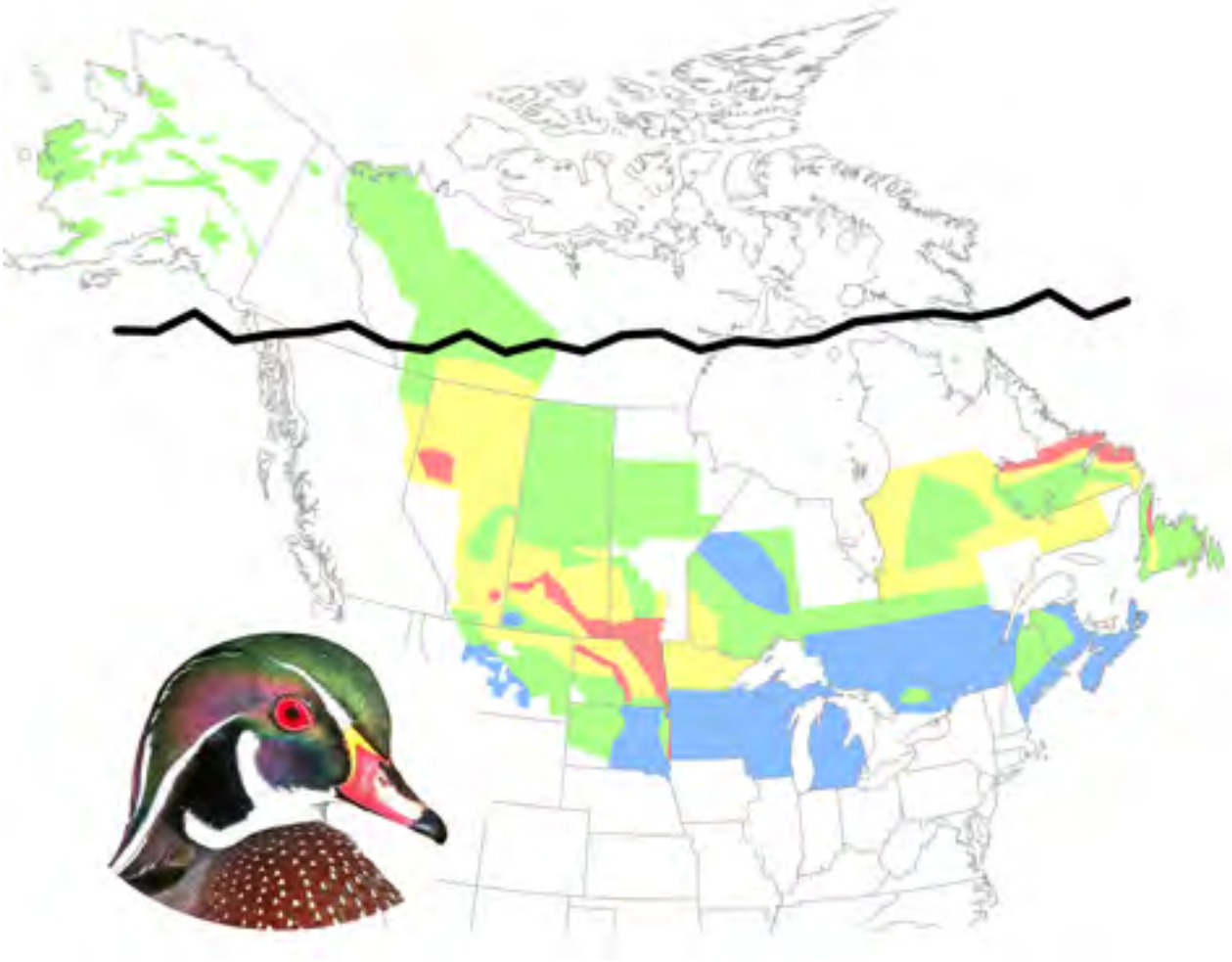
U.S. Fish & Wildlife Service

Waterfowl

Population Status, 2019



Waterfowl Population Status, 2019

August 19, 2019

In the United States the process of establishing hunting regulations for waterfowl is conducted annually. This 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. In addition to providing current information on the status of populations, this report is intended to aid the development of waterfowl harvest regulations in the United States for the 2020–2021 hunting season.

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.

This report was compiled by the U.S. Fish and Wildlife Service, Division of Migratory Bird Management, branches of Assessment and Decision Support, Monitoring and Data Management, and Migratory Bird Surveys. The principal authors are Joshua Dooley, 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. Pamela Garrettson, James Dubovsky, Rebecca Rau and others 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. 2019. Waterfowl population status, 2019. U.S. Department of the Interior, Washington, D.C. USA.

All Division of Migratory Bird Management reports are available from our website (https://www.fws.gov/birds/surveys-and-data/reports-and-publications.php).

Executive Summary

This report summarizes the most recent information about the status of North American waterfowl populations and their habitats to facilitate the development of harvest regulations. The annual status of these populations is monitored and assessed through abundance and harvest surveys. This report details abundance estimates; harvest survey results are discussed in separate reports. The data and analyses were those most currently available when this report was written. Future analyses may yield slightly different results as databases are updated and new analytical procedures become available.

In general, habitat conditions during the 2019 Waterfowl Breeding Population and Habitat Survey (WBPHS) were similar to or declined relative to 2018, with a few exceptions. Much of the Canadian prairies experienced below-average precipitation from fall 2018 through spring 2019. Fall and winter temperatures were mainly below average. Southern Alberta and Saskatchewan had a warm spell in December 2018 through January 2019 but February 2019 was brutally cold across all of the Canadian prairies. Spring temperatures were average to slightly below average. The U.S. prairies experienced average to above-average precipitation over most of the region. Habitat conditions were generally drier near the North Dakota border with Canada. Conditions in much of the eastern survey area remained similar or improved relative to 2018. The region experienced mainly average to above-average precipitation in the south and Maritimes but below-average precipitation across the northern areas since September 2018. The entire region tended to have a cool spring. Spring phenology and ice-out was generally normal but substantially delayed in northern Quebec and Labrador. Conditions for waterfowl production were good to excellent in the south and poorer farther north. Spring phenology was earlier than average across much of Alaska and the eastern Arctic and Subarctic, whereas spring snow and ice cover in the central and western Arctic and Subarctic were generally comparable to last year.

The total pond estimate (Prairie Canada and northcentral U.S. combined) was 5.0 ± 0.2 million, which was similar to the 2018 estimate of 5.2 ± 0.2 million and the long-term average of 5.2 ± 0.03 million. The 2019 estimate of ponds in Prairie Canada was 2.9 ± 0.1 million. This estimate was 22% below the 2018 estimate of 3.7 ± 0.1 million and 19% below the long-term average (3.5 ± 0.02 million). The 2019 pond estimate for the northcentral U.S. was 2.1 ± 0.1 million, which was 36% above the 2018 estimate (1.6 ± 0.09 million) and 26% above the long-term average (1.7 ± 0.01 million). Spring phenology and timing of ice-out was normal or slightly delayed in places within the traditional survey area. Alaska experienced above-average temperatures and below- to above-average precipitation in a northward gradient. The boreal forest experienced generally below-average precipitation and temperatures but December 2018 was warmer than average. Habitat quality generally declined across the survey area compared to last year, with the exception of most of the Dakotas and Montana which continued to improve. Overall habitat quality remained fair to good over a large portion of the traditional survey area and should lead to average waterfowl production this year, however dry areas, particularly in the Canadian prairies, have expanded since 2018.

Summary of Duck Populations

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* spp.], long-tailed ducks [*Clangula hyemalis*], mergansers [*Mergus* spp. and *Lophodytes cucullatus*], and wood ducks [*Aix sponsa*]) was 38.9 ± 0.7 million birds. This estimate was 6% lower than the 2018 estimate

of 41.2 ± 0.7 million and 10% higher than the long-term average (1955–2018). Estimated mallard (*Anas platyrhynchos*) abundance was 9.4 ± 0.3 million, which was similar to the 2018 estimate of 9.3 ± 0.3 million but 19% above the long-term average of 7.9 ± 0.04 million. The 2019 estimate for blue-winged teal (*Spatula discors*; 5.4 ± 0.3 million) was 16% below the 2018 estimate and similar the long-term average of 5.1 ± 0.04 million. Estimated abundance of gadwall (*Mareca strepera*; 3.3 ± 0.2 million) was similar to the 2018 estimate and 61% above the long-term average. The 2019 northern shoveler (*Spatula clypeata*; 3.6 ± 0.1 million) estimate was 13% below last year and 39% above the long-term average of 2.6 ± 0.02 million. The estimated abundance of green-winged teal (*Anas crecca*) was 3.2 ± 0.2 million, which was similar to the 2018 estimate of 3.0 ± 0.2 million and 47% above the long-term average (2.2 ± 0.02 million). Estimated abundance of redheads (*Aythya americana*; 0.7 ± 0.06 million) was 27% lower than the 2018 estimate and similar to the long-term average of 0.7 ± 0.01 million. Northern pintail (*Anas acuta*) abundance (2.3 ± 0.1 million) was similar to the 2018 estimate and 42% below the long-term average of 3.9 ± 0.03 million. Abundance estimates for American wigeon (*Mareca americana*; 2.8 ± 0.2 million) and canvasbacks (*Aythya valisineria*; 0.7 ± 0.05 million) were similar to their 2018 estimates and their long-term averages of 2.6 ± 0.02 million and 0.6 ± 0.01 million, respectively. The combined estimate of lesser and greater scaup (*A. affinis* and *A. marila*; 3.6 ± 0.2 million) was similar to the 2018 estimate and 28% below the long-term average of 5.0 ± 0.04 million.

A time series for assessing changes in green-winged teal, ring-necked duck (*A. collaris*), goldeneye (*Bucephala clangula* and *B. islandica*), merganser, and American black duck (*A. rubripes*) population status in the eastern survey area is provided by breeding waterfowl surveys conducted by the USFWS and CWS in Maine and eastern Canada. The estimate of green-winged teal (0.3 ± 0.1 million) was similar to the 2018 estimate and 19% below the long-term average. Ring-necked ducks (0.7 ± 0.2 million), goldeneyes (0.5 ± 0.1 million), and mergansers (0.6 ± 0.1 million) were similar to last year's estimates and the long-term averages. The 2019 estimate of American black ducks in the eastern survey area was 0.7 ± 0.1 million, which was similar to last year's estimate of 0.7 ± 0.1 million but 16% below the 1998–2018 average. The black duck estimate at the plot survey scale, which is used for management, was 0.56 ± 0.04 million. Eastern mallard population status is derived by integrating data from the eastern survey area and ground plot surveys conducted in the northeastern U.S. states of Virginia north to New Hampshire. The estimated abundance of mallards in 2019 was 1.0 ± 0.15 million, which was similar to the 2018 estimate but 16% below the long-term average of 1.2 ± 0.1 million.

Summary of Goose and Swan Populations

Of the 26 applicable goose and tundra swan (*Cygnus columbianus*) populations included in this year's report with updated estimates, the primary monitoring indices for six of these populations had significant ($P < 0.05$) positive trends (% change per year) during the most recent 10-year period: Rocky Mountain Population (+7%), Pacific Population (+4%), and Aleutian (+6%) Canada geese (*Branta canadensis*), Pacific Flyway Population light geese (lesser snow geese, *Chen caerulescens* and Ross's geese, *Chen rossii*; +7%), Wrangel Island Population lesser snow geese (+12%), and emperor geese (*Chen canagica*; +4%). Two populations had a significant negative 10-year trend: Ross's geese (−6%) and Atlantic Population Canada geese (−5%). Of the 19 populations for which primary indices included variance estimates, the most recent estimate significantly increased from the prior year's estimate for one population and significantly decreased for three populations: Dusky (+52%) and Rocky Mountain Population (−30%) Canada geese, Ross's geese (−25%), and greater snow geese (*C. c. atlantica*; −19%). Of the eight populations for which primary indices did not include variance estimates, the most recent count was greater than the prior count for four populations and was less than the prior count for four populations: Mississippi Flyway Giant Canada geese (−4%),

Pacific Flyway Population light geese (+4%), Wrangel Island Population lesser snow geese (+45%), Pacific (−19%) and Mid-continent (0%) Population white-fronted geese (*Anser albifrons*), Atlantic (−29%) and Pacific (+21%) brant (*Branta bernicla*), and Eastern Population tundra swans (−17%).

Table of Contents

List of Tables and Figures

Tables

Figures

Status of Ducks

This section summarizes the most recent information about the status of North American duck populations and their habitats. The annual status of these populations is assessed using databases resulting from surveys which include estimates of the sizes 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 (WBPHS)

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 by ground (Atlantic Flyway Breeding Waterfowl Survey; Sauer et al. 2014) or by 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 (Figure 1). Specifics on the survey design are provided in Smith (1995). The eastern survey area (strata 51–53, 56, and 62–72) includes parts of Ontario, Quebec, Labrador, Newfoundland, Nova Scotia, Prince Edward Island, New Brunswick, and Maine, covering an area of approximately 0.7 million square miles (Figure 1). Historically, surveys in the east were also conducted in strata 54, 55, and 57–59. Surveys in strata 57–59 were discontinued in 2011 due to a reduction in aviation staff. In 2012, stratum 55 was discontinued primarily because it overlapped with an existing ground survey. In 2017, stratum 54 was discontinued due to increased aviation hazards such as wind turbines and power lines. None of the discontinued strata in the eastern survey are part of existing management frameworks. 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 the eastern survey area (except stratum 69); however, some portions of the eastern survey area have been surveyed since 1990 (strata 51–53, 56, 63–64, 66–68, 70–72). 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 for calculation of measures of precision for their estimates. Information about habitat conditions was supplied primarily by biologists working in those survey areas. Unless otherwise noted, z-tests were used for assessing statistical significance, with alpha levels 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 traditional survey area, to estimate waterfowl abundance. Additionally, the Canadian Wildlife Service (CWS) has conducted a helicopter-based aerial plot survey

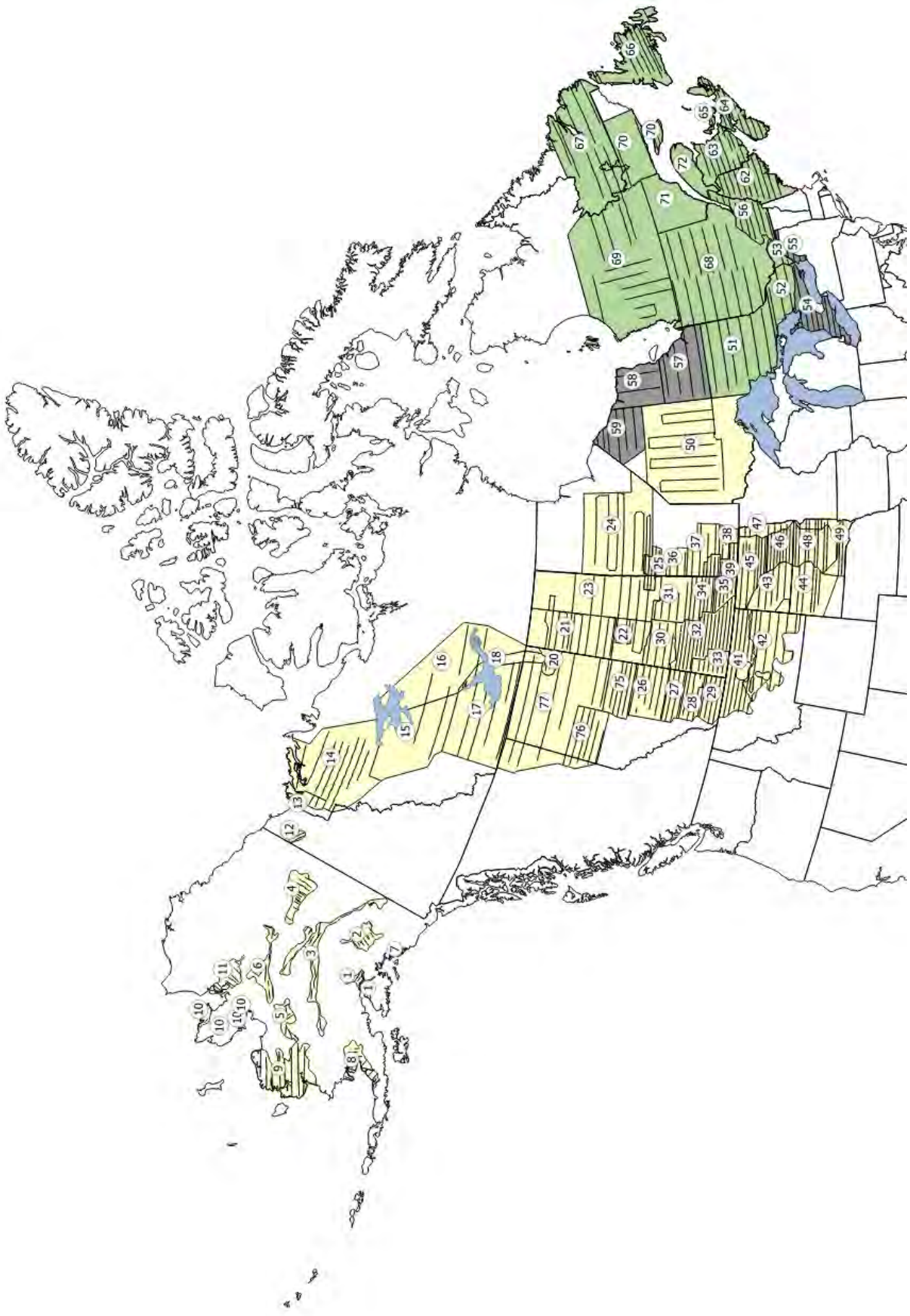


Figure 1. Strata and transects of the Waterfowl Breeding Population and Habitat Survey (yellow = traditional survey area, green = eastern survey area, grey = discontinued strata).

in core American black duck breeding regions of Ontario, Quebec, and the Atlantic Provinces. Initially, 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, since 2005, waterfowl abundances for eastern North America have been 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 (e.g., mergansers, goldeneyes), estimates are produced for multi-species groupings. Previously, this report provided composite estimates for the eastern survey area using data collected in strata 51, 52, 63, 64, 66–68, and 70–72, which corresponds to the area covered by the CWS plot survey. These strata contain either (1) both USFWS airplane survey transects and CWS helicopter plots or (2) only helicopter plots (strata 71 and 72). Beginning in 2018, eastern breeding waterfowl population estimates will be presented at the full eastern survey scale (strata 51–53, 56, 62–72) or eastern North America scale, depending on the breeding distribution of the species. The eastern North America scale includes the full eastern survey area plus data from the Atlantic Flyway Breeding Waterfowl Survey (AFBWS, Sauer et al. 2014). The AFBWS is a ground-based survey conducted annually from Virginia north to New Hampshire. The time series at these larger scales is shorter (1998–present) but provides a more complete assessment of the status of waterfowl in the east.

For widely distributed and abundant species including American black ducks, mallards, green-winged teal, ring-necked ducks, goldeneyes (common and Barrow's) and mergansers (common, red-breasted, and hooded), composite estimates of abundance 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 over the area of each stratum to produce a stratum/year/method-specific population estimate. Estimates from the airplane surveys were adjusted for visibility bias by multiplying them by the total CWS helicopter survey estimates for all years, divided by the total USFWS airplane survey 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. For strata containing just USFWS surveys (strata 53, 56, 62, 65, and 69) visibility-correction factors based on the ratio of counts from helicopters to fixed-wing aircraft along selected segments were used to adjust counts (Zimmerman et al. 2012). No visibility adjustments were made for strata with only CWS plots (strata 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. Not enough green-winged teal, ring-necked ducks, goldeneyes, and mergansers were were counted in the AFBWS to fit the models for those species at the eastern North America scale. Black duck and mallard counts were adequate to fit the model to the AFBWS data and derive breeding population estimates at the eastern North America scale. However, due to differences in how the indicated pairs are calculated between the eastern survey area and the AFBWS for American black ducks (described below), we did not combine data from these two surveys for this species. Therefore, we present estimates for American black ducks, green-winged teal, ring-necked ducks, goldeneyes, and mergansers at the eastern survey scale, and estimates for mallards at the eastern North America scale. The zero-inflated Poisson 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 (lesser [*Aythya affinis*] and greater [*A. mar-*

ila]), scoters (black [*Melanitta americana*], white-winged [*M. deglandi*], and surf [*M. perspicillata*]), bufflehead (*Bucephala albeola*), and American wigeon (*Anas americana*). This model-based approach and changes in analytical procedures for some species may preclude comparisons with results from previous reports. We will continue to investigate methods that might allow us to estimate abundance of these rarer species within a 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 previous CWS helicopter surveys in eastern Canada, which indicated that approximately 50% of black duck pair observations are actually two males. 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).

Total Duck Species Composition

In the traditional survey area, our estimate of total ducks excludes scoters, eiders (common [*Somateria mollissima*], king [*S. spectabilis*], spectacled [*S. fisheri*], and Steller's [*Polysticta stelleri*]), long-tailed ducks (*Clangula hyemalis*), mergansers, and wood ducks (*Aix sponsa*) because the traditional survey area does not include a large portion of their breeding ranges (Smith 1995).

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 WBPHS traditional survey area, as well as Michigan, Minnesota, and Wisconsin. However, since 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 describe 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 2019).

Results and Discussion

2019 Overall Habitat Conditions and Population Status

In general, habitat conditions during the 2019 WBPHS were similar to or declined relative to 2018, with a few exceptions (Figure 2). Much of the Canadian prairies experienced below-average precipitation from fall 2018 through spring 2019. Fall and winter temperatures were mainly below average. Southern Alberta and Saskatchewan had a warm spell in December 2018 through January 2019 but February 2019 was brutally cold across all of the Canadian prairies. Spring temperatures were average to slightly below average. The U.S. prairies experienced average to above-average precipitation over most of the region. Habitat conditions were generally drier near the North Dakota border with Canada. The total pond estimate (Prairie Canada and northcentral U.S. combined) was 5.0 ± 0.2 million, which was similar to the 2018 estimate of 5.2 ± 0.2 million and the long-term average of 5.2 ± 0.03 million (Table 1, Figure 3). The 2019 estimate of ponds in Prairie Canada was 2.9 ± 0.1 million. This estimate was 22% below the 2018 estimate of 3.7 ± 0.1 million and 19% the long-term average (3.5 ± 0.02 million). The 2019 pond estimate for the northcentral U.S. was 2.1 ± 0.1 million, which

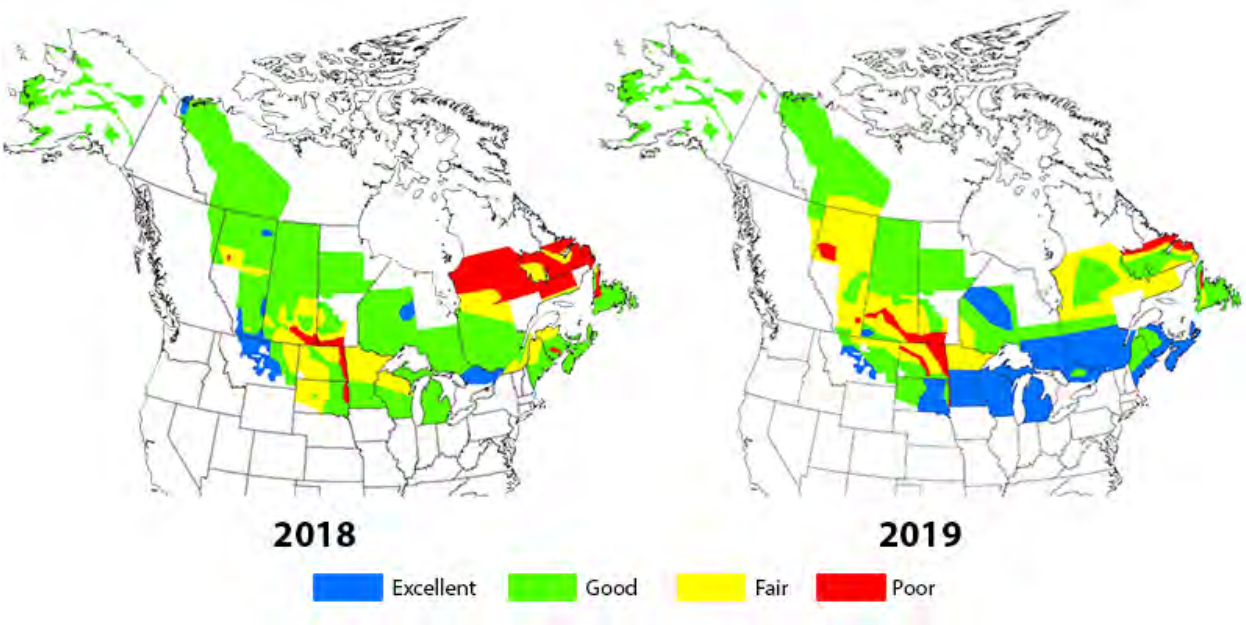


Figure 2. Breeding waterfowl habitat conditions during the 2018 and 2019 Waterfowl Breeding Population and Habitat Surveys, as judged by U.S. Fish and Wildlife Service and Canadian Wildlife Service biologists.

was 36% above the 2018 estimate (1.6 ± 0.09 million) and 26% above the long-term average (1.7 ± 0.01 million). Spring phenology and timing of ice-out was normal or slightly delayed in places within the traditional survey area. Alaska experienced above-average temperatures and below- to above-average precipitation in a northward direction. The boreal forest experienced generally below-average precipitation and temperatures but December 2018 was warmer than average. Habitat quality generally declined across the survey area compared to last year, with the exception of most of the Dakotas and Montana which continued to improve. Overall habitat quality remained fair to good over a large portion of the traditional survey area and should lead to average waterfowl production this year, however dry areas, particularly in the Canadian prairies, have expanded since 2018.

Conditions in much of the eastern survey area remained similar or improved relative to 2018. The region experienced mainly average to above-average precipitation in the south and Maritimes but below-average precipitation across the northern areas since September 2018. The entire region tended to have a cool spring. Spring phenology and ice-out was generally normal but substantially delayed in northern Quebec and Labrador. Conditions for waterfowl production were good to excellent in the south and poorer farther north.

In the WBPHS traditional survey area, the total duck population estimate was 38.9 ± 0.7 million birds. This estimate was 6% below the 2018 estimate of 41.2 ± 0.7 million and 10% higher than the long-term average (1955–2018). In the eastern Dakotas, total duck numbers were 29% higher than the 2018 estimate and 70% above the long-term average. The total duck estimate in southern Alberta was 18% below last year's estimate and similar to the long-term average. The total duck estimate was 24% lower than last year's in southern Saskatchewan and 19% below the long-term average. In southern Manitoba, the total duck population estimate was 27% below last year's estimate and 22% below the long-term average. The total duck estimate in central and northern Alberta–northeastern British Columbia–Northwest Territories was similar to the 2018 estimate and 38% above the long-term average. The estimate in the northern Saskatchewan–northern Manitoba–

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

			Change from 2018			Change from LTA	
Region	2019	2018	%	*P*	LTA[a]	%	*P*
Prairie & Parkland Canada							
S. Alberta	947	1,179	−20	0.020	781	+21	0.018
S. Saskatchewan	1,372	1,936	−29	<0.001	2,086	−34	<0.001
S. Manitoba	536	546	−2	0.871	660	−19	0.001
Subtotal	2,856	3,660	−22	<0.001	3,527	−19	<0.001
Northcentral U.S.							
Montana & western Dakotas	1,099	753	+46	0.022	579	+90	<0.001
Eastern Dakotas	1,036	814	+27	0.001	1,116	−7	0.149
Subtotal	2,135	1,567	+36	0.001	1,695	+26	0.001
Total	4,990	5,227	−5	0.331	5,235	−5	0.160

[a] Long-term average. Prairie and and Parkland Canada, 1961–2018; northcentral U.S. and Total 1974–2018.

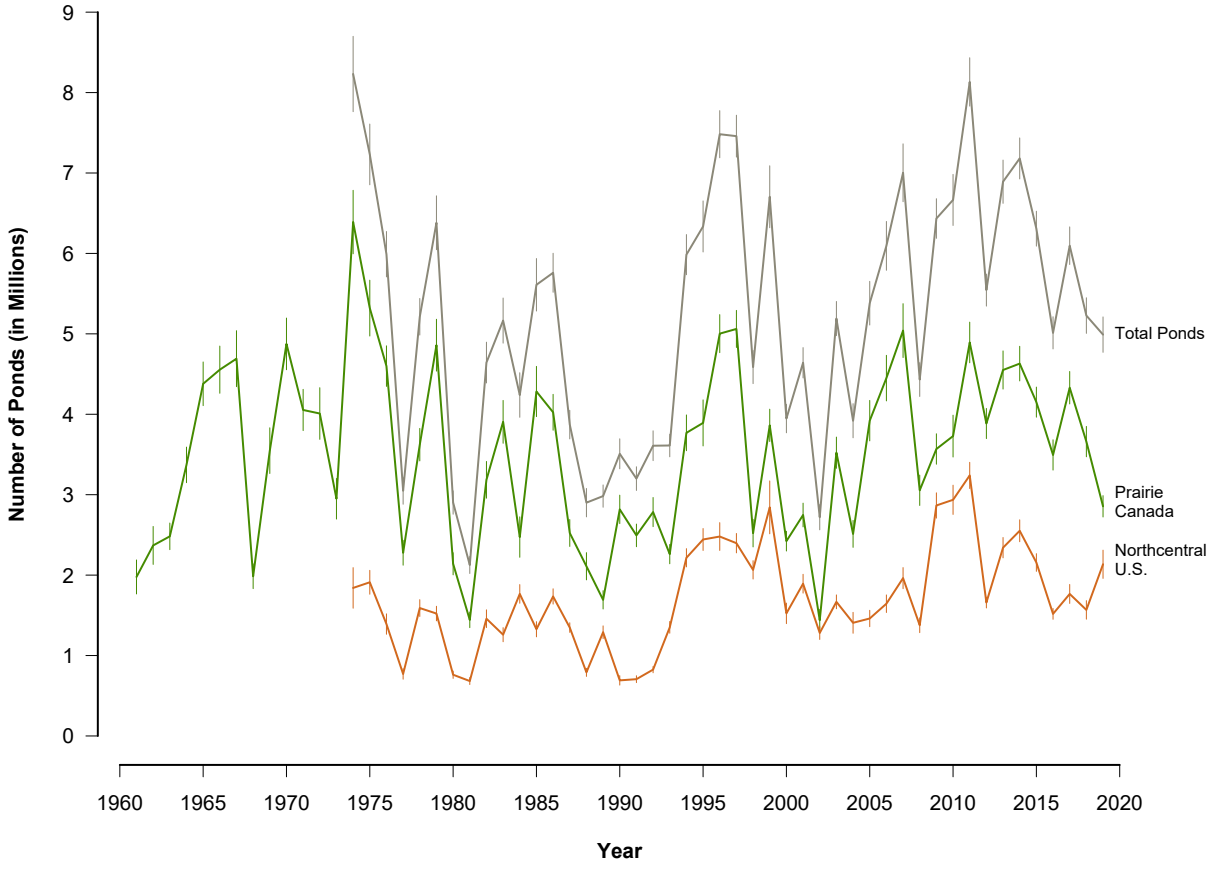


Figure 3. Number of ponds in May and 90% confidence intervals in Prairie Canada, the northcentral U.S., and both areas combined (Total ponds).

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

			Change from 2018			Change from LTA	
Region	2019	2018	%	*P*	LTA[b]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	2,612	3,381	−23	<0.001	3,698	−29	<0.001
C. & n. Alberta–n.e. British Columbia–NWT	10,377	9,916	+5	0.413	7,496	+38	<0.001
N. Saskatchewan–n. Manitoba–w. Ontario	2,460	3,167	−22	0.003	3,440	−29	<0.001
S. Alberta	4,575	5,546	−18	0.002	4,367	+5	0.290
S. Saskatchewan	6,479	8,492	−24	<0.001	7,997	−19	<0.001
S. Manitoba	1,222	1,665	−27	0.001	1,556	−22	<0.001
Montana & Western Dakotas	2,404	2,239	+7	0.375	1,745	+38	<0.001
Eastern Dakotas	8,771	6,787	+29	<0.001	5,147	+70	<0.001
Total	38,899	41,193	−6	0.014	35,446	+10	<0.001
Other regions							
British Columbia	409	346	+18	0.036	345	+19	0.012
California	471	549	−14	0.306	553	−15	0.102
Michigan	334	452	−26	0.122	625	−47	<0.001
Northeast U.S.[c]	1,307	1,448	−10	0.437	1,371	−5	0.455
Oregon	251	294	−14	0.301	264	−5	0.606
Washington	248	281	−12	0.220	189	+32	<0.001
Wisconsin	414	439	−6	0.771	441	−6	0.720

[a] Includes 10 species in Appendix B.3, plus American black ducks, ring-necked ducks, goldeneyes, bufflehead, and ruddy ducks (*Oxyura jamaicensis*); excludes eiders, long-tailed ducks, scoters, mergansers, and wood ducks.
[b] Long-term average for regions in the traditional survey area, 1955–2018; years for other regions vary (see Appendix B.2)
[c] Includes all or portions of CT, DE, MD, MA, NH, NJ, NY, PA, RI, VT, and VA.

western Ontario survey area was 22% below the 2018 estimate and 29% below the long-term average. The total duck estimate in the Montana–western Dakotas area was similar to the 2018 estimate but 38% above the long-term average. In the Alaska–Yukon Territory–Old Crow Flats region, the total duck estimate was 23% below last year's estimate and 29% below the long-term average.

Several states and provinces conduct breeding waterfowl surveys in areas outside the geographic extent of the WBPHS (estimates are provided in Appendix B.2). In California, Oregon, Washington, British Columbia, Michigan, Wisconsin, 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 2018 estimate and similar to the long-term average (1992–2018). Oregon's 2019 total duck estimate was similar to 2018 and the long-term average (1994–2018). In Washington, the total duck estimate was unchanged from the 2018 estimate and 32% above the long-term average (2010–2018). British Columbia's total duck estimate was 18% above the 2018 estimate and 19% above the long-term average (2006–2018). In Michigan, the total duck estimate was similar to the 2018 estimate and 47% below the long-term average (1991–2018). Wisconsin's 2019 total duck estimate was similar to the 2018 estimate and the long-term average (1973–2018). In Minnesota, which does not have a measure

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

			Change from 2018			Change from LTA	
Region	2019	2018	%	*P*	LTA[a]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	361	451	−20	0.117	387	−7	0.469
C. & n. Alberta–n.e. British Columbia–NWT	1,701	1,550	+10	0.457	1,150	+48	<0.001
N. Saskatchewan–n. Manitoba–w. Ontario	1,105	1,277	−13	0.394	1,149	−4	0.743
S. Alberta	972	1,328	−27	0.005	1,098	−12	0.107
S. Saskatchewan	1,712	2,094	−18	0.006	2,118	−19	<0.001
S. Manitoba	441	460	−4	0.758	396	+11	0.295
Montana & Western Dakotas	771	560	+38	0.054	533	+45	0.008
Eastern Dakotas	2,360	1,536	+54	<0.001	1,088	+117	<0.001
Total	9,423	9,255	+2	0.683	7,918	+19	<0.001
Eastern survey area	1,050	1,067	−2	−−[b]	1,244	−16	−−[b]
Other regions							
British Columbia	75	79	−6	0.612	80	−7	0.477
California	240	273	−12	0.533	337	−29	0.004
Michigan	179	251	−29	0.135	341	−47	<0.001
Minnesota	286	295	−3	0.878	229	+25	0.112
Northeast U.S.[c]	565	482	+17	0.197	700	−19	0.004
Oregon	84	97	−28	<0.001	91	−8	0.330
Washington	126	125	+1	0.934	88	+44	0.002
Wisconsin	204	217	−6	0.840	183	+12	0.690

[a] Long-term average. Traditional survey area 1955–2017; eastern survey area 1990–2017; years for other regions vary (see Appendix B.2).
[b] *P*-values not provided because these data were analyzed using Bayesian methods.
[c] Includes all or portions of CT, DE, MD, MA, NH, NJ, NY, PA, RI, VT, and VA.

of precision for total duck numbers, the 2019 estimate of total ducks was 10% lower than the 2018 estimate and 5% above the long-term average (1968–2018). The total breeding duck estimate in the northeast U.S. was similar to the 2018 estimate and the long-term average (1993–2018).

Trends and annual breeding population estimates for 10 principal duck species for the traditional survey area are provided in this report (Tables 3–12, Figure 4, Appendix B.3). Percent change was computed prior to rounding of estimates and therefore may not match the rounded estimates presented in the tables and text. Estimated mallard abundance was 9.4 ± 0.3 million, which was similar to the 2018 estimate of 9.3 ± 0.3 million but 19% above the long-term average of 7.9 ± 0.04 million (Table 3). In the eastern Dakotas, the mallard estimate was 54% above last year's count and 117% above the long-term average. The mallard estimate in southern Alberta was 27% below last year's estimate and similar to the long-term average. In the central and northern Alberta–northeastern British Columbia–Northwest Territories region, the mallard estimate was similar to the 2018 estimate and 48% above the long-term average. The mallard estimate in Montana–western

Dakotas was similar to 2018 and 45% above the long-term average. In northern Saskatchewan–northern Manitoba–western Ontario, the Alaska–Yukon Territory–Old Crow Flats and southern Manitoba survey areas, the mallard estimates were similar to their 2018 estimates and long-term averages. Mallard numbers in southern Saskatchewan were 18% below the 2018 estimate and 19% below the long-term average.

The estimated abundance of mallards in eastern North America was 1.0 ± 0.15 million, which was similar to the 2018 estimate but 16% below the long-term average. Mallard abundances with estimates of precision are also available for other areas where surveys are conducted (California, Oregon, Washington, British Columbia, Nevada, Minnesota, Michigan, Wisconsin, and the northeast U.S.; Table 3). Mallard numbers in California were similar to last year and 29% below the long-term average (1992–2018). The Oregon mallard estimate was 28% below the 2018 estimate and similar to the long-term average (1994–2018). In Washington, mallard numbers were similar to the 2018 estimate and 44% above the long-term average (2010–2018). British Columbia mallard numbers were similar to last year and the long-term average (2006–2018). In Nevada, the mallard estimate was 28% below the 2018 estimate and 23% above the long-term average (2009–2018). Minnesota mallard numbers were similar to last year and the long-term average (1968–2018). In Michigan, the 2019 mallard estimate was similar to the 2018 estimate and 47% below the long-term average (1991–2018). Wisconsin mallard numbers were similar to last year's estimate and the long-term average (1973–2018). The northeast U.S. mallard estimate was similar to the 2018 estimate and 19% below the long-term average (1993–2018).

In the traditional survey area the 2019 estimate for blue-winged teal (5.4 ± 0.3 million) was 16% below the 2018 estimate and similar to the long-term average of 5.1 ± 0.04 million (Table 7). Estimated abundance of gadwall (3.3 ± 0.2 million) was similar to the 2018 estimate and 61% above the long-term average (Table 4). The 2019 northern shoveler estimate was 13% below last year and 39% above the long-term average of 2.6 ± 0.02 million (Table 8; 3.6 ± 0.1 million). The estimated abundance of green-winged teal was 3.2 ± 0.2 million, which was similar to the 2018 estimate of 3.0 ± 0.2 million and 47% above the long-term average (2.2 ± 0.02 million; Table 6). Estimated abundance of redheads (0.7 ± 0.06 million) was 27% lower than the 2018 estimate and similar to the long-term average of 0.7 ± 0.01 million (Table 10). Northern pintail abundance (2.3 ± 0.1 million) was similar to the 2018 estimate and 42% below the long-term average of 3.9 ± 0.03 million (Table 9). Abundance estimates for American wigeon (2.8 ± 0.2 million) and canvasbacks (0.7 ± 0.05 million) were similar to their 2018 estimates and their long-term averages of 2.6 ± 0.02 million and 0.6 ± 0.05 million, respectively (Table 5 and Table 11). The combined estimate of lesser and greater scaup (3.6 ± 0.2 million) was similar to the 2018 estimate and 28% below the long-term average of 5.0 ± 0.04 million (Table 12).

In the eastern survey area, the estimate of goldeneyes was 0.5 ± 0.1 million, which was similar to the 2018 estimate and the 1998–2018 average. The green-winged teal estimate (0.3 ± 0.1 million) was similar to the 2018 estimate and 19% below the long-term average. Ring-necked ducks (0.7 ± 0.2 million) and mergansers (0.6 ± 0.1 million) were similar to last year's estimates and the long-term averages (Table 13, Figure 5, Appendix B.5). The 2019 estimate of American black ducks in the eastern survey area was 0.7 ± 0.1 million, which similar to last year's estimate of 0.7 ± 0.1 million, and 16% below the 1998–2018 average. The black duck estimate at the plot survey scale, which is used for management, was 0.56 ± 0.04 million. In addition, black duck population estimates for northeastern states from New Hampshire south to Virginia were also available from the Atlantic Flyway Breeding Waterfowl Survey. The estimate for the northeastern states for black ducks was 80,500 which was 127% above the 2018 estimate and 38% above the long-term (1993–2018) average of 58,200. These northeastern state estimates for American black ducks are not explicitly integrated with the eastern survey area as is done for mallards. The USFWS and black duck joint venture are currently working on integrating these data to derive a more

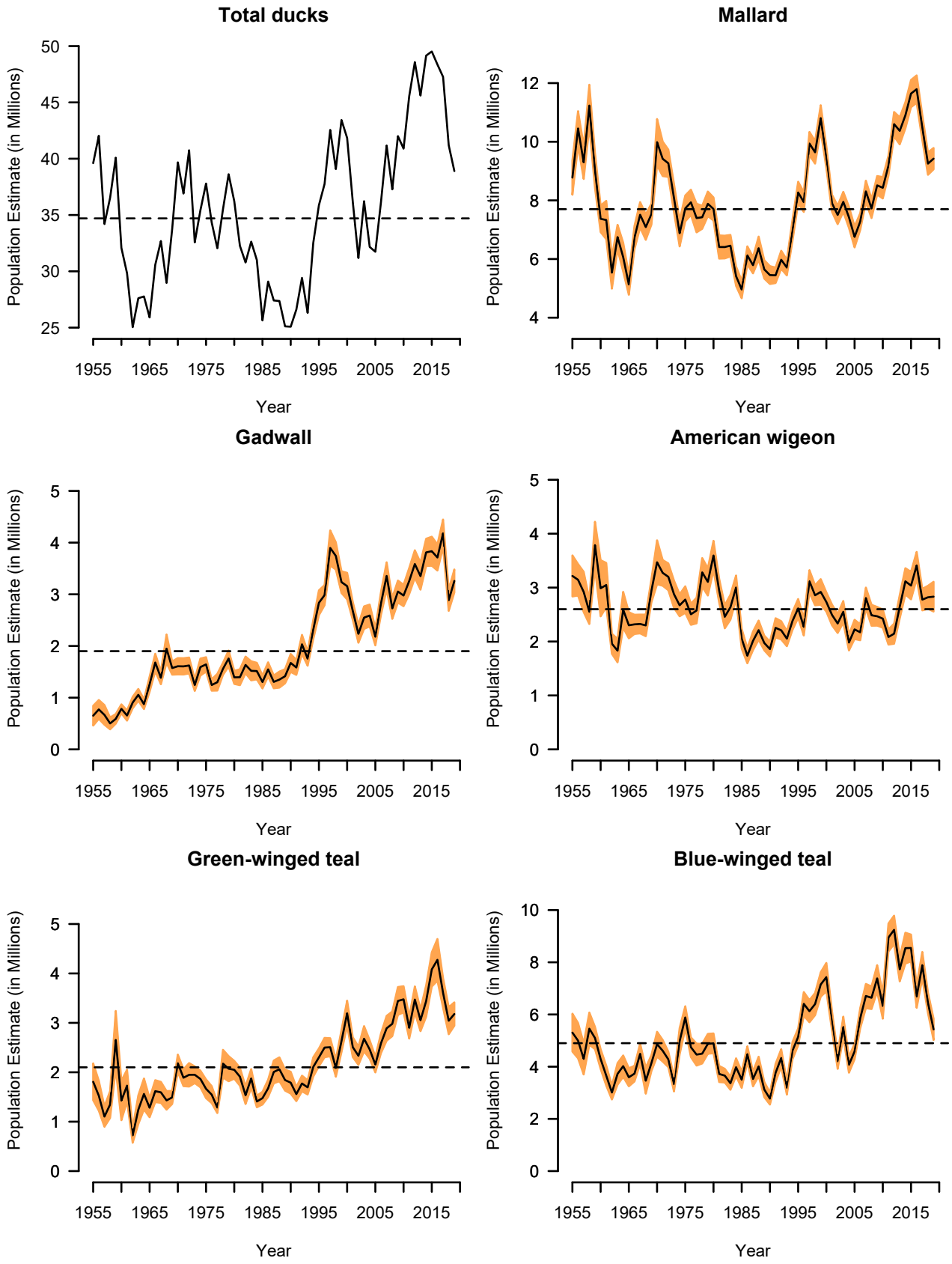


Figure 4. Breeding population estimates, 90% confidence intervals, and North American Waterfowl Management Plan population goals (dashed line; North American Waterfowl Management Plan Committee 2014) for selected species in the traditional survey area (strata 1–18, 20–50, 75–77).

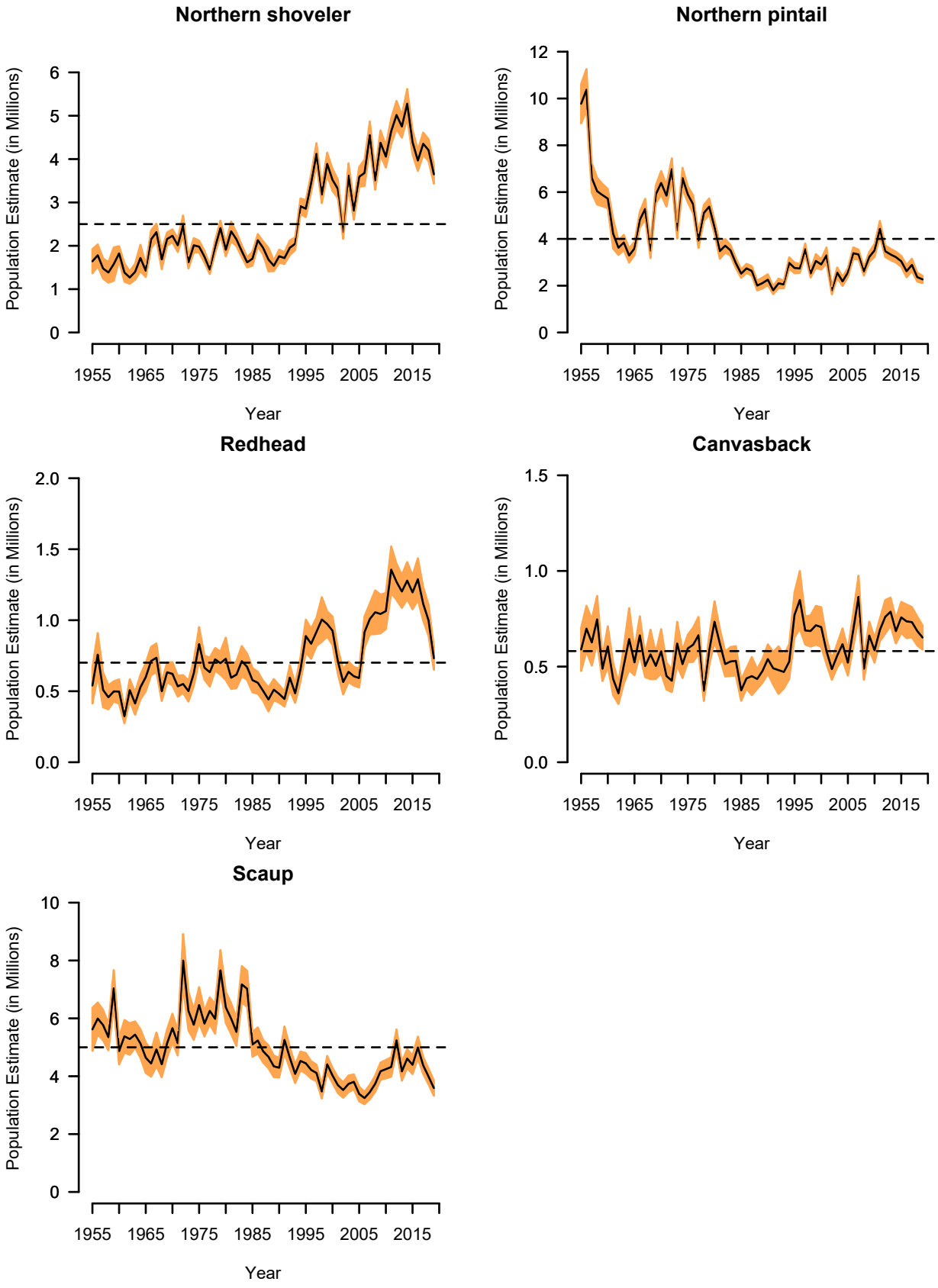


Figure 4. Continued.

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

			Change from 2018			Change from LTA	
Region	2019	2018	%	*P*	LTA[a]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	0	0	0		2	−78	0.001
C. & n. Alberta–n.e. British Columbia–NWT	77	51	+52	0.249	51	+51	0.125
N. Saskatchewan–n. Manitoba–w. Ontario	4	8	−44	0.409	25	−83	<0.001
S. Alberta	592	418	+42	0.122	341	+74	0.005
S. Saskatchewan	1,107	1,218	−9	0.422	694	+60	<0.001
S. Manitoba	140	101	+39	0.332	80	+75	0.054
Montana & Western Dakotas	409	422	−3	0.852	226	+81	<0.001
Eastern Dakotas	928	668	+39	0.049	610	+52	0.001
Total	3,259	2,886	+13	0.116	2,029	+61	<0.001

[a] Long-term average, 1955–2018.

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

			Change from 2018			Change from LTA	
Region	2019	2018	%	*P*	LTA[a]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	398	597	−33	0.001	561	−29	<0.001
C. & n. Alberta–n.e. British Columbia–NWT	1,555	1,326	+17	0.350	940	+65	0.002
N. Saskatchewan–n. Manitoba–w. Ontario	107	147	−27	0.258	225	−53	<0.001
S. Alberta	251	208	+21	0.418	277	−9	0.577
S. Saskatchewan	240	272	−12	0.412	395	−39	<0.001
S. Manitoba	13	12	+10	0.773	51	−75	<0.001
Montana & Western Dakotas	152	118	+29	0.411	112	+36	0.168
Eastern Dakotas	116	140	−18	0.666	61	+89	0.146
Total	2,832	2,820	0[b]	0.966	2,622	+8	0.334

[a] Long-term average, 1955–2018.
[b] Rounded values mask change in estimates.

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

			Change from 2018			Change from LTA	
Region	2019	2018	%	*P*	LTA[a]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	416	449	−7	0.636	419	−1	0.960
C. & N. Alberta–n.e. British Columbia–NWT	1,681	1,587	+6	0.717	900	+87	<0.001
N. Saskatchewan–n. Manitoba–w. Ontario	219	187	+17	0.366	200	+10	0.513
S. Alberta	301	190	+59	0.042	207	+46	0.032
S. Saskatchewan	277	324	−14	0.329	279	−1	0.945
S. Manitoba	72	85	−15	0.406	57	+27	0.160
Montana & Western Dakotas	45	49	−9	0.760	41	+9	0.715
Eastern Dakotas	167	171	−3	0.910	62	+168	<0.001
Total	3,178	3,043	+4	0.631	2,164	+47	<0.001

[a] Long-term average, 1955–2018.

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

			Change from 2018			Change from LTA	
Region	2019	2018	%	*P*	LTA[a]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	0	0	0		1	−100	<0.001
C. & n. Alberta–n.e. British Columbia–NWT	711	490	+45	0.123	286	+148	<0.001
N. Saskatchewan–n. Manitoba–w. Ontario	5	71	−93	0.014	226	−98	<0.001
S. Alberta	707	1,171	−40	0.010	651	+9	0.477
S. Saskatchewan	932	1,700	−45	<0.001	1,458	−36	<0.001
S. Manitoba	158	341	−54	0.026	375	−58	<0.001
Montana & Western Dakotas	198	399	−50	0.010	314	−37	0.013
Eastern Dakotas	2,717	2,279	+19	0.159	1,790	+52	<0.001
Total	5,428	6,450	−16	0.021	5,102	+6	0.310

[a] Long-term average, 1955–2018.

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

			Change from 2018			Change from LTA	
Region	2019	2018	%	*P*	LTA[a]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	322	367	−12	0.415	300	+7	0.567
C. & n. Alberta–n.e. British Columbia–NWT	335	415	−19	0.313	245	+37	0.075
N. Saskatchewan–n. Manitoba–w. Ontario	20	22	−10	0.823	38	−48	0.021
S. Alberta	716	1,027	−30	0.030	445	+61	0.001
S. Saskatchewan	820	1,066	−23	0.026	803	+2	0.788
S. Manitoba	60	109	−45	0.060	113	−47	<0.001
Montana & Western Dakotas	309	387	−20	0.301	176	+75	0.005
Eastern Dakotas	1,067	814	+31	0.064	501	+113	<0.001
Total	3,649	4,208	−13	0.031	2,622	+39	<0.001

[a] Long-term average, 1955–2018.

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

			Change from 2018			Change from LTA	
Region	2019	2018	%	*P*	LTA[a]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	431	651	−34	0.072	915	−53	<0.001
C. & n. Alberta–n.e. British Columbia–NWT	530	497	+6	0.730	374	+42	0.025
N. Saskatchewan–n. Manitoba–w. Ontario	3	22	−85	0.019	35	−91	<0.001
S. Alberta	133	344	−61	<0.001	645	−79	<0.001
S. Saskatchewan	164	269	−39	0.005	1,100	−85	<0.001
S. Manitoba	14	11	+25	0.557	96	−86	<0.001
Montana & Western Dakotas	373	193	+93	0.003	253	+47	0.024
Eastern Dakotas	622	379	+64	0.003	505	+23	0.087
Total	2,268	2,365	−4	0.618	3,924	−42	<0.001

[a] Long-term average, 1955–2018.

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

			Change from 2018			Change from LTA	
Region	2019	2018	%	*P*	LTA[a]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	0	0	0	0.339	1	−70	0.049
C. & n. Alberta–n.e. British Columbia–NWT	61	78	−22	0.549	41	+48	0.388
N. Saskatchewan–n. Manitoba–w. Ontario	4	19	−80	0.259	25	−84	<0.001
S. Alberta	172	245	−30	0.115	133	+29	0.169
S. Saskatchewan	173	290	−40	0.090	240	−28	0.085
S. Manitoba	31	135	−77	0.004	77	−60	<0.001
Montana & Western Dakotas	8	31	−73	0.084	11	−27	0.329
Eastern Dakotas	283	202	+40	0.068	200	+42	0.018
Total	732	999	−27	0.012	729	0	0.956

[a] Long-term average, 1955–2018.

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

			Change from 2018			Change from LTA	
Region	2019	2018	%	*P*	LTA[a]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	78	85	−8	0.855	84	−7	0.761
C. & n. Alberta–n.e. British Columbia–NWT	106	108	−2	0.964	78	+36	0.257
N. Saskatchewan–n. Manitoba–w. Ontario	25	43	−42	0.287	50	−51	0.008
S. Alberta	133	73	+84	0.037	66	+101	0.010
S. Saskatchewan	160	208	−23	0.176	202	−21	0.050
S. Manitoba	56	81	−30	0.259	57	−1	0.947
Montana & Western Dakotas	30	29	+6	0.874	10	+202	0.004
Eastern Dakotas	64	61	+4	0.872	43	+48	0.019
Total	652	686	−5	0.657	591	+10	0.218

[a] Long-term average, 1955–2018.

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

			Change from 2018			Change from LTA	
Region	2019	2018	%	*P*	LTA[a]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	499	670	−26	0.075	892	−44	<0.001
C. & n. Alberta–n.e. British Columbia–NWT	1,793	1,965	−9	0.481	2,513	−29	<0.001
N. Saskatchewan–n. Manitoba–w. Ontario	259	268	−3	0.877	536	−52	<0.001
S. Alberta	352	260	+36	0.202	328	+8	0.684
S. Saskatchewan	353	409	−14	0.483	418	−16	0.252
S. Manitoba	69	82	−16	0.533	125	−45	<0.001
Montana & Western Dakotas	30	28	+7	0.845	47	−35	0.025
Eastern Dakotas	235	307	−23	0.245	132	+78	0.006
Total	3,591	3,989	−10	0.179	4,990	−28	<0.001

[a] Long-term average, 1955–2018.

comprehensive estimate of population status.

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 per year) and associated 95% credible intervals (LCL, UCL in parentheses following trend estimates) presented here. In the Atlantic and Mississippi flyways combined, the BBS wood duck index increased by an average of 1.42% (1.04%, 1.79%) per year over the entire survey period (1966–2019), 1.55% (0.97%, 2.15%) over the past 20 years (1999–2018), and 2.11% (1.09%, 3.22%) over the most recent (2009–2018) 10-year period. The Atlantic Flyway wood duck index increased 1.19% (0.64%, 1.73%) annually over the entire time series (1966–2018), 1.62% (0.71%, 2.53%) over the past 20 years (1999–2018), and 1.90% (0.16%, 3.57%) from 2009 to 2018. In the Mississippi Flyway, the corresponding BBS wood duck indices increased by 1.54% (1.07%, 1.99%, 1966–2018), 1.53% (0.77%, 2.30%, 1999–2018), and 2.21% (0.93%, 3.62%, 2009–2018; J. Sauer, U.S. Geological Survey Biological Resources Division, unpublished data). An independent wood duck population estimate was available from the Atlantic Flyway Breeding Waterfowl Survey for the northeast states from New Hampshire south to Virginia. The 2019 survey estimate of 399,100 (SE = 37,200) was similar to 2018 estimate (394,400, SE = 36,600) and slightly above the 1993–2018 average (385,300, SE = 34,700).

Regional Habitat Conditions

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

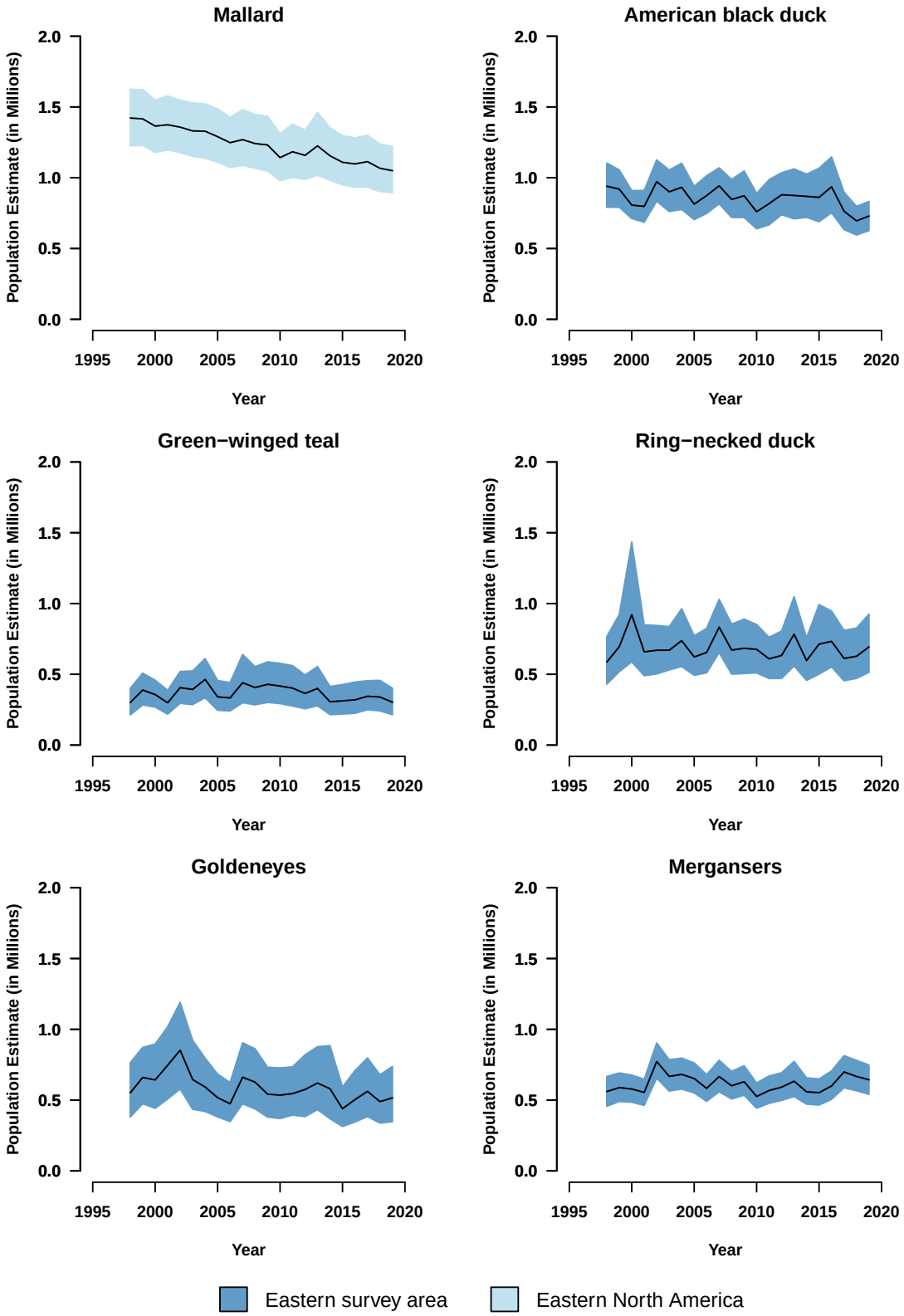


Figure 5. Breeding population estimates and 90% credible intervals from Bayesian hierarchical models for species in the eastern survey area. Time series are presented for two spatial scales: eastern survey area (Blue; strata 51–53, 56, 62–72 for black ducks, green-winged teal, ring-necked ducks, goldeneye, and mergansers) and eastern North America (Light blue; eastern survey area plus the northeastern states from Virginia north to New Hampshire for mallards).

Table 13. Duck breeding population estimates for the six most abundant species in the eastern survey area. Estimates for black ducks, green-winged teal, ring-necked ducks, goldeneye, and mergansers are at the eastern survey scale (strata 51–53, 56, 62–72) and mallards at the eastern North America scale (eastern survey area plus Virginia north to New Hampshire).

	2019	2018	% Change from 2018	Average[a]	% Change from average
Mallard	1,050	1,067	−2	1,244	−16[b]
American black duck	729	695	+5	861	−16[b]
Green-winged teal	303	339	−11	370	−19[b]
Ring-necked duck	694	627	+10	685	0
Goldeneyes (common and Barrow's)	516	489	+5	589	−13
Mergansers (common, red-breasted, and hooded)	643	667	−3	616	+4

[a] Average for 1998–2018.
[b] Indicates significant change. Significance ($P \leq 0.10$) determined by non-overlap of Bayesian credibility intervals.

in this report. More detailed information on regional waterfowl and habitat conditions during the May waterfowl survey is also available on USFWS Division of Migratory Bird Management website (https://www.fws.gov/birds/surveys-and-data/population-surveys/aerial-ground-crew-blog.php).

Southern Alberta (strata 26–29, 75–76)
reported by biologist-pilot Rob Spangler

With the exception of a colder than normal September, fall temperatures were generally within 2°C of normal throughout southern Alberta. Winter brought warmer temperatures, averaging from 2–6°C above normal from November 2018—January 2019. However, a large arctic air mass pushed south in February 2019 causing temperatures to dip 10°C below normal. Spring 2019 temperatures were typical, which was a stark contrast to 2018 when February—April temperatures were 5°C below normal, resulting in a late snowmelt. Precipitation was below average across most of southern Alberta. The drought continued in the Peace River and Lloydminster regions with precipitation only 25–50% of normal. The only area to receive average fall precipitation was near Grand Prairie. Most areas received near-normal winter moisture but spring conditions were once again drier. Precipitation was only 25–50% of normal near Lloydminster and Peace River received less than 25% of normal. Spring precipitation averaged 50–80% of normal in the Edmonton, Calgary, and Lethbridge regions. A late snowstorm and lower temperatures caused a slight delay in waterfowl-breeding phenology but timing was about normal. This was a change from 2018 when cooler temperatures delayed migration by over a week. Overall, habitat conditions have declined across Alberta when compared to 2018. The best habitat conditions were found near the Montana border on the Milk River Ridge and southeast of Edmonton where more permanent wetlands were found in the parklands region. Areas near Lac la Biche were also relatively good in the mostly undisturbed boreal forest habitats but water levels were lower than usual. Fair habitat predominated throughout most of the survey area with some poor areas found to the northeast of Lethbridge and near Peace River. Fair waterfowl production is expected from most of southern Alberta.

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

Southern Saskatchewan experienced a very dry summer and early fall (less than 40% of normal) in 2018. Precipitation returned in late fall and brought much needed above-average precipitation (115–200%). Most of that precipitation fell in the southern grasslands and northwest

Parklands. Winter and spring precipitation across the survey area was below to well-below average (40–85%). Temperatures during fall 2018 were average to below average (0–4°C). A temperature roller coaster ride occurred through winter with above-average temperatures (2–4°C) in December and January and then record low temperatures (greater than −5°C) in February 2019. February was a frequent topic when discussing weather with Saskatchewan residents and the general theme was how cold it was and how long the record-low temperatures lasted. Seasonal spring temperatures returned to the province, with only slightly cooler May temperatures (0–2°C) during the survey.

No sheetwater (i.e., ephemeral and temporary wetlands) was observed and seasonal wetlands were already dry or would be in a couple weeks. Semi-permanent wetlands were drawn-down and even permanent lakes in some areas were visibly low. Although the Missouri Coteau was the bright spot in the grasslands, wetlands were very low and many were already dry during the survey. The central grasslands had poor production potential because of drought conditions and very little wetland habitat. The southern and southwest grasslands had good-to-excellent production potential because of better wetland conditions. Vegetation phenology varied but overall appeared normal for the start date and survey timing was good. The Parklands were drier than 2018. Fair conditions were observed in the south and habitats improved to good on the northern survey lines. Fair-to-good production is expected in the Parklands due to better waterfowl breeding habitat. Overall, the majority of Southern Saskatchewan should have fair waterfowl recruitment but wetland and upland habitat conditions have declined and are some of the driest the province has had in many years.

Southern Manitoba (strata 34–40; includes southeast Saskatchewan)
reported by biologist-pilot Sarah Yates

Southern Manitoba and southeastern Saskatchewan remained dry in 2019. Similar to 2018, the region recorded below-average winter and spring precipitation and mainly below-average temperatures. Winter precipitation was mostly below average (40–85%) in the survey area but southeastern Saskatchewan had average precipitation in February and April 2019. These are some of the driest conditions Manitoba has seen in many years. Winter temperatures were below average, with February 2019 brutally cold (−5°C). Spring continued dry (less than 40–85%) and temperatures were average to slightly below average.

Habitat quality declined in all strata in 2019. The lack of water was striking with no sheetwater or seasonal wetlands in any stratum and larger, semi-permanent wetlands extremely low. Rivers, streams, and canals were either dried up or very low. Stratum 39 habitat conditions were poor, with better areas near Oak Lake, Whitewater Lake, and Turtle Mountain Provincial Park. Habitat conditions improved slightly in southeastern Saskatchewan (stratum 35) but most wetlands were extremely low and will not remain without additional precipitation. While stratum 34 was drier than 2018 it still had some of the better habitat due to the presence of permanent and semi-permanent wetlands. Conditions improved in Parkland and forested strata (36, 37, and 40) but were rated poor to fair due to noticeably drier conditions. The only areas rated good were habitats and larger marshes associated with lakes Manitoba, Winnipegosis, and Winnipeg but even these were drier than in recent years. Southeastern Manitoba (stratum 38) was almost bone dry, including dugouts, and was once again rated poor.

Montana and western Dakotas (strata 41–44)
reported by biologist-pilot Ryan Anthony

Temperatures were average over the last year for the Montana and western Dakotas crew area. Two exceptions were cold snaps in October 2018 and February 2019 when temperatures dropped well below normal. April 2019 temperatures were above average followed by another cold snap in May 2019. Spring temperatures were not cold enough, however, to cause a delay in waterfowl migration and breeding phenology. It

was another very wet year for this crew area. Fall precipitation was average but increased dramatically starting in February 2019. Above-average precipitation (125–600%) fell in most of the western Dakotas and eastern Montana in February and April 2019. The wet pattern (125–400%) continued during May except in northwestern North Dakota where precipitation was 50% of normal. The above-average precipitation continued to recharge wetlands and ponds in the western Dakotas that experienced drought several years ago. Wetland conditions in western South Dakota and southwestern North Dakota were relatively good whereas habitat in northwest North Dakota was fair due to drier conditions and little nesting cover. Southern Montana wetland conditions were good and excellent wetland habitat was observed near Great Falls and Lewistown. Ponds and wetlands were nearly full, many streams at capacity, and sheetwater was present in many areas. Rain and high-elevation snow continued to fall during the survey, which likely pushed wetlands to capacity and summer snowmelt should keep streams charged. Near the Canada–U.S. border, fair conditions existed on the eastern portion of the crew area and improved to good moving west. Good waterfowl production is likely in the western Dakotas and eastern Montana from improved habitat conditions.

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

Habitat conditions in the eastern Dakotas crew area declined in a northerly direction. South Dakota habitat conditions continued to improve in 2019 whereas North Dakota, with the exception of the southeast, had declined further. Above-average precipitation since fall 2018, including severe blizzards in March and April 2019 that each deposited up to 30 inches of snow, provided significant moisture for wetlands. Record cold temperatures into the survey period contributed to a good frost seal. Average to below-average snowfall in North Dakota resulted in inadequate runoff for wetland basins despite a good frost seal. Many wetlands north of Interstate 94 had low water or were dry, particularly north of Devil's Lake.

In strata 48 and 49 in South Dakota, conditions were excellent west of the James River and good to the east. Most wetlands were flooded and all streams and rivers were well out of their banks, with moderate to extreme flooding along portions of the James, Vermillion, and Big Sioux rivers. Stratum 49 had more full wetlands and sheetwater than I have observed since I began flying the crew area in 2008. Production should be average or slightly above average in South Dakota.

Conditions were considerably drier moving northward in strata 45 and 46 in North Dakota, with most of the state considered fair to poor, except in the coteau region and areas south and east of Jamestown that were rated good. Most drift plain seasonal wetlands were dry but permanent coteau wetland basins were at least 50% full. The Souris and James rivers were within their banks and Devil's Lake and Lake Sakakawea had little exposed beach area due to limited water discharge to prevent downstream flooding. There were few intact wetlands remaining in stratum 47 and most segments remained void of wetlands and waterfowl once again.

Overall, the eastern Dakotas crew area was rated fair. The coteau regions of both states were rated good, and should produce average numbers of waterfowl. While South Dakota was wetter in 2019 and should produce average to above-average production, North Dakota declined further to mostly fair to poor, with strata 45 and 47 again rated poor.

Northern Saskatchewan, northern Manitoba, and western Ontario (strata 21–25, 50)
reported by biologist-pilots Walt Rhodes and Jim Wortham

Northern Saskatchewan and northern Manitoba (strata 21–25) generally experienced below-average temperatures and precipitation since September 2018. With the exception of above-average temperatures (0–4°C) in December 2018, fall and winter temperatures ran below average, with February 2019 brutally cold (greater than −5°C), before moderating to average in March

and April 2019. It was cooler than normal during the survey and phenology and waterfowl migration was slightly delayed. With the exception of northwest Saskatchewan, the region received average to above-average precipitation in September 2018. La Ronge, SK, east to Flin Flon, MB, received average precipitation in October 2018 but the rest of the area was below average, and the entire region remained drier through December 2018. Average to above-average (85–115%) winter precipitation fell in January 2019 but from February through May 2019 precipitation was below to well-below average. There were only scattered locations of average precipitation during spring. Despite the drier conditions, forest fires were non-existent. Boreal wetlands remained adequately full of water but lower than in 2018. The Parklands continued to exhibit good wetland conditions. Overall, good habitat conditions were expected across the crew area.

It was another late spring in western Ontario (stratum 50). Winter was characterized by slightly below-average temperatures (–4–0°C) and below-average snowfall (less than 40–85%). Only February 2019 recorded above-average precipitation, and that was concentrated in the southern portion of the stratum. Spring precipitation was average in the south and below average (40–85%) farther north while spring temperatures were slightly below average (–2–0°C). Snow cover did not melt until the second week of May. Driest areas were concentrated near Dryden, Kenora, and Red Lake, ON and were rated as fair. Well-charged wetlands and good populations of beaver characterized the remainder of western Ontario habitats, which were judged good to excellent.

Central and northern Alberta, northeastern British Columbia, and Northwest Territories (strata 13–18, 20, 77)
reported by biologist-pilot Brian Lubinski

Due to the large size of the crew area temperatures and precipitation can vary significantly across locations. Bistcho Lake, AB, weather station data indicated that northern AB and southern NT experienced average winter temperatures. Temperatures ranged from –34 to 5°C from October 2018 through March 2019. The four-year average (2015–2018) was –35 to 6°C. Northern AB annual precipitation was 249mm, below the 2015–2018 average of 300mm. Dry conditions led to a major forest fire (greater than 280,000ha) near High Level, which forced evacuation of the town and canceled 18 survey segments. The remainder of the crew area, based on Norman Wells, NT, weather station data, experienced slightly above-average fall and winter temperatures and slightly below-average winter precipitation. Survey timing was perfect based on bird behavior and ice coverage. Water levels were noticeably lower on the Mackenzie, Peace, and Athabasca rivers and connected wetlands. Isolated wetland water levels appeared closer to normal. Stratum 77 near High Level, AB, was rated as poor but farther north in the Peace-Athabasca Delta (stratum 20) habitat conditions improved to fair. There was an abundance of water throughout the rest of the crew area, primarily central and northern NT, and ice cover was absent except on the largest, deepest lakes (e.g., Great Slave, Great Bear, Willow, Coleville, and Simpson lakes). Habitat conditions were considered good in this region.

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

Alaska experienced warmer-than-average winter temperatures, especially in the southwestern, western, and northern portions of the state. Snowfall was below average in southwestern Alaska, near average along the south-central coast and in the central and eastern interior, and substantially above average in the north-central and northwestern regions. Record-high temperatures occurred statewide in March 2019, causing the spring thaw to begin extremely early. Although cooler temperatures in April 2019 slowed thawing, final snowmelt, river-breakup, and leaf-out dates were slightly or very early in most areas. The breakup date for the Kuskokwim River at Bethel (stratum 9) was 12 April, which was four weeks earlier than normal and nine days earlier than the previous record. The

Tanana River at Nenana (stratum 3) also broke up extremely early on 14 April, two weeks earlier than normal and six days earlier than its previous record. An exception to the early spring phenology was the Koyukuk River basin (stratum 6) where record-high snowfall and below-average spring temperatures resulted in a slight delay in snow- and ice-melt timing. Rivers throughout the crew area generally experienced a thermal, rather than dynamic, breakup pattern, which allowed them to thaw in place without causing major flood events. The survey crew did observe mild, localized flooding in many areas, however, which was presumably due to an abundance of snow-meltwater runoff. Duck production in these localized areas may have been negatively impacted. Otherwise, nesting habitat conditions in strata 1–12 appeared to be good in 2019.

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

The majority of southern Ontario and southern Quebec experienced average precipitation (85–115%), with some wetter (115–150%) pockets in the southeast, between 1 November 2018 and 31 March 2019. The northern and western extremes tended to be below average. April 2019 had above-average precipitation (115–200%) while May recorded average precipitation. The overall picture was wetter than average but only near normal in northern and western regions. October 2018 through April 2019 temperatures were 0–3°C below average, with a warm spell (0–2°C) during December 2018. Snow and ice-melt timing was similar to last year in most areas but, like 2018, much later in the higher-elevation regions of stratum 68. Most streams, beaver ponds, string bogs, and permanent lakes and reservoirs across Ontario and Quebec were full during the survey, with levels extending into surrounding forest fringes. We began the survey two days later than last year with hopes phenology could advance in stratum 68. Tree leaf-out was normal when we began surveys in stratum 53. No ice was observed on Georgian Bay or either of the Great Lakes. Many tree species were leafing out in both in strata 52 and 53 and in lower elevation areas of stratum 56, but not so much as to preclude observation of waterfowl. Four weather days and flying fewer segments on some days did not allow the northern lines in stratum 68 time to advance. Transects 13 and 14 were still not ready on 25 May, which was two days later than 2018. These two high-elevation transects can be problematic due to cold, northwesterly systems coming off the James Bay. Other than these two transects, timing in most of stratum 68 and other strata was appropriate. Habitat was rated a mix of fair, good and excellent, and should not be a widespread limiting factor for waterfowl production in 2019.

Below-average winter and spring temperatures resulted in a very late spring in northern Quebec (stratum 69). Breeding waterfowl did not settle across the landscape until the fourth week of May. Habitats along James Bay were rated as fair due to recent wildfires and drier conditions. Better habitat conditions were seen in central area lying northeast of Lac Mistassini. Farther east toward Labrador, high water levels and late-spring conditions challenged breeding waterfowl. It was a late spring in stratum 70 as well, with lake ice persisting until late May and habitats considered fair.

Winter temperatures were generally average to below average throughout the Maine and Atlantic Canada crew area. Below-average temperatures continued through the survey season into early June 2019. Winter and spring precipitation was generally above average across the survey area as well. Snow melt and ice breakup in coastal Maine and most of the Maritime Provinces was generally normal and gradual, resulting in less widespread flooding than in 2018. Significant flooding, however, did occur again in the St. John River Valley of New Brunswick. Ice and snow persisted longer than normal in the mountains of western and northern Maine and northwestern New Brunswick, but spring phenology was only slightly later. Habitat conditions were rated excellent in most of Maine and the Maritimes but western and northern regions were considered good due to delayed phenology. Newfoundland and Labrador experienced average to slightly below-average winter temperatures and average precipitation.

Clouds, precipitation, and colder-than-average temperatures delayed spring phenology. Habitats across the island were still rated good, with the exception of some higher-elevation regions which were classified as fair or poor due to persistent ice cover. Southern Labrador habitats below 1,700 feet were generally ice free but only small wetlands and lakes were open above this elevation. Habitats were assessed as good to fair but some local snow-melt flooding may have impacted waterfowl production. Northern Labrador, high-elevation areas in the Mealy Mountains, and coastal regions in the northeastern portion of stratum 67 were basically locked in winter during the survey, with as much as 3- to 4-feet of snow remaining in forested areas. Habitats were rated poor to fair as a result.

Other areas

Breeding-waterfowl habitat conditions over most of the Pacific Flyway improved due to late-winter and spring precipitation and above-average snowpack. California's habitat conditions remained good. Winter precipitation was above average and rare, above-average rains in the Central valley during May 2019 should extend good habitat conditions. Water allocations were forecasted at 100% for wetland management and rice agriculture and Sierra and Cascade ranges' snowpack should sustain unmanaged wetlands in northeastern California. Oregon wetland conditions were very good to excellent in 2019 due to abundant late-winter precipitation and above-average snowpack, especially in eastern Oregon. British Columbia habitat conditions declined from 2018 to 2019 due to El Niño conditions. Although the trend of warmer winters under this phenomenon was not experienced, winter precipitation was below average. No British Columbia regions had average or above-average snowpack. Low- to mid-elevation snow melt was 2 to 3 weeks early and no snow remained by early May, but above 1,600m snowmelt was delayed somewhat. Spring water levels were below normal although some flooding occurred in areas affected by wildfires in 2017 and 2018. Habitat conditions were below average in most of British Columbia. The mallard estimate in Nevada of 10,000 was 28% below the 2018 estimate and 23% above the long-term average.

The midwestestern U.S. had average to above-average fall and winter precipitation and below-normal early-spring temperatures. Minnesota wetland conditions improved in 2019. The number of permanent or semi-permanent wetlands was 19% above the 2018 estimate and 23% above the long-term average. Ice-out was about 1 week later than average. Michigan habitat conditions improved as well in 2019. Wetland abundance increased 15% from 2018 and was 26% above the long-term average. It was estimated that water level in lakes Huron and Michigan were about 2-feet above average. Habitat conditions were rated as excellent. Wisconsin experienced similar conditions as elsewhere in the Great Lakes. Fall-through-spring precipitation was well above average. Wetland abundance increased over 2018 and was well above the 10-year average. Near or above-average production is expected.

Atlantic Flyway Breeding Waterfowl survey states experienced average to below-average spring temperatures. Spring rainfall totals were higher than normal, with some areas receiving rain on 25 of 30 days in April 2019. Melting snow and spring rains recharged many wetlands and habitat conditions were generally considered good.

Mallard Fall-flight Index

The mid-continent mallard population is composed of mallards from the traditional survey area (revised in 2008 to exclude mallards from Alaska and the Old Crow Flat area of the Yukon Territory), Michigan, Minnesota, and Wisconsin, and was estimated to be 10.7 ± 1.0 million birds in 2019 (Figure 6). This was similar to the 2018 estimate of 11.8 ± 1.1 million.

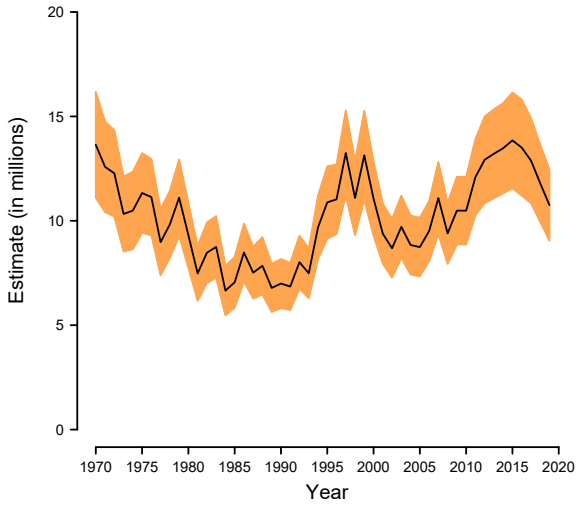


Figure 6. Estimates and 90% confidence intervals for the predicted size of the mallard population in the fall.

References

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

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

North American Waterfowl Management Plan Committee. 2014. Revised Objectives: An addendum to the 2012 North American Waterfowl Management Plan. Technical report. URL https://nawmp.org/sites/default/files/2017-12/NAWMP_Revised_Objectives_North_American_Waterfowl_Management_Plan_Final_9-22-14.pdf.

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

Sauer, J. R., G. S. Zimmerman, J. D. Klimstra, and W. A. Link. 2014. Hierarchical Model Analysis of the Atlantic Flyway Breeding Waterfowl Survey. Journal of Wildlife Management 78:1050–1059.

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

U.S. Fish and Wildlife Service. 2019. Adaptive Harvest Management: 2019 Hunting Season. U.S. Department of Interior Technical report, Washington, D.C. URL https://www.fws.gov/birds/management/adaptive-harvest-management/publications-and-reports.php.

Zimmerman, G. S., J. R. Sauer, W. A. Link, and M. Otto. 2012. Composite analysis of black duck breeding population surveys in eastern North America. Journal of Wildlife Management 76:1165–1176.

Status of Geese and Swans

This section summarizes information regarding the status and productivity of goose and 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 7), 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 above 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 initiation is delayed much beyond 15 June. For temperate-nesting Canada goose populations, productivity is generally less variable among years, but recruitment can be affected by local factors such as drought or weather events.

Methods

We have used common nomenclature for various goose and swan populations, but they may differ from other published information. Common-name nomenclature follows the List of Migratory Birds in Title 50 of the Code of Federal Regulations, Section 10.13, revised 1 November 2013 (78 FR 65844). 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 C.1, C.2, and C.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 Waterfowl Breeding Population and Habitat Survey (WBPHS, see Status of Ducks section of this report), the Midwinter Survey (conducted each December or January in wintering areas), the Yukon–Kuskokwim Delta (YKD) Coastal Zone Survey, the Arctic Coastal Plain (ACP) Survey, and surveys that are specifically designed for various goose populations. Where survey methodology allowed, 95% confidence intervals are presented in parentheses following population estimates. Trends of population estimates were calculated by regressing the natural logarithms of survey results on year, and slope coefficients were presented and tested for equality to zero (t-statistic). Changes in population indices between the most recent 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 used as management plan population objectives are described, graphed, and included in appendices. Beginning in 2019, we no longer report secondary abundance indices for goose populations. This information can be found in the Flyway Databooks at: https://www.fws.gov/birds/surveys-and-data/reports-and-publications/flyway-data-books.php or in USFWS Region 7 reports at: https://www.fws.gov/alaska/mbsp/mbm/waterfowl/reports.htm. Information was the best available at the time of finalizing this report but can differ from final estimates or observed conditions. Habitat and breeding conditions were primarily based on observations made during various waterfowl surveys and information from field biologists. These observations provide reliable information for specific locations, but may not provide an accurate assessment over vast geographic ranges.

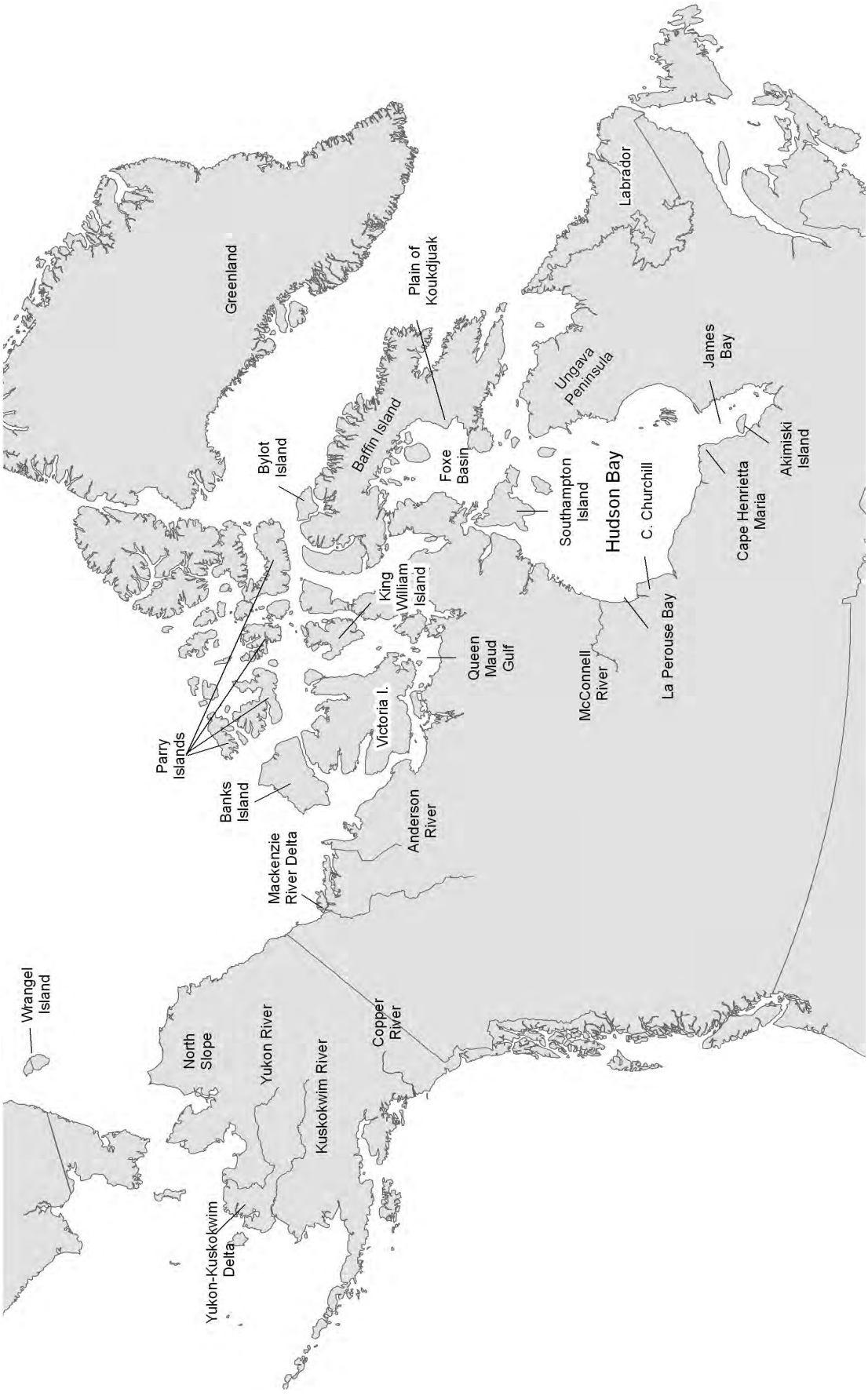


Figure 7. Important goose and swan nesting areas in Arctic and Subarctic North America.

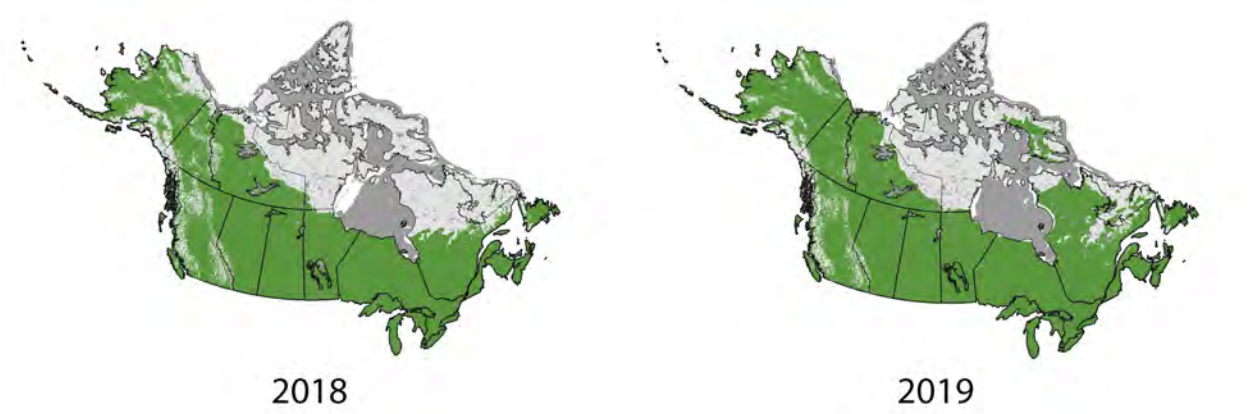


Figure 8. The extent of snow (light gray) and ice (dark gray) cover in North America on 2 June 2018 and 2 June 2019 (National Ice Center 2019).

Results and Discussion

Conditions in the Arctic and Subarctic

In 2019, spring phenology was earlier than average across much of Alaska and the eastern Arctic and Subarctic. The snow and ice cover graphics (Figure 8) illustrate that ice or snow cover on 2 June 2019 compared to the same date in 2018 was generally comparable in the central and western Arctic and Subarctic but less extensive in other areas (National Ice Center 2019). Biologists reported early spring phenology or good breeding conditions at Bylot, Baffin, Akimiski, Southampton, and Wrangel Islands, the Ungava Peninsula, and in southwestern Alaska; average conditions in northern Alaska and some areas of the central Arctic and Subarctic (Queen Maud Gulf and southwestern coast of Hudson Bay); and below-average conditions at Banks Island and some areas of the northwestern coast of Hudson Bay.

Conditions in Southern Canada and the United States

In 2019, habitat conditions were generally average or variable for goose production across most of southern Canada and the U.S. lower 48 states. In the Pacific Flyway, many areas had below-average precipitation in the winter but conditions improved throughout the spring and were generally average or above average in most states, except for portions of British Columbia and Washington where precipitation remained below average. In the Central Flyway, biologists reported above-average conditions and productivity in North Dakota and Oklahoma and average or below-average conditions in most other states. In the Mississippi Flyway, habitat conditions and productivity were generally average or above average in many northern and central states and below average in some southern states; additionally, biologists reported above-average numbers of molt migrant geese along areas of the Hudson Bay, indicating overall nesting effort in the Mississippi Flyway may have been below average. In the Atlantic Flyway, spring rainfall was above average in most areas, but overall habitat conditions and nesting efforts were generally average or good.

Description of Populations and Primary Monitoring Surveys

Canada Geese

See Figure 11, Table 14, and Appendices C.1.

North Atlantic Population (NAP)

NAP Canada geese principally nest in Newfoundland and Labrador. They commingle during winter with other Atlantic Flyway Canada goose populations, although NAP geese have a more coastal distribution than other populations

(Figure 9). In 2016, biologists revised the index used to monitor this population to a composite estimate that combines data from both the Canadian Wildlife Service (CWS) helicopter plot survey and the WBPHS (strata 66, 67, and 70). The new composite time series is updated annually due to the estimation procedure. Estimates presented are mean and 2.5% and 97.5% Bayesian credible intervals.

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. This population winters from New England to South Carolina, but the largest concentrations occur on the Delmarva Peninsula (Figure 9). This population is monitored by a spring survey of the Ungava Peninsula in northern Quebec (Atlantic Flyway Council 2008).

Atlantic Flyway Resident Population (AFRP)

AFRP Canada geese were introduced and established throughout the Atlantic Flyway during the early 20^{th} century and are composed 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 9). The breeding population is estimated during the spring via the Atlantic Flyway Breeding Waterfowl Plot Survey (Atlantic Flyway Council 1999).

Southern Hudson Bay Population (SHBP)

SHBP Canada geese nest in the Hudson Bay Lowlands, on Akimiski Island, and along the eastern and southern portions of Hudson and James Bays, and they concentrate during fall and winter throughout Manitoba, Ontario, and the Mississippi Flyway states (Figure 9). SHBP Canada geese are comprised of the former Southern James Bay, Mississippi Valley, and Eastern Prairie Populations of Canada geese. In 2016 a new aerial survey was developed to monitor SHBP Canada geese along the south and west coastal areas of the Hudson and James Bays (Mississippi Flyway Council 2017).

Mississippi Flyway Giant Population (MFGP)

MFGP Canada geese nest in the Mississippi Flyway states and in southern Ontario and southern Manitoba. Giant Canada geese were reestablished or introduced in all Mississippi Flyway states (Figure 9), and they now represent a large proportion of all Canada geese in the Mississippi Flyway. The total population is estimated during spring surveys within the Mississippi Flyway states and provinces (Mississippi Flyway Council 2017).

Western Prairie and Great Plains Populations (WPP/GPP)

WPP Canada geese 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. These two populations are managed jointly. Geese from these breeding populations commingle during migration and winter with Canada geese from other populations (Figure 9). The WBPHS (strata 21–25, 31, 34–40, 43–49) provide indices of this population within its primary breeding range.

Central Flyway Arctic Nesting Canada Geese (CFAN)

CFAN were previously managed separately as the Short Grass Prairie (SGP) and Tall Grass Prairie (TGP) populations of Canada geese (Central and Mississippi Flyway Councils 2013). CFAN nest across the Canadian Arctic and winter throughout the Central and Mississippi Flyways (Figure 9). Alternative nomenclature and delineation is used by the Mississippi Flyway, the Canadian Wildlife Service, and others in reference to the subspecies *Branta hutchinsii hutchinsii*. In those documents, those geese are referred to as Mid-continent cackling geese and defined as geese breeding north of the tree line in Canada. Lincoln estimates of the adult cohort are the primary management indices for this population. Lincoln estimates are derived from annual estimates of total harvest and harvest rate

and represent an indirect measure of abundance just prior to banding season. Due to the timing of data availability Lincoln estimates are typically not available for the most recent year.

Hi-line Population (HLP)

HLP Canada geese nest in southeastern Alberta, southwestern Saskatchewan, eastern Montana and Wyoming, and Colorado. This population winters in these states and New Mexico (Figure 9). A breeding index of HLP geese is based on the WBPHS estimates from portions of Alberta (strata 26–29), Saskatchewan (strata 30, 32, 33), and Montana (strata 41–42; (Central Flyway Council 2010).

Rocky Mountain Population (RMP)

RMP Canada geese 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 9). An index of breeding RMP geese is based on WBPHS estimates from portions of strata 26–29 in Alberta and strata 41–42 in Montana (Pacific Flyway Council 2000*b*).

Pacific Population (PP)

PP Canada geese nest and winter west of the Rocky Mountains from northern Alberta and British Columbia to California (Figure 9). An index of breeding PP geese is based on WBPHS estimates from strata 76–77 in Alberta and the standardized surveys in British Columbia, Washington, Oregon, and California (Pacific Flyway Council 2000*a*).

Dusky Canada Geese

Dusky Canada geese nest on the Copper River Delta of southcentral Alaska and winter in the Willamette and Lower Columbia River Valleys of Oregon and Washington (Figure 9). Dusky Canada geese are surveyed on their breeding grounds on the Copper River Delta and Middleton Island, Alaska (Pacific Flyway Council 2015).

Cackling Canada Geese

Cackling Canada geese nest on the YKD of western Alaska and primarily winter in the Willamette and Lower Columbia River Valleys of Oregon and Washington (Figure 9). The total fall population is estimated from 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 2016*a*).

Lesser Canada Geese

Lesser Canada geese nest throughout interior and south-central Alaska and winter in Washington, Oregon, and California (Figure 9). Population indices for lesser Canada geese are based on WBPHS estimates in stratum 1 (Kenai-Susitna), stratum 2 (Nelchina), stratum 3 (Tanana-Kuskokwim), stratum 4 (Yukon Flats), and stratum 12 (Old Crow Flats).

Taverner's Canada Geese

Taverner's Canada geese nest throughout tundra areas of the North Slope and western Alaska and winter in Washington, Oregon, and California (Figure 9). Population indices for Taverner's Canada geese are derived from three breeding survey efforts: the Arctic Coastal Plain Survey, the YKD Coastal Zone Survey, and the WBPHS (stratum 9 [inland portions of the YKD], stratum 10 [Seward Peninsula], and stratum 11 [Kotzebue Sound]).

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 9). The total Aleutian Canada goose population during the fall and winter is estimated from mark-resight observations of neck-banded geese (Pacific Flyway Council 2006*a*).

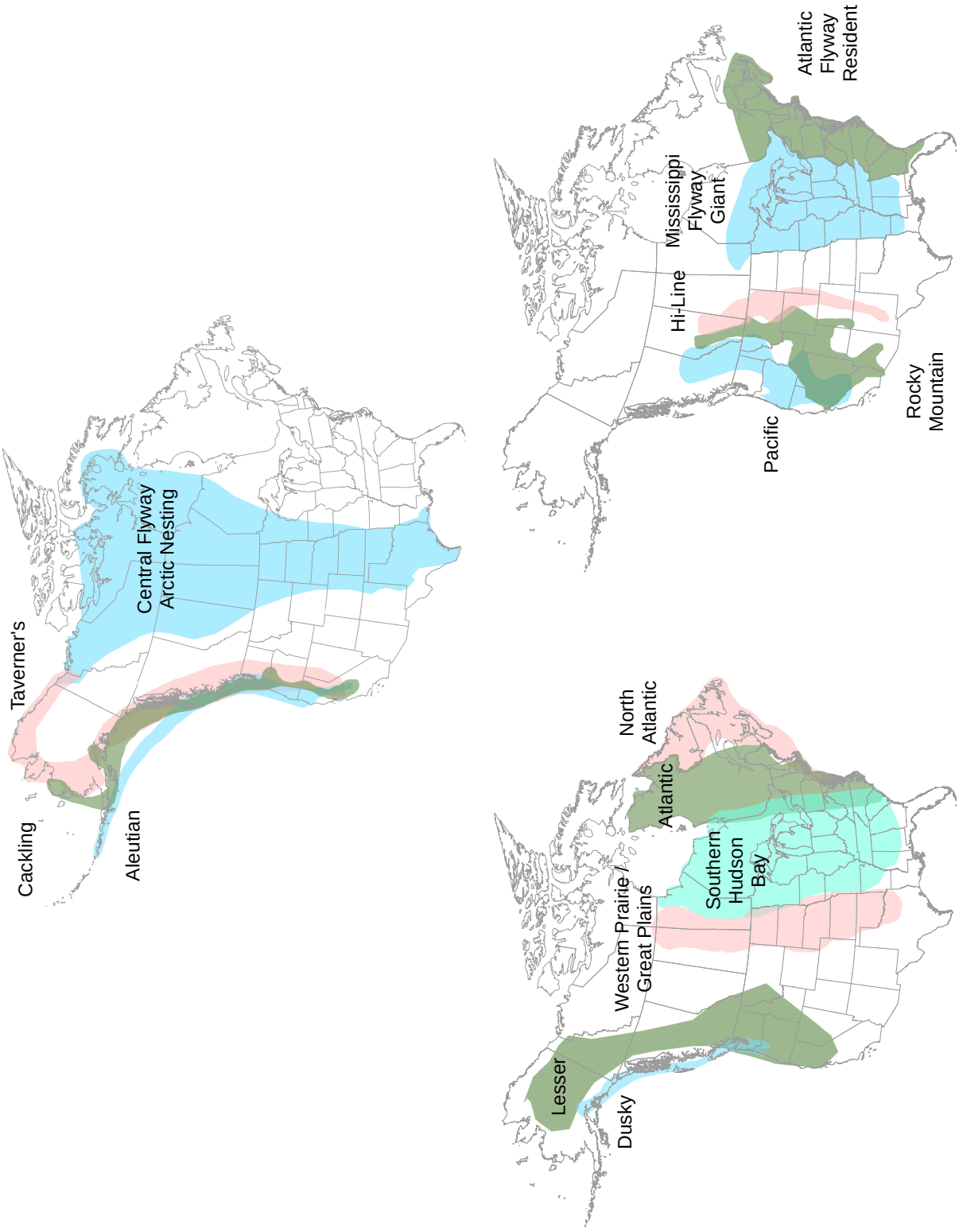


Figure 9. Approximate ranges of Canada goose populations in North America.

Light Geese

See Figure 12, Table 15, and Appendices C.2.

The term light geese collectively refers to Ross's geese (*Chen rossii*) and both the lesser (*C. caerulescens 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). 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.

Ross's Geese

Ross's geese nest primarily in the Queen Maud Gulf region, but increasing numbers are nesting in other areas of the central and eastern Arctic and along the western coast of Hudson Bay. Ross's geese primarily winter in California, New Mexico, Texas, and Mexico, with increasing numbers wintering in other portions of the Central and Mississippi Flyways (Figure 10). Ross's geese are annually surveyed at Karrak Lake in the Queen Maud Gulf region. Estimates from Karrak Lake are typically not available until after the publication of this report, so we present the previous year's estimate.

Mid-continent Population (MCP)

MCP lesser snow geese winter in the Central and Mississippi Flyways and nest primarily from Banks Island in the western Arctic to Baffin Island in the eastern Arctic (Figure 10). The management plan for MCP lesser snow geese was updated in 2018 and replaced prior management guidelines for MCP and Western Central Flyway Population (WCFP; wintering population) lesser snow geese (Mississippi Flyway Council 2018, Central Flyway Council 2018). Lincoln estimates of the adult cohort are now the primary management indices.

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 on Wrangel Island, Russia. WA lesser snow geese nest primarily on Banks Island, with smaller colonies in coastal areas of the Northwest Territories, and along the Alaskan Arctic Coastal Plain. WI lesser snow geese nest on Wrangel Island. 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, the western Central Flyway, and the northern highlands of Mexico. WI lesser snow geese principally winter in the Skagit-Fraser River Deltas in British Columbia and Washington and in northern and central California (Figure 10). Light geese in the Pacific Flyway (Pacific Flyway Population) are indexed by fall and winter surveys in California, Oregon, Washington and British Columbia. Breeding ground surveys are periodically conducted for WA (Pacific Flyway Council 2013) and WI lesser snow geese (Pacific Flyway Council 2006*b*).

Greater Snow Geese

Greater snow geese 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 10). This population is monitored on spring staging areas near the St. Lawrence Valley in Quebec by an annual aerial photographic survey (Atlantic Flyway Council 2009).

Greater White-fronted Geese

See Figure 13, Table 16, and Appendices C.3.

Pacific Population White-fronted Geese

Pacific Population white-fronted geese (*Anser albifrons*) primarily nest on the YKD in Alaska and winter in the Central Valley of California (Figure 10). This population is monitored using a predicted fall population index, which is based on the number of indicated total birds from the

YKD Coastal Zone Survey and the WBPHS in the Bristol Bay area (stratum 8) and interior portions of the YKD (stratum 9), and expanded by a factor derived from the correlation of these indices with past fall counts in Oregon and California (Pacific Flyway Council 2003).

Mid-continent Population White-fronted Geese

Mid-continent Population white-fronted geese nest from central and northwestern Alaska to the west coast of Hudson Bay and the Melville Peninsula. This population concentrates in southern Saskatchewan and Alberta during the fall and in southern Central and Mississippi Flyway states and Mexico during the winter (Figure 10). This population is monitored via a fall staging survey in Saskatchewan and Alberta (Central, Mississippi, and Pacific Flyway Councils 2015).

Brant

See Figure 13, Table 16, and Appendices C.3.

Atlantic Brant (ATLB)

Atlantic brant (*Branta bernicla bernicla*) primarily nest on islands in the eastern Canadian Arctic and winter along the Atlantic Coast from Massachusetts to North Carolina (Figure 10). The Midwinter Survey provides an index of this population within its winter range in the Atlantic Flyway (Atlantic Flyway Council 2002).

Pacific Brant (PACB)

PACB include black brant (BLBR; *B. b. nigricans*) and western high arctic brant (WHAB; *B. b. bernicla*). BLBR nest across the YKD and North Slope in Alaska, Banks Island, other islands of the western and central Arctic, the Queen Maud Gulf, and Russia. They stage during fall at Izembek Lagoon, Alaska, and winter as far south as Mexico. WHAB nest on the Parry Islands of the Northwest Territories and Nunavut. They stage during fall at Izembek Lagoon, Alaska, and predominantly winter in the Padilla, Samish, and Fidalgo Bays of Washington and near Boundary Bay, British Columbia, although some individuals have been observed as far south as Mexico (Figure 10). Fall and winter counts in the U.S., Canada, and Mexico are the primary management indices for PACB (Pacific Flyway Council 2018).

Emperor Geese

See Figure 13, Table 16, and Appendices C.3.

Emperor geese (*C. canagica*) breed along coastal areas of the Bering Sea, with the largest concentration on the YKD in Alaska. Emperor geese stage along the Alaska Peninsula during the fall and spring and winter along the Aleutian Islands (Figure 10). This population is monitored during spring by the YKD Coastal Zone Survey (Pacific Flyway Council 2016*b*).

Swans

See Figure 13, Table 16, and Appendices C.3.

Western Population Tundra Swans

Western Population tundra swans (*Cygnus columbianus*) nest along the coastal lowlands of western Alaska, and the YKD is a primary breeding area. Western Population tundra swans primarily winter in California, Utah, and the Pacific Northwest (Figure 10). The management plan for Western Population tundra swans was updated in 2017, and the primary management indices are derived from the YKD Coastal Zone Survey and the WBPHS (stratum 8 [Bristol Bay], stratum 9 [inland portions of the YKD], stratum 10 [Seward Peninsula], and stratum 11 [Kotzebue Sound]; Pacific Flyway Council 2017).

Eastern Population Tundra Swans

Eastern Population tundra swans nest from the Seward Peninsula of Alaska to the northeast shore of Hudson Bay and Baffin Island. The Mackenzie River Delta and adjacent areas in the Northwest Territories are of particular importance. This population predominantly winters in coastal areas from Maryland to North Carolina (Figure 10). The Midwinter Survey provides an index of this population within its winter range

of the Atlantic and Mississippi Flyways (Atlantic, Mississippi, Central, and Pacific Flyway Councils 2007).

Trumpeter Swans

Trumpeter swans (*C. buccinator*) nest south of the Brooks Range and east of the YKD in Alaska and within localized areas of Yukon Territory, western Northwest Territories, southern Canadian provinces from British Columbia to Quebec, and some northern U.S. states from Washington to New York. There are three recognized North American populations: the Pacific Coast, Rocky Mountain, and Interior Populations. Trumpeter swan abundance and productivity is comprehensively monitored through the North American Trumpeter Swan Survey. This range-wide survey was first conducted in 1968, repeated in 1975, and has continued at 5-year intervals thereafter. The first survey in 1968 recorded 2,600 adult and subadult trumpeter swans. The most recent survey was completed in 2015, and 63,000 adult and subadult trumpeter swans were observed. Information from this, and other, trumpeter swan surveys can be found at: https://www.fws.gov/birds/surveys-and-data/reports-and-publications.php.

References

Atlantic Flyway Council. 1999. Atlantic Flyway Resident Canada Goose Management Plan.

Atlantic Flyway Council. 2002. Atlantic Brant Management Plan.

Atlantic Flyway Council. 2008. A Management Plan for the Atlantic Population of Canada Geese.

Atlantic Flyway Council. 2009. Management Plan for Greater Snow Geese in the Atlantic Flyway.

Atlantic, Mississippi, Central, and Pacific Flyway Councils. 2007. Management Plan for the Eastern Population of Tundra Swans.

Central and Mississippi Flyway Councils. 2013. Management Guidelines for the Central Flyway Arctic Nesting Canada Geese. Special Report in the files of the Central Flyway Representative. Denver, CO.

Central Flyway Council. 2010. Management Guidelines for Hi-Line Canada Geese.

Central Flyway Council. 2018. Management Guidelines for Midcontinent Lesser Snow Geese in the Central Flyway.

Central, Mississippi, and Pacific Flyway Councils. 2015. Management Plan for Mid-continent Greater White-fronted Geese.

Mississippi Flyway Council. 2017. A Management Plan for Mississippi Flyway Canada Geese.

Mississippi Flyway Council. 2018. Management Plan for Midcontinent Lesser Snow Geese in the Mississippi Flyway.

National Ice Center. 2019. IMS daily Northern Hemisphere snow and ice analysis at 1 km and 4 km resolution. Digital media. URL http://www.natice.noaa.gov/ims/.

Pacific Flyway Council. 2000*a*. Pacific Flyway Management Plan for the Pacific Population of Western Canada Geese.

Pacific Flyway Council. 2000*b*. Pacific Flyway Management Plan for the Rocky Mountain Population of Canada Geese.

Pacific Flyway Council. 2003. Pacific Flyway Management Plan for the Greater White-fronted Goose.

Pacific Flyway Council. 2006*a*. Pacific Flyway Management Plan for the Aleutian Goose.

Pacific Flyway Council. 2006*b*. Pacific Flyway Management Plan for the Wrangel Island Population of Lesser Snow Geese.

Pacific Flyway Council. 2013. Pacific Flyway Management Plan for the Western Arctic Population of Lesser Snow Geese.

Pacific Flyway Council. 2015. Pacific Flyway Management Plan for the Dusky Canada Goose.

Pacific Flyway Council. 2016*a*. Management Plan for the Cackling Canada Goose.

Pacific Flyway Council. 2016*b*. Management Plan for the Emperor Goose.

Pacific Flyway Council. 2017. Management Plan for the Western Population of Tundra Swans.

Pacific Flyway Council. 2018. Management Plan for the Pacific Population of Brant.

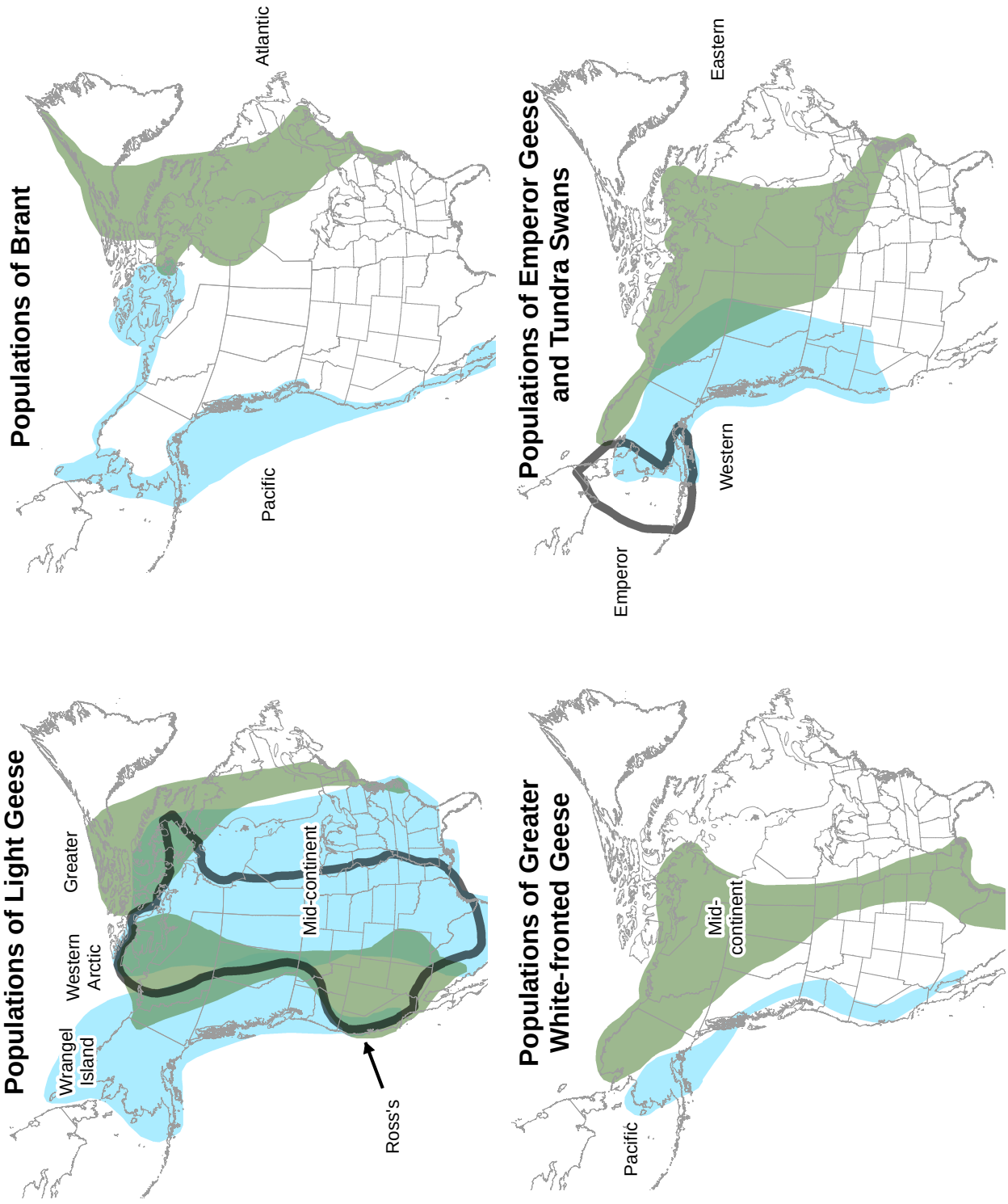


Figure 10. Approximate ranges of tundra swan and Ross's, snow, brant, greater white-fronted, and emperor goose populations in North America.

Table 14. Canada goose abundance indices (in thousands) from primary monitoring surveys.

	Estimate/Count		Change from 2018		10-year Trend	
Population	2019	2018	%	*P*	%/yr[a]	*P*
North Atlantic	53	54	−3	0.894	0	0.690
Atlantic	120	112	+6	0.658	−5	0.029
Atlantic Flyway Resident	1,040	1,031	+1	0.944	+1	0.450
Southern Hudson Bay[b]	86	90	−4	0.119	−−	−−
Mississippi Flyway Giant	1,501	1,563	−4	−−	+1	0.390
Western Prairie and Great Plains	1,443	1,350	+7	0.461	+2	0.074
Central Flyway Arctic Nesting[c]	2,499	2,479	+1	0.977	−4	0.174
Hi-Line	375	409	−8	0.468	+4	0.128
Rocky Mountain	176	253	−30	0.044	+7	0.018
Pacific	347	351	−1	0.950	+4	0.013
Dusky	18	12	+52	0.022	+4	0.068
Cackling	205	208	−1	0.867	0	0.883
Lesser	13	2	+550	0.118	+1	0.840
Taverner's	59	45	+32	0.081	+2	0.456
Aleutian	199	171	+16	0.390	+6	0.003

[a] Rounded values mask change in estimates.
[b] New survey began 2016; 10-year trend not available.
[c] Years presented refer to year–2.

Table 15. Light goose (Ross's goose and lesser and greater snow goose) abundance indices (in thousands) from primary monitoring surveys.

	Estimate/Count		Change from 2018		10-year Trend	
Population	2019	2018	%	*P*	%/yr	*P*
Ross's geese[a]	337	447	−25	<0.001	−6	0.012
Mid-continent Population lesser snow geese[b]	12,009	13,249	−9	0.428	−3	0.227
Pacific Flyway Population light geese	1,414	1,355	+4	−−	+7	0.010
Wrangel Island Population lesser snow geese	442	306	+45	−−	+12	<0.001
Greater snow geese	714	877	−19	0.012	−2	0.111

[a] Years presented refer to year–1.
[b] Years presented refer to year–2.

Table 16. White-fronted goose, emperor goose, brant, and tundra swan indices (in thousands) from primary monitoring surveys.

	Estimate/Count		Change from 2018		10-year Trend	
Population	2019	2018	%	P	%/yr	P
Pacific Population white-fronted geese	479	590	−19	−−	−1	0.430
Mid-continent Population white-fronted geese[a]	774	772	0	−−	+4	0.078
Atlantic brant	120	170	−29	−−	+1	0.780
Pacific brant	161	133	+21	−−	−2	0.109
Emperor geese	27	30	−12	0.064	+4	0.030
Western swans	101	152	−33	0.078	+1	0.496
Eastern swans	93	112	−17	−−	+1	0.499

[a] Years presented refer to year–1.

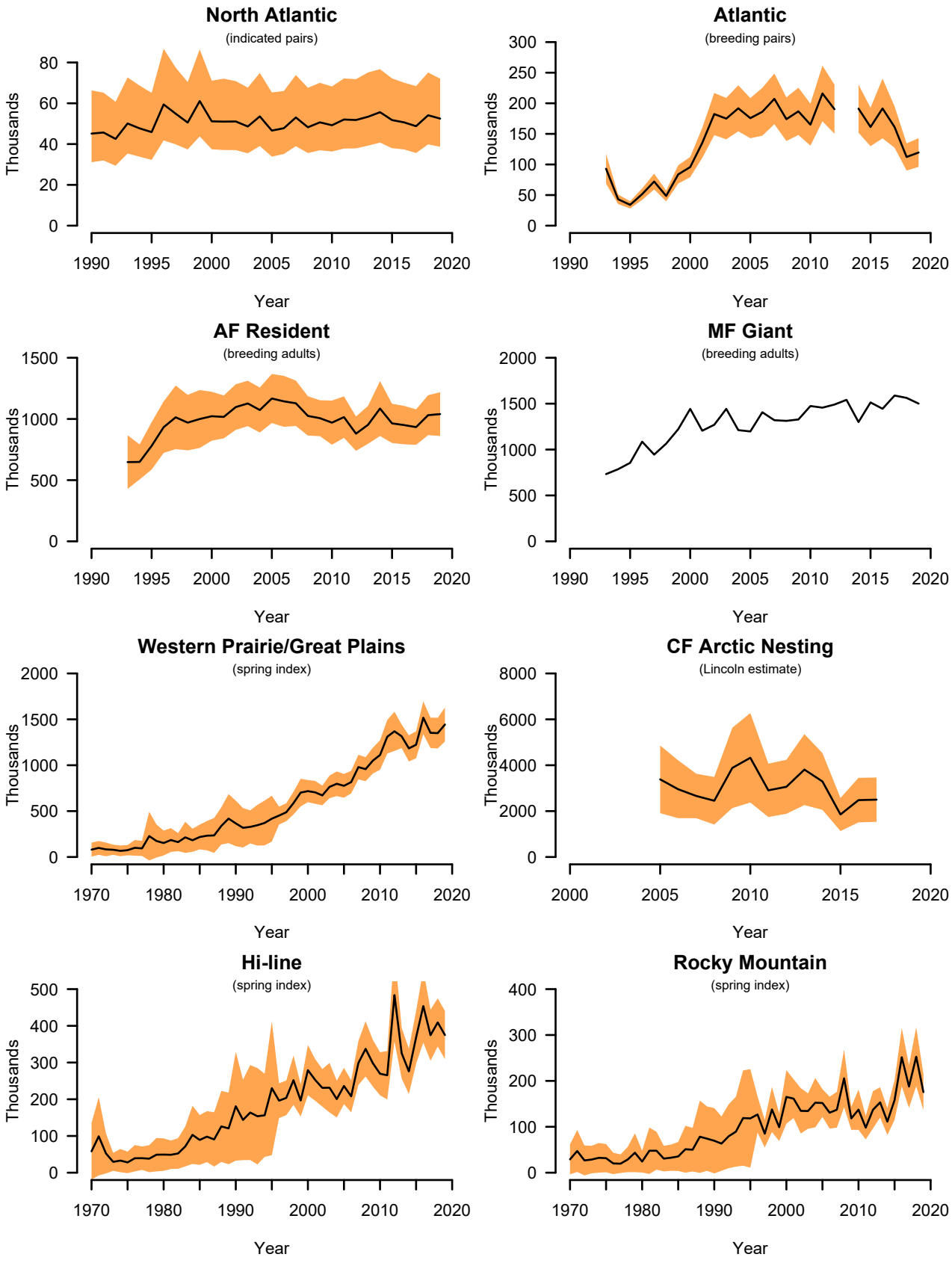


Figure 11. Estimated numbers (and 95% confidence intervals, where applicable) of Canada goose populations based on primary management surveys.

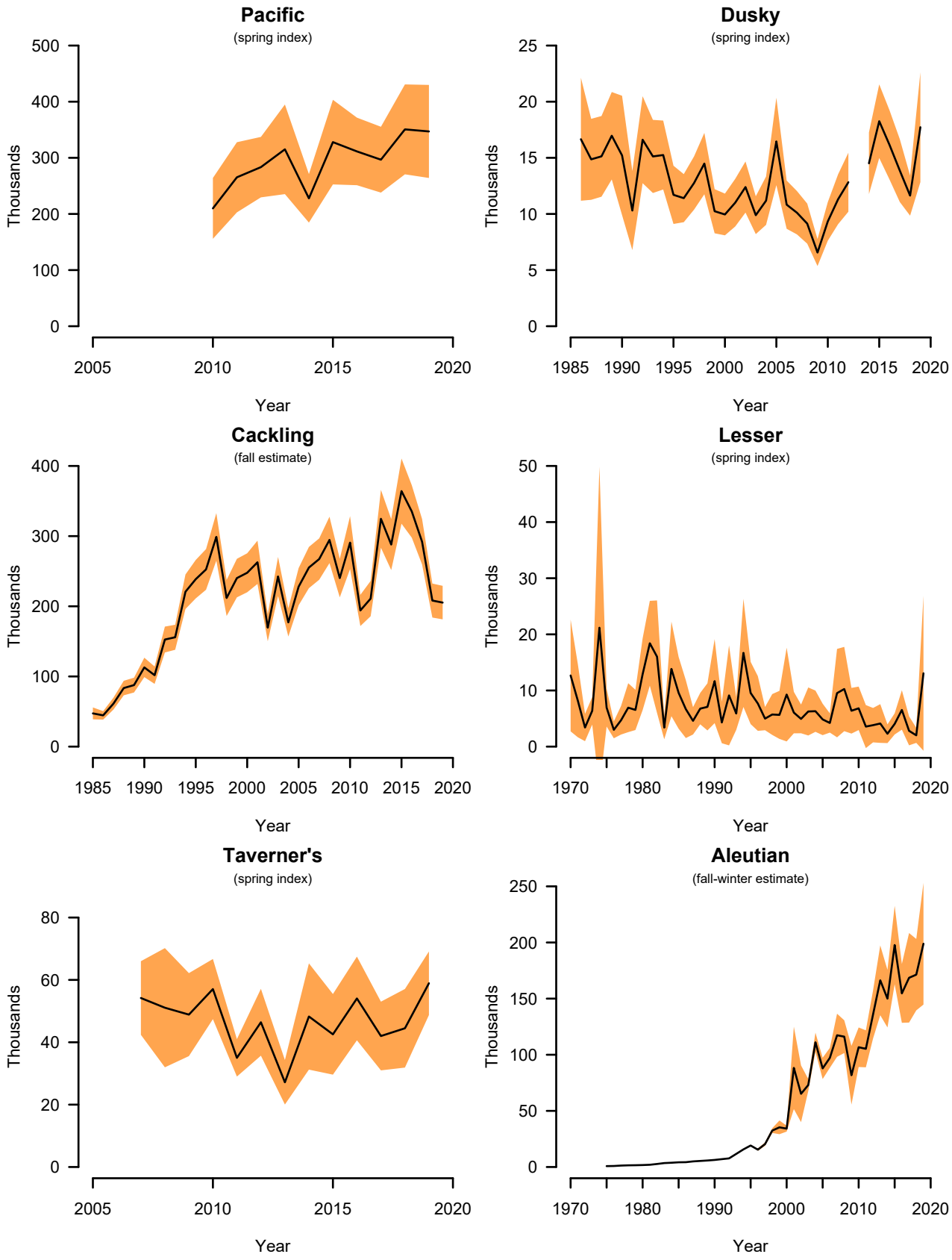


Figure 11. Continued.

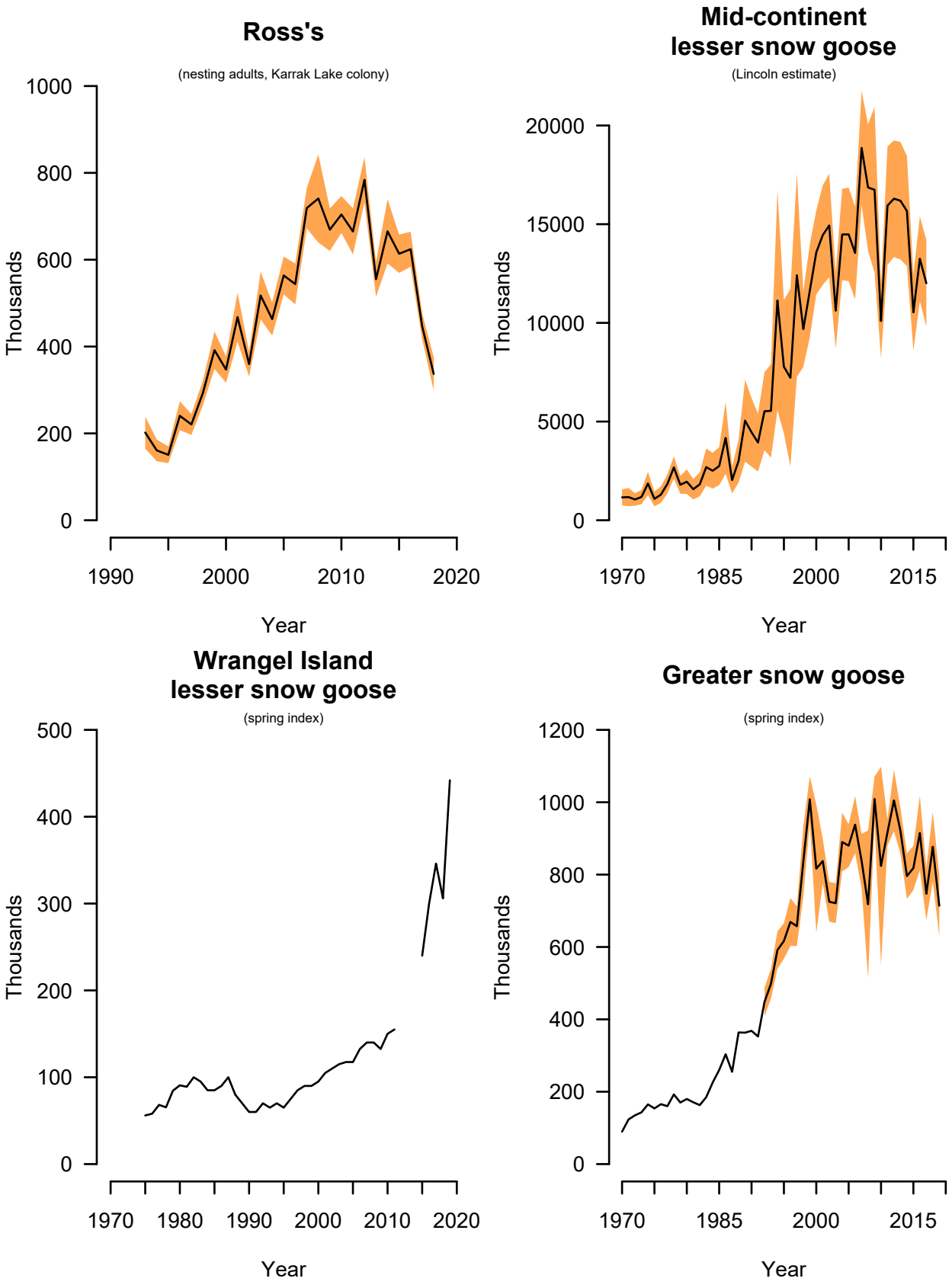


Figure 12. Estimated numbers (and 95% confidence intervals, where applicable) of Ross's and snow goose populations based on primary management surveys.

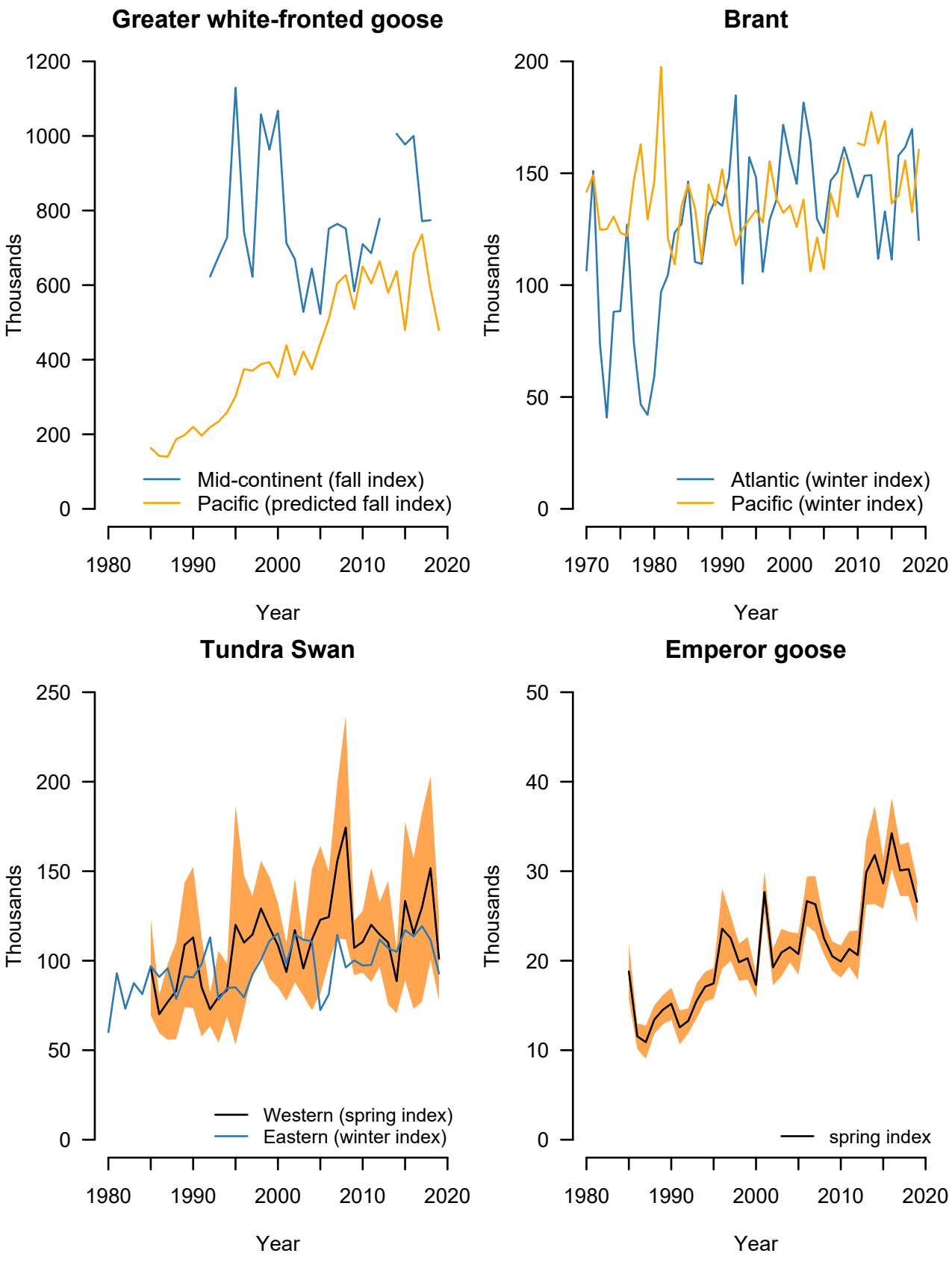


Figure 13. Estimated numbers (and 95% confidence intervals, where applicable) of greater white-fronted goose, brant, tundra swan, and emperor goose populations based on primary management surveys.

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

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

Air B. Lubinski and S. Olson

Northern Saskatchewan and Northern Manitoba (Strata 21–25)

Air W. Rhodes and J. Whitaker

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

Air R. Spangler and J. Sands

Ground G. Raven[a], M. Watmough[a], E. Beck[a], D. Gettis[a], T. Phillps[a], M. Curteanu[a], and J. Caswell[b]

Southern Saskatchewan (Strata 30–33)

Air P. Thorpe and S. Chandler

Ground B. Bartzen[a], K. Dufour[a], K. Warner[a], K. Bas[a], M. Gerbrandt[a], K. Dionne-Nisbet[a], and B. Wallace[a]

Southern Manitoba (Strata 34–40)

Air S. Yates and J. Drahota

Ground M. Schuster[a], J. Leafloor[a], F. Baldwin[a], D. Walker[a], G. Ball[a], R. Buss[a], T. Toffan[a], A. Scott[c], and M. Porath[c]

Montana and Western Dakotas (Strata 41–44)

Air J. Rayfield and R. Anthony

Ground D. Collins and C. Cain

Eastern Dakotas (Strata 45–49)

Air T. Liddick and D. Fronczak

Ground A. Roberts, S. Catino, J. Dickson, and S. LeJeune

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

Air J. Wortham and D. Demarest

Eastern Ontario and Southern Quebec (Strata 51–53, 56, 68)

Air S. Earsom and G. Wilkerson

Maine and Atlantic Canada (Strata 62–67)

Air M. Koneff and J. Bidwell[e]

Canadian Wildlife Service helicopter plot survey

Quebec	C. Lepage[a], C. Marcotte[a], S. Orichefsky[a], R. Potvin[d], Y. Delage[d], Y. Gingras[d], J. Gravel[d], and M. Vaugeois[d]
Ontario	S. Meyer[a], C. Sharp[a], B. Campbell[a], D. Sadler[a], and Y. Gingras[d]
New Brunswick & Nova Scotia	Not reported
Newfoundland & Labrador	S. Gilliland[a], M. English[a], C. Roy[a], P. Ryan[a], A. Hanson[d], and R. Martin[d]

California

Fixed-wing	M. Weaver[b], D. Skalos[b], and M. Breiling[b]
Helicopter	O. Rocha[b] and R. Carrothers[b], and G. Woefel[b]

Michigan

Air	B. Barlow[b], J. Darling[b], B. Dybas-Berger[b], C. Eckloff[b], J. Heise[b], J. Imber[b], N. Kalejs[b], N. Levitte[b], T. McFadden[b], M. Nichols[b], M. Richardson[b], J. Robison[b], D. Luukkonen[d], A. Huinker[d], T. McClinton,[d] and N. Yost[d]

Minnesota

Air	B. Geving[b] and S. Cordts[b]
Ground	K. Van Beek, W. Brininger, D. Hertel, N. Yates, T. Cooper, E. Zlonis[b], G. Dehmer, J. Maile[b], G. Kemper, C. Becker, K. Mattson, L. Michelson, A. Forbes, K. Daly, A. Sidle-Slettdahl, J. Orr, C. Kringstad, C. Beyer, K. Jenson

Northeastern U.S.

Data Analysis	A. Roberts
Connecticut	M. Huang[b] and K. Kubik[b]
Delaware	Division of Fish and Wildlife agency personnel and cooperators
Maryland	Department of Natural Resources agency personnel and cooperators
Massachusetts	Division of Fisheries and Wildlife personnel and cooperators
New Hampshire	Department of Fish and Game agency personnel and cooperators
New Jersey	T. Nichols[b], L. Clark[b], J. Garris[b], J. Powers[b], and A. Damminger[b]
New York	Department of Environmental Conservation personnel and cooperators
Pennslyvania	Game Commission agency personal and cooperators
Rhode Island	Division of Fish and Wildlife agency personnel and cooperators
Vermont	Department of Fish and Wildlife agency personnel and cooperators
Virginia	Department of Game and Inland Fisheries agency personnel and cooperators

Nevada

Fixed-wing	C. Nicolai and A. Coonen[b]
Helicopter	C. Brady[d] and B. Huber[d]

Oregon

Air	B. Reishus[b], K. Walton[b], J .Thompson[b], C. Sponseller[b], A. Walsh[b], T. Collom[b], J. Journey[b], and M. St. Louis[b], and helicopter service provided by JL Aviation Inc.[d]

Washington

Air	J. Evenson[b], M. Hamer[b], B. Reilly[d], M. Wilson[b], W. Michaelis[b], K. Spragens[b], and G. Belikka[b]

Wisconsin

Air	L. Waskow[b], T. Finger[b], C. Cold[b], P. Eyers[b], and N. Hayden[b]
Ground	J. Biehm[b], M. Carlisle[b], T. Carlson[b], J. Carstens[b], C. Mogen[b],N. Christel[b], J. Christopoulos[b], C. Cole[b], J. Cotter[b], M. Soergel[b], T. Finger[b], A. Fischer[b], J. Hopp[b], S. Easterly[b], B. Woodbury[b], A. Jahns[b], D. Goltz[b], W. Hirt[b], B. Kelly[b], E. Kroening[b], J. Jackl[b], J. Spiegel[b], R. McDonough[b], K. Morgen[b], J. Pritzl[b], P. Samerdyke[b], M. Sparrow-Lein[b], B. Stefanski[b], J. Wanner[b], M. Woodford[b], M. Engel, and G. VanVreede

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

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

Flyway and Regional Survey Reports

J. Dubovsky, J. Fischer, D. Fronczak, D. Groves, D. Marks, S. Olson, P. Padding, A. Roberts, D. Safine, T. Sanders, M. Swaim, B. Shults, and H. Wilson

Information from the Waterfowl Breeding Population and Habitat Survey

See Appendix A.1

Atlantic Population Canada Geese

B. Harvey[b], J. Rodrigue[a], and R. Spangler

Southern Hudson Bay Population Canada Geese

S. Badzinski[a] and R. Brook[b]

Mississippi Flyway Population Giant Canada Geese

O. Jones[b]

Central Flyway Arctic Nesting Canada Geese

J. Leafloor[a], J. Malpass[d], R. Raftovich, A. Smith[a]

Ross's Geese and Mid-continent Lesser Snow Geese

R. Alisauskas[a] and D. Kellett[a]

Wrangel Island Population Lesser Snow Geese

V. Baranyuk[d]

Greater Snow Geese

G. Gauthier[d] and J. Lefebvre[a]

Mid-continent Population White-fronted Geese

B. Bartzen[a], J. Jackson[b], T. Liddick, R. Spangler, K. Warner[a], and J. Whitaker[b]

---

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

B. Historical estimates of May ponds and regional waterfowl populations

Table B.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 B.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
2016	3,494.50	147.20	1,518.00	52.70	5,012.50	156.40
2017	4,330.30	157.70	1,765.70	92.20	6,096.00	182.70
2018	3,660.20	147.60	1,567.20	90.20	5,227.40	173.00
2019	2,855.60	103.80	2,134.70	137.30	4,990.30	172.10

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

Table B.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	
Year	Total ducks	Mallards	Total ducks	Mallards	Total ducks	Mallards	Total ducks	Mallards
1955								
1956								
1957								
1958								
1959								
1960								
1961								
1962								
1963								
1964								
1965								
1966								
1967								
1968							321.0	83.7
1969							323.2	88.8
1970							324.2	113.9
1971							277.1	78.5
1972							217.2	62.2
1973							389.5	99.8
1974							281.6	72.8
1975							471.6	175.8
1976							684.1	117.8
1977							501.1	134.2
1978							462.5	146.8
1979							552.4	158.7
1980							690.6	172.0
1981							439.8	154.8
1982							465.2	120.5
1983							367.1	155.8
1984							529.7	188.1
1985							562.9	216.9
1986							520.8	233.6
1987							589.0	192.3
1988							725.2	271.7
1989							813.6	273.0
1990							807.9	232.1
1991					408.4	289.3	753.7	225.0
1992			497.4	375.8	867.5	385.8	973.3	360.9
1993			666.7	359.0	742.8	437.2	837.2	305.8
1994			483.2	311.7	683.1	420.5	1,115.6	426.5
1995			589.7	368.5	791.9	524.1	797.1	319.4
1996			843.7	536.7	680.5	378.2	889.1	314.8
1997			824.3	511.3	784.0	489.3	868.1	407.4
1998			706.8	353.9	1,068.5	523.0	693.1	368.5
1999			851.0	560.1	744.6	466.1	680.5	316.4

Table B.2. Continued.

	British Columbia		California		Michigan		Minnesota	
Year	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
2001			413.5	302.2	497.8	324.2	716.4	320.6
2002			392.0	265.3	742.5	323.2	1,171.5	366.6
2003			533.7	337.1	535.4	298.9	721.8	280.5
2004			412.8	262.4	624.5	342.0	1,008.3	375.3
2005			615.2	317.9	468.3	258.1	632.0	238.5
2006	364.4	90.4	649.4	399.4	412.2	244.6	521.1	160.7
2007	383.9	98.8	627.6	388.3	641.9	337.7	488.5	242.5
2008	377.1	81.1	554.3	297.1	437.5	200.5	739.6	297.6
2009	349.7	72.5	510.8	302.0	493.6	258.9	541.3	236.4
2010	339.3	81.1	541.3	367.9	595.3	338.3	530.7	241.9
2011	277.8	69.7	558.6	314.7	471.4	258.6	687.5	283.3
2012	313.7	75.6	529.7	387.1	860.1	439.3	468.6	225.0
2013	333.6	82.9	451.3	298.6	678.6	288.4	682.9	293.2
2014	355.8	82.6	448.7	238.7	395.3	230.1	474.4	257.0
2015	365.8	81.4	315.6	173.9	431.1	237.8	524.2	206.2
2016	321.3	74.0	417.8	263.8	502.6	278.1	787.1	250.2
2017	351.3	70.9	393.7	198.4	684.5	298.1	636.0	213.6
2018	346.3	79.3	549.2	272.9	452.4	251.4	692.6	295.4
2019	409.2	74.5	470.8	239.8	333.9	179.1	694.8	286.4

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

Table B.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

Table B.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
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
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	200.9	92.9	386.5	199.1
2011	2.3	1,265.0	586.1	158.4	61.6	157.1	71.4	513.7	187.9
2012	4.1	1,309.9	612.6	263.5	88.8	169.0	89.5	521.1	197.0
2013	8.8	1,281.8	604.2	251.7	84.3	157.2	74.4	527.3	181.2
2014	4.2	1,343.8	634.6	315.2	85.3	177.0	86.3	395.1	158.7
2015	5.5	1,197.2	540.1	279.7	87.4	193.1	86.4	372.8	176.2
2016	14.4	1,240.8	551.3	213.6	87.3	121.5	59.9	390.5	164.1
2017	6.4	1,330.8	448.5	239.9	71.7	242.2	103.4	479.1	180.9
2018	13.9	1,448.1	482.1	293.9	97.1	281.1	124.9	439.4	216.7
2019	10.0	1,307.0	564.6	251.4	83.9	248.3	126.2	413.7	204.3

[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 B.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), 1955–2019.

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

Table B.3. Continued.

	Mallard		Gadwall		American wigeon		Green-winged teal		Blue-winged teal	
Year	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$
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
2016	11,792.5	367.4	3,712.0	197.3	3,411.3	196.4	4,275.4	329.8	6,689.4	340.1
2017	10,488.5	333.9	4,180.0	209.0	2,777.1	156.0	3,605.3	233.3	7,888.9	395.8
2018	9,255.2	298.9	2,885.9	161.7	2,820.4	166.5	3,042.7	213.9	6,450.5	307.7
2019	9,423.4	284.5	3,258.7	173.5	2,832.1	215.8	3,178.2	184.4	5,427.6	318.8

Table B.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
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

Table B.3. Continued.

	Northern shoveler		Northern pintail		Redhead		Canvasback		Scaup	
Year	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$
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
2016	3,966.9	189.0	2,618.5	204.2	1,288.8	115.4	736.5	68.8	4,991.7	297.6
2017	4,353.1	202.3	2,889.2	206.2	1,115.4	91.8	732.5	61.7	4,371.7	228.7
2018	4,207.9	196.5	2,365.3	150.2	999.0	85.3	686.1	59.1	3,989.3	212.5
2019	3,649.2	169.0	2,268.5	123.3	732.2	63.7	651.9	49.1	3,590.8	207.0

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

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

Table B.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
2016	48,362.8	827.6
2017	47,265.6	773.6
2018	41,193.2	662.1
2019	38,898.9	658.3

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

Table B.5. Breeding population estimates and 90% credibility intervals (in thousands) for the six most abundant species of ducks in the eastern survey area, 1990–2019[a].

	Mallard		American black duck		Green-winged teal		Ring-necked duck		Goldeneyes[b]		Mergansers[c]	
Year	$\widehat{N}$	90% CI	$\widehat{N}$	90% CI	$\widehat{N}$	90% CI	$\widehat{N}$	90% CI	$\widehat{N}$	90% CI	$\widehat{N}$	90% CI
1998	1,421.8	(1,226.5, 1,623.8)	939.9	(791.4, 1,103.6)	300.3	(212.8, 400.5)	585.8	(429.7, 765.4)	550.5	(379.6, 763.6)	560.3	(456.2, 666.8)
1999	1,415.8	(1,228.2, 1,623.7)	919.6	(791.1, 1,055.5)	388.7	(283.4, 508.0)	694.8	(518.1, 923.0)	659.9	(474.6, 872.0)	588.1	(489.9, 691.6)
2000	1,364.6	(1,178.0, 1,548.3)	806.7	(711.8, 909.0)	356.7	(268.2, 458.6)	921.0	(587.8, 1,434.3)	642.5	(442.0, 896.1)	578.5	(484.8, 677.1)
2001	1,374.1	(1,196.7, 1,577.7)	797.4	(685.7, 909.9)	298.5	(218.4, 387.0)	658.4	(490.3, 849.1)	746.2	(507.6, 1,018.0)	554.1	(462.6, 647.6)
2002	1,357.4	(1,176.9, 1,548.8)	972.7	(834.2, 1,126.5)	405.6	(294.6, 519.9)	669.7	(502.6, 844.8)	852.6	(578.3, 1,191.0)	772.6	(655.0, 904.1)
2003	1,330.7	(1,151.6, 1,529.1)	900.6	(761.4, 1,054.0)	393.0	(285.5, 523.8)	670.1	(530.6, 837.1)	644.8	(435.0, 922.8)	667.5	(563.7, 785.2)
2004	1,328.6	(1,137.2, 1,521.9)	932.4	(775.9, 1,102.9)	463.5	(334.3, 611.0)	737.5	(554.9, 963.0)	592.5	(419.7, 795.9)	681.5	(577.8, 797.1)
2005	1,290.1	(1,109.2, 1,487.8)	813.6	(703.8, 939.5)	340.4	(245.8, 456.4)	622.5	(492.8, 772.0)	517.0	(381.3, 684.1)	652.4	(550.8, 762.5)
2006	1,247.6	(1,072.1, 1,426.8)	873.9	(747.4, 1,014.4)	333.2	(240.8, 441.4)	654.2	(510.3, 824.9)	474.0	(347.8, 624.6)	583.1	(491.0, 680.3)
2007	1,268.9	(1,087.7, 1,480.6)	942.8	(815.8, 1,070.2)	440.6	(299.2, 640.5)	833.0	(652.9, 1,030.1)	661.3	(473.9, 905.0)	666.2	(558.5, 780.9)
2008	1,241.5	(1,066.5, 1,446.5)	846.3	(719.6, 988.0)	406.3	(284.3, 553.7)	671.3	(500.8, 854.8)	626.8	(437.6, 862.0)	601.1	(507.7, 702.7)
2009	1,231.5	(1,046.8, 1,434.1)	872.6	(718.8, 1,048.2)	429.0	(300.9, 588.1)	683.9	(505.5, 889.9)	541.9	(379.7, 732.0)	630.0	(534.4, 743.2)
2010	1,141.9	(979.2 , 1,311.7)	759.8	(639.1, 889.5)	417.1	(293.0, 577.7)	675.9	(509.3, 851.8)	534.8	(369.4, 727.1)	525.3	(442.2, 621.2)
2011	1,183.6	(1,001.6, 1,379.1)	816.9	(667.0, 986.6)	402.3	(275.7, 561.3)	609.3	(470.1, 761.1)	545.9	(393.7, 735.4)	567.8	(477.0, 670.9)
2012	1,158.0	(987.7 , 1,336.0)	879.6	(738.8, 1,035.5)	364.7	(256.8, 495.4)	633.1	(470.4, 806.2)	574.7	(383.0, 819.3)	591.2	(498.0, 693.0)
2013	1,225.0	(1,017.5, 1,462.0)	874.4	(709.5, 1,062.0)	400.1	(277.0, 554.7)	783.2	(558.5, 1,048.3)	620.3	(432.3, 877.4)	633.3	(524.6, 773.3)
2014	1,154.8	(982.3 , 1,353.9)	868.1	(719.9, 1,025.3)	305.8	(214.9, 414.3)	596.8	(456.6, 757.6)	580.0	(368.1, 884.7)	558.3	(471.3, 657.4)
2015	1,109.1	(950.0 , 1,296.9)	861.3	(689.3, 1,067.1)	312.6	(219.0, 427.1)	713.2	(501.2, 992.8)	439.0	(312.8, 592.8)	552.5	(464.8, 649.4)
2016	1,097.5	(932.3 , 1,282.6)	936.0	(752.6, 1,146.9)	319.4	(224.2, 445.2)	732.6	(551.8, 947.1)	503.4	(345.2, 708.2)	599.7	(505.5, 706.1)
2017	1,113.8	(933.1 , 1,299.9)	763.1	(633.9, 898.2)	344.7	(249.3, 454.8)	611.9	(454.2, 810.4)	561.6	(383.5, 797.7)	698.7	(586.3, 814.0)
2018	1,066.5	(901.7 , 1,238.0)	695.2	(595.4, 797.9)	339.5	(241.2, 457.1)	627.5	(470.8, 826.8)	489.1	(337.5, 678.9)	666.9	(565.8, 780.5)
2019	1,049.8	(894.9 , 1,221.5)	729.4	(626.0, 832.7)	302.8	(214.6, 401.8)	693.5	(514.0, 924.7)	515.9	(347.4, 738.0)	643.4	(540.4, 747.8)

[a] Estimates for six most abundant species in the eastern survey area. Estimates for black ducks, green-winged teal, ring-necked ducks, goldeneye, and mergansers are at the eastern survey scale (strata 51–53, 56, 62–72) and mallards at the eastern North America scale (eastern survey area plus Virginia north to New Hampshire)

[b] Common and Barrow's.

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

C. Historical estimates of goose and swan populations

Table C.1. Abundance indices (in thousands) for North American Canada goose populations, 1969–2019.

	North Atlantic[a,b]		Atlantic[a,b]		Atlantic Flyway Resident[a]		Southern Hudson Bay[a]		Mississippi Flyway Giant[a]
Year	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$
1969/70									
1970/71									
1971/72									
1972/73									
1973/74									
1974/75									
1975/76									
1976/77									
1977/78									
1978/79									
1979/80									
1980/81									
1981/82									
1982/83									
1983/84									
1984/85									
1985/86									
1986/87									
1987/88									
1988/89									
1989/90	45.1	8.7							
1990/91	45.7	8.6							
1991/92	42.5	8.0							
1992/93	50.1	9.6	93.0	12.5	647.5	111.8			732.7
1993/94	47.7	8.7	43.2	4.0	648.7	73.0			785.7
1994/95	45.9	8.5	34.0	3.0	780.0	98.8			855.2
1995/96	59.4	11.3	51.5	4.8	932.7	107.4			1,085.8
1996/97	54.9	9.6	72.1	6.6	1,013.3	132.5			944.8
1997/98	50.6	8.5	48.6	4.5	970.1	115.7			1,064.4
1998/99	61.1	11.0	83.7	7.6	999.5	120.8			1,221.2
1999/00	51.1	8.6	95.8	8.4	1,022.3	101.9			1,443.1
2000/01	51.0	8.9	135.2	12.5	1,016.6	89.3			1,205.2
2001/02	51.1	8.6	182.4	17.6	1,097.1	95.1			1,269.9
2002/03	48.6	8.3	174.9	17.2	1,126.7	94.5			1,443.2
2003/04	53.6	9.3	191.8	19.2	1,073.1	93.8			1,211.5
2004/05	46.6	8.0	175.7	16.7	1,167.1	102.3			1,197.2
2005/06	47.8	8.1	186.1	20.0	1,144.0	106.2			1,406.4
2006/07	53.0	9.0	207.3	21.1	1,128.0	94.5			1,319.5
2007/08	48.2	8.1	174.0	18.2	1,024.9	82.1			1,312.6
2008/09	50.6	8.5	186.8	19.7	1,006.1	74.8			1,327.7

Table C.1. Continued.

Year	North Atlantic[a,b]		Atlantic[a,b]		Atlantic Flyway Resident[a]		Southern Hudson Bay[a]		Mississippi Flyway Giant[a]
	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$
2009/10	49.2	8.2	165.1	17.5	969.9	92.1			1,474.3
2010/11	52.0	8.8	216.0	23.2	1,015.1	86.5			1,456.4
2011/12	51.8	8.6	190.3	20.4	879.8	71.6			1,490.2
2012/13	53.4	9.2			951.9	79.1			1,541.4
2013/14	55.6	9.2	191.2	20.1	1,084.9	114.4			1,299.7
2014/15	51.8	8.7	161.3	16.0	963.8	81.7			1,513.4
2015/16	50.6	8.4	191.5	24.9	950.0	80.1	69.6	1.3	1,444.3
2016/17	48.8	8.3	161.1	17.2	933.3	74.0	89.7	1.8	1,588.7
2017/18	54.1	8.9	112.2	11.3	1,030.9	83.2	85.7	1.8	1,562.8
2018/19	52.5	8.5	119.5	12.0	1,039.5	91.3			1,500.6

[a] Surveys conducted in spring.
[b] Number of breeding pairs.
[c] Lincoln estimates of adults.
[d] Fall-winter indices.

Table C.1. Continued.

Year	W. Prairie & Great Plains[a]		Central Flyway Arctic Nesting[c]		Hi-line[a]		Rocky Mountain[a]		Pacific[a]	
	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$
1969/70	80.4				58.3	39.2	29.1	16.7		
1970/71	98.9				99.0	54.3	47.2	23.3		
1971/72	83.0				52.4	27.8	26.7	16.7		
1972/73	78.8				29.5	12.5	28.6	15.3		
1973/74	66.8				32.9	16.2	32.4	16.5		
1974/75	74.4				28.0	14.9	31.6	15.7		
1975/76	99.9	43.7			39.3	18.3	20.1	11.9		
1976/77	94.0	42.0			39.4	16.3	19.6	10.3		
1977/78	227.9	135.4			38.1	18.8	28.6	14.0		
1978/79	174.7	92.0			48.9	23.2	43.5	21.6		
1979/80	152.1	69.0			49.3	22.5	24.2	12.1		
1980/81	184.9	66.2			48.7	19.8	47.8	25.8		
1981/82	162.1	50.1			52.4	21.3	47.8	21.0		
1982/83	214.2	86.5			71.5	27.7	30.7	14.2		
1983/84	182.4	64.2			103.1	40.5	32.7	14.6		
1984/85	217.7	68.7			89.1	34.6	35.3	16.2		
1985/86	232.1	81.3			98.2	35.4	51.1	26.1		
1986/87	235.0	97.1			90.6	37.8	50.1	24.2		
1987/88	338.9	103.3			126.0	49.3	78.4	40.2		
1988/89	418.3	136.2			120.6	49.7	74.1	35.8		
1989/90	366.3	126.5			180.9	75.6	69.6	36.3		
1990/91	318.2	109.6			143.7	55.9	63.3	30.2		
1991/92	328.1	91.9			163.8	66.0	79.3	35.5		
1992/93	346.5	113.1			153.7	67.0	89.4	38.9		
1993/94	371.0	124.5			156.2	57.8	119.0	53.0		
1994/95	417.7	127.5			230.3	93.1	118.3	54.8		
1995/96	451.4	49.8			196.2	24.1	126.8	20.1		
1996/97	487.3	50.0			203.7	24.1	85.0	15.3		
1997/98	587.1	63.0			252.0	34.3	137.8	25.1		
1998/99	702.1	76.8			196.6	22.3	99.1	15.3		
1999/00	717.7	61.6			279.3	34.9	165.1	29.8		
2000/01	704.5	63.8			252.8	29.0	161.4	21.6		
2001/02	670.9	54.6			231.0	26.1	134.7	25.2		
2002/03	764.1	62.8			231.5	34.4	134.3	19.6		
2003/04	797.7	68.5			200.5	25.6	152.5	27.5		
2004/05	775.6	65.9	3,384.2	751.8	236.2	25.2	151.8	15.4		
2005/06	816.1	62.8	3,952.0	642.8	208.0	22.2	130.7	17.7		
2006/07	979.6	68.3	2,660.6	494.8	298.8	30.5	137.2	19.9		

Table C.1. Continued.

	W. Prairie & Great Plains[a]		Central Flyway Arctic Nesting[c]		Hi-line[a]		Rocky Mountain[a]		Pacific[a]	
Year	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$
2007/08	957.1	66.5	2,452.1	528.6	337.3	38.4	205.6	32.0		
2008/09	1,049.7	71.8	3,880.9	892.5	298.4	32.5	118.4	12.8		
2009/10	1,111.1	82.0	4,324.3	995.3	269.5	29.9	137.3	22.4	209.9	27.7
2010/11	1,309.9	93.4	2,906.0	593.1	265.4	33.6	98.1	13.1	265.3	31.9
2011/12	1,369.6	109.0	3,059.4	600.4	483.6	64.4	137.0	20.7	283.4	27.5
2012/13	1,314.7	65.5	3,809.9	788.7	325.5	35.3	153.2	16.8	315.1	40.7
2013/14	1,183.4	72.8	3,291.9	631.7	275.9	31.5	111.3	14.9	227.8	22.0
2014/15	1,223.1	75.3	1,853.0	367.5	368.5	36.6	158.2	22.0	328.0	38.5
2015/16	1,517.7	91.2	2,479.3	495.6	453.9	50.8	251.6	32.4	311.4	30.7
2016/17	1,352.8	84.8	2,499.1	492.1	374.6	35.4	187.7	23.7	296.7	29.9
2017/18	1,349.7	85.2			409.2	33.4	252.7	32.7	350.7	40.9
2018/19	1,443.4	94.4			374.9	33.5	175.7	20.0	347.0	42.3

[a] Surveys conducted in spring.
[b] Breeding pairs.
[c] Lincoln estimate.
[d] Fall-winter indices

Table C.1. Continued.

	Dusky[a]		Cackling[d]		Lesser[a]		Taverner's[a]		Aleutian[d]	
Year	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$
1969/70					12.7	5.1				
1970/71					8.2	3.3				
1971/72					3.4	1.2				
1972/73					6.4	1.3				
1973/74					21.2	14.6				
1974/75					6.9	1.7			0.8	
1975/76					3.0	0.8			0.9	
1976/77					4.7	1.3			1.3	
1977/78					6.9	2.2			1.5	
1978/79					6.5	1.8			1.6	
1979/80					12.9	3.3			1.7	
1980/81					18.4	3.9			2.0	
1981/82					16.0	5.1			2.7	
1982/83					3.4	1.1			3.5	
1983/84					13.8	4.3			3.8	
1984/85			47.3	4.3	9.6	3.3			4.2	
1985/86	16.7	2.8	44.5	3.1	6.7	2.6			4.3	
1986/87	14.9	1.8	61.3	4.3	4.6	1.2			5.0	
1987/88	15.1	1.8	83.4	5.3	6.8	1.4			5.4	
1988/89	17.0	2.0	87.7	5.4	7.1	2.1			5.8	
1989/90	15.2	2.7	112.9	7.1	11.7	3.8			6.3	
1990/91	10.3	1.8	101.8	6.3	4.3	1.9			7.0	
1991/92	16.6	2.0	152.6	9.4	9.1	4.5			7.7	
1992/93	15.1	1.7	155.8	9.1	5.9	1.5			11.7	
1993/94	15.2	1.6	220.7	12.6	16.7	4.9			15.7	
1994/95	11.7	1.3	238.6	14.0	9.6	2.8			19.2	
1995/96	11.4	1.1	252.5	14.8	7.7	2.5			15.5	0.6
1996/97	12.8	1.2	298.9	17.3	5.0	1.1			20.4	0.8
1997/98	14.5	1.4	211.8	13.1	5.7	1.9			32.4	1.1
1998/99	10.2	1.0	240.2	14.0	5.7	2.2			35.3	3.1
1999/00	10.0	0.9	247.8	14.2	9.3	4.3			34.2	1.3
2000/01	11.0	1.1	262.7	15.7	6.1	1.9			88.3	18.7
2001/02	12.4	1.2	169.5	9.9	4.9	1.3			65.2	12.9
2002/03	9.9	0.9	242.5	14.2	6.3	2.2			73.0	2.8
2003/04	11.2	1.1	177.1	10.3	6.3	1.9			111.1	4.4
2004/05	16.5	2.0	227.9	13.5	4.8	1.4			87.8	4.8
2005/06	10.8	1.1	255.2	15.0	4.2	0.9			97.2	4.5
2006/07	10.1	1.0	267.3	15.0	9.5	4.0	54.2	6.0	117.3	9.8
2007/08	9.1	0.9	294.6	16.9	10.3	3.8	51.1	9.8	116.1	7.4

Table C.1. Continued.

	Dusky[a]		Cackling[d]		Lesser[a]		Taverner's[a]		Aleutian[d]	
Year	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$
2008/09	6.6	0.6	240.2	14.0	6.4	2.1	48.9	6.8	81.8	13.3
2009/10	9.3	0.9	290.7	19.2	6.8	2.0	57.1	4.9	106.7	9.0
2010/11	11.3	1.1	194.1	11.3	3.6	2.0	35.0	3.1	105.3	8.4
2011/12	12.8	1.3	210.9	12.8	3.8	1.6	46.4	5.5	135.9	10.9
2012/13			324.7	21.0	4.1	1.8	27.2	3.6	166.3	15.9
2013/14	14.5	1.4	288.0	18.6	2.3	0.8	48.3	8.7	150.0	13.1
2014/15	18.3	1.7	364.1	23.7	4.0	1.0	42.5	6.6	197.7	17.8
2015/16	16.2	1.6	335.1	19.1	6.5	1.8	54.0	6.8	154.7	13.4
2016/17	13.9	1.4	292.0	16.5	2.8	1.3	42.0	5.6	168.5	20.3
2017/18	11.6	0.9	208.2	12.4	2.0	0.7	44.5	6.4	171.3	16.2
2018/19	17.7	2.5	205.3	12.2	13.1	7.0	58.9	5.2	198.9	27.7

[a] Surveys conducted in spring.
[b] Breeding pairs.
[c] Lincoln estimate.
[d] Fall-winter indices

Table C.2. Abundance indices (in thousands) for Ross's and snow goose populations, 1969–2019.

			Snow Geese					
	Ross's geese[a]		Mid-continent[c]		Pacific Flyway[b]	Wrangel Island[a]	Greater [a]	
Year	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{N}$	$\widehat{N}$	$\widehat{SE}$
1969/70			1,158.2	208.4			89.6	
1970/71			1,172.4	235.0			123.3	
1971/72			1,051.4	164.0			134.8	
1972/73			1,179.1	185.8			143.0	
1973/74			1,859.4	301.6			165.0	
1974/75			1,080.7	191.4		56.0	153.8	
1975/76			1,298.6	214.5		58.0	165.6	
1976/77			1,840.0	244.6		68.2	160.0	
1977/78			2,674.6	288.6		65.4	192.6	
1978/79			1,795.6	231.7		84.5	170.1	
1979/80			1,951.5	317.0	528.1	90.7	180.0	
1980/81			1,573.1	265.4	204.2	89.0	170.8	
1981/82			1,818.6	308.9	759.9	100.0	163.0	
1982/83			2,691.5	480.3	354.1	95.0	185.0	
1983/84			2,507.6	462.3	547.6	85.0	225.4	
1984/85			2,745.6	491.5	466.3	85.0	260.0	
1985/86			4,169.5	930.7	549.8	90.0	303.5	
1986/87			2,037.0	344.8	521.7	100.0	255.0	
1987/88			3,005.4	557.7	525.3	80.0	363.8	
1988/89			5,046.5	1,060.9	441.0	70.0	363.2	
1989/90			4,456.1	887.3	463.9	60.0	368.3	
1990/91			3,936.5	749.8	708.5	60.0	352.6	15.7
1991/92			5,523.4	1,006.5	690.1	70.0	448.1	20.1
1992/93	201.9	18.8	5,542.3	1,210.5	639.3	65.0	498.4	20.8
1993/94	160.8	12.7	11,132.4	2,846.9	569.2	70.0	591.4	26.5
1994/95	150.7	9.8	7,777.5	1,724.5	478.2	65.0	616.6	25.1
1995/96	240.5	16.9	7,218.9	2,295.1	501.4	75.0	669.1	33.9
1996/97	220.6	12.3	12,412.6	2,630.3	366.3	85.0	657.5	28.0
1997/98	293.3	14.4	9,685.0	977.7	416.4	90.0	836.6	49.2
1998/99	391.7	22.1	11,628.8	1,202.3	354.3	90.0	1,008.0	32.3
1999/00	347.1	15.5	13,565.7	1,083.5	579.0	95.0	816.5	90.5
2000/01	467.8	28.8	14,443.1	1,287.1	656.8	105.0	837.4	31.6
2001/02	359.7	14.7	14,934.8	1,339.7	448.2	110.0	725.0	28.0
2002/03	517.5	28.1	10,619.3	986.4	596.8	115.0	721.0	28.2
2003/04	463.3	19.4	14,479.0	1,182.6	587.8	117.5	890.0	41.4
2004/05	563.7	22.2	14,481.7	1,209.4	750.3	117.5	880.0	30.2
2005/06	543.9	24.0	13,541.9	1,200.3	710.7	132.5	938.0	40.2
2006/07	718.9	23.8	18,864.5	1,472.9	799.7	140.0	838.0	38.1
2007/08	741.0	51.7	16,858.0	1,639.6	1,073.5	140.0	718.0	104.1

Table C.2. continued.

			Snow Geese					
	Ross's geese[a]		Mid-continent[c]		Pacific Flyway[b]	Wrangel Island[a]	Greater [a]	
Year	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{N}$	$\widehat{N}$	$\widehat{SE}$
2008/09	669.2	25.0	16,741.6	2,139.5	957.4	132.5	1,009.0	31.6
2009/10	704.1	21.7	10,098.0	957.0	901.0	150.0	824.0	139.8
2010/11	665.1	27.0	15,939.2	1,532.4	863.8	155.0	917.0	18.9
2011/12	784.0	26.6	16,291.7	1,507.0	1,097.9		1,005.0	43.4
2012/13	555.1	20.7	16,188.3	1,519.1	881.4	160.0	921.0	32.1
2013/14	665.4	37.7	15,666.8	1,423.5	1,351.2		796.0	32.1
2014/15	613.8	22.6	10,536.1	992.6	1,199.6	240.0	818.0	31.1
2015/16	624.1	20.5	13,248.9	1,094.8		300.0	915.0	52.6
2016/17	446.6	15.3	12,008.6	1,119.4	1,906.8	346.0	747.0	37.2
2017/18	337.0	19.5			1,355.2	306.0	877.0	49.0
2018/19					1,413.8	442.0	714.0	42.9

[a] Surveys conducted in spring.
[b] Fall-winter indices.
[c] Lincoln estimates of adults.

Table C.3. Abundance indices (in thousands) of North American white-fronted geese, brant, emperor geese, and tundra swan populations, 1969–2019.

	White-fronted geese		Brant				Tundra swans		
	Pacific[b]	Mid-continent[b]	Atlantic[b]	Pacific[b]	Emperor geese[a]		Western[a]		Eastern[b]
Year	$\widehat{N}$	$\widehat{N}$	$\widehat{N}$	$\widehat{N}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$
1969/70			106.5	141.7					
1970/71			151.0	149.2					
1971/72			73.3	124.8					
1972/73			40.8	125.0					
1973/74			88.1	130.7					
1974/75			88.4	123.4					
1975/76			127.0	122.0					
1976/77			73.8	147.0					
1977/78			46.7	162.9					
1978/79			42.0	129.4					
1979/80			59.2	146.4					60.1
1980/81			97.0	197.5					93.0
1981/82			104.5	121.0					73.2
1982/83			123.5	109.3					87.5
1983/84			127.3	135.0					81.4
1984/85	163.2		146.3	145.1	18.8	1.6	96.3	13.7	96.9
1985/86	141.9		110.4	134.2	11.6	0.7	70.1	5.3	90.9
1986/87	140.0		109.4	110.9	10.9	0.9	77.0	10.8	95.8
1987/88	186.7		131.2	145.0	13.4	0.8	83.2	13.8	78.7
1988/89	198.1		137.9	135.6	14.5	0.8	108.9	17.8	91.3
1989/90	220.0		135.4	151.7	15.2	0.9	113.0	20.1	90.6
1990/91	196.5		147.7	132.7	12.6	1.0	85.2	14.1	98.2
1991/92	218.8		184.8	117.8	13.3	0.7	72.8	4.7	113.0
1992/93	234.1	622.9	100.6	125.0	15.5	1.0	79.8	13.1	78.2
1993/94	258.9	676.3	157.2	129.3	17.1	0.8	83.6	7.5	84.8
1994/95	302.2	727.3	148.2	133.5	17.5	0.9	120.0	34.1	85.1
1995/96	374.6	1,129.4	105.9	128.0	23.6	2.3	110.2	19.2	79.5
1996/97	370.5	742.5	129.1	155.3	22.5	1.3	114.6	10.9	92.4
1997/98	388.0	622.2	138.0	138.8	19.8	1.1	129.2	13.6	100.6
1998/99	393.4	1,058.3	171.6	132.3	20.3	1.2	118.5	14.5	111.0
1999/00	352.7	963.1	157.2	135.6	17.3	0.7	108.7	12.0	115.3
2000/01	438.9	1,067.6	145.3	126.0	27.7	1.2	93.7	8.2	98.4
2001/02	359.7	712.3	181.6	138.2	19.3	1.0	117.1	14.9	114.7
2002/03	422.0	669.7	164.5	106.1	20.9	1.4	95.6	7.8	111.7
2003/04	374.9	528.2	129.6	121.3	21.5	0.9	111.7	20.1	110.8
2004/05	443.9	644.3	123.2	107.2	20.7	1.2	122.9	21.1	72.5
2005/06	509.3	522.8	146.6	141.0	26.7	1.4	124.4	12.9	81.3
2006/07	604.7	751.3	150.6	130.6	26.3	1.6	155.6	22.1	114.4
2007/08	627.0	764.3	161.6	157.0	22.5	0.9	174.3	31.8	96.2

Table C.3. continued.

	White-fronted geese		Brant				Tundra swans		
	Pacific[b]	Mid-continent[b]	Atlantic[b]	Pacific[b]	Emperor geese[a]		Western[a]		Eastern[b]
Year	$\widehat{N}$	$\widehat{N}$	$\widehat{N}$	$\widehat{N}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$
2008/09	536.7	751.7	151.3		20.5	0.8	107.2	7.7	100.2
2009/10	649.8	583.2	139.4	163.5	19.9	0.9	110.6	8.8	97.3
2010/11	604.3	709.8	148.9	162.5	21.3	1.0	120.1	16.3	97.6
2011/12	664.2	685.7	149.2	177.3	20.6	1.4	114.6	9.2	111.7
2012/13	579.9	777.9	111.8	163.3	29.9	1.8	110.2	17.6	107.1
2013/14	637.2		132.9	173.3	31.8	2.8	88.6	9.1	105.0
2014/15	479.1	1,005.6	111.4	136.5	28.6	1.4	133.4	22.6	117.1
2015/16	685.5	977.1	157.9	140.0	34.2	2.0	115.2	21.5	113.6
2016/17	735.6	1,000.1	161.7	155.7	30.1	1.5	129.9	26.9	119.3
2017/18	590.0	771.6	169.7	132.6	30.2	1.5	151.7	26.1	111.6
2018/19	479.3	774.1	120.1	160.6	26.6	1.2	101.1	11.8	92.8

[a] Surveys conducted in spring.
[b] Fall-winter indices.

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

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

For state transfer relay service
TTY/Voice: 711