting conditions were generally good across the states and provinces of the Mississippi Flyway, as biologists noted average or above average conditions. Overall, production of temperate-nesting Canada geese from most of their North American range was expected to be average.

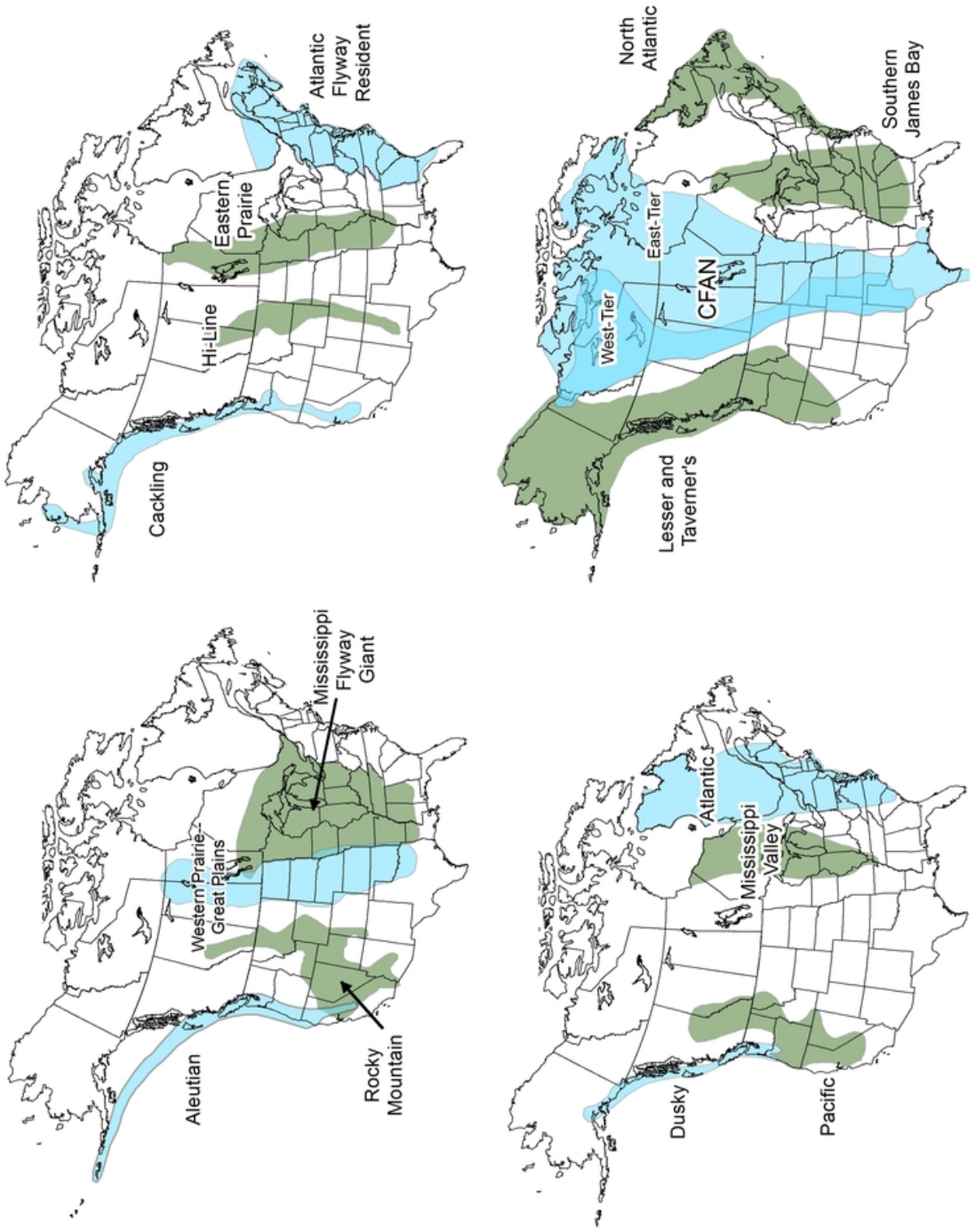
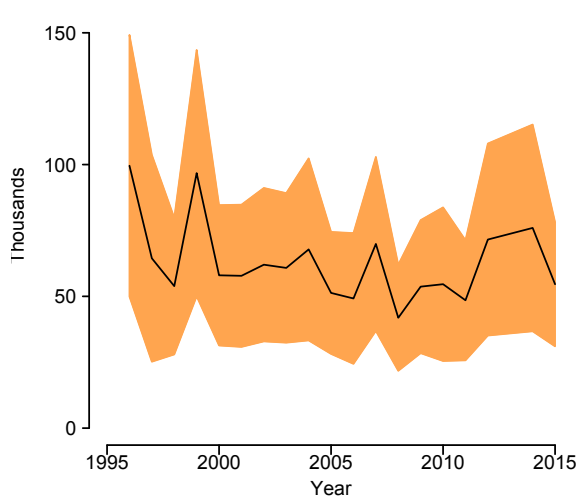
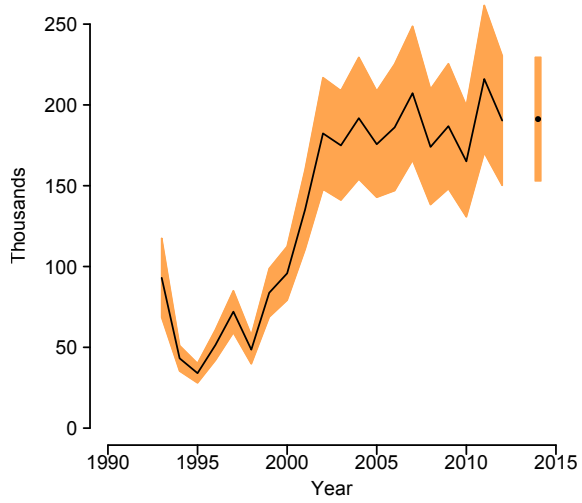


Figure 7. Approximate ranges of Canada goose populations in North America.



8.1: North Atlantic Population



8.2: Atlantic Population

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

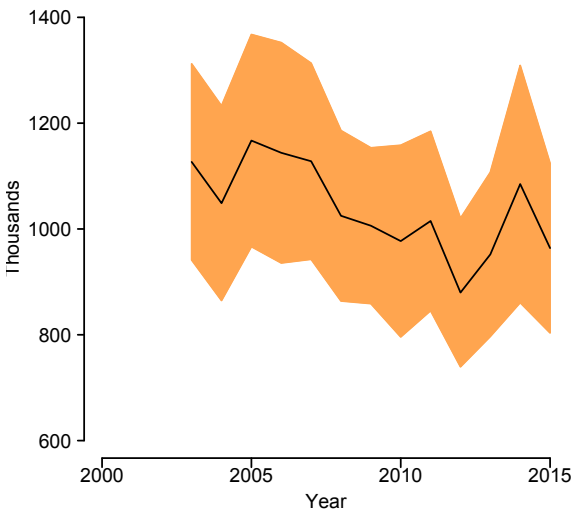
Status of Canada Geese

North Atlantic Population (NAP)

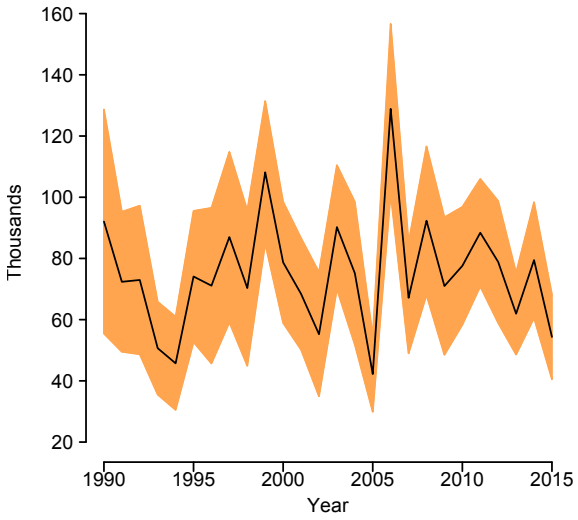
NAP Canada geese principally nest in Newfoundland and Labrador. They generally commingle during winter with other Atlantic Flyway Canada goose populations, although NAP geese have a more coastal distribution than other populations (Figure 7). The NAP goose estimate (Figure 8.1) is calculated using data from the WBPHS in Newfoundland and Labrador (strata 66–67). In 2015, the NAP total indicated pairs estimate was 54,600 (31,000–78,100), and the estimate of total indicated birds was 133,900 (75,100–192,700), similar to ($P \geq 0.360$) both the 76,000 (36,700–115,200) indicated pairs and 183,600 (87,400–279,700) total indicated birds estimated in 2014. Over the past 10 years, neither the total indicated pair estimates ($P = 0.312$) nor the total indicated bird estimates ($P = 0.318$) have shown significant trends. Biologists are 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 the new index has not yet been adopted. Habitat conditions across Atlantic Canada were generally good. Exceptions were higher elevation areas in Newfoundland and Labrador, which retained substantial snow and ice cover late into the spring. Because of this late phenology, conditions in these higher elevation and higher latitude areas were characterized as fair. The outlook for NAP goose production was rated as good, and an average fall flight of NAP geese was expected.

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). This population winters from New England to South Carolina, but the largest concentrations occur on the Delmarva Peninsula (Figure 7). This population is monitored using estimates from a spring survey of the Ungava Peninsula in northern Quebec (Atlantic Flyway Council 2008). The estimated number of breeding pairs was 161,300 (129,900–192,700), similar to ($P = 0.224$) last year's revised estimate of 191,200 (151,900–230,500). The total population estimate (breeding pairs and grouped birds) was 864,400 (689,200–1,039,500), which was similar to ($P = 0.45$) the revised 2014 estimate of 807,730 (636,800–978,700). The total population estimate may contain large numbers of molt migrant geese and both estimates are uncorrected



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.

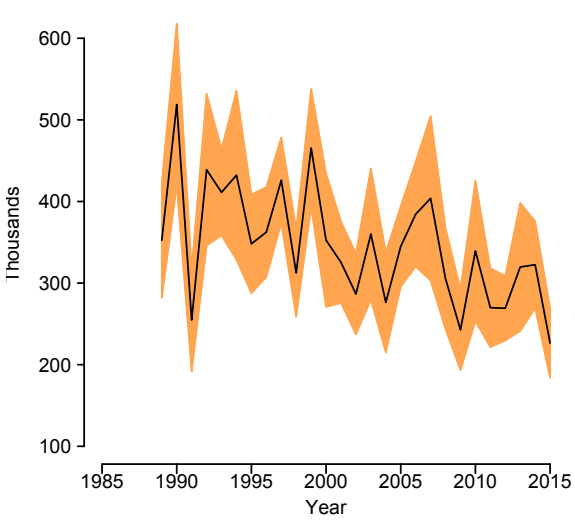
for visibility bias, so estimates represent an index to the population and should be interpreted cautiously. Over the past 10 years, breeding pair estimates have been stable ($P = 0.51$), and total population estimates have decreased by an average of 5% per year ($P = 0.015$). The proportion of indicated pairs observed as single geese (49%) was slightly below the long-term average of 51% (1993–2015; range = 34–63%). A high proportion of single geese usually forecasts above-average production. Additionally, a model that uses May temperatures and June snowfall to predict recruitment suggested an average nesting season (Sheaffer and Malecki 1996). Late spring phenology was noted along some areas of the Hudson Bay coast, where most lakes and ponds remained frozen in mid-June. Overall, an average fall flight of AP geese was expected.

Atlantic Flyway Resident Population (AFRP)

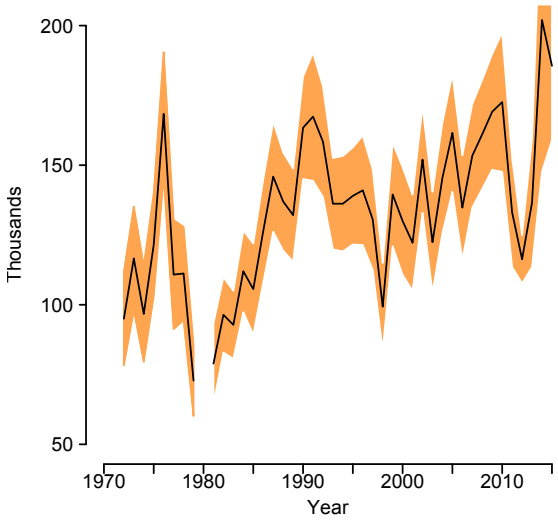
AFRP Canada geese were introduced and established throughout the entire Atlantic Flyway during the early 20^{th} century and are comprised of various subspecies. This population of large Canada geese inhabits all states of the Atlantic Flyway and southern portions of Quebec and the Maritime provinces (Figure 7). The breeding population is estimated during the spring via the Atlantic Flyway Breeding Waterfowl Plot Survey (Atlantic Flyway Council 1999). 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 963,800 (803,600–1,124,000) AFRP Canada geese was estimated during the spring of 2015, similar ($P = 0.389$) to the 2014 estimate of 1,084,900 (860,800–1,309,100; Figure 9.1), and similar to the long-term (1993–2015) average of 1,052,000 ($P = 0.338$). The 10-year trend for these estimates was not significant ($P = 0.080$). Cold temperatures and high snowfall delayed spring phenology across much of the survey area by 5–10 days. Despite heavy winter snows, drier than normal spring conditions were reported in Massachusetts, New Jersey, Pennsylvania, and Rhode Island. Although nest initiation was later than normal over much of the survey area, average production and an average fall flight was expected.

Southern James Bay Population (SJBP)

SJBP Canada geese nest on Akimiski Island and in the Hudson Bay Lowlands to the west and south of James Bay. This population winters from southern Ontario and Michigan to Mississippi, Alabama, Georgia, and South



10.1: Mississippi Valley Population



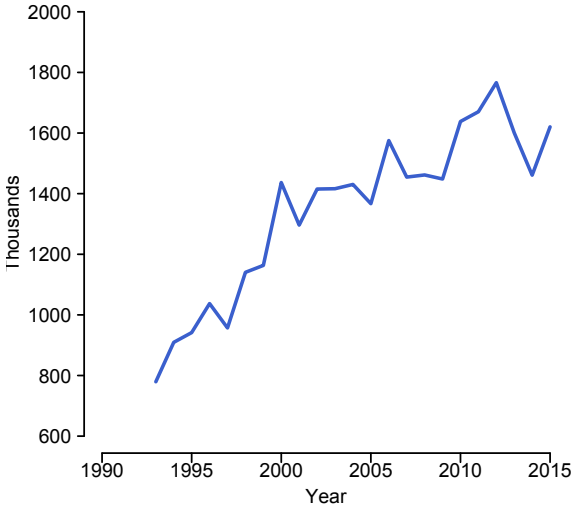
10.2: Eastern Prairie Population

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

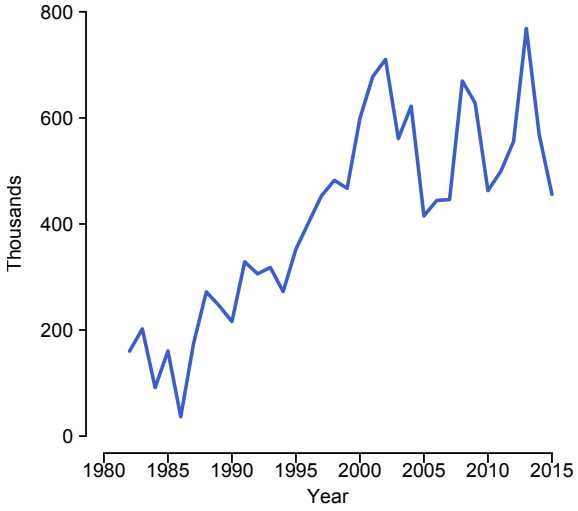
Carolina (Figure 7). Breeding and total SJBP geese are monitored via a spring survey on their breeding grounds (Mississippi and Atlantic Flyway Councils 2008). The estimated number of breeding SJBP geese in spring 2015 was 54,300 (40,500–68,200), 32% fewer than ($P = 0.036$) the revised 2014 estimate of 79,500 (60,600–98,400). The total population index of 60,700 (45,900–75,500) was similar to ($P = 0.076$) last year's index of 82,600 (50,500–77,600; Figure 9.2). The index of breeding geese decreased by 5% per year ($P = 0.053$), and the total goose index decreased by 7% per year ($P = 0.006$) over the 2006–2015 time series. Additionally, transect-level analyses indicated that breeding bird numbers were down relative to recent years on both the mainland and on Akimiski Island. A minor coding error was corrected this year, so the revised time series differs slightly from those presented in previous reports. Spring phenology was much earlier than in 2013 and 2014, and similar to the long-term average. There was an average to below-average snow pack on the SJBP range last winter, and spring was characterized by a rapid snow melt and relatively early arrival and dispersal by SJBP geese. The timing of peak hatch at Akimiski Island (6 to 9 June) was similar the long-term average. An average fall flight was expected.

Mississippi Valley Population (MVP)

MVP Canada geese nest in northern Ontario, principally in the Hudson Bay lowlands, west of the Hudson and James Bays. This population primarily concentrates during fall and winter in Wisconsin, Illinois, and Michigan (Figure 7). Breeding and total MVP geese are monitored via a spring survey on their breeding grounds (Mississippi Flyway Council 1998). Surveys conducted in 2015 produced an estimate of 226,500 (183,800–269,200) MVP breeding adults, 30% fewer than the revised estimate of 322,500 (269,400–375,600) for 2014 ($P = 0.006$; Figure 10.1), and about 35% below the 1989–2014 average of 351,000. Estimates of breeding adults during 2006–2015 have not shown a statistically significant trend ($P = 0.075$). Transect level counts also indicated that the number of breeding pairs was significantly lower than the 2010–2014 average ($P < 0.001$). Surveys indicated a total population of 254,800 (208,500–301,200), 45% fewer ($P = 0.019$) than the 2014 estimate of 466,100 (295,200–636,900). Spring phenology in 2015 was similar to the 5-year average. An average winter snowpack (plus a mid-May snowfall) persisted longer than normal but not enough to set back phenology noticeably. River break-ups were similar to the long-term average, and snow



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).

melt at the Burntpoint Creek research station east of Peawanuck was similar to the 7-year average. There was little snow on nesting areas, and wetland conditions were excellent as of 1 June. Crews there estimated an average breeding effort, average levels of nest predation, and a peak hatch between 14 and 18 June. Low breeding pair numbers combined with an average phenology and nesting effort suggested an average to below-average fall flight for MVP geese.

Eastern Prairie Population (EPP)

EPP Canada geese nest in the Hudson Bay Lowlands of Manitoba and concentrate primarily in Manitoba, Minnesota, and Missouri during the winter (Figure 7). This population is surveyed during the spring on their breeding grounds (Mississippi Flyway Council 2008). Because of the variable influence of molt migrants, EPP geese are monitored using the estimate of geese counted as singles and pairs, as they better represent geese nesting in the current year. The 2015 estimate of 142,900 (121,700–164,100) single and paired EPP geese was similar to last year's estimate of 157,800 (133,700–181,900; $P = 0.363$; Figure 10.2). The 2015 spring estimate of 185,600 (158,900–212,300) total geese was similar to the 202,000 (174,300–229,700) estimated in 2014 ($P = 0.403$). Neither of these estimates exhibited a trend over the 2006–2015 time series ($P \geq 0.392$). The timing of spring was earlier than average throughout the EPP Canada goose range. May temperatures in Churchill were similar to 2014, and nearly 2^oC above the long-term (1970–2014) average. Biologists sampled nests near the town of Churchill and estimated a median hatch date of 14 June. Average to above-average production and an above-average fall flight were expected for EPP geese.

Mississippi Flyway Giant Population (MFGP)

MFGP Canada geese nest in the Mississippi Flyway states, in southern Ontario and southern Manitoba. Giant Canada geese were reestablished or introduced in all Mississippi Flyway states, and they now represent a large proportion of all Canada geese in the Mississippi Flyway (Figure 7). The total population is estimated during spring surveys within the Mississippi Flyway states and provinces (Mississippi Flyway Council 1996). In 2015, biologists estimated 1,620,400 MFGP geese, 11% higher than the revised 2014 estimate of 1,461,000 (Figure 11.1). Over the past 10 years, this population does not show a significant trend ($P = 0.310$), following many years of increasing abundance.

Nesting conditions were generally good across the states and provinces of the MFGP range, as all biologists noted average (IL, LA, MN, MS, OH, ON, WI) or above average (AL, IN, IA, MB) conditions. Some localized spring flooding occurred in Illinois and Iowa, but this did not appear to affect productivity. MFGP Canada geese remain abundant across the Mississippi Flyway, and fall abundance will likely be similar to 2014.

Western Prairie and Great Plains Populations (WPP/GPP)

WPP Canada geese are composed of mid-sized and large Canada geese that nest in eastern Saskatchewan and western Manitoba. GPP Canada geese are 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 the Midwinter Survey and WBPHS provide an index of this population within its primary wintering and breeding ranges, respectively. During the 2015 Midwinter Survey, 455,800 WPP/GPP geese were counted, 20% fewer than the 568,800 recorded in 2014 (Figure 11.2). Midwinter indices have shown no trend from 2006 to 2015 ($P = 0.540$). In 2015, the estimated spring population in the portion of WPP/GPP range included in the WBPHS (strata 21–25, 30–40, 43–49) was 1,483,700 (1,320,900–1,646,500) geese, similar to last year's estimate of 1,381,200 (1,226,400–1,536,000; $P = 0.895$). The WBPHS estimates have increased at an average of 9% per year since 2006 ($P \leq 0.001$). Conditions were rated as good in Saskatchewan, Manitoba, and central North Dakota, but fair to poor over the rest of the Dakotas. Overall, most of the WPP/GPP range was drier than in 2014. Severe storms in May could have affected young goslings, but biologists in North Dakota, Nebraska, and Oklahoma noted that production in those states was above average nonetheless. However, below average production was noted in South Dakota. Overall, average production and an average fall flight were expected.

Central Flyway Arctic Nesting Canada Geese (CFAN)

As of 2014, the Short Grass Prairie (SGPP) and Tall Grass Prairie (TGPP) populations of Canada geese are now managed as one population, Central Flyway Arctic Nesting Canada geese (CFAN), and referred to as West-tier and East-tier CFAN, respectively (Central and Mississippi Flyway Councils 2013). These small Canada geese nest in different areas, but mix on their wintering areas. East-tier CFAN 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. East-tier CFAN winter mainly in Oklahoma, Texas, and northeastern Mexico (Figure 7). West-tier CFAN 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).

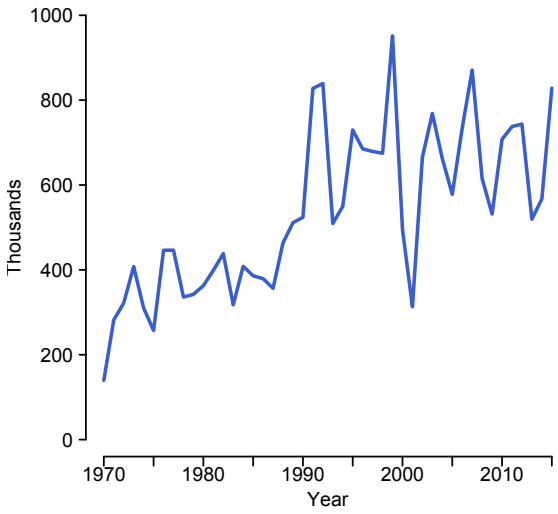
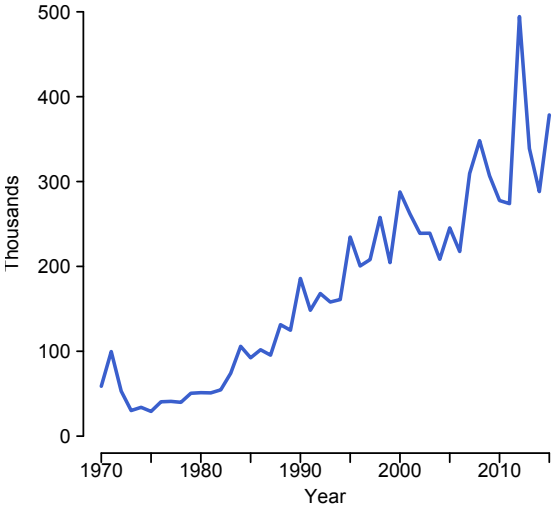
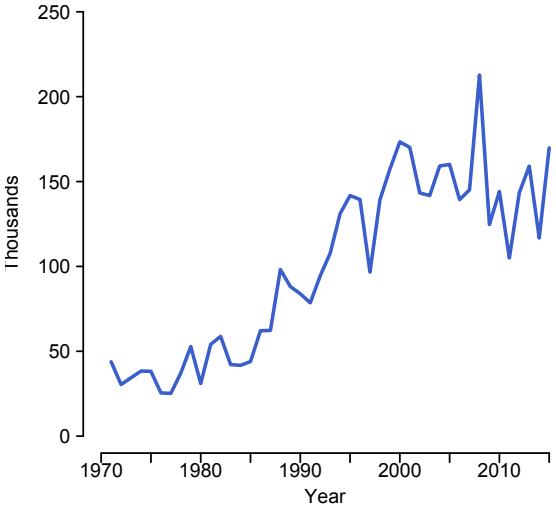


Figure 12. Estimated numbers of Central Flyway Arctic Nesting Canada geese estimated during winter surveys.



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.

The Midwinter Survey provides an index of CFAN within their winter range of the Central Flyway. In 2015, 828,100 CFAN were counted, 46% greater than the 2014 index of 567,300 (Figure 12). Over the past 10 years, Midwinter Survey counts of the CFAN population have not exhibited a significant trend ($P = 0.634$). Because East-tier CFAN nest outside of the area covered by the WBPHS, no breeding ground abundance estimates are available. Available information suggests that the production of East-tier CFAN will be variable, and likely below-average or average in eastern portions of their range and average in western portions of their range. In 2015, the estimated spring abundance of West-tier CFAN geese in the Northwest Territories (WBPHS strata 13–18) was 291,800 (186,700–395,800), similar to last year's estimate of 184,800 (117,100–252,400, $P = 0.094$). WBPHS estimates have increased an average of 9% per year since 2005 ($P < 0.001$). Conditions in boreal forest over most West-tier CFAN nesting areas were assessed as good. Spring breakup was early in the Northwest Territories, and there was no significant flooding on the Mackenzie River Delta, where conditions for breeding waterfowl were excellent. Thus, production of West-tier CFAN in 2015 was expected to be above average.

Hi-line Population (HLP)

HLP Canada geese are large geese that nest in southeastern Alberta, southwestern Saskatchewan, eastern Montana and Wyoming, and in Colorado. This population winters in these states and central New Mexico (Figure 7). The primary index of breeding HLP geese 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. A winter index of HLP geese is based on Midwinter Survey counts in portions of Montana, Wyoming, Colorado, New Mexico, Nebraska, and Alberta, and Saskatchewan (Central Flyway Council 2010). In 2015, breeding population surveys yielded an estimate of 378,500 geese, a 31% increase over last year's value of 288,200 (Figure 13.1). The breeding population survey indices have not shown a significant trend over the 2006–2015 time frame ($P = 0.173$). The Midwinter Survey index for 2015 was 238,800, 15% lower than last year's count of 281,300. Over the past 10 years, Midwinter Survey indices for this population have not shown a significant trend ($P = 0.129$). Overall, wetland conditions were drier than in

2014, and most of eastern Montana was rated only fair. Conditions were better in the southern Saskatchewan and southern Alberta portions of the HLP range, where conditions were rated good. Spring phenology was early, and goose broods were commonly observed during the survey. Late rains could have adversely affected some broods, but also improved pond conditions, especially in Montana. Average production and an average fall flight were expected.

Rocky Mountain Population (RMP)

RMP are large Canada geese that nest in southern Alberta and western Montana, and the inter-mountain regions of Utah, Idaho, eastern Nevada, Wyoming, and Colorado. This population winters mainly in central and southern California, Arizona, Nevada, Utah, Idaho, and Montana (Figure 7). An index of breeding RMP geese is 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 (Pacific Flyway Council 2000*b*). The index for 2015 was 169,800 geese, 46% higher than the index from 2014, which totaled 116,700 (Figure 13.2). RMP indices exhibited no trend over the 2006–2015 time series ($P = 0.782$). Habitat conditions were fair to poor in western Montana and southern Alberta, and dry in many western states. Average to below-average gosling production and a fall flight similar to last year was expected.

Pacific Population (PP)

PP Canada geese are large geese that nest and winter west of the Rocky Mountains from northern Alberta and British Columbia south through the Pacific Northwest to California (Figure 7). A total PP goose index is based on breeding ground surveys in Alberta, British Columbia, Washington, Oregon, California, Nevada, Idaho, and Montana (Pacific Flyway Council 2000*a*). The total PP goose index in 2015 was 256,800, 59% higher than the 161,800 counted in 2014. There was no trend in the total PP index from 2006 to 2015 ($P = 0.834$). Most PP geese are surveyed in Alberta (WBPHS strata 76–77). During 2015, 153,900 (89,400–218,400) geese were estimated in this area, an increase of 127% ($P = 0.014$) over the 2014 estimate of 67,800 (43,500–92,100). The 10-year trend for PP geese counted in Alberta was non-significant ($P = 0.418$). Conditions were rated fair to poor in Alberta, but most wetlands retained enough water to last through the brood-rearing season. In British Columbia conditions were good to fair. Habitat conditions in much of the southern portions of the western U.S. were poor, with extremely dry conditions. Gosling production should be average to below average, with a fall flight similar to last year.

Dusky Canada Geese

Dusky Canada geese predominantly nest on the Copper River Delta of southeastern Alaska, and winter in the Willamette and Lower Columbia River Valleys of Oregon and Washington (Figure 7). Dusky Canada geese are surveyed on their breeding grounds on the Copper River Delta and Middleton Island, Alaska (Pacific Flyway Council 2008; Figure 14). In 2015, the estimate for breeding Dusky Canada geese was 17,700 (14,400–21,000), which was similar to ($P = 0.300$) the 2014 estimate of 15,400 (12,500–18,300). Over the past 10 years, these estimates have increased by 7% per year ($P = 0.045$). This estimate, along with the aerial indicated breeding

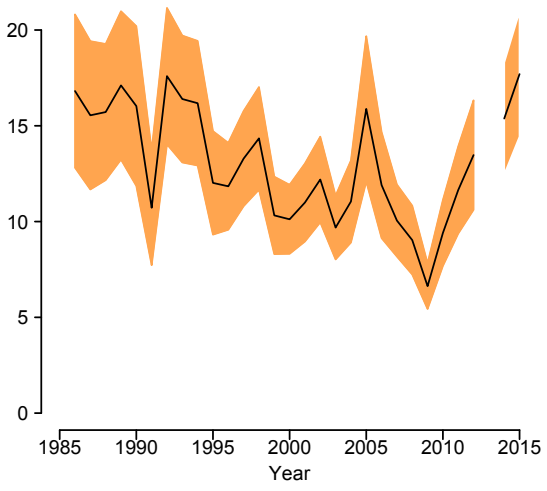


Figure 14. Estimated numbers of breeding adult Dusky Canada geese (95% confidence intervals), 1986–2015.

bird index of 4,200 and aerial indicated total birds index of 6,100, were among the highest recorded in the 30 years of the survey. Population increases could be due in part to high production on the Copper River Delta from 2008–2013, and higher numbers on Middleton Island. In 2015, southcentral Alaska experienced a warm spring compared to most years. For the second year in a row, no snow was observed on the survey area, which was somewhat unusual as some snow and ice are usually present. Conditions were good to excellent, and above-average production and an above-average fall flight were expected.

Cackling Canada Geese

Cackling Canada geese nest on the Yukon–Kuskokwim Delta (YKD) of western Alaska. This population primarily winters in the Willamette and Lower Columbia River Valleys of Oregon and Washington (Figure 7). The total fall Cackling Canada goose population is estimated by counts of adults during the YKD Coastal Zone Survey during the spring, expanded by a ratio derived from neck collared individuals observed in the fall and winter (Pacific Flyway Council 1999; Appendix D.1). The estimate for 2015 was 339,700 (289,100–390,300) geese, similar to last year's estimate of 281,300 (243,700–318,800; $P = 0.069$). Over the 2006–2015 time series, there has been no significant trend ($P = 0.327$ Figure 15). With high observed counts and early spring phenology on the YKD, above-average production and fall flight were expected.

Lesser and Taverner's Canada Geese

Lesser and Taverner's Canada geese 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 and southcentral regions.

Population indices for lesser Canada geese in 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),

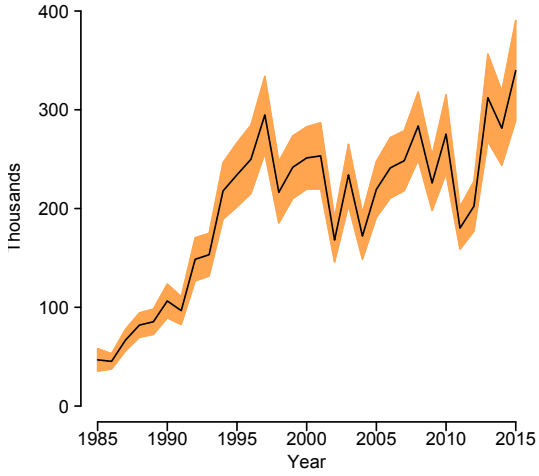


Figure 15. Estimated numbers of Cackling Canada geese (predicted fall goose population, with 95% confidence intervals).

and stratum 12 (Old Crow Flats) of the WBPHS. The 2015 breeding index was 3,100, 157% higher than the 2014 index of 1,200. The 2015 total index was 4,000, 77% higher than the 2014 index of 2,300. From 2006 to 2015, the index of total geese decreased by 10% per year ($P = 0.035$), and the trend of the breeding goose index was not significant ($P = 0.092$).

Population indices for Taverner's Canada geese in Alaska are based on expanded counts from three breeding pair survey efforts: the Arctic Coastal Plain Breeding Pair Survey, the Yukon–Kuskokwim Delta (YKD) Coastal Zone Survey, stratum 10 (Seward Peninsula), stratum 11 (Kotzebue Sound), and stratum 9 (inland portions of the YKD) of the WBPHS. The 2015 Taverner's indices were not available at the time of this report, but will be reported at a later date. Productivity and fall flights of both lesser and Taverner's Canada geese were expected to be above average, as early spring conditions were favorable for breeding throughout Alaska.

Aleutian Canada Geese

Aleutian Canada geese nest primarily on the Aleutian Islands and winter along the Pacific Coast as far south as central California (Figure 7). The Aleutian Canada goose was listed as endangered under the Endangered Species Act (ESA) in 1967 when abundance was less

than 1,000 individuals. As abundance increased, it was downgraded to threatened in 1990 and removed from protection under the ESA in 2001. The total Aleutian goose population during the fall and winter is estimated from mark-resight observations of neck-banded geese in California (Pacific Flyway Council 2006*a*). Because of the estimation procedure, the time series is revised annually. The preliminary population estimate during the winter of 2015 was 189,100 (154,000–224,200), similar to the 2014 estimate of 147,600 (122,300–172,900; $P = 0.060$; Figure 16). These estimates have increased an average of 7% per year since 2006 ($P = 0.004$), and the latest estimate is an order of magnitude higher than the 1996 estimate of 15,400 (14,300–16,500). With high winter abundance observed and early spring conditions reported on the Alaska Peninsula and Aleutian Islands, productivity and falls flights are expected to be average to above-average.

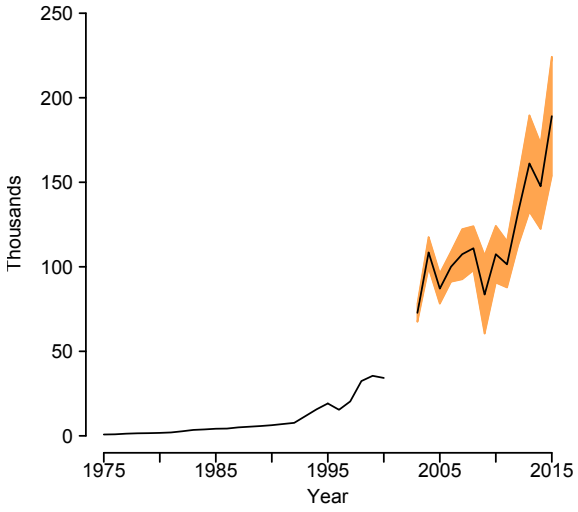


Figure 16. Estimated numbers of Aleutian Canada geese (winter geese, with 95% confidence intervals).

Status of Light Geese

The term light geese collectively refers to Ross's geese and both the lesser (*C. c. caerulescens*) and greater (*C. c. atlantica*) snow goose subspecies (including all hybrids, and both white and blue color phases). There are three populations of lesser snow geese based on their breeding ranges (Wrangel Island, Western Arctic, and Mid-continent) and one population based upon winter distribution (Western Central Flyway). Lesser snow geese and Ross's geese occur in many wintering areas together and are not typically differentiated during the Midwinter Survey, so, we report indices of light geese from this survey. Most light goose populations exceed population objectives and biologists remain concerned about their high abundance.

Ross's Geese

Ross's geese nest primarily 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 primarily winter in California, New Mexico, Texas, and Mexico, and in increasing numbers in Louisiana and Arkansas (Figure 17). Ross's geese are annually surveyed at Karrak Lake in the Queen Maud Gulf region, their largest nesting colony. Since 2007, Ross's geese have outnumbered lesser snow geese at Karrak Lake, and abundance of nesting Ross's geese has been relatively stable around 700,000. Estimates from Karrak Lake are typically not available until after the current year's breeding season and the publication of this report, so we present the previous year's estimate. The estimate of nesting Ross's geese at Karrak Lake during 2014 was 659,600 (594,200–724,913), which was a 22% increase from the 2013 estimate of 539,500 (502,800–576,200; $P = 0.002$; Figure 18). There was not a significant trend during 2005–2014 ($P = 0.728$). Ice breakup at the Karrak Lake colony was 1 day earlier than the long-term average (1991–2015), and goslings were first seen 2 days earlier than average, suggesting average production and an average fall flight for Ross's geese from this area. Production in eastern portions of their range may be below average due to late spring conditions.

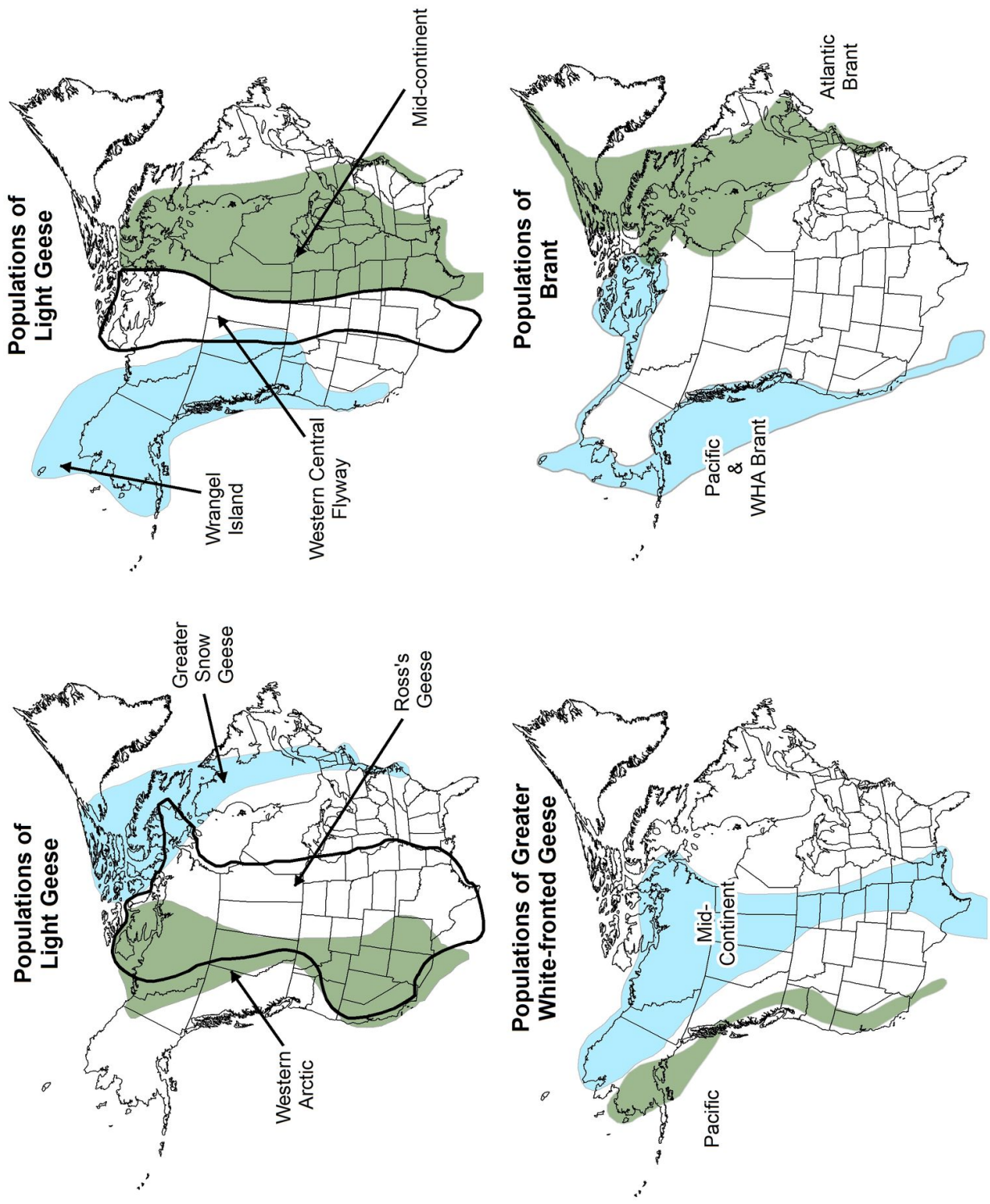


Figure 17. Approximate ranges of brant and snow, Ross's, and white-fronted goose populations in North America.

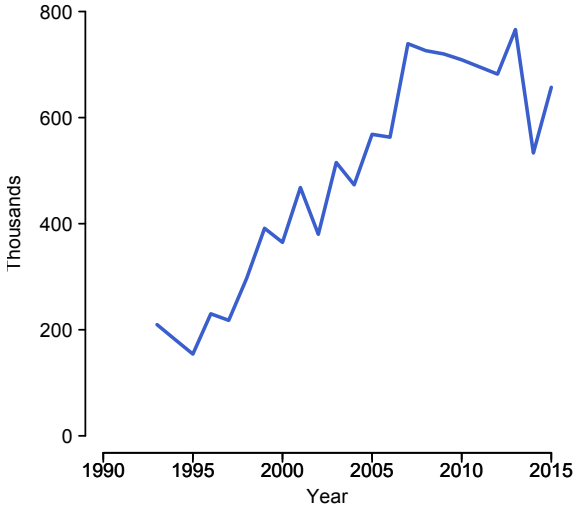


Figure 18. Estimated numbers of nesting adult Ross's geese at the Karrak Lake colony, Nunavut (1993–2014).

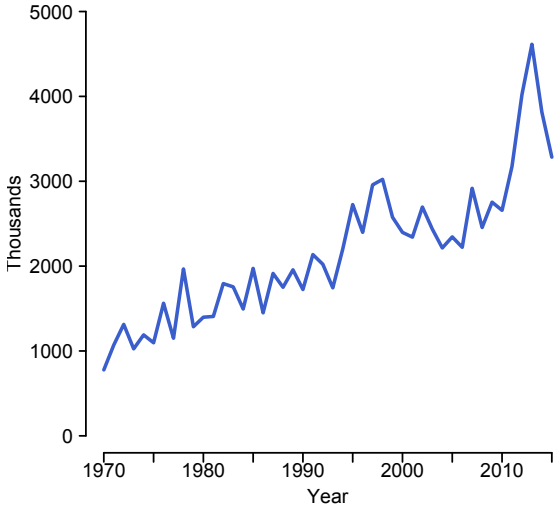


Figure 19. Estimated numbers of Mid-continent Population light geese (winter geese).

Mid-continent Population Light Geese (MCP)

The MCP includes lesser snow geese and Ross's geese from the central Arctic. Midcontinent lesser snow geese nest on Baffin and Southampton Islands, along the west coast of the Hudson Bay, and throughout the Queen Maud Gulf region in the central Arctic (Figure 17). These geese winter primarily in eastern Texas, Louisiana, and Arkansas and are indexed by the Midwinter Survey. In 2015, biologists counted 3,284,100 light geese in these wintering areas, a 14% decrease relative to the 2014 index of 3,814,7000 (Figure 19). Winter indices during 2006–2015 increased by an average of 6% per year ($P = 0.007$). Ice and snow conditions and phenologies on Southampton Island, western portions of the Hudson Bay, and Baffin Island were later than average, but conditions were generally average in the Queen Maud Gulf region and central Arctic. Overall, available information suggested average to below-average MCP production and fall flight.

Western Central Flyway Population (WCFP)

The WCFP includes lesser snow geese and Ross's geese wintering in the western Central Flyway portions of southeastern Colorado, New Mexico, the Texas Panhandle, and the northern highlands of Mexico. Most of these geese nest in the western and central Arctic, with large nesting colonies near the Queen Maud Gulf and on Banks Island. Many of these geese stage during the fall in eastern Alberta and western Saskatchewan (Figure 17). WCFP geese wintering in the U.S. portion of their range are surveyed annually by the Midwinter Survey. Their entire winter range, including Mexico, is usually surveyed once every three years, but Mexico surveys have not been conducted since 2009. During the 2015 Midwinter Survey in the U.S. portion of the WCFP range, 243,200 light geese were counted, 8% fewer than the 264,800 counted in 2014 (Figure 20). Midwinter Survey indices for the WCFP have increased 5% per year from 2006 to 2015 ($P = 0.035$). Breeding conditions were average to above average in the central and western Arctic, and an above-average fall flight for WCFP geese was expected.

Western Arctic (WA) and Wrangel Island (WI) Populations

Lesser snow geese in the Pacific Flyway originate from nesting colonies in the western and central Arctic and Wrangel Island, Russia. WA lesser snow geese nest primarily in the Egg River colony on Banks Island (approximately 88% of the population), with smaller colonies in coastal areas of the Northwest Territories on the Anderson and Mackenzie River Deltas and

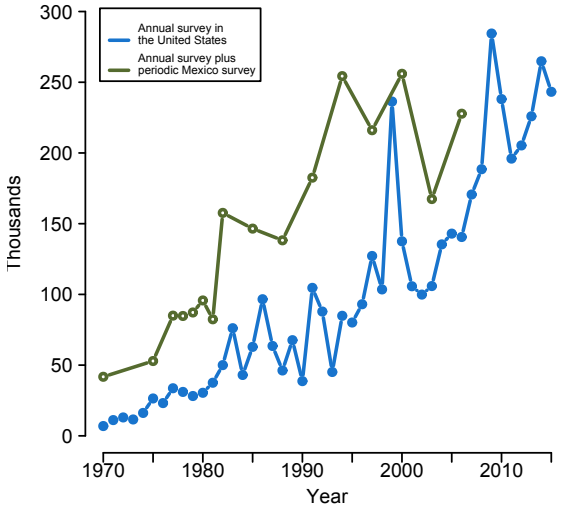


Figure 20. Estimated numbers of Western Central Flyway Population light geese (winter geese).

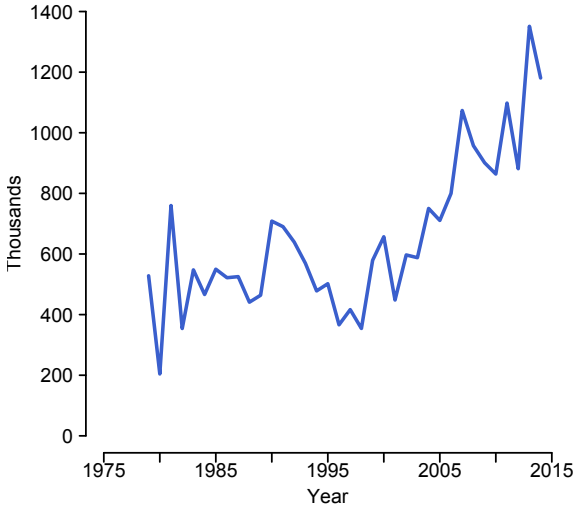


Figure 21. Estimated numbers of Western Arctic/Wrangel Island population snow geese (fall geese).

Kendall Island, and along the Alaskan Arctic Coastal Plain. WI lesser snow geese nest on Wrangel Island, Russia and represent the last major snow goose population breeding in Asia. WA and WI lesser snow geese mix during winter and also occur with MCP lesser snow geese and Ross's geese. WA lesser snow geese primarily winter in central and southern California, and the Western Central Flyway areas of southeastern Colorado, New Mexico, the Texas Panhandle, and the northern highlands of Mexico. WI lesser snow geese principally winter in the Puget Sound area of Washington and in northern and central California (Figure 17). Light geese in the Pacific Flyway are indexed by special surveys in California and the Skagit/Fraser area in Washington and British Columbia during the fall and December. The fall 2014 index of light geese from these surveys was 1,180,700, 13% lower than the 1,351,200 counted 2013 (Figure 21). These indices have increased by an average of 5% per year from 2005 to 2014 ($P = 0.018$). Breeding ground surveys are periodically conducted for WA (Pacific Flyway Council 2013) and WI lesser snow geese (Pacific Flyway Council 2006*c*). In 2015, photographic breeding ground surveys for WA lesser snow geese were not conducted. However, biologists noted high lesser snow goose nest survival (>95%) on the Colville River Delta and Ikpikpuk colonies on the Alaskan Arctic Coastal Plain. The timing of gosling development was earlier than any prior documented instance at the latter site. Favorable nesting conditions were also observed across much of the North Slope of Alaska and western Arctic. On Wrangel Island, the 2015 spring WI lesser snow goose preliminary estimate was 107,800 nests, which was the highest count on record, and 49% above the last survey in 2011. With favorable breeding conditions in northern Alaska and the western Arctic and high breeding abundance on Wrangel Island, gosling production and fall flights from these two populations should be above average.

Greater Snow Geese

Greater snow geese principally nest on Bylot, Axel Heiberg, Ellesmere, and Baffin Islands, and in Greenland, and winter along the Atlantic coast from New Jersey to North Carolina (Figure 17). This population is 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 (Atlantic Flyway Council 2009). The preliminary estimate from the 2015 spring survey was 818,000 (757,000–879,000) geese, similar to the 796,000 (733,000–859,000) estimated last year ($P = 0.623$; Figure 22). Spring estimates of greater snow geese have shown no trend over the past 10 years ($P = 0.598$), which provides some

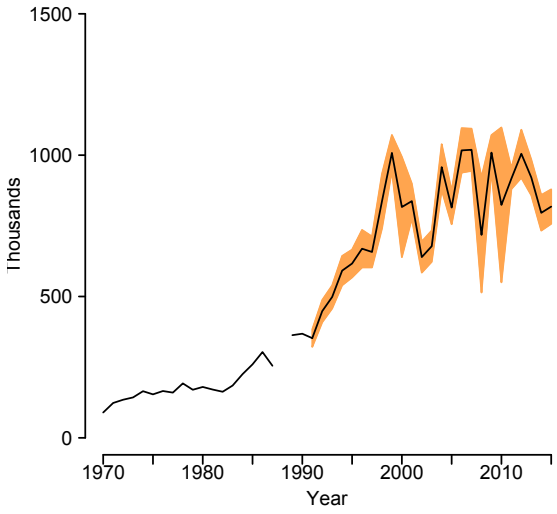


Figure 22. Estimated numbers of greater snow geese (spring staging geese, with 95% confidence intervals), 1970–2015.

evidence that this over-abundant population is stabilizing. During the 2015 Midwinter Survey in the Atlantic Flyway 250,400 light geese were counted, 8% fewer than the 271,600 counted during the 2014 survey. At Bylot Island, breeding conditions for greater snow geese were good. There was a moderate snow pack last winter, and snow melt was fairly rapid in early June. Spring and early summer weather was generally cool and dry. Greater snow geese arrived relatively early, and the colony density was average. Predator density and activity in the colony was higher than last year, but lemming abundance remained moderate and should lessen predation impacts. Mean nest initiation date (11–12 June), mean hatching date (9 July), and mean clutch size (3.60 eggs/nest) were all at or near their 20-year averages, and mean nesting success to late incubation (84%) was 18% higher than the long-term average. Overall, an average to above-average fall flight was expected for greater snow geese in 2015.

Status of Greater White-fronted Geese

Pacific Population White-fronted Geese

Pacific Population White-fronted geese primarily nest on the Yukon–Kuskokwim Delta (YKD) of Alaska and winter in the Central Valley of California (Figure 17). The predicted fall population index for Pacific Population White-fronted geese is based on the number of estimated indicated total birds from the YKD Coastal Zone Survey and the Alaska–Yukon Breeding Population and Habitat Survey. These estimates are then expanded by a factor derived from the correlation of these indices with past fall counts in Oregon and California (Pacific Flyway Council 2003). The 2015 predicted fall estimate is 479,100, 25% lower than the 2014 estimate of 637,200 (Figure 23), but the ten year trend was not significant ($P = 0.415$). From the YKD Coastal Zone survey, indices for total and breeding birds were 140,300 (112,600–168,100) and 60,700 (47,500–73,900), which were 32% and 30% lower, respectively, than those of 2014. Ten year trends for these indices were not significant ($P \geq 0.537$). Late timing of the survey relative to the early spring phenology, may have contributed to low counts. Early spring phenology on the YKD bodes well for production, but, with low observed counts, average production and fall flights are expected.

Mid-continent Population White-fronted Geese

Mid-continent Population White-fronted geese nest across a broad region from central and northwestern Alaska to Foxe Basin on Baffin Island. This population concentrates in southern Saskatchewan and Alberta during the fall and in Texas, Louisiana, Arkansas, and Mexico during winter (Figure 17). These geese are counted during a special fall aerial survey in Saskatchewan and Alberta (Central, Mississippi, and Pacific Flyway Councils 2005). In fall 2014, 1,005,600 geese were counted (Figure 23). No survey was conducted in 2013, but the 2014 estimate was 29% higher than the fall count of 777,900 geese in 2012. Over the 2005–2014 time period, annual estimates did not exhibit a significant trend ($P = 0.065$). With good nesting conditions in the western Arctic and Alaska and average or variable conditions in the central and eastern Arctic, gosling productivity and the fall flight are expected to be average to above average.

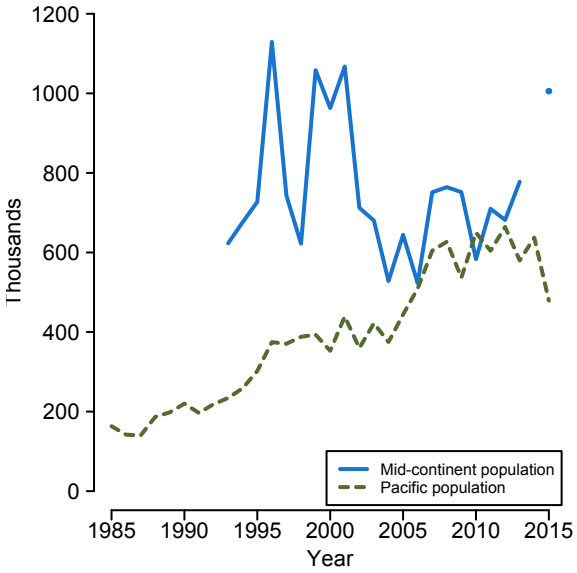


Figure 23. Estimated numbers of mid-continent population and Pacific population white-fronted geese (fall geese).

Status of Brant

Atlantic Brant (ATLB)

Atlantic brant primarily nest on islands of the eastern Canadian Arctic and winter along the Atlantic Coast from Massachusetts to North Carolina. The Midwinter Survey provides an index of this population within its winter range of the Atlantic Flyway (Atlantic Flyway Council 2002; Figure 17). The 2015 Midwinter Survey index was 111,400 brant, 16% lower than the 2014 estimate of 132,900 (Figure 24). These estimates have declined by an average of 3% per year over the 2006–2015 time period ($P = 0.014$). Productivity from the previous year is estimated by the proportion of juveniles in the population during November and December. In the fall of 2014, juveniles comprised 9.5% of the population. For the past 3 years, the proportion of juveniles in the counts have been below 10% and well below the long-term average of 18%. At East Bay on Southampton Island, biologists reported typical brant arrival dates, but later than average snow melt, with substantial snow still present in mid-June. With later than average spring phenology in portions of the eastern Arctic, below average production of Atlantic brant was expected again in 2015.

Pacific Brant (PACB) and Western High Arctic Brant (WHAB)

Pacific 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). Western High Arctic Brant nest on the Parry Islands of the Northwest Territories and Nunavut (Figure 17). They stage during fall at Izembek Lagoon, Alaska, and 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. For many years Pacific and WHA Brant were surveyed and managed separately. However, they cannot be reliably distinguished while on their wintering grounds, so they are now indexed together using Mid-winter surveys in the U.S. and Mexico. Due to political unrest in Mexico, beginning in 2008, aerial counts could not be consistently completed. Work by Palacios and Avila (Olson, S. M., Compiler 2015) suggested that ground surveys in Mexico could adequately index Pacific brant, and these numbers are now used in the time series when aerial counts are not available. The time series presented here includes WHA and Pacific brant (U.S. aerial and Mexico aerial

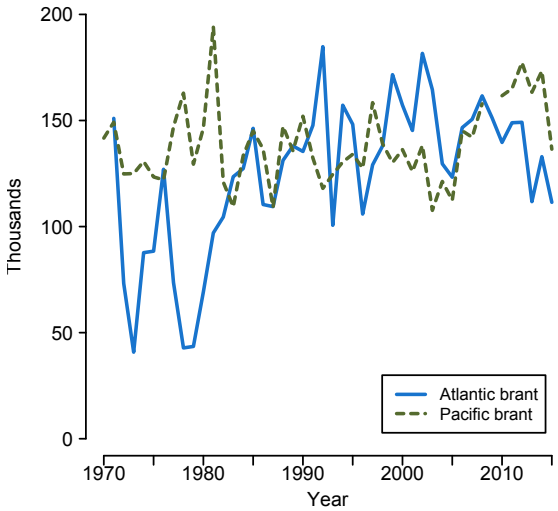


Figure 24. Numbers of Atlantic and Pacific brant estimated during winter surveys.

or ground counts) and thus differs from those presented in prior reports. In 2015, these surveys recorded 136,500 brant, which was 21% lower than the 2014 estimate of 173,300 (Figure 24). The ten-year trend from 2006 to 2015 was not significant ($P = 0.430$). The YKD Coastal Zone Survey was not specifically designed to assess populations of colonial nesting species, but it provides useful information to better understand population trends and distribution. In 2015, brant indices for total and breeding birds were 19,800 and 3,800, 30% and 5% lower respectively than in 2014. These indices have not shown a significant trend during the past ten years ($P = 0.989$ and 0.200). Late timing of the survey relative to the early spring phenology, may have contributed to low counts. Spring was early on the YKD and throughout Alaska and the western Arctic. Based on satellite imagery, biologists expected WHAB production on the Parry Islands to be good, and high brant nest survival (86%) was noted on the Colville Delta on the Alaskan Arctic Coastal Plain. Overall, production and fall flight of Pacific brant was expected to be average to above average.

Status of Emperor Geese

Emperor geese breed along coastal areas of the Bering Sea, with the largest concentration on the Yukon–Kuskokwim Delta (YKD) in Alaska. Emperor geese stage along the Alaska Peninsula during the fall and spring, and winter on the Aleutian Islands (Figure 25). Emperor geese are surveyed annually on spring staging areas in southwestern Alaska, and this survey is used as the management index (Pacific Flyway Council 2006*b*; Figure 26.1). The 2015 spring count of emperor geese was 98,200, 23% above last year's count of 79,800 and 49% above the long-term average during 1981–2014. The spring index for Emperor geese was the highest count recorded in more than three decades. The ten-year trend of the spring survey was non-significant ($P = 0.278$). From the YKD Coastal Zone survey, emperor goose indices for total and breeding birds were 26,200 (23,100–29,300) and 14,600 (13,000–16,300), respectively, which were 19% and 10% lower, respectively, than in 2014. These indices have not shown a significant trend during the past ten years ($P = 0.109$ and 0.304). Late timing of the survey relative to the early spring phenology may have contributed to low counts on the breeding grounds, particularly since a high number of emperor geese were counted during the spring survey. During the spring survey conducted the last week of April, biologists noted that sea and estuarine ice were absent in southwest Alaska and snow cover was light. Early spring phenology on the YKD suggests above-average production and fall flights for emperor geese.

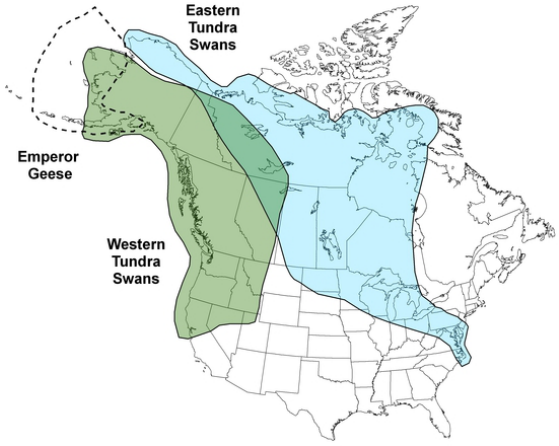
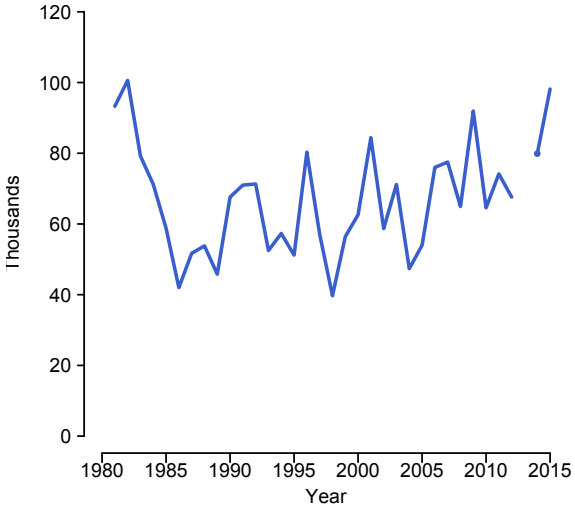


Figure 25. Approximate ranges of emperor geese, and Eastern and Western Populations of tundra swans in North America.

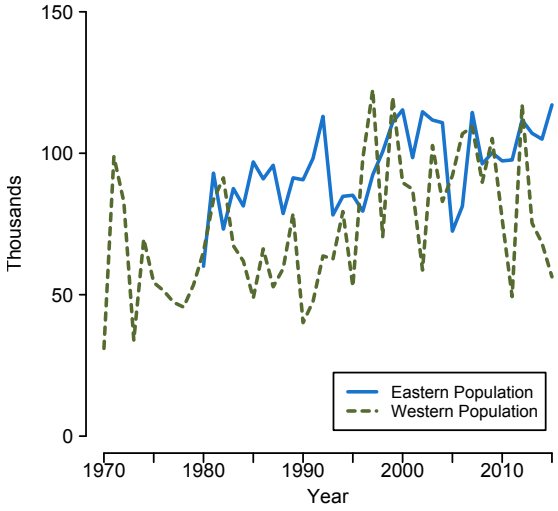
Status of Tundra Swans

Western Population Tundra Swans

Western Population Tundra swans nest along the coastal lowlands of western Alaska, particularly within Yukon–Kuskokwim Delta (YKD). This population winters primarily in California, Utah, and the Pacific Northwest. The Midwinter Survey provides an index of this population within its winter range of the Pacific Flyway (Pacific Flyway Council 2001; Figure 25). The 2015 Midwinter Survey index was 56,300 swans, 17% lower than last year's estimate of 68,200 (Figure 26.2). Midwinter Survey indices have shown no significant trend over the last 10 years ($P = 0.055$). The YKD is the core breeding area for this population. In 2015, the indicated



26.1: Emperor geese



26.2: Tundra swans

Figure 26. Estimated numbers of emperor geese (spring staging geese; 1986–2015), and Eastern and Western populations of tundra swans (winter swans).

total bird index from the YKD Coastal Zone Survey was 23,000 swans, 16% lower than the count of 27,400 in 2014. Indices for singles and pairs and for nests were also much lower than last year, 40% and 31% respectively, and late survey timing likely contributed to low counts. During the last 10 years, the total swan index has not shown a significant trend ($P = 0.212$). Early spring phenology on the YKD suggested above average production, but, with low observed counts, average production and an average fall flight were 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, and the Mackenzie River Delta and adjacent areas in the Northwest Territories are of particular importance. These birds winter in coastal areas from Maryland to North Carolina (Figure 25). The Midwinter Survey provides the primary index of this population within its winter range of Atlantic and Mississippi Flyways (Atlantic, Mississippi, Central, and Pacific Flyway Councils 2007). During the 2015 Midwinter Survey, 117,100 swans were observed, 12% more than the 105,000 counted in 2014 (Figure 26.2). These estimates have not exhibited a significant trend during the 2006–2015 time frame ($P = 0.062$). Productivity from the previous year is estimated by the proportion of juveniles in the population during November and December. In the fall of 2014, juveniles comprised 11% of the population, which was 6% above the estimate in 2013 but below the long-term average of 13.5%. Breeding conditions were average in the central Arctic and favorable in many important nesting areas for Eastern Population tundra swans across the western Arctic, Alaska, Yukon, and the Northwest Territories. No significant spring flooding was observed on the Mackenzie River Delta, and this area appeared excellent for nesting waterfowl. Overall, production and fall flight was expected to be above average.

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A. Individuals who supplied information for the generation of this report

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

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

Air	B. Shults and D. Groves (Strata 1, 4, and 6)
Air	B. Shults, J. Bredy, and D. Groves (Strata 3 and 5)
Air	H. Wilson and D. Groves (Stratum 7)
Air	J. Bredy and D. Groves (Strata 2, 8–12)

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

Air	F. Roetker and S. Olson

Northern Saskatchewan and Northern Manitoba (Strata 21–25)

Air	W. Rhodes and D. Head II

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

Air	J. Bredy and J. Sands
Ground	G. Raven[a], M. Gillespie[c], J. Caswell[b], K. Zimmer[a], M. Watmough[a], M. Tanguay[a], D. Knop[a], and N. Clements[d]

Southern Saskatchewan (Strata 30–33)

Air	P. Thorpe and S. Chandler
Ground	B. Bartzen[a], K. Dufour[a], K. Warner[a], A. Raquel[d], P. Bergen[c], H. Fehr[a], and J. Brewster[a]

Southern Manitoba (Strata 34–39, 40)

Air	K. Fox and J. Bidwell[e]
Ground	M. Schuster[a], J. Leafloor[a], D. Walker[c], G. Ball[c], M. Ross[a], R. Bazin[a], and R. Buss[c]

Montana and Western Dakotas (Strata 41–44)

Air	R. Spangler and B. Kelly[b]
Ground	P. Garrettson and A. Roberts

Eastern Dakotas (Strata 45–49)

Air	T. Liddick and D. Fronczak
Ground	K. Kruse, H. Alvarez, S. LeJeune, and C. Reighn

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

Air	J. Wortham and B. Pendley

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

Air	S. Earsom and N. Wirwa

Maine and Atlantic Canada (Stratum 62–67)

Air	M. Koneff and B. Rodgers

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Ontario	S. Meyer[a], C. Sharp[a], S. Badzinski[a], and D. Sadler[a]
New Brunswick & Nova Scotia	B. Pollard[a] and A. Hicks[a]
Newfoundland & Labrador	S. Gilliland[a], P. Ryan[a], R. Wells[a], B. Pollard[a], P. Devers, D. Whittaker[d], and L. Pike[d]

California

Air	M. Weaver[b], D. Skalos[b], and O. Rocha[b]

Michigan

Air	B. Barlow[b], B. Dybas-Berger[b], J. Heise[b], N. Kalejs[b], T. Maples[b], T. McFadden[b], J. Robinson[b], and B. Sova[b]

Minnesota

Air	B. Geving[b] and S. Cordts[b]
Ground	S. Kelly, W. Brininger, D. Hertel, F. Oslund, J. Kelley, T. Cooper, A. Forbes, B. Davis[b], G. Kemper, G. Dehmer, R. Olsen[b], L. Deede, T. Zimmerman, J. Swart, P. Richert, S. Lewis, K. Svendsgaard, J. Rorah, K. Rittenhouse, E. Broich, K. Spaeth, J. Riens

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Washington

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All others—U.S. Fish & Wildlife Service

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

Flyway-wide and Regional Survey Reports

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Information from the Breeding Population and Habitat Survey

See Appendix A.1

North Atlantic Population of Canada Geese

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Atlantic Population of Canada Geese

S. Earsom, B. Harvey[b], E. Reed[a], and J. Rodrigue[a]

Atlantic Flyway Resident Population of Canada Geese

T. Nichols[b], G. Costanzo[b], W. Crenshaw[b], M. DiBona[b], J. Dunn[b], B. Evans[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], J. Osenkowski[b], P. Ricard[b], A. Roberts, M. Siegesi, D. Sausville[b], G. Somogie[b], and B. Swift[b]

Southern James Bay Population of Canada Geese

S. Badzinski[a], K. Bennett[b], R. Brook[b], and G. Dibben[a]

Mississippi Valley Population of Canada Geese

F. Aquino[b], S. Badzinski[a], K. Bennett[b], and R. Brook[b]

Mississippi Flyway Population Giant Canada Geese

J. Benedict[b], R. Brook[b], J. Brunjes[b], F. Baldwin[b], S. Cordts[b], M. Ervin[b], H. Havens[b], O. Jones[b], J. Leafloor[a], D. Luukkonen[b], S. Maddox[b] L. Naylor[b], A. Phelps[b], A. Radeke[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[e], K. Fox, S. Chandler, D. Fronczak, B. Kelly[b], T. Liddick, W. Rhodes, D. Head II, R. Spangler, P. Thorpe, B. Bartzen[a], K. Dufour[a], K. Warner[a], P. Bergen[c], J. Brewster[a], A. Raquel[d], H. Fehr [a], M. Schuster[a], J. Leafloor[a], D. Walker[c], G. Ball[c], M. Ross[a], R. Bazin[a], R. Buss[c], P. Garrettson, A. Roberts, K. Kruse, S. LeJeune, H. Alvarez, C. Reighn[b], M. Vritiska[b], M. Szymanski[b], J. Gammonley[b], J. Richardson[b], and R. Murano[b]

Central Flyway Arctic Nesting Canada Geese

R. Alisauskas[a], D. Kellett[a], C. Nissley[d], C. Williams[d], K. Kruse, S. Olson, and F. Roetker

Hi-Line Population of Canada Geese

J. Bredy, S. Chandler, B. Kelly[b], J. Sands, P. Thorpe, E. Silverman, L. Roberts,[b], R. Spangler, G. Raven[a], M. Gillespie[c], J. Caswell[b], K. Zimmer[a], M. Watmough[a], M. Tanguay[a],D.Knop,[a], N. Clements[d], B. Bartzen[a], K. Dufour[a], K. Warner[a], P. Bergen[c], A. Raquel[d], H. Fehr [a], J. Brewster[a], P. Garrettson, and A. Roberts

Rocky Mountain Population of Canada Geese

J. Bredy, B. Kelly[b], R. Spangler, J. Sands, E. Silverman, R. Woolstenhulme[b], G. Raven[a], M. Gillespie[c], J. Caswell[b], K. Zimmer[a], M. Watmough[a], M. Tanguay[a],D.Knop,[a], N. Clements[d], P. Garrettson, and A. Roberts

Pacific Population of Canada Geese

A. Breault[b], J. Bredy, D. Kraege[b], S. Olson, C. Gower[b], B. Reishus[b], J. Sands, M. Weaver[b], J. Knetter[b], R. Woolstenhulme[b], G. Raven[a], M. Gillespie[c], J. Caswell[b], K. Zimmer[a], M. Watmough[a], M. Tanguay[a], D.Knop[a], and N. Clements[d]

Dusky Canada Geese

E. Cooper, W. Larned, D. Marks, H. Wilson, E. Taylor, J. Fischer, J. Hodges, B. Eldridge, B. Stehn[e], and D. Rosenberg

Lesser and Taverner's Canada Geese

D. Groves and B. Shults

Cackling Canada Geese

A. Anderson, J. Fischer, J. Hodges[e], T. Sanders, and T. Zeller

Aleutian Canada Geese

K. Griggs, R. Lowe, E. Nelson, S. Olson, B. Reishus[b], T. Sanders, S. Stephensen, M. Weaver[b], J. Sands, E. Taylor, H. Renner, D. Brazil[d] K. Guerena, E. Davis, and B. Henry[d]

Greater Snow Geese

J. Bachand[d], F. Bolduc[a], R. Cotter[a], G. Gauthier[d], M. Labonté[d], J. Lefebvre[a], C. Maurice[a], J. Rodrigue[a], and F. Saint-Pierre[d]

Mid-continent Population Light Geese

R. Alisauskas[a], D. Kellett[a], K. Abraham[d], C. Nissley[d], C. Williams[d], and K. Kruse

Western Central Flyway Population Light Geese

R. Alisauskas[a], D. Kellett[a], and K. Kruse

Western Arctic/Wrangel Island Population of Lesser Snow Geese

T. Anderson, V. Baranyuk[d], R. Corcoran, M. Creegen, J. Hailine, J. Hupp[d], J. Isola, D. Kraege[b], C. Langner[b], B. Lubinski, T. Keldsen, S. Olson, B. Ritchie[d], T. Sanders, D. Skalos[b], M. Weaver[b], M. Wolder, and D. Woolington

Ross's Geese

K. Abraham[d], C. Nissley [d], C. Williams[d], R. Alisauskas[a], and D. Kellett[a]

Pacific Population White-fronted Geese

A. Anderson, J. Fischer, and J. Hodges[e]

Mid-continent Population White-fronted Geese

R. Alisauskas[a], J. Hupp[d], D. Kellett[a], D. Groves, K. Kraii[b], B. Larned, M. Robertson, B. Shults, M. Spindler, K. Warner[a], and H. Wilson

Pacific Brant

A. Anderson, C. Dau, J. Fischer, J. Hupp[d], J. Hodges[e], D. Kraege[b], and E. Palacios[d]

Atlantic Brant

K. Abraham[d], A. Roberts, 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], S. Meyer, T. Nichols[b], P. Padding, A. Roberts, W. Stanton, J. Stanton, D. Stewart, B. Swift[b], H. Walbridge, D. Webster, M. Whitbeck, T. Willis, C. Nissley[d], and C. Williams[d]

Emperor Geese

A. Anderson, C. Dau, J. Fischer, J. Hodges[e], and H. Wilson

Western Population of Tundra Swans

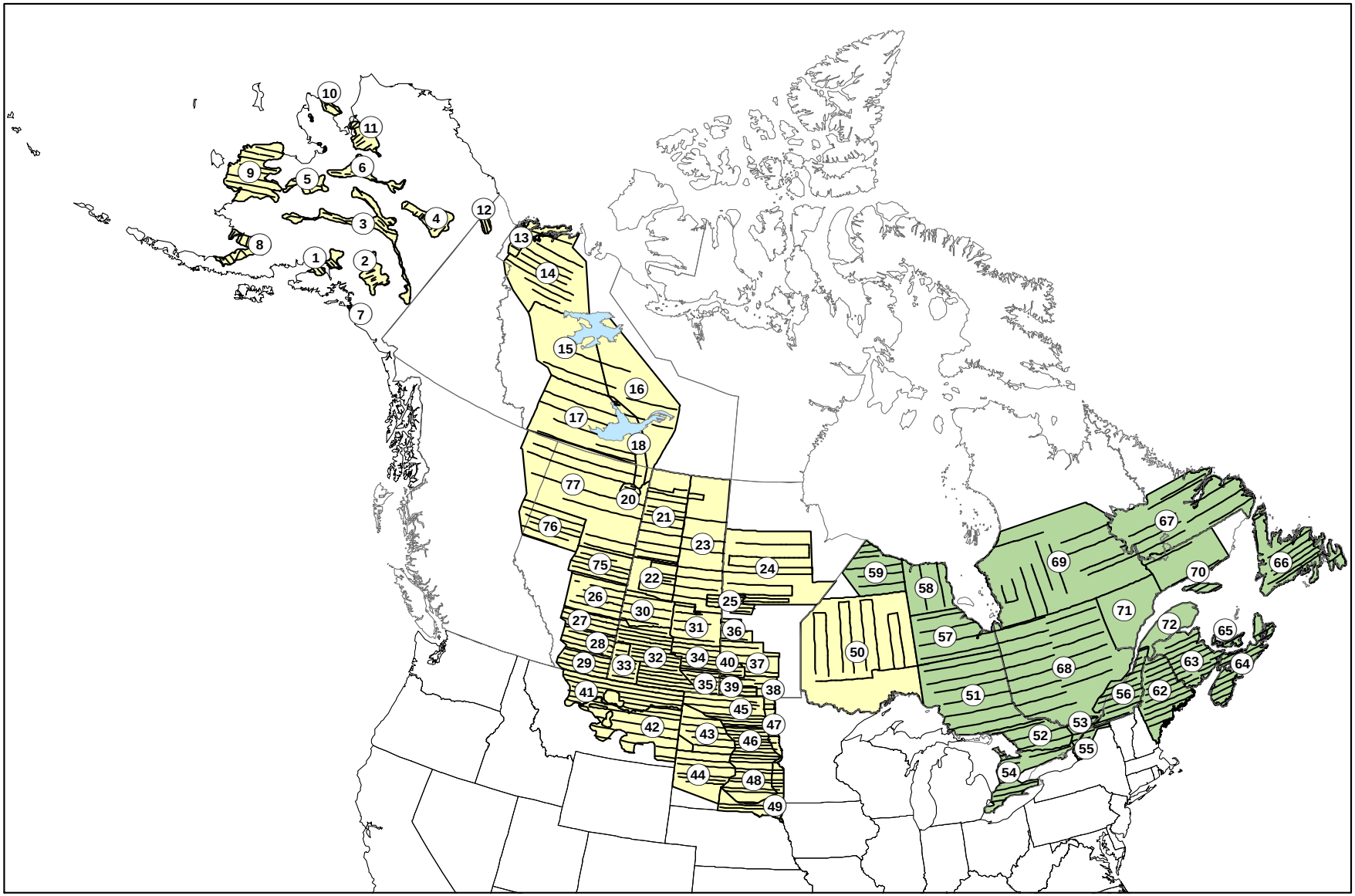
A. Anderson, J. Fischer, J. Hodges[e], and S. Olson

Eastern Population of Tundra Swans

S. Campbell, M. DiBona[b], D. Faith, M. Fisher, D. Fronzcak, J. Fuller[b], I. Gregg[b], W. Harper, K. Hamilton, J. Heise, L. Hindman[b], M. Hoff, D. Howell[b], P. Jayne, O. Jones[b], S. Meyer, T. Nichols[b], P. Padding, A. Roberts, 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]Ducks Unlimited Canada
[d]Other Organization
[e]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	2,215.60	88.80	5,984.80	195.30
1995	3,892.50	223.80	2,442.90	106.80	6,335.40	248.00
1996	5,002.60	184.90	2,479.70	135.30	7,482.20	229.10

Table C.1. Continued.

	Prairie Canada		Northcentral U.S.[a]		Total	
Year	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$
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
2014	4,629.90	168.30	2,551.30	106.50	7,181.20	199.20
2015	4,151.00	146.30	2,156.80	86.00	6,307.70	169.70

[a] No comparable survey data available for the northcentral U.S. during 1961–1973.

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

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

Table C.2. Continued.

	British Columbia		California		Michigan		Minnesota		Nebraska	
Year	Total ducks	Mallards	Total ducks	Mallards	Total ducks	Mallards	Total ducks	Mallards	Total ducks	Mallards
2000			562.4	347.6	793.9	427.2	747.8	318.1	178.8	54.3
2001			413.5	302.2	497.8	324.2	716.4	320.6	225.3	69.2
2002			392.0	265.3	742.5	323.2	1,171.5	366.6	141.8	50.6
2003			533.7	337.1	535.4	298.9	721.8	280.5	96.7	32.9
2004			412.8	262.4	624.5	342.0	1,008.3	375.3	69.9	23.2
2005			615.2	317.9	468.3	258.1	632.0	238.5	117.1	29.3
2006	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		
2014	324.5	81.6	448.7	238.7	395.3	230.1	474.4	257.0		
2015	364.5	82.1	315.6	173.9	431.1	237.8	524.2	206.2		

[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	Mallards	Total ducks	Mallards	Total ducks	Mallards	Total ducks	Mallards	Total ducks	Mallards
1955									
1956									
1957									
1958									
1959	2.1								
1960	2.1								
1961	2.0								
1962	1.7								
1963	2.2								
1964	3.0								
1965	3.5								
1966	3.4								
1967	1.5								
1968	1.2								
1969	1.4								
1970	1.5								
1971	1.1								
1972	0.9								
1973	0.7							412.7	107.0
1974	0.7							435.2	94.3
1975	0.6							426.9	120.5
1976	0.6							379.5	109.9
1977	1.0							323.3	91.7
1978	0.6							271.3	61.6
1979	0.6					98.6	32.1	265.7	78.6
1980	0.9					113.7	34.1	248.1	116.5
1981	1.6					148.3	41.8	505.0	142.8
1982	1.1					146.4	49.8	218.7	89.5
1983	1.5					149.5	47.6	202.3	119.5
1984	1.4					196.3	59.3	210.0	104.8
1985	1.5					216.2	63.1	192.8	73.9
1986	1.3					203.8	60.8	262.0	110.8
1987	1.5					183.6	58.3	389.8	136.9
1988	1.3					241.8	67.2	287.1	148.9
1989	1.3					162.3	49.8	462.5	180.7
1990	1.3					168.9	56.9	328.6	151.4
1991	1.4					140.8	43.7	435.8	172.4
1992	0.9					116.3	41.0	683.8	249.7
1993	1.2	1,158.1	686.6			149.8	55.0	379.4	174.5
1994	1.4	1,297.3	856.3	323.6	116.4	123.9	52.7	571.2	283.4
1995	1.0	1,408.5	864.1	215.9	77.5	147.3	58.9	592.4	242.2
1996	1.7	1,430.9	848.6	288.4	102.2	163.3	61.6	536.3	314.4
1997	2.5	1,423.5	795.2	359.5	121.2	172.8	67.0	409.3	181.0
1998	2.1	1,444.0	775.2	345.1	124.9	185.3	79.0	412.8	186.9
1999	2.3	1,522.7	880.0	320.0	125.6	200.2	86.2	476.6	248.4
2000	2.1	1,933.5	762.6	314.9	110.9	143.6	47.7	744.4	454.0

Table C.2. Continued.

	Nevada[b]	Northeast U.S.[c]		Oregon		Washington		Wisconsin	
Year	Mallards	Total ducks	Mallards	Total ducks	Mallards	Total ducks	Mallards	Total ducks	Mallards
2001	2.0	1,397.4	809.4			146.4	50.5	440.1	183.5
2002	0.7	1,466.2	833.7	364.6	104.5	133.3	44.7	740.8	378.5
2003	1.7	1,266.2	731.9	246.1	89.0	127.8	39.8	533.5	261.3
2004	1.7	1,416.9	805.9	229.8	82.5	114.9	40.0	651.5	229.2
2005	0.7	1,416.2	753.6	210.4	74.1	111.5	40.8	724.3	317.2
2006	1.8	1,384.2	725.2	251.2	81.1	135.4	45.5	522.6	219.5
2007	2.1	1,500.1	687.6	319.1	92.5	128.3	46.1	470.6	210.0
2008	1.9	1,197.1	619.1	224.3	75.4	120.9	50.6	626.9	188.4
2009	12.7	1,271.1	666.8	186.0	72.6	116.5	47.5	502.4	200.5
2010	8.9	1,302.0	651.7	205.1	66.8	176.0	81.2	386.5	199.1
2011	2.3	1,265.0	586.1	158.4	61.6	141.5	62.6	513.7	187.9
2012	4.1	1,309.9	612.6	263.5	88.8	168.9	89.4	521.1	197.0
2013	8.8	1,281.8	604.2	251.7	84.3	156.5	74.1	527.3	181.2
2014	4.2	1,343.8	634.6	315.2	85.3	117.2	86.5	395.1	158.7
2015	5.5	1197.2	540.1	279.7	87.4	193.1	86.4	372.8	176.2

[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; 1955–2015).

	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

Table C.3. 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
2014	10,899.8	347.6	3,811.0	206.0	3,116.7	190.4	3,439.9	247.4	8,541.5	461.9
2015	11,643.3	361.8	3,834.1	219.4	3,037.0	199.2	4,080.9	269.8	8,547.3	401.1

Table C.3. Continued.

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

Table C.3. Continued.

	Northern shoveler		Northern pintail		Redhead		Canvasback		Scaup	
Year	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$
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
2014	5,278.9	265.3	3,220.3	179.7	1,278.7	102.5	685.3	50.7	4,611.1	253.3
2015	4,391.4	219.0	3,043.0	182.5	1,195.9	92.9	757.3	63.3	4,395.3	252.5

Table C.4. Total breeding duck estimates (1955–2015) 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
2014	49,152.2	831.1
2015	49,521.7	812.1

[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, 1990–2015[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	308.9	(208.4, 469.2)	589.4	(526.7, 667.1)	246.6	(195.0, 323.8)	511.0	(407.3, 652.2)	375.3	(295.0, 483.8)	384.1	(326.3, 456.5)
1991	355.4	(238.0, 547.2)	594.8	(525.6, 685.2)	239.8	(187.8, 321.5)	452.9	(362.6, 575.4)	390.1	(310.2, 501.0)	455.8	(384.1, 545.9)
1992	354.1	(234.7, 543.8)	568.5	(506.0, 647.7)	229.8	(181.1, 309.1)	463.2	(368.5, 599.3)	402.6	(317.7, 515.0)	457.9	(379.3, 559.9)
1993	360.3	(240.4, 552.6)	547.8	(483.0, 626.7)	210.4	(162.6, 284.1)	431.1	(341.1, 555.8)	387.7	(305.9, 503.6)	434.6	(361.7, 525.1)
1994	370.5	(243.8, 571.2)	508.5	(446.4, 576.9)	219.6	(169.2, 296.0)	426.2	(337.3, 547.7)	402.0	(314.7, 517.4)	430.8	(354.4, 537.1)
1995	304.6	(203.6, 469.1)	592.2	(522.7, 680.1)	225.3	(172.8, 302.0)	442.3	(347.8, 563.7)	350.4	(276.3, 455.4)	470.5	(387.0, 572.2)
1996	339.3	(227.0, 520.7)	713.1	(635.2, 803.6)	298.1	(235.2, 390.4)	561.9	(445.8, 716.6)	429.3	(338.4, 552.6)	425.2	(362.9, 505.0)
1997	364.0	(242.0, 559.8)	593.7	(533.3, 666.1)	231.1	(182.7, 307.5)	502.5	(402.4, 640.0)	428.5	(340.3, 550.5)	432.4	(367.8, 513.0)
1998	401.9	(268.8, 610.7)	629.3	(563.9, 702.8)	220.7	(172.8, 288.8)	439.0	(353.4, 558.9)	375.8	(296.5, 482.8)	355.4	(303.4, 421.5)
1999	413.3	(276.3, 628.2)	712.6	(640.4, 802.6)	264.1	(206.3, 354.4)	518.8	(414.9, 656.1)	466.3	(365.2, 608.8)	417.0	(354.0, 496.6)
2000	373.1	(256.4, 569.8)	650.5	(587.2, 723.6)	274.1	(219.2, 349.2)	553.2	(440.9, 706.6)	444.9	(351.8, 578.7)	430.0	(368.5, 507.9)
2001	399.4	(271.3, 597.4)	608.9	(547.4, 679.0)	227.4	(181.2, 299.2)	496.1	(397.8, 623.1)	514.3	(398.9, 682.0)	408.8	(349.5, 479.9)
2002	390.2	(264.3, 589.7)	703.4	(628.1, 783.2)	269.3	(214.7, 357.2)	496.4	(397.5, 634.2)	579.0	(443.6, 809.2)	560.9	(472.8, 666.0)
2003	407.1	(278.7, 621.6)	645.6	(579.5, 725.1)	269.5	(212.5, 350.0)	510.5	(413.0, 646.3)	432.7	(340.6, 563.6)	479.3	(403.9, 568.7)
2004	432.4	(293.7, 653.5)	644.4	(578.0, 725.5)	309.3	(242.3, 406.4)	553.7	(448.1, 707.5)	426.9	(341.1, 540.8)	514.1	(436.7, 605.8)
2005	415.5	(279.7, 641.9)	614.3	(548.9, 695.0)	245.8	(195.2, 321.1)	522.8	(420.5, 658.0)	389.8	(308.5, 497.9)	478.5	(404.9, 568.5)
2006	387.7	(260.3, 586.4)	632.0	(562.1, 709.8)	249.7	(195.0, 327.2)	535.3	(431.7, 676.4)	386.9	(307.5, 495.8)	431.2	(367.1, 509.4)
2007	438.6	(297.9, 671.3)	737.8	(656.9, 831.3)	276.7	(219.7, 361.5)	659.2	(530.6, 840.7)	466.3	(365.4, 604.7)	459.8	(389.5, 543.8)
2008	431.1	(293.5, 650.8)	634.5	(571.3, 714.2)	303.5	(228.3, 422.1)	538.6	(434.6, 676.3)	438.2	(346.2, 571.7)	438.9	(373.6, 518.1)
2009	452.9	(303.8, 682.5)	591.1	(531.1, 661.2)	294.9	(228.9, 396.3)	530.3	(424.9, 668.9)	404.0	(317.7, 528.5)	463.5	(393.1, 549.2)
2010	367.5	(248.6, 555.5)	561.0	(503.8, 631.4)	275.7	(216.8, 359.9)	534.1	(432.0, 672.5)	400.8	(313.3, 522.8)	381.3	(322.7, 449.7)
2011	419.2	(281.2, 630.5)	539.5	(484.3, 603.3)	247.0	(197.2, 325.5)	514.1	(412.7, 648.1)	402.2	(318.0, 522.7)	401.6	(340.6, 478.7)
2012	400.6	(274.6, 601.1)	600.3	(537.7, 673.6)	253.9	(199.9, 331.5)	515.0	(409.9, 646.2)	395.7	(313.7, 505.6)	423.4	(361.7, 504.5)
2013	489.7	(317.5, 770.2)	620.5	(556.9, 691.6)	285.1	(226.4, 376.4)	627.4	(500.3, 816.6)	458.6	(365.1, 587.0)	469.6	(399.1, 558.0)
2014	432.4	(293.5, 659.9)	610.3	(543.5, 689.8)	228.7	(178.4, 298.5)	490.0	(395.3, 622.6)	390.0	(298.9, 545.2)	416.4	(352.9, 493.7)
2015	405.7	(274.9, 611.7)	540.6	(483.1, 609.5)	221.0	(171.6, 290.5)	505.2	(404.6, 643.3)	357.6	(280.4, 466.6)	409.3	(348.1, 484.7)

[a] Estimates for mallards, American black ducks, green-winged teal, ring-necked duck, goldeneyes, and mergansers from Bayesian hierarchical analysis using FWS 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, 1969–2015.

Year	North Atlantic[a,b]	Atlantic[a,b]	Atlantic Flyway Resident[a]	Southern James Bay[a]	Miss. Valley[a]	Miss. Flyway Giant[a]	Eastern Prairie[a]
1969/70							
1970/71							
1971/72							95.0
1972/73							116.6
1973/74							96.7
1974/75							121.5
1975/76							168.4
1976/77							110.8
1977/78							111.2
1978/79							72.8
1979/80							
1980/81							78.9
1981/82							96.4
1982/83							92.8
1983/84							112.0
1984/85							105.6
1985/86							126.4
1986/87							145.9
1987/88		118.2					137.0
1988/89					352.5		132.1
1989/90				92.1	518.8		163.4
1990/91				72.4	254.8		167.4
1991/92				73.0	438.9		158.4
1992/93		93.0		50.7	411.2	779.4	136.2
1993/94		43.2		45.7	432.2	909.4	136.2
1994/95		34.0		74.1	348.2	941.6	139.0
1995/96	99.6	51.5		71.1	362.4	1,037.3	141.0
1996/97	64.4	72.1		87.0	426.0	957.0	130.5
1997/98	53.9	48.6		70.3	312.5	1,140.5	99.3
1998/99	96.8	83.7		108.1	465.5	1,163.3	139.5
1999/00	58.0	95.8		78.7	352.6	1,436.7	130.0
2000/01	57.8	135.2		68.4	325.4	1,296.3	122.2
2001/02	62.0	182.4		55.2	286.5	1,415.2	152.0
2002/03	60.8	174.9	1,126.7	90.2	360.1	1,416.3	122.4
2003/04	67.8	191.8	1,073.1	75.2	276.3	1,430.4	145.5
2004/05	51.3	175.7	1,167.1	42.2	344.9	1,367.0	161.6
2005/06	49.2	186.1	1,144.0	128.9	384.4	1,575.2	134.8
2006/07	69.9	207.3	1,128.0	67.1	403.9	1,454.7	153.4
2007/08	41.9	174.0	1,024.9	92.3	305.2	1,461.7	161.1
2008/09	53.7	186.8	1,006.1	71.0	242.8	1,448.3	169.2
2009/10	54.6	165.1	977.1	77.6	339.3	1,638.0	172.6
2010/11	48.5	216.0	1,015.1	88.4	269.8	1,670.3	133.1
2011/12	71.6	190.3	879.8	78.8	269.2	1,766.2	116.3
2012/13			951.9	61.9	319.7	1,600.7	136.6
2013/14	76.0	191.2	1,084.9	79.5	322.5	1,461.0	202.0
2014/15	54.6	161.3	963.8	54.3	226.5	1,620.4	185.6

Table D.1. Continued

Year	W. Prairie & Great Plains[c]	Central Flyway Arctic Nesting[c]	Hi-line[a]	Rocky Mountain[a]	Dusky	Cackling[d]	Aleutian[d]
1969/70		139.6	58.8				
1970/71		281.9	99.6	43.8			
1971/72		321.9	53.0	30.4			
1972/73		407.8	30.1	34.4			
1973/74		310.1	33.9	38.3			
1974/75		257.2	29.1	38.2			0.8
1975/76		446.2	40.5	25.4			0.9
1976/77		446.4	40.9	25.2			1.3
1977/78		335.9	39.8	37.2			1.5
1978/79		342.2	50.5	52.8			1.6
1979/80		362.8	51.2	31.0			1.7
1980/81		398.8	51.0	54.0			2.0
1981/82	160.2	438.3	54.5	58.8			2.7
1982/83	202.1	317.6	74.1	42.1			3.5
1983/84	91.4	408.3	105.8	41.7			3.8
1984/85	160.6	386.1	92.3	43.9		46.8	4.2
1985/86	36.5	379.2	101.8	62.1	16.8	45.2	4.3
1986/87	174.4	356.5	95.4	62.2	15.5	66.7	5.0
1987/88	272.1	463.7	131.3	98.2	15.7	82.0	5.4
1988/89	245.9	511.2	124.8	88.1	17.1	85.3	5.8
1989/90	216.0	523.9	185.8	83.9	16.0	106.4	6.3
1990/91	328.7	827.7	148.3	78.5	10.7	96.6	7.0
1991/92	305.9	839.2	168.0	94.4	17.6	148.6	7.7
1992/93	318.0	509.2	158.0	107.7	16.4	153.3	11.7
1993/94	272.5	549.6	160.9	131.1	16.2	217.8	15.7
1994/95	352.5	729.8	234.6	141.7	12.0	234.1	19.2
1995/96	403.3	685.1	200.5	139.4	11.8	249.8	15.4
1996/97	453.4	679.1	208.0	96.6	13.3	294.9	20.4
1997/98	482.3	674.8	257.7	139.2	14.3	216.4	32.4
1998/99	467.1	951.4	204.5	157.3	10.3	241.8	35.5
1999/00	599.3	495.0	287.7	173.4	10.1	251.2	34.2
2000/01	677.7	313.2	261.9	170.1	11.0	253.3	
2001/02	710.3	665.6	239.0	143.3	12.2	168.1	
2002/03	561.0	768.5	239.1	141.7	9.7	234.1	72.8
2003/04	622.1	662.3	208.4	159.2	11.0	172.2	108.5
2004/05	415.1	578.0	245.4	160.1	15.9	219.4	87.1
2005/06	444.4	734.5	217.6	139.3	11.9	241.2	100.0
2006/07	446.0	870.8	309.5	145.1	10.1	248.4	107.4
2007/08	669.5	615.1	348.2	212.8	9.0	283.6	111.0
2008/09	628.0	531.5	306.7	124.7	6.6	225.9	83.6
2009/10	462.8	707.8	277.6	144.1	9.4	275.3	107.4
2010/11	499.0	737.7	274.0	104.9	11.6	180.2	101.4
2011/12	555.4	743.6	494.4	143.4	13.5	202.3	132.5
2012/13	768.8	519.5	338.9	159.1		312.2	161.1
2013/14	568.8	567.3	288.2	116.7	15.4	281.3	147.6
2014/15	455.8	828.1	378.5	169.8	17.7	339.7	189.1

[a] Surveys conducted in spring.
[b] Breeding pairs
[c] Surveys conducted in January.
[d] 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, 1969–2015.

	Snow and Ross's geese				White-fronted geese		
Year	Greater snow geese[a]	Mid-continent[b]	Western Central Flyway[c]	Western Arctic & Wrangel Isl.[d]	Mid-continent[d]	Pacific[e]	Emperor geese[a]
1969/70	89.6	777.0	6.9				
1970/71	123.3	1,070.2	11.1				
1971/72	134.8	1,313.4	13.0				
1972/73	143.0	1,025.3	11.6				
1973/74	165.0	1,189.8	16.2				
1974/75	153.8	1,096.6	26.4				
1975/76	165.6	1,562.4	23.2				
1976/77	160.0	1,150.3	33.6				
1977/78	192.6	1,966.4	31.1				
1978/79	170.1	1,285.7	28.2				
1979/80	180.0	1,398.1	30.4	528.1			
1980/81	170.8	1,406.7	37.6	204.2			93.3
1981/82	163.0	1,794.1	50.0	759.9			100.6
1982/83	185.0	1,755.5	76.1	354.1			79.2
1983/84	225.4	1,494.5	43.0	547.6			71.2
1984/85	260.0	1,973.0	62.9	466.3		163.2	58.8
1985/86	303.5	1,449.4	96.6	549.8		141.9	42.0
1986/87	255.0	1,913.8	63.5	521.7		140.0	51.7
1987/88		1,750.7	46.2	525.3		186.7	53.8
1988/89	363.2	1,956.2	67.6	441.0		198.1	45.8
1989/90	368.3	1,724.3	38.7	463.9		220.0	67.6
1990/91	352.6	2,135.8	104.6	708.5		196.5	71.0
1991/92	448.1	2,021.9	87.9	690.1		218.8	71.3
1992/93	498.4	1,744.1	45.1	639.3	622.9	234.1	52.5
1993/94	591.4	2,200.8	84.9	569.2	676.3	258.9	57.3
1994/95	616.6	2,725.1	80.1	478.2	727.3	302.2	51.2
1995/96	669.1	2,398.1	93.1	501.9	1,129.4	374.6	80.3
1996/97	657.5	2,957.7	127.2	366.3	742.5	370.5	57.1
1997/98	836.6	3,022.2	103.5	416.4	622.2	388.0	39.7
1998/99	1,008.0	2,575.7	236.4	354.3	1,058.3	393.4	56.4
1999/00	816.5	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	680.2	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	1,016.9	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	196.0	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	.
2013/14	796.0	3,814.7	264.8	1351.2		637.2	79.9
2014/15	818.0	3,284.1	243.3	1,180.7	1,005.6	479.1	98.2

[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, 1969–2015.

	Brant		Tundra swans	
Year	Atlantic	Pacific[a]	Western	Eastern
1969/70			31.0	
1970/71	151.0		98.8	
1971/72	73.2		82.8	
1972/73	40.8		33.9	
1973/74	87.7		69.7	
1974/75	88.4		54.3	
1975/76	127.0		51.4	
1976/77	73.6		47.3	
1977/78	42.8		45.6	
1978/79	43.5		53.5	
1979/80	69.2		65.2	
1980/81	97.0		83.6	
1981/82	104.5		91.3	73.2
1982/83	123.5		67.3	87.5
1983/84	127.3		61.9	81.4
1984/85	146.3		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	165.0	49.3[b]	97.7
2011/12	149.2	177.3	117.2	111.7
2012/13	111.8	163.3	75.3	107.1
2013/14	132.9	173.3	68.2	105.0
2014/15	111.4	136.5	56.3	117.1

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

[b] Incomplete or preliminary.

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