U.S. Fish and Wildlife Service

Waterfowl

Population Status, 2002

WATERFOWL POPULATION STATUS, 2002

July 24, 2002

In North America the process of establishing hunting regulations for waterfowl is conducted annually. In the United States the process involves a number of scheduled meetings in which information regarding the status of waterfowl is presented to individuals within the agencies responsible for setting hunting regulations. In addition, public hearings are held and 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 (FWS), the Canadian Wildlife Service (CWS), various State and Provincial conservation agencies, and private conservation organizations. This report is intended to aid the development of waterfowl harvest regulations in the U.S. for the 2002-2003 hunting season.

Cover art: Black scoters. Joseph Hautman, winner of the 2002-2003 Federal Duck Stamp design competition.

ACKNOWLEDGEMENTS

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 Direccion General de Conservacion Ecologica 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. Some habitat and weather information was taken from the NOAA/USDA Joint Agriculture Weather Facility (http://www.usda.gov/oce/waob/jawf/), Environment Canada (http://www1.tor.ec.gc.ca/ccrm/bulletin/), and Waterfowl Population Surveys reports (http://migratorybirds.fws.gov/reports/reports.html). Appendix A provides a list of individuals responsible for the collection and compilation of data for the Ducks section of this report. Appendix B provides a list of individuals who were primary contacts for information included in the Geese and Swans section. We apologize for any omission of individuals from these lists, and thank all participants for their contributions. Without this combined effort, a comprehensive assessment of waterfowl populations and habitat would not be possible.

Authors: This report was prepared by the U.S. Fish and Wildlife Service, Division of Migratory Bird Management, Branch of Surveys and Assessment. The principal authors are Pamela R. Garrettson, Tim Moser, and Khristi Wilkins. The authors compiled information from the numerous sources to provide an assessment of the status of waterfowl populations.

Report Preparation: The preparation of this report involved substantial efforts on the part of many individuals. Support for the processing of data and publication was provided by Mark C. Otto, James A. Dubovsky, Judith P. Bladen, and Michael Runge. Graham Smith reviewed drafts of this report and provided helpful comments. Ray Bentley, John Bidwell, Karen Bollinger, Elizabeth Buelna, Bill Butler, Carl Ferguson, Rod King, Mark Koneff, Fred Roetker, John Solberg, Phil Thorpe, James Voelzer, and James Wortham provided habitat narratives, reviewed portions of the report that addressed major breeding areas, and provided helpful comments.

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STATUS OF DUCKS

Abstract: In the traditional survey area (strata 1-18, 20-50, and 75-77), total duck abundance was 31.2 ± 0.5 [SE] million birds. This was 14% below (P< 0.001) last year's estimate of 36.1 ± 0.6 million birds, and 6% below the long-term (1955-2001) average (P<0.001). Mallard (*Anas platyrhynchos*) abundance was 7.5 ± 0.2 million, similar to (P=0.23) the 2001 estimate of 7.9 ± 0.2 million, and essentially identical to the long-term average (P=1.00). Blue-winged teal (*A. discors*) abundance was 4.2 ± 0.2 million, which was 27% below last year's estimate of 5.8 ± 0.3 million (P<0.001), but similar to the long-term average (P=0.22). Gadwall (*A. strepera*; 2.2 ± 0.1 million, -17%), shovelers (*A. clypeata*; 2.3 ± 0.1 million, -30%), and pintails (*A. acuta*; 1.8 ± 0.1 million, -46%) were below 2001 estimates (P≤0.02). Wigeon (*A. americana*; 2.3 ± 0.1 million), green-winged teal (*A. crecca*; 2.3 ± 0.1 million), redheads (*Aythya americana*; 0.6 ± 0.1 million), canvasbacks (*Aythya valisineria*; 0.5 ± 0.1 million), and scaup (*Aythya marila* and *A. affinis* combined; 3.5 ± 0.2 million) were unchanged from 2001 estimates. Gadwall (+37%), green-winged teal (+28%), and shovelers (+10%) all remained above their long-term averages, whereas wigeon (-12%), pintail (-58%), canvasback (-14%), and scaup numbers (-34%) were below long-term averages. Northern pintails and scaup were the lowest and second lowest counts on record, respectively. The redhead estimate was similar to the long-term average. Below-average winter and spring precipitation in the prairies and parklands were reflected in pond counts much lower than in 2001. Total May ponds (U.S. prairies and prairie and parkland Canada combined) of 2.7 ± 0.1 million were the second lowest since 1974, when this estimate was first recorded, 41% below last year's estimate of 4.6 ± 0.1 million (P<0.001), and 45% below (P<0.001) the long-term average. The projected mid-continent mallard fall flight index is 8.9 million, statistically similar to last year's. The eastern survey area is comprised of strata 51-56 and 62-69. The 2002 total duck population estimate for this area was 4.4 ± 0.3 million birds, 32% higher than last year's (3.3 ± 0.3 million, P=0.01), and 41% higher than the 1996-2001 average (P<0.001). Numbers of most individual species were similar to those of last year, with the exception of mergansers (*Lophodytes cucullatus* and *Mergus spp.*; 0.8 ± 0.1 million, +90%, P<0.001) and green-winged teal (0.7 ± 0.1 million, +174%, P=0.01), which increased compared to last year. Mergansers (+68%) and green-winged teal (+102%) were also above their 1996-2001 averages, as were scoters (*Melanitta spp.*; 0.3 ± 0.1 million, +178%, P=0.01). Estimates for all other species were similar to last year's estimates and to long-term averages.

This section summarizes the most recent information about the status of North American duck populations and their habitats in order to facilitate development of harvest regulations in the U.S. The annual status of these populations is monitored using a variety of databases, which include estimates of the size of breeding populations, production, and harvest. 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

Breeding Population and Habitat Survey

Federal, provincial, and state agencies conduct surveys each spring to estimate the size of breeding populations and to evaluate the condition of the habitats. These surveys are conducted using fixed-wing aircraft and encompass principal breeding areas of North America, and cover over 2.0 million square miles. The traditional survey area (strata 1-18, 20-50, and 75-77) is comprised of parts of Alaska, Canada, and the north-central U.S., and includes approximately 1.3 million square miles (Appendix C). The eastern survey area (strata 51-56 and 62-69) includes parts of Ontario, Quebec, Labrador, Newfoundland, Nova Scotia, Prince Edward Island, New Brunswick, New York and Maine, covering an area of approximately 0.7 million square miles.

In Prairie Canada and the north-central U.S., estimates of ducks and ponds seen from the air are corrected annually for visibility bias by conducting ground counts. In the northern portions of the traditional survey area and the eastern survey area, duck estimates are corrected using visibility rates derived from a comparison of airplane and helicopter counts. Annual estimates of duck abundance are available since 1955 for the traditional survey area and for all strata in the eastern survey area since 1996, although portions of the eastern survey area have been surveyed since 1990. In the traditional survey area, estimates of pond abundance in Prairie Canada are available since 1961, whereas estimates for the north-central U.S. are available only since 1974. Several provinces and states also conduct breeding waterfowl surveys using various methods; some have survey designs that allow calculation of measures of precision for estimates of duck abundance. Information about habitat conditions was

supplied primarily by biologists in the survey areas. However, much ancillary weather information was obtained from agricultural and weather internet sites (see references). In 2002, May survey data was unavailable for stratum 36, so we predicted 2002 population estimates using past stratum 36 (1971-2001) estimates, and past and current estimates for strata 31 and 37, and ground pond counts (1971-2002) in a time series regression model.

Production and Habitat Survey

In July, aerial observers assess summer habitat conditions and duck production in a portion of the traditional survey area (strata 20-49 and 75-77). This survey provides indices of duck brood and pond numbers. Ground counts are not conducted concurrently with July aerial surveys, so indices of duck broods and ponds are not corrected for visibility bias. The coefficients of variation for May pond estimates are used to estimate the precision of July pond counts.

Total Duck Species Composition

In the traditional survey area, our estimate of total ducks excludes scoters (*Melanitta* spp.), eiders (*Somateria* and *Polysticta* spp.), long-tailed ducks (*Clangula hyemalis*). mergansers (*Mergus* and *Lophodytes* spp.), and wood ducks (*Aix sponsa*), because the traditional survey area does not cover a large portion of their breeding range. However, scoters and mergansers breed throughout a large portion of the eastern survey area. Therefore, in 2000, we redefined the total duck species composition in this region to include these species, and recalculated historical estimates to reflect this change. Canvasbacks, redheads, and ruddy ducks (*Oxyura jamaicensis*) are excluded from the eastern total-duck estimate because these species rarely breed there. Due to the added survey areas and change in total duck composition, estimates for the eastern survey area published in this document are not comparable to those published in status reports prior to 2000. Wood ducks are also not included in the total duck estimate for the eastern survey area, even though this species breeds over much of the region, as their wooded habitats make them difficult to detect from the air.

Mallard Fall-flight Index

Mallard fall-flight indices predict the size of the fall population originating from the mid-continent region of North America. For management purposes, the mid-continent population is comprised of mallards originating from the traditional survey area, as well as Michigan, Minnesota, and Wisconsin. Indices are based on the mallard models used for Adaptive Harvest Management, and consider breeding population size, habitat conditions, adult summer survival, and projected fall age ratio (young/adult). The projected fall age ratio is predicted from a model that depicts how the age ratio varies with changes in spring population size and 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 2002), using current model probabilities as weights. Fall flight indices provided in this report may differ from those published previously because model weights change each year based on a comparison of model predictions and observed population size.

RESULTS AND DISCUSSION

2001 in Review

Spring weather was generally warmer than normal across Canada, and temperatures were at or slightly below normal in most of the northern U.S. However, precipitation and habitat conditions in the traditional survey area were variable. The estimate of May ponds (north-central U. S. and Prairie Canada combined) had increased 18% (4.6 ± 0.1 million, P=0.001) compared to 2000, but was not statistically different from the long-term average (-6%, P=0.07). May ponds in prairie Canada were estimated at 2.7 $\pm$ 0.1 million, 13% higher than the 2000 estimate (P=0.03), but 20% below the long-term average (P<0.001). In the north-central U. S., counts produced an estimate of 1.9 $\pm$ 0.09 million ponds, 24% greater than in 2000 (P=0.006), and 25% above the long-term average (P<0.001). Continued drought made for fair-to-poor conditions in most of Alberta, central and southern Saskatchewan, and eastern Montana. By contrast, North and South Dakota generally had good-to-excellent water conditions, with the best conditions in the eastern portions of these states, and drier conditions to the west. Southern Manitoba and extreme southeastern Saskatchewan had higher-than-normal water conditions for two years, and that residual water, together with above-normal precipitation due to an early, snowy winter, produced excellent habitat for breeding ducks. Average to above-average precipitation also made for excellent wetland conditions across most of northern Manitoba and Saskatchewan. Record drought and poor wetland conditions were the rule in Alberta, with the exception of the northernmost areas, which had above-average winter and spring precipitation. Good conditions for breeding ducks prevailed in the Northwest Territories, except for a small northern area that was rated only fair due to late

breakup of ice on wetlands that reduced available breeding habitat for early-nesting species. In Alaska, breeding conditions depend largely on the timing of spring, as wetland conditions are less variable than on the prairies. Although winter temperatures had been mild, spring was late, and waterfowl production was below average to the north and west, and average to the south and east. Overall, conditions were good in the traditional survey area despite drought in parts of Prairie Canada. In the eastern survey area, conditions for breeding ducks were variable but generally good. Southern Ontario and northern New York enjoyed an early spring and normal precipitation. Spring-like weather also came early in Quebec, with good-to-excellent habitat in the central and northern portions. However, southern Quebec was drier, and conditions there ranged from fair to poor. In Maine and the Maritime provinces spring-like weather was late, with lower-than-normal temperatures, but above-average precipitation, so habitat conditions were rated good throughout the region. Overall, eastern habitats were in good condition, with average to above-average waterfowl production expected.

In 2001, the estimated breeding population of all ducks (excluding scoters, eiders, long-tailed ducks, mergansers, and wood ducks) in the traditional survey area was 36.1 $\pm$ 0.6 million birds, 14% below (P=0.001) the 2000 estimate of 41.8 $\pm$ 0.7 million birds, but 9% above the long-term (1955-2000) average (P<0.001). Approximately 60% of these ducks were found in the prairie-pothole region (strata 26-49), the same percentage recorded during the 1970s, which is the historical benchmark for good wetland conditions in this region. However, habitat conditions, and therefore distribution of birds, varied considerably. Total duck numbers had increased compared to the 2000 estimate (P=0.020) and were above the long-term average in Southern Manitoba (P=0.007). Estimates decreased compared to 2000 and were below long-term averages in central and northern Alberta-northeastern British Columbia-Northwest Territories, northern Saskatchewan-northern Manitoba-western Ontario, southern Saskatchewan and southern Alberta, (P<0.05). The 2001 total-duck population estimate for the eastern survey area (excluding canvasbacks, redheads, ruddy ducks, eiders, long-tailed ducks and wood ducks) was 3.3 $\pm$ 0.2 million birds. This was similar to the 2000 estimate of 3.2 $\pm$ 0.3 million birds.

The July Production Survey indicated that the number of late-season ponds in Prairie Canada and the north-central U.S. combined was 2.9 $\pm$ 0.09 million. This was 26% lower than the 2000 estimate of 3.9 $\pm$ 0.1 million ponds (P<0.001), and similar to the long-term average (P=0.74). July ponds in Prairie Canada were estimated at 1.8 $\pm$ 0.07 million, 25% below the 2000 estimate of 2.5 $\pm$ 0.1 million (P<0.001) but similar to the long-term average (P=0.47). In the north-central U.S., there were 1.0 $\pm$ 0.06 million July ponds. This was 26% below the 2000 estimate of 1.4 $\pm$ 0.08 million, and similar to the long-term average (P=0.48). The number of broods in the north-central U.S. and Prairie Canada combined was 11% lower than in 2000, but 15% above the long-term average. The number of broods in Prairie Canada and the north-central U.S. were 9% above and 19% below 2000 estimates, respectively. Brood indices in Prairie Canada were 33% below the long-term average, while brood counts were 81% above the long-term average in the north-central U.S. The brood index in the Canadian boreal forest was 10% lower than in 2000, and 31% below the long-term average.

2002 Breeding Habitat Conditions, Populations, and Production

Overall Habitat and Population Status

Below average winter and spring precipitation in the prairies and parklands and cold spring temperatures in the East resulted in generally poorer habitat conditions for breeding waterfowl this year than in 2001. Dry conditions were reflected in the number of ponds counted this year. Total May ponds (U.S. prairies and Canadian prairies and parkland combined) were 2.7 $\pm$ 0.1 million (Table 1, Figure 1, Appendix B), which is the second lowest count recorded since this estimate was first calculated in 1974. This value was 41% below last year's estimate of 4.6 $\pm$ 0.1 million (P<0.001), and 45% below (P<0.001) the long-term average (4.9 $\pm$ 0.1 million). May ponds in Canada (1.4 $\pm$ 0.1 million) and the U.S. (1.3 $\pm$ 0.1 million) were below 2001 estimates (-48% in Canada and -32% in the U.S; P<0.001) and their long-term averages (-58% in Canada and -16% in the U.S; P<0.001). Canadian May ponds were the lowest recorded since surveys began in 1961.

In both the traditional and eastern survey areas, most regions entered into the spring of 2002 with a water deficit remaining from winter. Spring rains helped recharge wetlands in most of the Northeast, but conditions remained very dry in the West. Western Montana, southern Saskatchewan, and much of southern Manitoba and southern and central Alberta were hardest hit by drought. Fewer ponds available to nesting birds caused crowding on remaining ponds. Relative to other parts of the prairies, the Dakotas were fair. Permanent wetlands remained in good condition

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

			Change from 2001			Change from LTA	
Survey Area	2001	2002	%	*P*	LTA[a]	%	*P*
Prairie Canada							
S. Alberta	426	477	+12	0.288	728	-35	<0.001
S. Saskatchewan	1536	635	-59	<0.001	1992	-68	<0.001
S. Manitoba	786	327	-58	<0.001	687	-52	<0.001
Subtotal	2747	1439	-48	<0.001	3408	-58	<0.001
Northcentral U.S.							
Montana and Western Dakotas	346	347	0	0.968	529	-34	<0.001
Eastern Dakotas	1548	934	-40	<0.001	1003	-7	0.247
Subtotal	1893	1281	-32	<0.001	1531	-16	<0.001
Grand Total	4640	2720	-41	<0.001	4906	-45	<0.001

[a]Long-term average. Prairie Canada, 1961-2001; northcentral U.S. and Grand Total, 1974-2001.

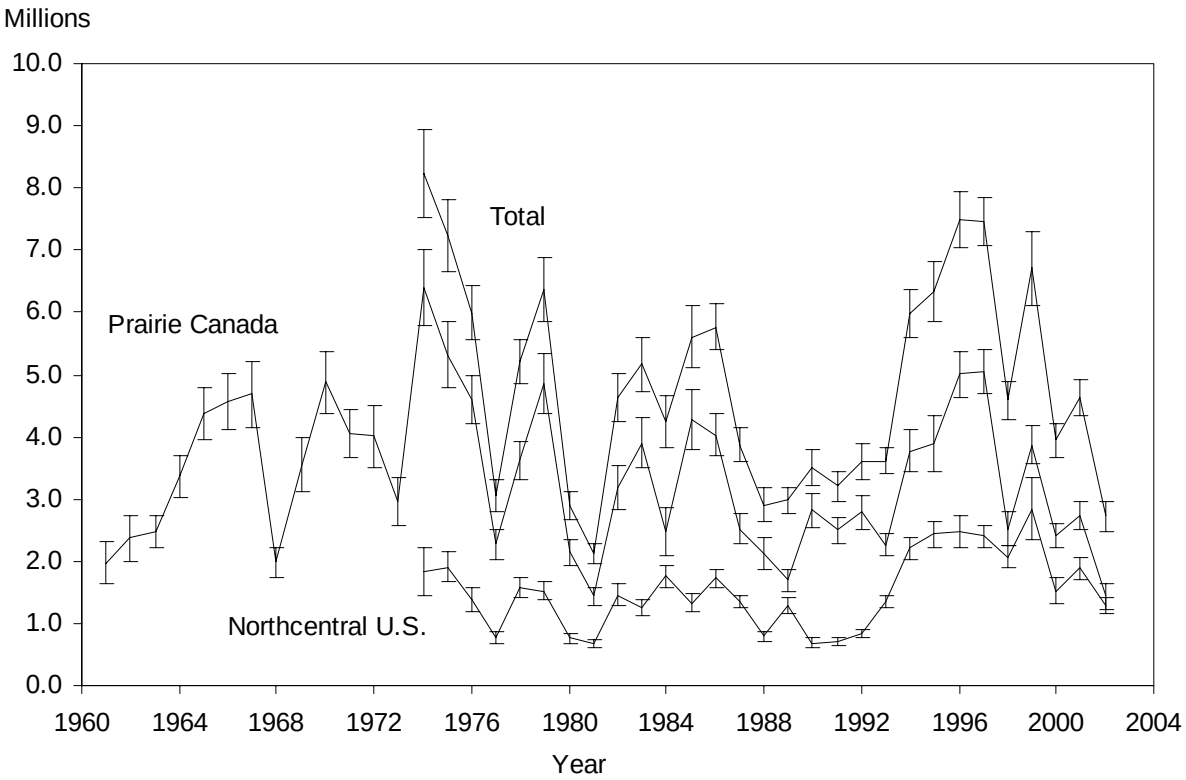


Figure 1. Number of ponds in May and 95% confidence intervals for Prairie Canada and the Northcentral U.S.

following the wet period of 1993-2001. However survey results suggest that many prairie-nesting species such as mallards, shovelers, pintails, and blue-winged teal, flew over the prairies and parklands to the boreal forest, where wetland conditions are more stable.

Cold spring temperatures also negatively affected nesting waterfowl this year. Winter-like conditions hit the entire surveyed area in early May, when snowstorms and cold temperatures caused birds to halt migration for several weeks. Snow and cold may have caused some nest loss in the prairies and parklands. Spring ice break-up was several weeks late over many of the northern survey areas. Break-up was so late in parts of the Northeast that biologists predicted little nesting activity in these areas. Conditions in northern Canada were generally good, but cold temperatures likely had a negative impact on early nesting species such as mallards, green-winged teal, and pintails. The only region where habitat conditions for breeding waterfowl improved over last year was Alaska, due to warmer post-thaw temperatures than last year. However, rapid ice melt may have caused flooding of nests in parts of Alaska as well as Labrador.

Since the breeding surveys were flown, water conditions have improved in Montana, the western Dakotas, southern Saskatchewan, and southern Alberta. In mid-June, these areas received several inches to a foot or more of rain and/or snow. However, most biologists think this precipitation probably came too late to help all but the latest nesting waterfowl this year.

In the traditional survey area, the total duck population estimate (excluding scoters, eiders [*Somateria* and *Polysticta* spp.], long-tailed ducks [*Clangula hyemalis*], mergansers, and wood ducks [*Aix sponsa*]) was 31.2 ± 0.5 [SE] million birds, 14% below (P<0.001) last year's estimate of 36.1 ± 0.6 million birds, and 6% below (P<0.001) the 1955-2001 long-term average (Table 2, Table 5, Appendix E). Total duck numbers decreased compared to last year, but remained above long-term averages in Alaska and the eastern Dakotas (P<0.001). Counts in southern Alberta were unchanged from last year, but were 47% below the long-term average (P<0.001). Total duck estimates decreased compared to last year and were below long-term averages in southern Saskatchewan, southern Manitoba, and in Montana and the western Dakotas ($P\leq$0.04). Perhaps reflecting overflight of the prairies in favor of the boreal forest, estimates in northern Saskatchewan and Manitoba and western Ontario were up 70% compared to last year (P<0.001), and were 27% higher than the long-term average (P<0.001). Counts in central and northern Alberta, northeast British Columbia and the Northwest Territories were also higher than last year (+20%, P=0.003) but slightly below the long-term average (P=0.020, Table 6, Appendix G). The 2002 total duck population estimate for the eastern survey area was 4.4 ± 0.3 million birds. This estimate is 32% higher than last year's (3.3 ± 0.3 million birds, P=0.010), and 41% higher than the 1996-2001 average (P<0.001). In some other areas where surveys are conducted, measures of precision for estimates are provided (British Columbia, California, Michigan, northeastern U.S., Washington, and Wisconsin). Total duck abundances were similar to last year's estimates and long-term averages in British Columbia and the northeastern U.S. In California, the total duck estimate was unchanged from 2001, and remained below the long-term average (P<0.001). Michigan's estimate is above last year's (P=0.019) and similar to its long-term average. Wisconsin's estimate is higher than last year's (P<0.01). Of the states without measures of precision for total duck numbers, Minnesota's estimate increased from 2001, but estimates for Nebraska, Nevada and Washington all decreased compared to last year.

Trends in abundances and annual breeding population estimates for 10 principal duck species from the traditional survey area are provided in Figure 2, Table 5, and Appendix F. The dashed lines in the species graphs in Figure 2 represent the population goal of the North American Waterfowl Management Plan for the traditional survey area. Mallard abundance was 7.5 $\pm$ 0.2 million, which is statistically similar to last year's estimate of 7.9 $\pm$ 0.3 million (P=0.23), and right at the long-term average (P=0.998, Table 3). Mallard numbers dropped significantly in the eastern Dakotas and in southern Saskatchewan compared to 2001 (P<0.001). However, numbers in the eastern Dakotas remained well above average, while southern Saskatchewan estimates were below the long-term average. In Alaska and southern Alberta, mallard numbers did not change relative to last year, but were higher than the long-term average in Alaska and in Southern Alberta, remained well below it ($P\leq$0.001). In the northern Saskatchewan--northern Manitoba--western Ontario area, mallard numbers were up compared to 2001 (P<0.001), but were similar to the long-term average. In other regions of the traditional survey area, mallard numbers remained unchanged relative to 2001 and to long-term averages. In other areas where surveys are conducted and measures of precision for estimates are provided (the same states as for total ducks, as well as Minnesota), mallard

Table 2. Total duck[a] breeding population estimates (in thousands).

			Change from 2001			Change from LTA	
Region	2001	2002	%	*P*	LTA[b]	2001	2002
Traditional Survey Area							
Alaska - Yukon Territory - Old Crow Flats	6427	4961	-23	<0.001	3401	+46	<0.001
C. & N. Alberta - N.E. British Columbia - Northwest Territories	5489	6584	+20	0.003	7259	-9	0.020
N. Saskatchewan - N. Manitoba - W. Ontario	2656	4502	+70	<0.001	3533	+27	<0.001
S. Alberta	2521	2364	-6	0.489	4419	-47	<0.001
S. Saskatchewan	6442	3547	-45	<0.001	7408	-52	<0.001
S. Manitoba	1793	1304	-27	<0.001	1548	-16	0.001
Montana and Western Dakotas	1588	1334	-16	0.037	1624	-18	0.001
Eastern Dakotas	9261	6585	-29	<0.001	4096	+61	<0.001
Total	36177	31181	-14	<0.001	33287	-6	<0.001
Eastern Survey Area	3337	4399	+32	0.007	3119	+41	<0.001
Other Regions							
British Columbia[c]	7	9	+17	0.639	8	+15	0.631
California	414	392	-5	0.714	6	-37	<0.001
Michigan	540	733	+36	0.019	721	+2	0.826
Northeastern U.S.[d]	1393	1466	+5	0.557	1403	+5	0.548
Wisconsin	543	913	+68	<0.010	419	+118	[e]

[a] Excludes eider, long-tailed duck, wood duck, scoter, and merganser in traditional survey area; excludes eider, long-tailed duck, wood duck, redhead, canvasback and ruddy duck in eastern survey area; species composition for other regions varies.
[b] Long-term average. Traditional survey area=1955-2001; eastern survey area=1996-2001; years for other regions vary (see Appendix E).
[c] Index to waterfowl use in prime waterfowl producing regions of the province.
[d] Includes all or portions of CT, DE, MD, MA, NH, NJ, NY, PA, RI, VT, and VA.
[e] Not estimable from current survey.

Table 3. Mallard breeding population estimates (in thousands).

			Change from 2001			Change from LTA	
Region	2001	2002	%	*P*	LTA[b]	2001	2002
Traditional Survey Area							
Alaska - Yukon Territory - Old Crow Flats	718	667	-7	0.492	323	+106	<0.001
C. & N. Alberta - N.E. British Columbia - Northwest Territories	979	1182	+21	0.158	1107	+7	0.546
N. Saskatchewan - N. Manitoba - W. Ontario	603	1115	+85	<0.001	1163	-4	0.673
S. Alberta	744	793	+7	0.689	1135	-30	0.001
S. Saskatchewan	1650	1213	-26	0.002	2107	-42	<0.001
S. Manitoba	446	401	-10	0.371	373	+7	0.306
Montana and Western Dakotas	463	428	-8	0.573	503	-15	0.085
Eastern Dakotas	2301	1704	-26	<0.001	792	+115	<0.001
Total	7904	7504	-5	0.232	7503	0	0.998
Eastern Survey Area	286	295	+3	0.867	303	-3	0.857
Other Regions							
British Columbia[b]	1	1	-20	0.145	1	-28	<0.001
California	302	265	-12	0.497	390	-32	0.001
Michigan	295	291	-1	0.943	395	-26	0.031
Minnesota	321	367	+14	0.450	213	+72	[d]
Northeastern U.S.[c]	808	833	+3	0.735	758	+10	0.202
Wisconsin	164	373	+127	<0.010	166	+125	[d]

[a] Long-term average. Traditional survey area=1955-2001; eastern survey area=1996-2001; years for other regions vary (see Appendix E).
[b] Index to waterfowl use in prime waterfowl producing regions of the province.
[c] Includes all or portions of CT, DE, MD, MA, NH, NJ, NY, PA, RI, VT, and VA.
[d] Value for test statistic was not available.

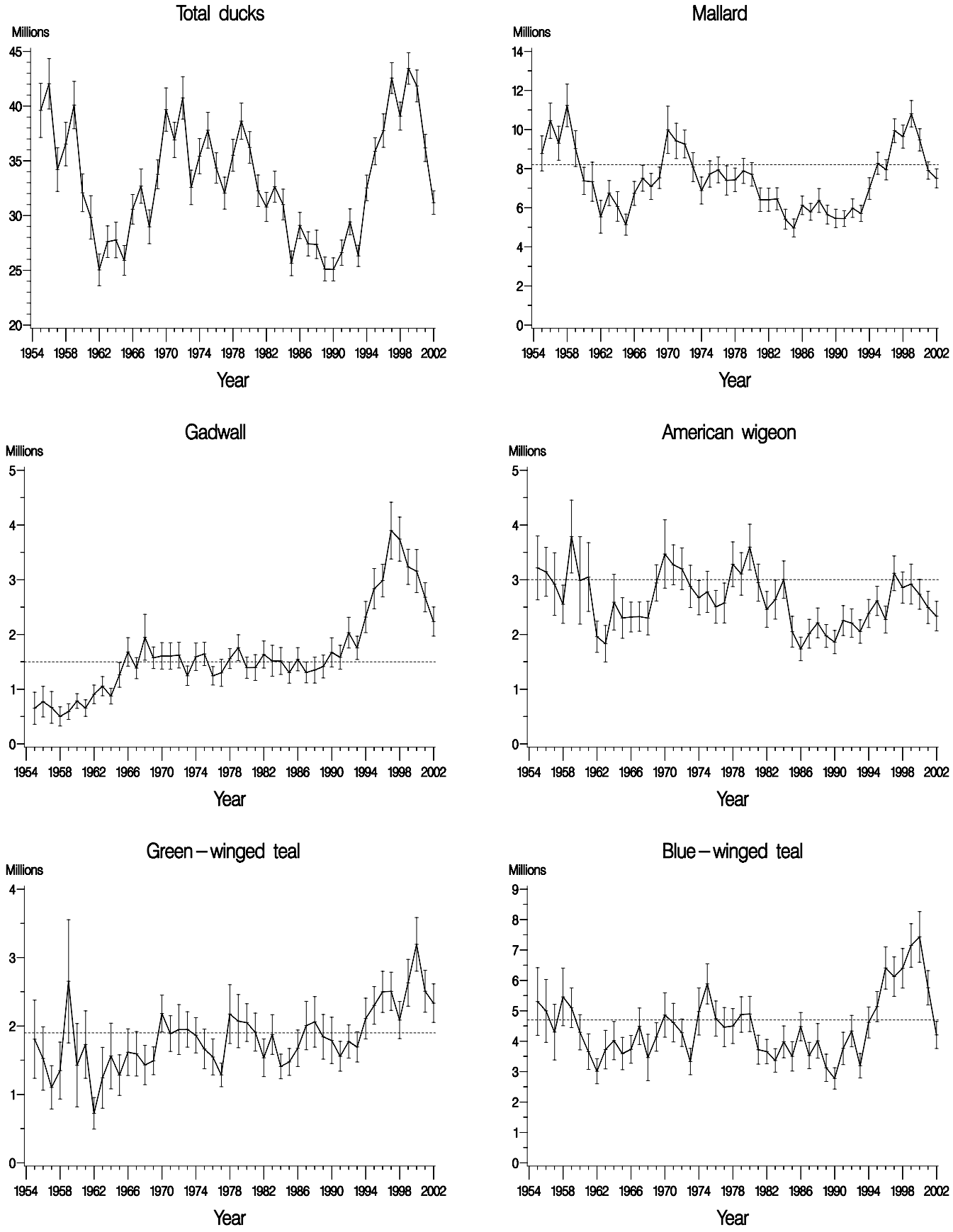
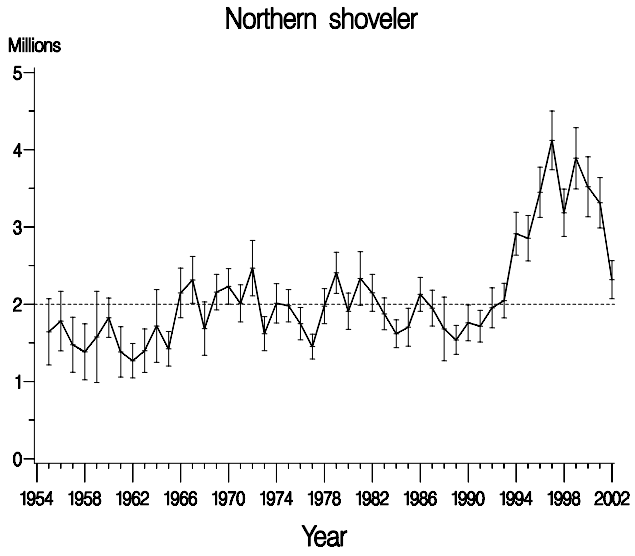
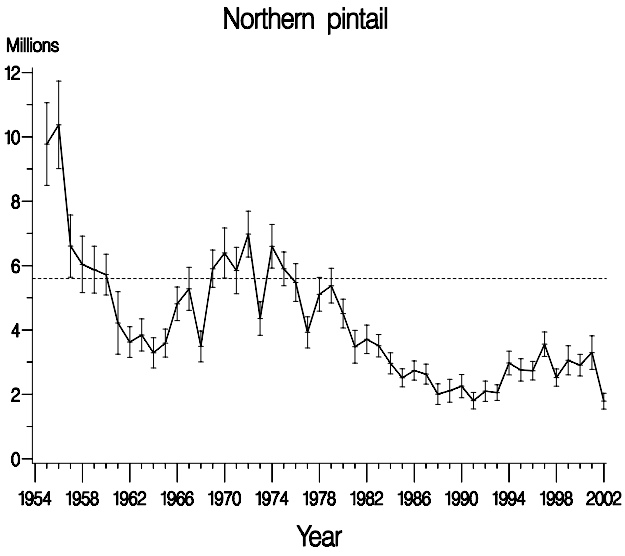
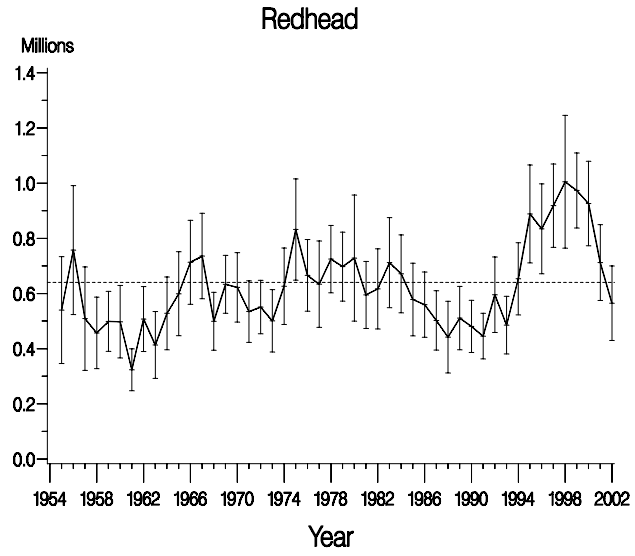
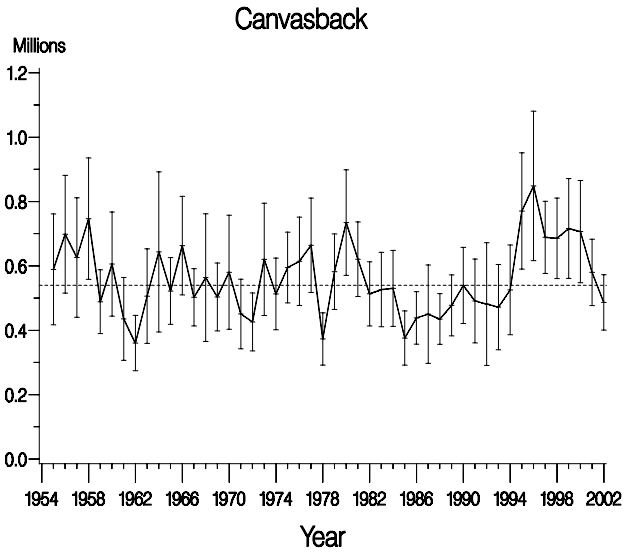


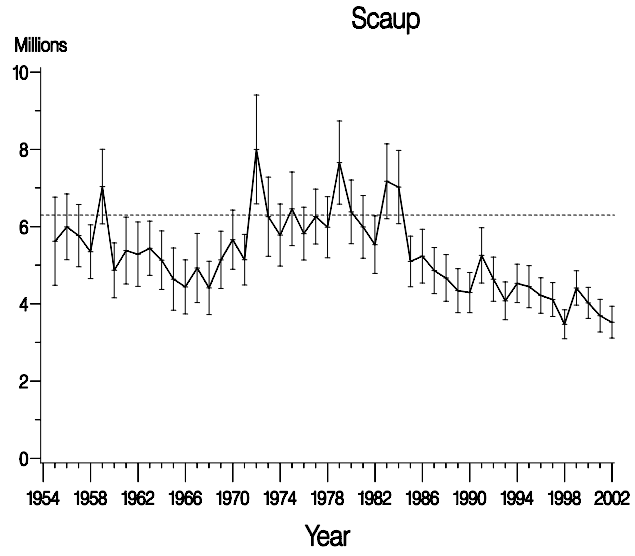
Figure 2. Breeding population estimates, 95% confidence intervals, and North American Waterfowl Management Plan population goal (dashed line) for selected species in the traditional survey area (strata 1-18, 20-50, 75-77).











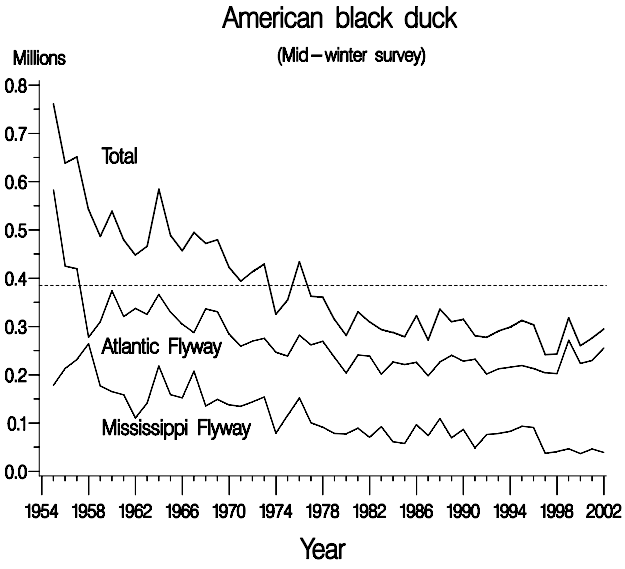


Figure 2 continued.

abundances remained unchanged from 2001, with the exception of Wisconsin, where mallards were up 127% (P<0.010). Mallard estimates were below long-term averages in British Columbia, California, and Michigan ($P \leq 0.03$). In Nebraska, Nevada and Washington, estimates of precision are unavailable, but in all these states, mallard counts were down compared to last year's.

Blue-winged teal abundance was estimated to be 4.2 ± 0.2 million birds, 27% below ($P<0.001$) last year's estimate of 5.8 ± 0.3 million, but unchanged ($P=0.22$) from the 1955-2001 average. Gadwall (2.2 ± 0.1 million, -17%), shovelers (2.3 ± 0.1 million, -30%), and pintails (1.8 ± 0.1 million, -46%) were below 2001 estimates ($P \leq 0.02$). Wigeon (2.3 ± 0.1 million), green-winged teal (2.3 ± 0.1 million), redheads (0.6 ± 0.1 million), canvasbacks (0.5 ± 0.1 million), and scaup (3.5 ± 0.2 million) were unchanged from 2001 estimates. Gadwall (+37%), green-winged teal (+28%), and shovelers (+10%) all remained above their long-term averages, whereas wigeon (-12%), pintails (-58%), canvasbacks (-14%), and scaup (-34%) numbers were below long-term averages. Pintail and scaup counts were the lowest and second lowest on record, respectively. Redhead numbers were similar to the long-term average ($P=0.38$).

Estimates for most of the 10 principal species in the eastern survey area species were similar to 2001 estimates and to long-term averages, with the exception of mergansers (0.8 $\pm$ 0.1 million) and green-winged teal (0.6 $\pm$ 0.1 million), both of which were above their 2001 counts and long-term averages ($P \leq 0.02$). Scoter numbers (0.3 $\pm$ 0.1 million) were higher than in 2001, though the difference was not statistically significant, and this species was above its long-term average ($P=0.01$).

The status of the American black duck (*Anas rubripes*) has been monitored primarily by mid-winter surveys conducted in January in states of the Atlantic and Mississippi Flyways. The trend in the winter index for the total population is depicted in Figure 2. Mid-winter counts suggested that black duck abundance in both flyways combined increased relative to 2001 counts but the two flyways showed opposite trends in abundance. Over both flyways, 294,800 black ducks were estimated from mid-winter inventories. This is 9% higher than the 2001 index (270,000), and 4% higher than the 1993-2001 mean (284,000). In the Atlantic Flyway, the mid-winter index was up 11% from 229,700 in 2001 to 255,400 in 2002, and was 14% higher than the 1993-2001 mean (224,700). In the Mississippi Flyway, the mid-winter estimate decreased 15% from 46,400 in 2001 to 39,400 in 2002, which is 34% below the most recent 10-year mean (59,300). In the eastern survey area, the 2002 estimate for breeding black ducks (602,800) was up 43%, but was statistically similar to the 2001 estimate (422,000) and the 1996-2001 average (474,000).

Trends in wood duck populations are monitored by the North American Breeding Bird Survey (BBS), a series of roadside routes surveyed during May and June each year. Wood ducks are encountered with low frequency along BBS routes, limiting the amount and quality of available information for analysis (Sauer and Droege 1990). However, the BBS provides the only long-term indices of this species' regional populations. Trend analysis suggests that wood duck numbers increased 4% per year over the long-term (1966-2001) and 2.5% over the short-term (1981-2001). Specifically, in the Atlantic Flyway, the BBS indicates a 4.8% annual increase in wood ducks over the long-term and a 4.2% annual increase over the short-term ($P<0.001$). In the Mississippi Flyway, the BBS indicates a 3.5% annual increase over the long-term ($P<0.001$), but no significant trend over the short-term (J. Sauer, U. S. Geological Survey/ Biological Resources Division, unpubl. data).

Weather and habitat conditions during the summer months can influence waterfowl production. Good wetland conditions increase renesting and brood survival. During late May and early June, many parts of the prairies, including Montana, the western Dakotas, and southern Saskatchewan and Alberta received substantial precipitation. Though this late rain and snow may have encouraged good reproductive effort by late-nesting species such as gadwall, many of the earlier nesting ducks likely bypassed the prairies altogether. For those ducks that did nest, this late water should improve brood-rearing conditions, as brood and duckling survival tends to increase with higher wetland densities. Results of the July Production Survey indicate that the number of ponds in Prairie Canada and the north-central U.S. combined was 1.8 $\pm$ 0.1 million ponds (Fig. 3, Table 4, Appendix H). This was 36% below last year's estimate of 2.9 $\pm$ 0.1 million ponds ($P<0.001$), and 33% below the long-term average ($P<0.001$). July ponds in Prairie Canada were at 1.0 $\pm$ 0.1 million. This was 46% below last year's estimate of 1.8 $\pm$ 0.07 million ($P<0.001$) and 43% below the long-term average ($P<0.001$). July ponds in the north-central U.S. were estimated at 0.84 $\pm$ 0.04 million. This was 19% below last year's estimate of 1.0 $\pm$ 0.06 million ($P=0.007$), but similar to the long-term average. The number of broods in the north-central U.S. and Prairie Canada combined was 352,600, 35% lower than last year's estimate, and 25% below the long-term

Table 4. Estimated number (in thousands) of July ponds in portions of Prairie Canada and the northcentral U.S.

			Change from 2001			Change from LTA	
Survey Area	2001	2002	%	*P*	LTA[a]	%	*P*
Prairie Canada							
S. Alberta	311	319	+3	0.836	461	-31	0.001
S. Saskatchewan	941	396	-58	<0.001	950	-58	<0.001
S. Manitoba	587	282	-52	<0.001	345	-18	0.325
Subtotal	1838	997	-46	<0.001	1756	-43	<0.001
Northcentral U.S.							
Montana and Western Dakotas	226	304	+34	0.025	375	-19	0.046
Eastern Dakotas	805	536	-33	<0.001	542	-1	0.924
Subtotal	1032	840	-19	0.007	917	-8	0.299
Grand Total	2870	1836	-36	<0.001	2745	-33	<0.001

[a]Long-term average. Prairie Canada, 1961-2000; northcentral U.S. and Grand Total, 1974-2001

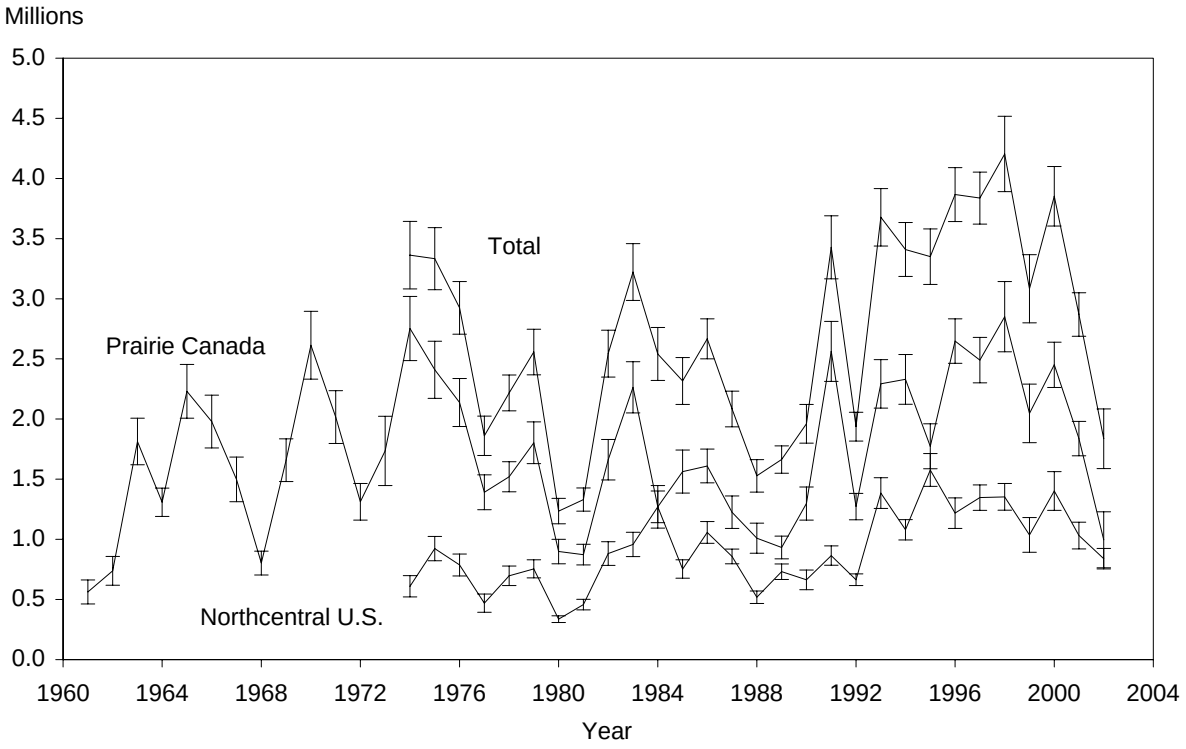


Figure 3. Number of ponds in July and 95% confidence intervals for Prairie Canada and the Northcentral U.S.

Table 5. Duck breeding population estimates (in thousands) for the traditional survey area.

			Change from 2001			Change from LTA	
Species	2001	2002	%	*P*	LTA [a]	%	*P*
Mallard	7904	7504	-5	0.232	7503	0	0.998
Gadwall	2679	2235	-17	0.021	1633	+37	<0.001
American wigeon	2494	2334	-6	0.434	2646	-12	0.027
Green-winged teal	2509	2333	-7	0.410	1821	+28	<0.001
Blue-winged teal	5757	4206	-27	<0.001	4493	-6	0.218
Northern shoveler	3314	2318	-30	<0.001	2100	+10	0.087
Northern pintail	3296	1790	-46	<0.001	4268	-58	<0.001
Redhead	712	565	-21	0.135	626	-10	0.378
Canvasback	580	487	-16	0.174	563	-14	0.088
Scaup (greater and lesser combined)	3694	3524	-5	0.572	5318	-34	<0.001
Total [b]	36177	31181	-14	<0.001	33287	-6	<0.001

[a] Long-term average (1955-2001).
[b] Includes black duck, ring-necked duck, goldeneneyes, bufflehead, and ruddy duck. Excludes scoter, eider, long-tailed duck, merganser, and wood duck.

Table 6. Duck breeding population estimates (in thousands, for the 10 most abundant species) for the eastern survey area.

			Change from 2001			Change from LTA	
Species	2001	2002	%	*P*	LTA [a]	%	*P*
Mergansers	429	815	+90	0.001	485	+68	0.003
Mallard	286	295	+3	0.867	303	-3	0.857
American Black Duck	422	603	+43	0.068	474	+27	0.153
American Wigeon	77	87	+12	0.772	64	+36	0.402
Green-winged teal	220	604	+174	0.004	299	+102	0.020
Lesser Scaup	204	136	-33	0.517	68	+99	0.185
Ring-necked duck	353	416	+18	0.367	503	-17	0.205
Goldeneye (common & Barrow's)	1032	955	-7	0.791	708	+35	0.268
Bufflehead	95	84	-12	0.701	55	+51	0.201
Scoters	179	314	+76	0.136	113	+178	0.010
Total [b]	3337	4399	+32	0.007	3119	+41	<0.001

[a] Long-term average from 1996.
[b] Includes gadwall, northern shoveler, northern pintail, and scaup. Excludes eider, long-tailed duck, wood duck, redhead, canvasback, and ruddy duck.

average. The number of broods in Prairie Canada and the North-central U.S. were 54% and 37% below last year's estimates, respectively. Brood indices in Prairie Canada were 69% below the long-term average, while brood counts were 12% above the long-term average in the north-central U.S. The brood index in the Canadian boreal forest was 21% higher than last year's, but 16% below the long-term average. The late-nesting index, the number of pairs and lone drakes without broods seen during July surveys, was 9% higher than last year but 43% lower than the long-term average, for all areas combined. The late-nesting index was down 12% and 33% relative to last year in boreal Canada and the north-central U.S., respectively, but up 32% in Prairie Canada, perhaps reflecting late rains there. However, the late nesting index was below the long-term average by more than 60% in boreal Canada and the north-central U.S., and by 24% in prairie Canada.

Regional Habitat and Population Status

A description of habitat conditions, populations, and production for each for the major breeding areas follows. More detailed reports of specific regions in the eastern survey area, as well as more detailed information on regions in the traditional survey area, are available in *Waterfowl Population Surveys* reports, located on the Division of Migratory Bird Management's home page. Some of the habitat information that follows was taken from these reports. http://migratorybirds.fws.gov/reports/reports.html.

Southern Alberta: This fall, winter, and spring, southern Alberta (strata 26-29) received below-average precipitation in most areas. April 2002 was the 3rd coldest in 120 years. Southern and Central Alberta saw well below normal (40-60% of average) precipitation in the eastern portions of the province and below normal (60-80% of average) precipitation in the western portions of the province. Environment Canada reported below average temperatures between November 2001 and April 2002. May temperatures and precipitation were below average in most areas of the province. The Milk River country along the Montana border was in fair condition. Most of the prairie grassland portions of strata 27, 28 and 29 were in poor condition. Dugouts were the main water remaining and they ranged from dry to 1/4 full in the southern portions of the prairie grasslands. Late spring snow storms near Calgary continued into June, and dumped as much as 3 feet of snow at a time, decreasing duck nesting habitat in those areas. The eastern portions of the aspen parklands of Stratum 26 were mostly in poor condition with areas of fair condition in a 50-mile radius around Edmonton and Red Deer. The agriculture to forest transition zone and the parklands of stratum 75 and 76 were generally in fair condition. May ponds were unchanged from 2001, and were 35% below the long-term average ($P \leq 0.005$). Total duck, mallard, blue-winged teal, Northern shoveler, canvasback, pintails, and scaup estimates did not change relative to 2001, but all remained below long-term averages ($P<0.001$). American wigeon decreased relative to 2001 counts (-59%, $P=0.016$), and were 75% below their long-term average ($P<0.001$). Gadwall, green-winged teal and redhead populations remained unchanged relative to 2001 estimates and to long-term averages. Southern Alberta received significant June precipitation, but wetland conditions remained fair to poor, with the exception the extreme southwest, where conditions were good as of July. The July pond index was similar to 2001, and 31% below the long-term average ($P<0.001$). The July brood index was 40% below last year's and 73% below the long-term average. The late-nesting index was 61% higher than last year's, but 21% below the long-term average.

Southern Saskatchewan: Wetland habitat was in extremely poor condition over the entire Southern Saskatchewan (Strata 30-35) survey area and the majority of wetland basins were dry during the survey. No ephemeral or temporary wetlands were observed and the few seasonal or semi-permanent basins that held water during the survey period were low. During the winter, the west, northwest, and northeast parts of the survey area received well below-average precipitation. The rest of the survey area received below average precipitation. Below average precipitation and above average temperatures during the winter resulted in little to no runoff this spring, with the exception of March, when temperatures were below average. Record setting dry conditions predominated during April and May with the driest conditions located in the central and northern parts of the survey area (<40% of average precipitation). May was characterized by below-average temperatures and by several snowstorms in the south. Residual cover for early-nesting species was sparse due to below average precipitation during the 2001 growing season. The May pond estimate was down 59% from 2001, 68% below the long-term mean ($P<0.001$), and was the second lowest since the survey began. Total ducks (-45%, -52% LTA), mallards (-26%,

-42% LTA), blue-winged teal (-47%, -45% LTA), Northern shovelers (-57%, -50% LTA), gadwalls (-50%, -34% LTA), Northern pintails (-73%, -83% LTA), redheads (-58%, -50% LTA), canvasbacks (-68%, -61% LTA), and scaup (-53%, -65% LTA) were all down relative to 2001 estimates ($P<0.001$) and their long-term averages ($P<0.001$). Wigeon and green-winged teal were 61% and 45% below their long-term averages, respectively ($P<0.001$). June rains brought some drought relief to the southern grasslands and flooding to the southwest corner of the Province, but the central grasslands and Parklands remained dry. July pond indices were 58% below both 2001 and long-term average estimates. July brood indices were 63% below last year's and 71% below the long-term average. The late-nesting index was similar to last years, but 50% below the long-term average.

Southern Manitoba: May conditions in Southern Manitoba (strata 36-40) were generally cold and dry, pushing the region further into drought. In June, precipitation was above average, but came too late to benefit most nesting waterfowl. In May and July, large flocks of ducks were observed, and most were judged as likely non-breeders. The west-central area (Stratum 40) was in good condition in May, and was improved by June rains. However, other areas were rated fair to poor, and were little improved by late precipitation. May pond counts were 58% below the 2001 estimate and 52% below the long-term average ($P<0.001$). Total duck (-27%, -16% LTA), blue-winged teal (-52%, -41% LTA), and Northern pintail (-67%, -75% LTA) estimates were down from 2001, and below their long-term averages ($P\leq0.001$). Northern shovelers were down 50% relative to 2001 ($P=0.002$), but similar to their long-term average. Wigeon, green-winged teal and scaup estimates were similar to 2001 numbers, but below their long-term averages. Gadwall was similar to 2001 estimates, and remained above the long-term mean (+114%, $P<0.001$). Mallard, redhead and canvasback numbers remained unchanged relative to 2001 estimates and long-term averages. July pond indices were down 52% compared to 2001 ($P<0.001$), but were similar to the long-term average. July brood indices were 48% lower than last year and 47% below the long-term average. The late-nesting index was more than 75% above that of 2001 and the long-term average.

Montana and Western Dakotas: In Montana (strata 41-42) and the western Dakotas (strata 43-44), conditions were variable. South Dakota showed a 12% increase in wetland numbers since May 2001. Habitat conditions were deemed poor in the west, though fair in the southeast, and good in central portions of the stratum. Production is expected to be below average due to the loss of early nests and crowding on remaining wetlands. Wetland counts in North Dakota decreased compared to last year and were below long-term averages. Larger ponds and stock dams contained adequate water, although depleted water levels were the rule. Residual nesting cover was rated below average. Nesting was late in western South Dakota, and normal to below production was expected. Montana was drier than the Dakotas, with most areas rated fair to poor. Overall, May pond counts were unchanged from 2001, but were 34% below ($P<0.001$) the long-term average. Total ducks were down 16% relative to 2001 ($P=0.037$) and were 18% below the long-term average ($P<0.001$). Northern pintails were below the 2001 estimate (-37%, $P=0.027$) and 64% below the long-term average ($P<0.001$). Gadwall numbers were 54% ($P=0.002$) below the 2001 estimate but similar to the long-term average. Wigeon were similar to there 2001 count, but 59% below the long-term average ($P<0.001$). Green-winged teal were unchanged from the 2001 estimate, and remained above their long-term average ($P=0.01$). Mallards, blue-winged teal, Northern shovelers, redheads, canvasbacks and scaup were unchanged relative to 2001 estimates and long-term averages. July pond indices were 34% higher than in 2001 ($P=0.025$), but remained 19% below the long-term average ($P=0.046$). July brood indices were 46% lower than last year and 50% below the long-term average. The late-nesting index was 15% below last year's and 43% below the long-term average. Extensive mowing of Conservation Reserve Program land may have hampered late nesting.

Eastern Dakotas: A relatively mild and dry winter was followed by a late, cold spring in North and South Dakota. Habitat conditions in the eastern Dakotas (strata 45-49) deteriorated since the spring of 2001 and ranged from poor to good. Residual upland nesting cover was generally adequate but over-water nesting sites were reduced due to diminished water conditions. Temporary and seasonal wetland basins were generally dry and most semi-permanent basins were at least partly recessed. This natural draw down should eventually revive wetland productivity, but meanwhile, some dry basins are being cultivated for agriculture, which may have a negative impact. May ponds were 40% below last year's figure ($P<0.001$), but similar to the long-term average.

Estimates of total ducks (-29%), mallards (-26%), and blue-winged teal (-31%) were down relative to 2001 figures ($P \leq 0.001$), but remained above long-term averages ($P<0.001$). Northern pintails were down 62% from the 2001 estimate ($P<0.001$), and were 46% below the long-term average ($P<0.001$). Gadwall and wigeon estimates did not differ from last year's, but were above their long-term averages ($P \leq 0.002$). Northern shoveler numbers were down relative to 2001, but remained above the long-term average. Green-winged teal, redheads and canvasbacks did not differ significantly from their 2001 estimates or long-term averages, though canvasbacks were 50% below the 2001 figure ($P=0.054$). July pond indices were down 33% compared to 2001 ($P<0.001$) and similar to the long-term average. July brood indices were 34% lower than last year, but 67% above the long-term average. The late-nesting index was 53% lower than in 2001, and 82% below the long-term average.

Northern Saskatchewan, Northern Manitoba, and Western Ontario: Northern Saskatchewan and Manitoba (strata 21-25, stratum 50) experienced one of the latest springs in recent history. Most areas received below normal precipitation over the winter. Cool temperatures persisted through May, and ice on the larger lakes was slow to break up. However, beaver ponds and reverie habitats had attracted early-nesting waterfowl several weeks earlier. As a result, the nesting season was protracted. Some basins were dry in May, especially in the southwestern portion of the survey area. However the reduced precipitation created more exposed shoreline habitat along permanent lakes and rivers. The absence of flooding along these expansive shorelines and associated upland meadows, combined with good beaver pond habitat, made for stable nesting conditions. Western Ontario (Stratum 50) experienced a cold, wet spring. As late as May 18, many large lakes in the southern portion of the Stratum remained 50-80% ice covered. Large lakes in the northern areas were 100% frozen. Rivers, marshes, and shallow lakes were open, but availability of this habitat was limited by skim ice that formed nightly in the cool temperatures and large areas remained too cold for duck nesting throughout the season. Overall, the total duck estimate for the region was 70% above last year's ($P<0.001$) and was 27% above the long-term average ($P<0.001$). Mallards (+85%), wigeon (+103%), blue-winged teal (+107%) and redheads (+249%) all increased compared to 2001 ($P \leq 0.01$), but remained unchanged from their long-term averages. Green-winged teal (+87%, $P=0.011$) also increased since last year, and were 83% above their long-term average ($P=0.006$). Northern pintails and scaup did not change relative to their 2001 numbers, but remained 74% and 37% below their long-term averages, respectively. Gadwall, Northern shoveler, and canvasback numbers were similar to last year's estimates and to long-term averages.

Northern Alberta, Northeastern British Columbia, and Northwest Territories: Conditions were generally good to excellent in northern Alberta, northeastern British Columbia, and the Northwest Territories (strata 13-18, 20, 75-77). In particular, the numerous small lakes on the Canadian shield near Yellowknife (strata 16 and 17) do not dry out as easily as those further south in the boreal forest plains. Despite the good conditions, production by early-nesting species such as mallards and green-winged teal was likely tempered by the very late spring in this area. Spring thaw was about 3 weeks later than normal. For scaup and scoters, which nest later in the season, good production is expected. Total ducks were up 20% over last year ($P=0.003$), but unchanged from the long-term average. Mallards, green-winged teal, and redheads were similar to 2001 estimates and to their long-term averages. Gadwall numbers were unchanged from 2001, but were 292% above their long-term average ($P<0.001$). Wigeon, Northern pintails, and scaup did not change relative to last year's estimates, but remained 28%, 53%, and 34% below their long-term averages ($P \leq 0.009$). The estimate for blue-winged teal was 154% higher than last year's ($P=0.003$), but did not differ from its long-term average. Northern shovelers (+82%) and canvasbacks (+93%) were higher than 2001 estimates ($P \leq 0.03$), and each was more than 70% above its long-term average for the area.

Alaska and Old Crow Flats, Yukon Territory: In Alaska and Old Crow Flats (strata 1-12), breeding conditions depend largely on the timing of spring phenology, because wetland conditions are less variable than on the prairies. In general, Alaska experienced a late spring until the last part of May, when temperatures warmed dramatically in most important waterfowl nesting areas. Record high temperatures also resulted in rapid snowmelt, which caused high water in many rivers and some flooding, especially along the Koyukuk, Innoko and lower Yukon rivers. Overall, good waterfowl production is anticipated, except in those flooded areas. The total duck estimate was 23% lower than last year's, but remained 46% above the

long-term average. Mallard (+106%), wigeon (+119%), and Northern shoveler (+147%) estimates were all higher than their long-term averages (P<0.001) but did not differ from 2001 estimates. Green-winged teal were 39% below the 2001 estimate, but 97% above their long-term average (P<0.001). Scaup were 31% below the 2001 estimate, but unchanged from the long-term average for the region. Neither canvasback or Northern pintails were statistically different from their 2001 estimates or long-term averages, though pintail numbers dropped 34% relative to 2001 (P=0.05).

Eastern Survey Area: Breeding waterfowl habitat conditions in the eastern survey area (strata 51-56 and 62-69) were highly variable, but all areas experienced a warm, dry winter. In the New York, Eastern Ontario and Southern Quebec survey area (Strata 52-56) the winter of 2001-2002 was warm and dry, and drought conditions persisted throughout much of this region. Waterfowl returned early to this region, but early spring habitat conditions were poor. However, several weeks before and during surveys, cooler temperatures and increased precipitation were the rule, and wetland habitat conditions greatly improved. A similar weather pattern was reported for western Ontario (Strata 50 and 51). Maine and the southern Maritimes (Strata 62-65) experienced a warm, dry winter, and above normal temperatures and precipitation in early spring that produced good to excellent conditions for breeding ducks. By contrast, Newfoundland and Labrador (Strata 66 and 67) experienced a late, cool spring. In Newfoundland, temperatures moderated and good waterfowl production was expected, but extended cold, stormy weather in Labrador made for poor nesting conditions. Total duck (+32%), green-winged teal (+174%), and merganser (+90%) estimates increased relative to last year (Table 6, Appendix G, $P \leq 0.007$), and all were above their long-term averages ($P \leq 0.020$). Scoter counts did not differ from the 2001 estimate, but were 178% above their long-term average (P=0.010). Estimates for other species did not differ significantly from 2001 counts or from long-term averages.

Other areas: Breeding habitat conditions in British Columbia were below average this year and worse than in the previous 4 years. Approximately 9,000 ducks were observed in British Columbia's annual survey, statistically similar to 2001 counts and the long-term average. In Washington, 3 years of drought led to the lowest pond count in eastern Washington since 1994. The Washington 2002 total duck breeding pair index was 133,000, down from 146,000 the previous year. Mallard pair numbers went from 50,500 in 2001 to 44,700 in 2002, and were 20% below the long-term average. In California, spring weather was cooler and drier after a winter of average precipitation. Nesting effort was delayed, and likely reduced. Below-average duck production is expected, with the exception of the Sacramento Valley, where average production is expected due to above-average nesting success. Total duck numbers remained unchanged from last year, but were 37% below the long-term average. Mallards were not significantly different from their 2001 estimate, but were 32% below the long-term average. A moderate to severe drought prevailed in much of the western U.S throughout the spring and summer. In Nebraska, wetland conditions were generally fair to average and all portions of the Sandhills were drier in 2002 than in 2001. The estimated breeding duck population in the Nebraska Sandhills for 2002 is 141,800 ducks, 37% below the 2001 estimate and 35% below the 1999-2001 average. This was lowest count since new operational procedures were implemented. Conditions in Nevada were dry; spring weather was about 2 weeks later than normal, and poor duck production was expected. Total duck pairs numbered 5,800, compared to 11,100 in 2001. Mallard pairs were also lower than 2001 counts. The Lake States received abundant rain, and conditions were generally good in Minnesota, Wisconsin and Michigan. Pond numbers decreased 16% in Minnesota compared to 2001, but were right at the 1968-2001 average. Mallard numbers were unchanged compared to 2001. Blue-winged teal (+217%) rebounded from the very low levels seen in 2001, but many of these may have been delayed migrants. Total ducks were up 64% from 2001, and were the highest on record. Wisconsin total duck numbers and mallard numbers were up from 2001 levels by 68% and 118%, respectively. In Michigan, total ducks were up 36% from last year (P=0.019), and were similar to the 1992-2001 average. Mallard numbers did not differ from last year's count, and remained 26% below the long-term average (P=0.03). In the Mid-Atlantic states, winter and spring temperatures were normal to above-normal. Winter precipitation was variable. As of May, soil moisture in much of the mid-Atlantic was normal; however, the piedmont and coastal plains of the mid-Atlantic and southeastern states continued to suffer moderate to severe drought. However, northwestern Pennsylvania and western New York were wet, and good duck production was expected. In New England, water levels were normal, except for

eastern Maine, which was dry. Total duck and mallard numbers from the Atlantic Flyway's plot survey were similar to the 2001 estimates ($P \geq 0.55$) and to the long-term averages ($P \geq 0.20$).

Mallard Fall-flight index

The size of the mid-continent mallard population, which is comprised of mallards from the traditional survey area, Michigan, Minnesota, and Wisconsin, was 8.5 million birds (Fig. 4). This is similar to that of 2001 (8.7 million). The 2002 mid-continent mallard fall-flight estimate is 8.9 million birds, statistically similar to the 2001 estimate of 9.7 million birds. These estimates were based on revised mid-continent mallard population models, and therefore, differ from those previously published (USFWS Adaptive Harvest Management Report 2002, Runge et al. 2002).

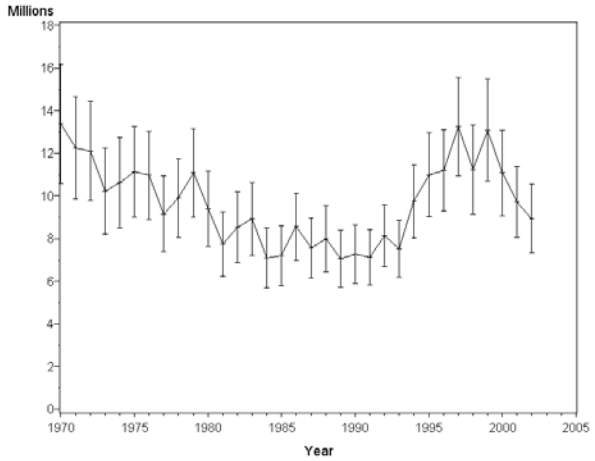


Fig. 4. Estimates and 95% confidence intervals for the size of the mallard population in the fall.

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STATUS OF GEESE AND SWANS

Abstract: We provide information on the population status and productivity of 31 populations of North American Canada geese (*Branta canadensis*), brant (*B. bernicla*), snow geese (*Chen caerulescens*), Ross's geese (*C. rossii*), emperor geese (*C. canagicus*), white-fronted geese (*Anser albifrons*) and tundra swans *(Cygnus columbianus*). Reproductive performance of several goose populations likely were impacted by colder and dryer than average conditions during spring migration in 2002. The timing of snowmelt in most areas of the Arctic was near average, but arrival to nesting areas and initiation of nesting for many goose populations were delayed by adverse migration conditions. In the Hudson Bay Lowlands and northern Quebec, a cold and snowy May delayed nesting and reduced production for several populations. Throughout most of Alaska, Wrangel Island, and the northwestern Canadian mainland the timing of snowmelt was early and conditions for nesting geese and swans were very favorable. Of the 25 populations for which current primary population indices were available, 11 populations (Atlantic Population, Aleutian, and 4 resident populations of Canada geese; greater snow geese; Pacific and Mid-continent White-fronted Goose Populations; Atlantic brant; and Eastern Population tundra swans) displayed positive trends, and only Short Grass Prairie Population Canada geese displayed a significant negative trend over the most recent 10-year period. Forecasts for production of young across the Arctic and subarctic in 2002 varied regionally, but generally will be improved in western areas and reduced in eastern areas compared to 2001.

This section summarizes information regarding the status and expected fall flights of goose and tundra swan populations in North America. Information was compiled from a broad geographic area and is provided to assist managers in regulating harvest. We have used the most widely accepted nomenclature for various waterfowl populations, but they may differ from other published information. Some of the goose populations described herein are comprised of more than one subspecies and some light goose populations contain lesser snow geese and Ross's geese**.**

Most populations of geese and swans in North America nest in the Arctic or subarctic regions of Alaska and Canada (Fig. 1), but several Canada goose populations nest in southern Canada and the U.S. ("resident" populations). Populations are monitored by various methods on breeding, migration, or wintering areas. The annual production of young by northern-nesting geese is influenced greatly by weather conditions on the breeding grounds, especially the timing of spring snowmelt and its impact on the initiation of nesting activity (i.e., phenology). Persistent snow cover reduces nest site availability, delays nesting activity, and often results in depressed reproductive effort and productivity. In general, goose productivity will be better than average if nesting begins by late May in western and central portions of the Arctic, and by early June in the eastern Arctic. Production usually is poor if nesting is delayed much beyond 15 June. For "resident" Canada goose populations, recruitment rates are less variable but local productivity is influenced by drought and flood events.

METHODS

Population estimates for geese are derived from a variety of surveys conducted by biologists from Federal, State, and Provincial agencies, and universities (Appendices B, I, and J). Surveys include the Midwinter Survey (MWS, conducted each January in wintering areas), the Breeding Population and Habitat Survey (BPHS, see Duck section of this report), surveys specifically designed for various populations, and others. When survey methodology allowed, 95% confidence intervals were presented with population estimates. The 10-year trends of population estimates were calculated through regression of the natural logarithm of survey results on year, and the slope coefficient was presented and tested for equality to zero (*t*-test). Changes in population indices between the current and previous years were calculated, and where possible assessed with a *z*-test using the sum of sampling variances for the 2 estimates. Primary population indices, those related to population objectives, are described first in population-specific sections.

Due to the preparation of this report prior to complete field assessment of goose and swan reproduction, the annual productivity of most goose populations can only be predicted qualitatively. Information on habitat conditions and forecasts of productivity were based primarily on information from various waterfowl surveys and interviews with field biologists. These reports provide reliable information for specific locations but may not provide accurate assessment for the vast geographic range of waterfowl populations.

RESULTS AND DISCUSSION

Spring Conditions

The spring migration period of 2002 was characterized by a prolonged period of below-average temperatures across a broad area of mid-latitude Canada. These cold conditions retarded ice and snowmelt and delayed the nesting of geese and swans in several eastern areas.

Fig. 1. Important goose nesting areas in Arctic and subarctic North America.

These conditions also delayed the migration of Arctic-nesting waterfowl whose nesting grounds had not been subjected to such harsh conditions. Many biologists reported that geese arrived to the nesting areas after nesting sites had been exposed for some time, an anomaly for species that generally initiate nests as soon as snowmelt allows. It is uncertain at this time if, 1) the delayed migration of 2002 depleted the energy reserves on which geese and swans rely during nesting, or allowed geese to build and maintain those reserves during the increased period in southern climates; and if, 2) the more advanced vegetative growth present during the delayed nesting period will ameliorate the negative effects on reproduction usually associated with delayed nesting. In addition to harsh spring temperatures, migrating waterfowl were subjected to reduced wetland abundance in the prairies of Canada and the U.S. Questions regarding the impacts of conditions in 2002 will be answered as more information is compiled from nesting studies and summer banding programs.

Conditions in the Arctic and Subarctic

Biologists report that spring phenology was early throughout most of Alaska, Wrangel Island, the Mackenzie Delta, and the northwestern Canadian mainland. In contrast, the Hudson Bay Lowlands (near Hudson and James Bays), northern Quebec, and Labrador experienced the arrival of spring-like conditions 2 or more weeks later than average. On the Copper River Delta and some areas in interior Alaska, the Queen Maud Gulf, and most islands of the Canadian Archipelago, spring phenology was near average. The snow and ice cover graphic (Fig. 2, provided by the National Oceanic and Atmospheric Administration) indicates the advanced spring conditions in Alaska and the delayed spring conditions in Quebec and near Hudson Bay compared to 2001.

Conditions in Southern Canada and the United States

Conditions influencing goose productivity vary less from year to year in mid-latitude areas of North America than in the Arctic. Given adequate wetland numbers and the absence of flood events these southern-nesting populations are reliably productive. Although the harsh conditions in Spring 2002 may have delayed nesting for resident Canada geese in these areas, impacts on production are not expected to be large. The Canadian prairies and portions of the western U.S. are experiencing drought conditions which may substantially reduce production of young in these areas. Reports of flooding during the nesting period were limited to a few areas in 2002.

Status of Canada Geese

North Atlantic Population (NAP): NAP Canada geese principally nest in Newfoundland and Labrador. They generally mix during winter with other Atlantic Flyway Canada geese, although NAP have a more coastal distribution than those other populations (Fig. 3).

During the 2002 BPHS biologists estimated 62,000 indicated pairs (singles plus pairs) in NAP range (strata 66 and 67), essentially unchanged from 2001 (57,800, Fig. 4). Indicated pair estimates have declined an average of 6% per year since surveys were initiated in 1996 (P=0.28). A total of 192,600 (± 59,956) Canada geese were estimated,

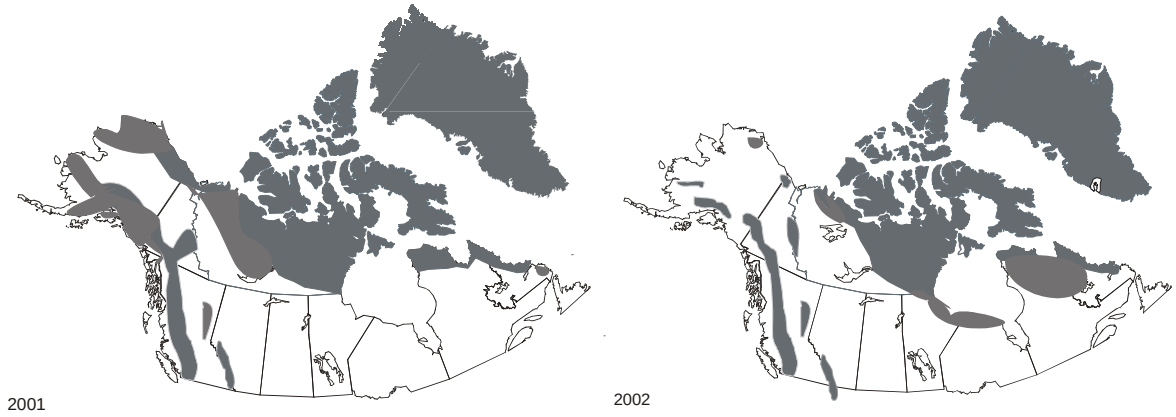

Fig. 2. The extent of snow and ice cover in North America for 3 June, 2001 and 2 June, 2002. The figures were produced from reports prepared by the National Oceanic and Atmospheric Administration.

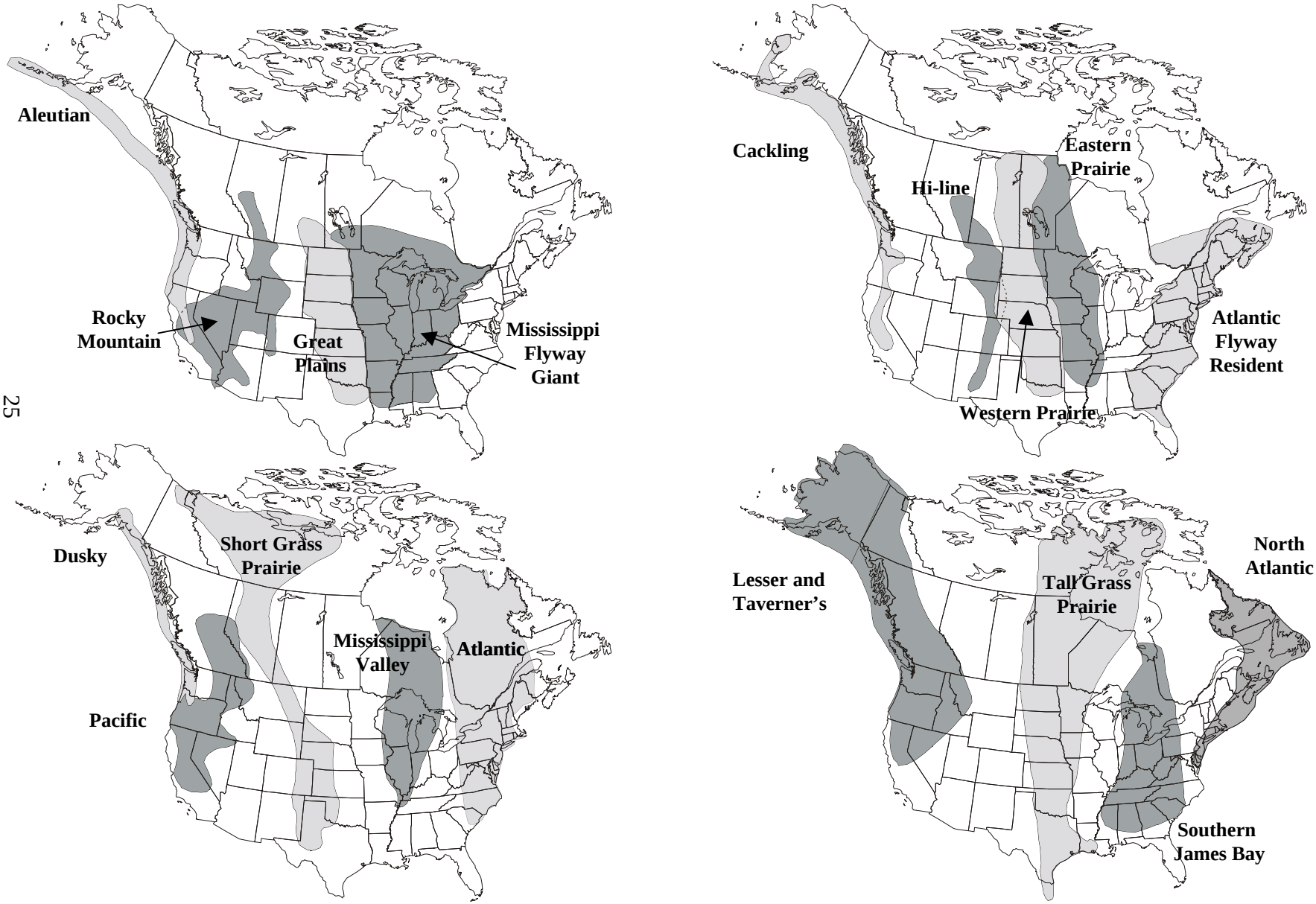

Fig. 3. Approximate ranges of Canada goose populations in North America.

during the BPHS, 49% higher than last year (*P*=0.28). Total goose estimates have declined an average of 3% per year during 1996-2002 (*P*=0.44). A cold and snowy May delayed nesting 2 weeks or more in Labrador and nesting effort is expected to be poor. Spring conditions on insular Newfoundland were delayed but not as severely as in Labrador. A NAP fall flight similar to last year is expected.

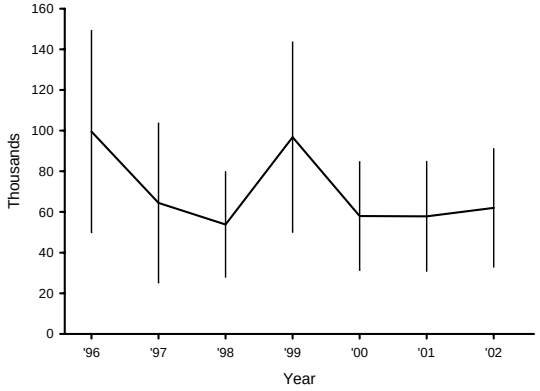

Fig. 4. Estimated number of North Atlantic Population Canada Geese indicated pairs (and 95% confidence intervals) during spring.

Atlantic Population (AP): AP Canada geese nest throughout much of Quebec, especially along Ungava Bay, the eastern shore of Hudson Bay, and on the Ungava Peninsula. The AP winters from New England to South Carolina, but the largest concentration occurs on the Delmarva Peninsula (Fig. 3).

Spring AP surveys estimated 164,800 (± 29,700) indicated breeding pairs in 2002, 12% higher than last year (*P*=0.41, Fig. 5). This population continues to increase from a low of 29,000 breeding pairs in 1995. The breeding pair estimates have increased 13% per year since 1993 (*P*=0.03). The estimated total spring population of 973,600 (± 210,300) geese in 2002 was 53% higher than last year (*P*=0.01). Spring phenology in 2002 was late and conditions along the Hudson Bay Coast, where much of the AP nests, were especially delayed. During surveys, a record low proportion of geese were observed as singles**,** suggesting a poor nesting effort. Ground studies confirmed late nesting phenology and lower than average clutch sizes and nest success. A fall flight smaller than last year is expected.

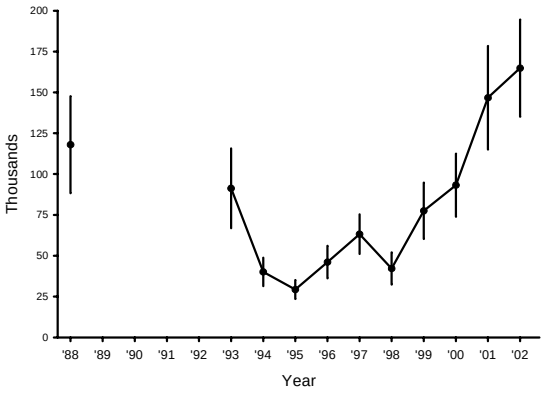

Fig. 5. Estimated number of breeding pairs (and 95% confidence intervals) of Atlantic Population Canada Geese in northern Quebec.

Atlantic Flyway Resident Population (AFRP): This population inhabits southern Quebec, the southern Maritime provinces, and all States of the Atlantic Flyway (Fig. 3).

Spring surveys in 2002 estimated there were 966,000 (± 170,400) Canada geese in the northeastern United States (Fig. 6), about 4% lower than the previous year's count (*P*=0.72). These estimates have increased an average of 5% per year since 1993 (*P*<0.001). Nesting conditions in most States were average to good. A large fall flight, similar to last year is expected.

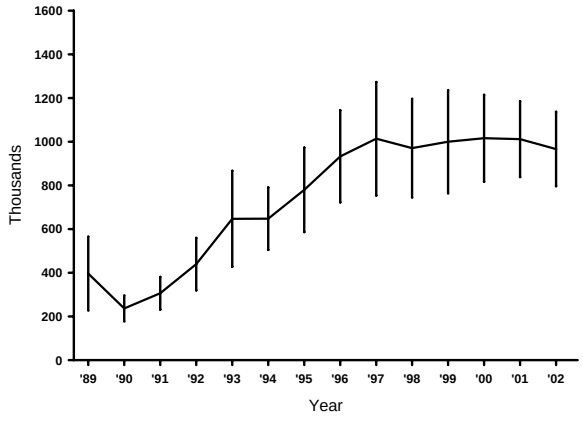

Fig. 6. Estimated number (and 95% confidence intervals) of Atlantic Flyway Resident Population Canada geese during spring.

Southern James Bay Population (SJBP): This population nests on Akimiski Island and in the Hudson Bay Lowlands to the west and south of James Bay. The SJBP winters from southern Ontario and Michigan to Mississippi, Alabama,

Georgia, and South Carolina (Fig. 3).

Breeding ground surveys indicated a spring population of 76,300 (± 18,300) Canada geese in 2002, 26% lower than last year (*P*=0.12, Fig. 7). There was no indication of a trend in these estimates since 1993 (*P*=0.87). In 2002 there were 29,056 (± 10,600) breeding pairs, which is 15% lower than last year (*P*=0.47). Molt migrants likely were not a factor in this year's survey but variability in phenology throughout SJBP range and prolonged nest initiation periods may have reduced survey efficiency. Overwinter snowfall in the SJBP range was light and the timing of initial snowmelt was about average. However, coastal areas and Akimiski Island were subjected to May snowfall, which together with subsequent melt and flooding, delayed nest site availability and prolonged the nest initiation period. On Akimiski Island, clutch sizes were below average and nest success (52%) was the lowest recorded since 1993. Overall, reproductive effort and success of SJBP geese was below average and a fall fight lower than last year is expected.

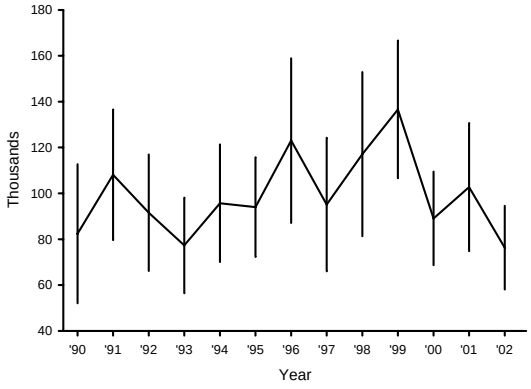

Fig. 7. Estimated total population (and 95% confidence intervals) of Southern James Bay Population Canada geese during spring.

Mississippi Valley Population (MVP): The principal nesting range of this population is in northern Ontario, especially in the Hudson Bay Lowlands, west of Hudson and James Bays. MVP Canada geese primarily concentrate during fall and winter in Wisconsin, Illinois, and Michigan (Fig. 3). The southern boundary of the nesting range was redefined in early 2002 and has resulted in slightly lower population estimates for this population (correction also applied to previous estimates).

Breeding ground surveys conducted in 2002 indicated a total population of 544,000 (± 148,400) Canada geese, a 40% increase from last spring (*P*=0.06, Fig. 8). These estimates have declined an average of 2% per year since 1993 (*P*=0.54). Biologists estimated there were 143,300 (± 24,700) nests in 2002, 13% fewer than in 2001 (*P=0.22*). Estimates of MVP nests have declined an average of 3% per year during 1993-2002 (*P*=0.12). Molt migrants likely were not a factor in this year's survey. Coastal and northern portions of the MVP breeding range experienced a cold and snowy May which, with subsequent flooding, delayed nesting activities. In interior portions of the range snowmelt and nesting phenology was near normal but late snows and cold temperatures may reduce nest success and production. Ground studies in the coastal area indicated reduced nest density, clutch sizes, and nest success consistent with the delayed phenology. A fall flight smaller than last year is predicted.

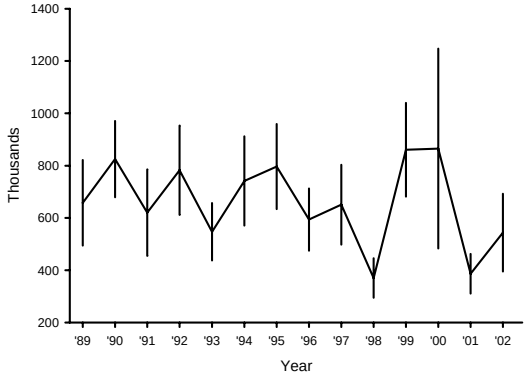

Fig. 8. Estimated number (and 95% confidence intervals) of Mississippi Valley Population Canada geese during spring.

Mississippi Flyway Giant Population (MFGP): Giant Canada geese have been reestablished or introduced in all States. This large subspecies now represents a significant portion of all Canada geese in the Mississippi Flyway (Fig. 3).

This population has been monitored with spring surveys since 1993. In 2002, the preliminary population estimate was 1,460,000, 6% higher than the 2001 estimate (Fig. 9). These estimates have increased an average of 6% per year since 1993 (*P*<0.001). Although flooding occurred in some States, biologists reported average to good nesting conditions in most areas. Another large fall flight is expected.

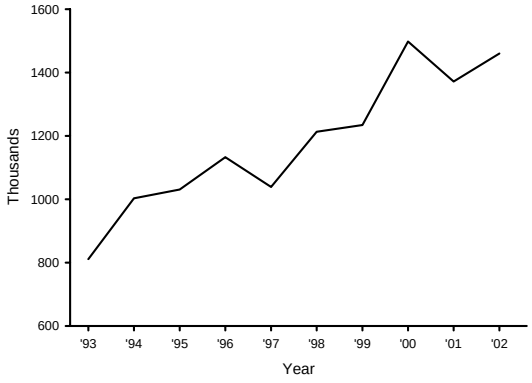

Fig. 9. Estimated number of Mississippi Flyway Giant Population of Canada geese during spring.

Eastern Prairie Population (EPP): These geese nest in the Hudson Bay Lowlands of Manitoba and migrate and winter primarily in Manitoba, Minnesota, and Missouri (Fig. 3).

The 2002 spring estimate of EPP geese was 216,300 (± 26,400), similar to the 2001 estimate of 215,400 (Fig. 10). Spring estimates have increased an average of 3% per year over the last 10 years (*P*=0.28). The 2002 estimate of singles and pairs was 152,000 (± 19,100), 24% higher than last year (*P*=0.02). A colder than average winter and late spring contributed to delayed nesting phenology in EPP range in 2002. Nesting studies near Cape Churchill indicated the second latest phenology on record. Nesting effort, clutch size, and nest success near Cape Churchill were reduced from 2001 levels, but higher than predicted by long-term relationships with phenology. Biologists expect a fall flight similar in size or larger than last year.

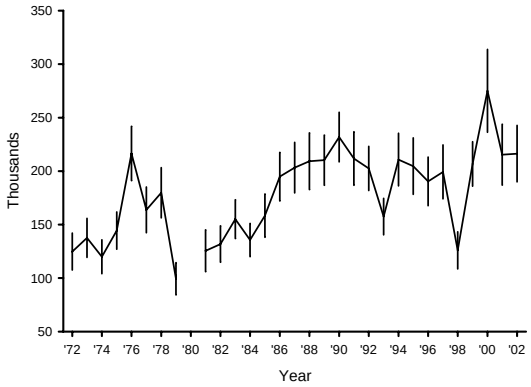

Fig. 10. Estimated number (and 95% confidence intervals) of Eastern Prairie Population Canada geese during spring.

Western Prairie Population and Great Plains Populations (WPP/GPP): The WPP is composed of mid-sized and large Canada geese that nest in eastern Saskatchewan and western Manitoba. The GPP is composed of large geese resulting from restoration efforts in Saskatchewan, North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, and Texas. Geese from these breeding populations commingle during migration with other Canada geese along the Missouri River in the Dakotas and on reservoirs from southwestern Kansas to Texas (Fig. 3). These 2 populations are managed jointly and surveyed during winter.

During the 2002 MWS survey, 710,300 WPP/GPP geese were counted, 4% more than the 2001 estimate (Fig. 11). This index has increased an average of 10% per year since 1993 (*P*<0.001). A 2002 index of the spring population in a portion of WPP/GPP range from the BPHS was 567,400. The BPHS estimates have also increased an average of 10% per year since 1993 (*P*<0.01). Nesting conditions in Saskatchewan were very dry and spring phenology was delayed. Northern States in GPP range indicated production appeared near average in 2002 but some southern States reported poor production due to drought. The WPP/GPP remains well above objective levels, but a fall flight lower than last year is expected.

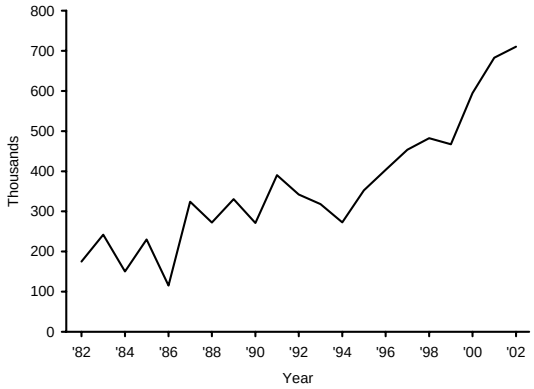

Fig. 11. Estimated number of Western Prairie Population/Great Plains Population Canada geese during winter.

Tall Grass Prairie Population (TGPP): TGPP small Canada geese nest on Baffin (particularly on the Great Plain of the Koukdjuak), Southampton, and King William Islands, north from the Maguse and McConnell Rivers on the Hudson Bay coast, and west to the Queen Maud Gulf. TGPP Canada

geese winter mainly in Oklahoma, Texas, and northeastern Mexico (Fig. 3). These geese mix with other Canada geese on wintering areas, making it difficult to estimate the size of the population.

During the 2002 MWS in the Central Flyway 504,700 TGPP geese were tallied, but methods were not comparable to previous surveys (Fig. 12). Previous MWS estimates in the Central Flyway had increased an average of 4% per year during 1991-2000 (*P*=0.15). Previous fall surveys of adult geese 1994-2001 on Baffin Island increased an average of 5% per year from 1994-2001 (*P*=0.14). Spring breakup in 2002 was late in southern portions of TGP range, and near average in northern areas, but nesting may have been delayed further by late arrival of geese (e.g., Southampton Island). At this time, there is little information on TGPP goose production or the impact of the cold conditions during migration.

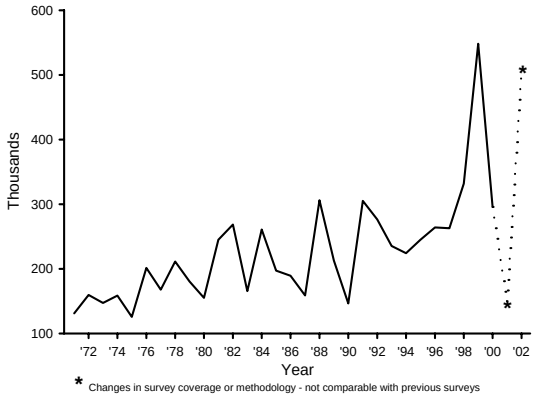

Fig. 12. Estimated number of Tall Grass Prairie Population Canada geese during winter in the Central Flyway.

Short Grass Prairie Population (SGPP): SGPP small Canada geese nest on Victoria and Jenny Lind Islands and on the mainland from Queen Maud Gulf west and south to the Mackenzie River and northern Alberta. These geese winter in southeastern Colorado, northeastern New Mexico, and the Oklahoma and Texas panhandles (Fig. 3).

During the 2002 MWS, biologists counted 160,900 SGPP Canada geese, 2% fewer than in 2001 (Fig. 13). This index has declined 12% per year since 1993 (*P*=0.02). A portion of the SGPP breeding range in the Northwest Territories is covered by the BPHS (strata 13-18). The 2002 BPHS estimated 138,300 (± 68,400) SGPP geese, a 19% increase from 2001 (*P*=0.58). These estimates have declined at an average of 1% per year since 1993 (*P*=0.78). Spring phenology near Queen Maud Gulf and on islands to the north was near average, earlier than average on western mainland, and nesting conditions appeared favorable in the boreal forest portions of SGPP range. Weather conditions in the Queen Maud Gulf were mild during the nesting period. At this time, the impact of the cold conditions during migration on SGP reproductive success is unknown.

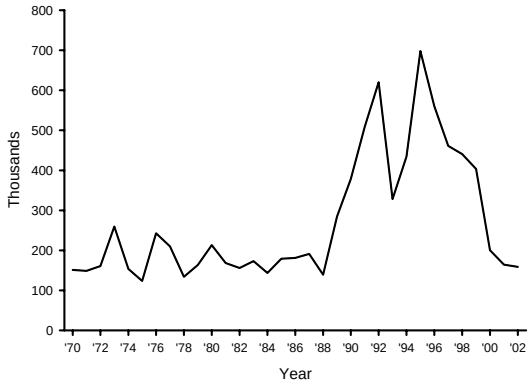

Fig. 13. Estimated number of Short Grass Prairie Population Canada geese during winter.

Hi-Line Population (HLP): These large Canada geese nest in southeastern Alberta, southwestern Saskatchewan, eastern Montana and Wyoming, and in Colorado. They winter in Colorado and in central New Mexico (Fig. 3).

The 2002 MWS indicated a total HLP population of 217,100 geese, which is 14% below last year's

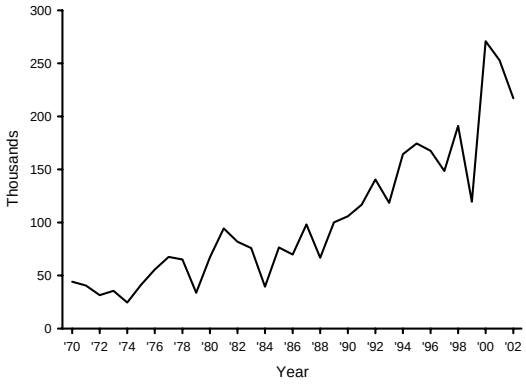

Fig. 14. Estimated number of Hi-Line Population Canada geese during winter.

estimate (Fig. 14). The MWS estimate has increased an average of 6% per year since 1993 (*P*=0.04). An estimate of the spring population was obtained from the 2002 BPHS in areas of Saskatchewan, Alberta, and Montana. The BPHS estimate was 231,000, 9% lower than the previous year (*P*=0.57). This population estimate has also increased 6% per year since 1993 (*P*<0.01). Nesting conditions were poor to fair throughout much of the breeding range due to drought. The fall flight of HLP geese is expected to be reduced from that of last year.

Rocky Mountain Population (RMP): These large Canada geese nest in southern Alberta, the inter-mountain regions of Utah, Idaho, Nevada, and Wyoming, and in western Montana. They winter mainly in central and southern California, Arizona, Nevada, Utah, Idaho, and Montana (Fig. 3).

During the 2002 MWS, 106,000 geese were counted, a 4% decrease from the previous year (Fig. 15). MWS estimates have increased an average of 4% per year since 1993 *(P=0.02).* The estimated spring population derived from the BPHS in 2002 was 134,700, 17% lower than last year (*P*=0.42). The BPHS estimate has increased 6% per year during the last 10 years (*P*=0.03). Most RMP breeding areas are experiencing drought, which is expected to reduce production. A fall flight lower than last year is expected.

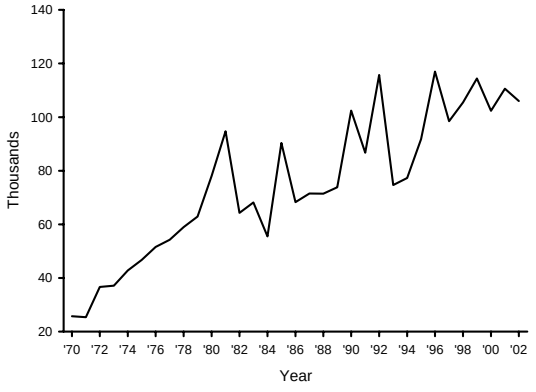

Fig. 15. Estimated number of Rocky Mountain Population Canada geese during winter.

Pacific Population (PP): These large geese nest and winter west of the Rocky Mountains from British Columbia south through the Pacific northwest to California (Fig. 3).

Wetland abundance in the range of the PP continues to be reduced by drought. In California and British Columbia, the 2002 estimates of breeding geese increased 15% and 44% from 2001, but remained 25% and 8% below the long-term averages, respectively. BPHS indices of PP geese in Alberta (strata 76-77) were 84,000 in 2002, 43% higher than in 2001 (*P*=0.37), and have increased an average of 12% per year since 1993 (*P*<0.01). The size of the fall flight can not be reliably predicted without more information.

Dusky Canada Geese: These mid-sized Canada geese predominantly nest on the Copper River Delta of southeastern Alaska. Dusky Canada geese principally winter in the Willamette Valley and Lower Columbia River of Oregon and Washington (Fig. 3).

The size of the population is estimated through observations of marked geese during December and January. The 2001-02 population estimate was 17,200 (± 5,500), essentially unchanged from 2000-01 (17,300, Fig. 16). These estimates have increased an average 4% per year during the last 10-year period (*P*=0.19). Preliminary results from the 2002 spring survey of the Copper River Delta indicated the index of total Dusky geese increased 25%, and singles and pairs increased 10% from last year's levels. A cold spring delayed nesting 7-10 days, which reduced predation through improved vegetative growth, improved nest concealment, and the increased availability of alternative prey to eagles. Gosling production appeared high. A fall flight higher than last year is expected.

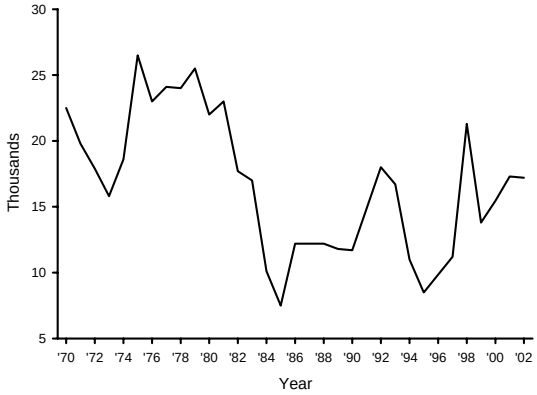

Fig. 16. Estimated number of dusky Canada geese during winter.

Cackling Canada Geese: Cackling Canada geese nest on the Yukon Delta of western Alaska. They primarily winter in the Willamette Valley and Lower Columbia River of Oregon and Washington (Fig. 3).

The index used for this population was a fall estimate from 1979-98. Since 1999, the index has been an estimate of the fall population derived from spring surveys on the Yukon Delta. The 2002 fall estimate is 136,100, 27% lower than in 2001. These estimates have increased an average of 2% per year since 1993 (*P*=0.21, Fig. 17). Surveys in the coastal zone of the Yukon Delta during spring 2002 indicated total cackling geese decreased 33%, and single and paired geese declined 14% from 2001. Survey timing, excellent nest success, and goose behavior (visibility bias) in 2002 may have contributed to the lower population estimates. A combination of early spring phenology, low levels of fox predation, and lack of flooding contributed to good production this spring, yet a fall flight smaller than last year is expected.

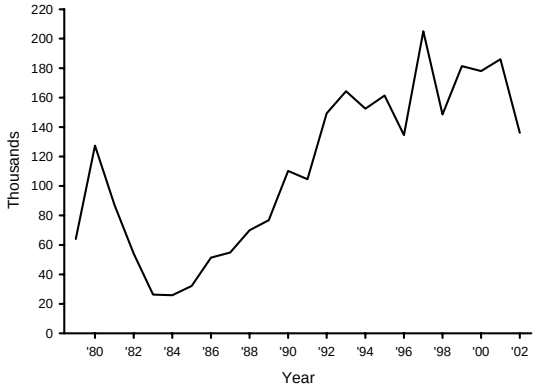

Fig. 17. Number of Cackling Canada geese estimated from fall and spring surveys.

Lesser and Taverner's Canada Geese: These subspecies nest throughout much of interior and south-central Alaska and winter in Washington, Oregon, and California (Fig. 3). Taverner's geese are more associated with the North Slope and tundra areas, while lesser Canada geese tend to nest in Alaska's interior. However, these subspecies mix with other Canada geese throughout the year and reliable estimates of separate populations are not presently available.

Spring breakup was early in western Alaska and on the North Slope, and average throughout much of interior Alaska. Despite a heavy snowpack in the interior, only minimal flooding was observed. The estimated number of Canada geese within BPHS strata predominantly occupied by these geese (strata 1-6, 8, 10-12) in 2002 declined 27% from 2001 levels, and have showed no trend since 1993 (*P*=0.63).

Aleutian Canada Geese (ACG): These geese currently breed only on the Aleutian Islands although historically they nested from near Kodiak Island, Alaska, to the Kuril Islands in Asia. They now winter along the Pacific Coast to central California. The Aleutian Canada goose was listed as endangered in 1967 (the population numbered approximately 800 birds in 1974) and delisted in 2001.

An indirect population estimate based on observations of neck-banded birds in California 2001-02 was 36,800, 24% higher than last year's estimate (*P*=0.29, Fig. 18). These indirect estimates have increased an average of 11% per year over the last 10 years (*P*<0.01). Nesting conditions were favorable for Aleutian geese, with an early green-up and little rain near hatching. Gosling production is expected to be high.

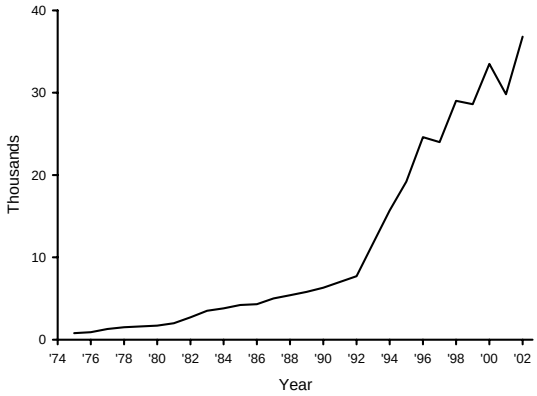

Fig. 18. Number of Aleutian Canada geese estimated from winter estimates and mark-resight methods.

Status of Light Geese

The term light geese refers to both snow geese and Ross's geese, including both white and blue color phases, and the lesser (*C. c. caerulescens)* and greater (*C. c. atlantica)* subspecies of snow goose. Another cumulative term, Mid-continent Light Geese, includes lesser snow and Ross's geese of 2 populations, the Mid-continent Population and the Western Central Flyway Population.

Ross's Geese: Most Ross's geese nest in the Queen Maud Gulf region, but increasing numbers summer along the western coast of Hudson Bay and

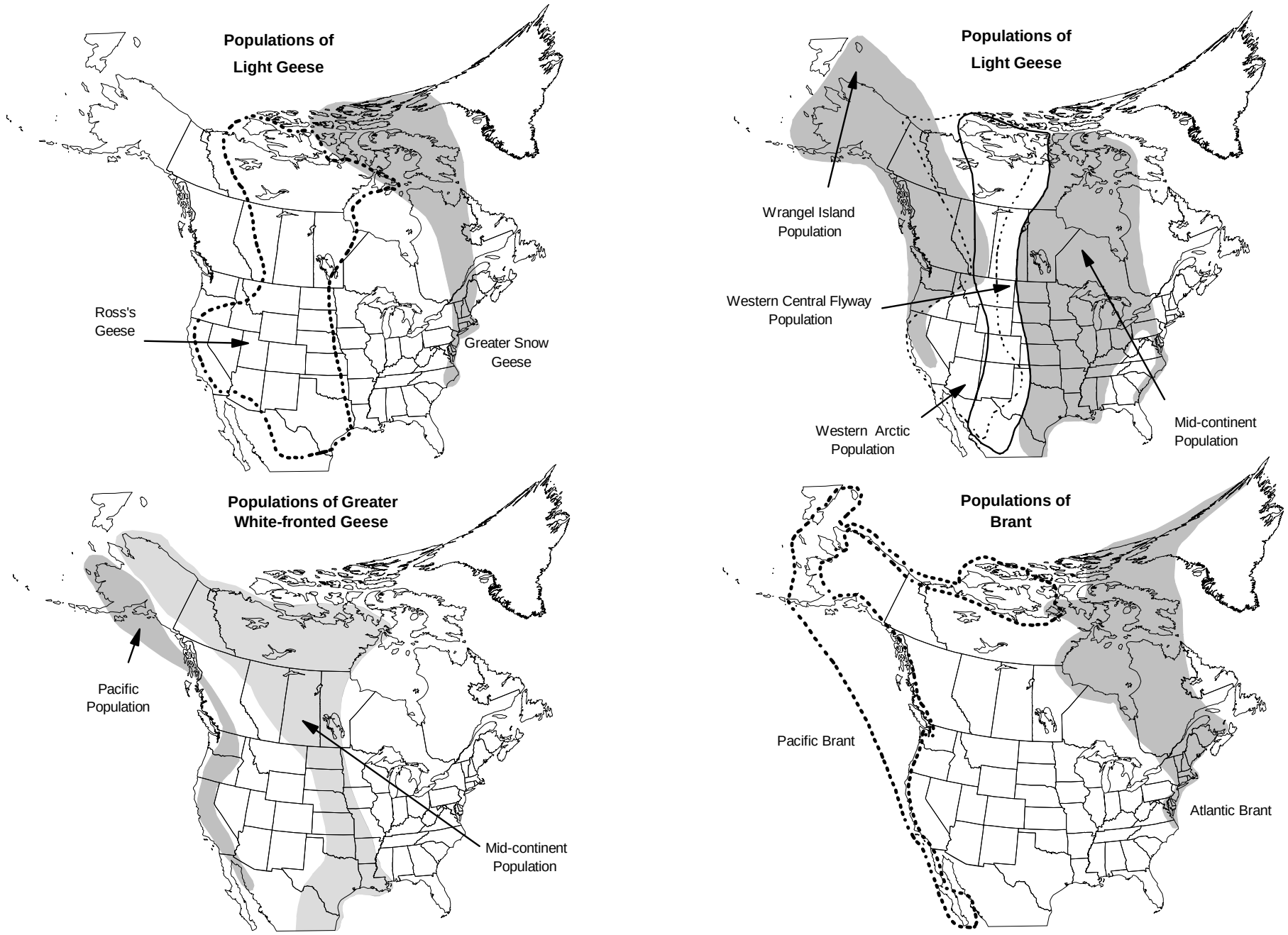

Fig. 19. Approximate ranges of selected goose populations in North America.

Southampton, Baffin, and Banks Islands. Ross's geese are present in the range of 3 different populations of light geese and primarily winter in California, New Mexico, Texas, and Mexico, with increasing numbers in Louisiana and Arkansas (Fig. 19).

Periodic photo-inventories and annual surveys in the Queen Maud Gulf indicate the spring Ross's goose population is increasing rapidly and has exceeded 800,000 geese in recent years. Annual estimates of total wintering population size are not available, but surveys on wintering areas of light geese indicate increases in range, number, and proportions of Ross's geese. The largest Ross's goose colony is near Karrak Lake in the Queen Maud Gulf. Researchers estimated that 479,000 adult Ross's geese nested there in 2001 (Fig. 20). These estimates have increased an average of 10% per year from 1993-2001 (P<0.01). Spring phenology in the Queen Maud Gulf was near average in 2002, but light geese arrived and initiated nesting later than average. Weather during nesting was mild but impacts of poor conditions during migration and late nest initiations are not known. Similar or harsher conditions likely existed for Ross's geese in areas of recent range expansion. The size of the fall flight cannot be predicted without an annual index to the size of the breeding population.

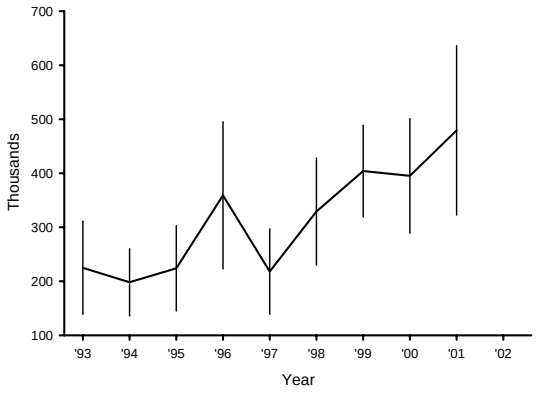

Fig. 20. Estimated number of nesting adult Ross's geese at Karrak Lake Colony, Nunavut.

Mid-continent Population (MCP): This population, including lesser snow and increasing numbers of Ross's geese, nests along the west coast of Hudson Bay and on Southampton and Baffin Islands (Fig. 19). These geese winter primarily in eastern Texas, Louisiana, and Arkansas.

During the 2002 MWS, biologists counted 2,696,100 light geese**,** 15% more than last year (Fig. 21). Despite 3 years of decline from 1999-2001, the MWS indices for the MCP have increased at an average of 2% per year since 1993 (P=0.17). The timing of spring breakup was later than average in Ontario and Manitoba. Nesting activities were 2 weeks late at La Perouse Bay and researchers noted geese staging in boreal forest areas prior to a 30 May migration to the north. Nest densities were reduced at La Perouse Bay which appeared to improve success of geese that did nest. Although spring breakup was near normal on Southampton and Baffin Islands, the arrival of geese, and the initiation of nesting was later than average. Nesting effort and distribution of snow geese on Baffin Island's Plain of the Koudjuak appeared reduced in 2002. MCP gosling production likely will be reduced compared to last year's good production, suggesting the fall flight will be no larger than in 2001.

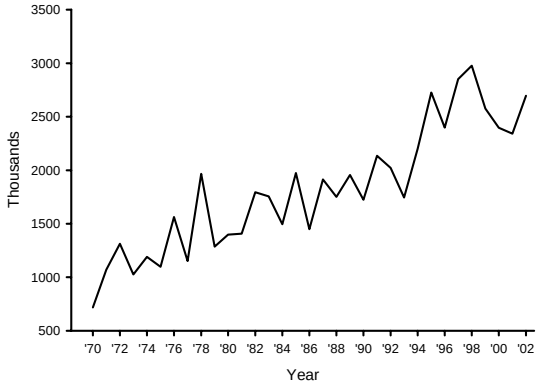

Fig. 21. Estimated number of Mid-continent Population light geese (lesser snow and Ross's geese) during winter.

Western Central Flyway Population (WCFP): This population is comprised primarily of snow geese but includes a substantial proportion of Ross's geese. WCF geese breed in the central and western Canadian Arctic, with large nesting colonies near the Queen Maud Gulf and on Banks Island. These geese stage in fall in eastern Alberta and western Saskatchewan and spend the winter in southeastern Colorado, New Mexico, the Texas Panhandle, and the northern highlands of Mexico (Fig. 19).

WCFP geese wintering in the U.S. portion of their range are surveyed annually, but the entire range, including Mexico, is surveyed only once every 3 years. In the U.S. portion of the survey, 99,900 geese were counted in January 2002, 6% fewer

than last year (Fig. 22). These MWS estimates have increased an average of 7% per year since 1993 (*P*=0.17). Biologists working near Karrak Lake in the Queen Maud Gulf region reported that spring phenology was near average in 2002, but light geese arrived and initiated nesting later than average. Weather during nesting was mild but impacts of poor conditions during migration and late nest initiation are not known. Spring phenology on Banks Island was near average and biologists reported a good nesting effort. Survey crews reported relatively small numbers of geese nesting at the Anderson River and Kendall Island colonies, where spring conditions were favorable**.** Production likely will be near average for this population.

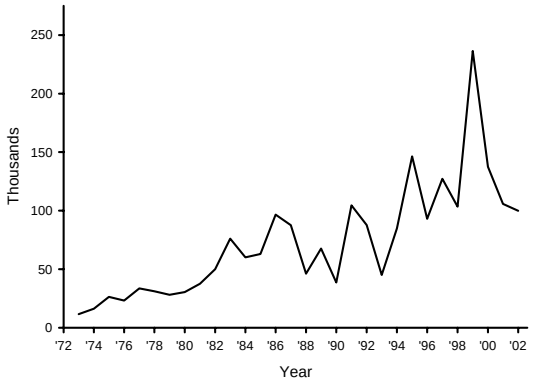

Fig. 22. Estimated number of Western Central Flyway Population light geese during winter in the United States.

Western Arctic/Wrangel Island Population (WAWI): Most of the snow geese in the Pacific Flyway originate from nesting colonies in the western and central Arctic (WA: Banks Island, the Anderson and Mackenzie River Deltas, Jenny Lind Island, the western Queen Maud Gulf region) or Wrangel Island (WI), located off the northern coast of Russia. The WA segment of the population winters in central and southern California, New Mexico, and Mexico; the WI segment winters in the Puget Sound area of Washington and in northern and central California (Fig. 19). Winter ranges overlap in California and interchange of individuals between the two breeding sites may occur. Separate winter counts for the WA and WI segments are not obtainable because of commingling with each other and other light geese.

The fall 2001 estimate of WAWI snow geese was 448,100, 32% lower than estimated in 2000 (Fig. 23). Fall estimates have declined 1% per year 1992-2001 (*P*=0.62). Spring phenology on Banks Island was near average and biologists reported a good nesting effort. Survey crews reported relatively small numbers of geese nesting at the Anderson River and Kendall Island colonies, where spring conditions were favorable. At Wrangel Island's Tundra River colony, nesting phenology was early and the total spring population was estimated at 107,500 geese, slightly higher than last year. Biologists estimated 30,300 nests, an average clutch size over 4.0 eggs, and nest success near 81%. Good production was also observed at a smaller colony on Wrangel Island. A snow storm and cold temperatures caused some gosling mortality around the hatching period, but biologists report the gosling production outlook remained favorable. Good production from WI and average or better production from Banks Island should produce a fall flight similar to, or larger than last year.

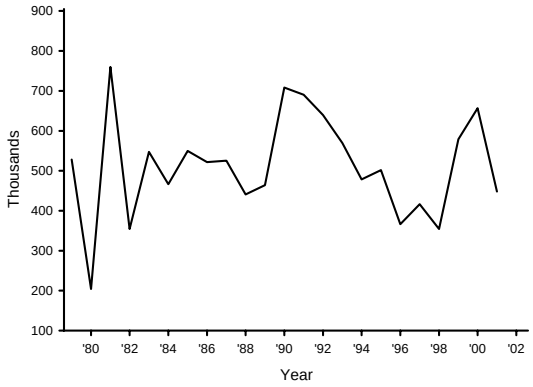

Fig. 23. Estimated number of Western Arctic/Wrangel Island Population of light geese during winter.

Greater snow geese (GSG): This subspecies nests principally on Bylot, Axel Heiberg, Ellesmere, and Baffin Islands, and on Greenland. They winter along the Atlantic coast from New Jersey to North Carolina (Fig. 19).

The preliminary estimate from the spring 2002 photographic survey of greater snow geese in the St. Lawrence Valley was 639,300. This preliminary estimate is 24% below last year's final and record high estimate of 837,400 geese (Fig. 24). Spring estimates of greater snow geese have increased an average of 4% per year since 1993 (*P*=0.01). The number of snow geese counted during the 2002 MWS in the Atlantic Flyway was 377,800, a 34% increase from the previous survey. Midwinter counts have increased an average of 7% per year during

1993-2002 (*P*=0.02). The largest known greater snow goose colony is on Bylot Island. There, spring snowmelt progressed quickly and slightly earlier than average, but geese arrived late, after nest sites had become available. Nesting phenology was 3-4 days later than average. Although nest densities in portions of the colony were very high, the extent of the colony and overall nesting effort was reduced from 2001. Average clutch size was 3.4, however, nest predation rates were high, and a 2-week period of cold, rain, and snow likely will result in poor to moderate production. A fall flight smaller than last year is expected.

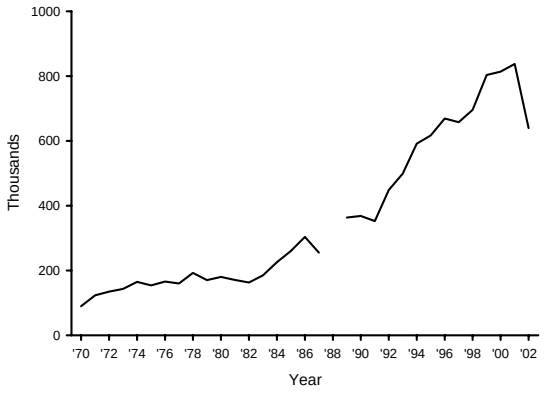

Fig. 24. Estimated number of greater snow geese during spring.

Status of Greater White-fronted Geese

Pacific Population (PP): These geese primarily nest on the Yukon Delta of Alaska and winter in the Central Valley of California (Fig. 19).

The index used for this population was a fall estimate from 1979-98. Since 1999, the index has been an estimate of the fall population derived from spring surveys on the Yukon Delta. The 2002 fall estimate is 358,000, 17% lower than in 2001 (Fig. 25). These estimates have increased an average of 3% per year since 1993 (*P*=0.02). Spring nesting phenology on the Yukon Delta was among the earliest on record. Spring aerial surveys in Alaska indicated decreases in total white-fronts and breeding pairs from 2001. Survey timing, excellent nest success, and nesting goose behavior (visibility bias) in 2002 may have contributed to the lower population estimates. Spring estimates of total geese have increased an average of 10% per year from 1993-2002 (*P*<0.01). A fall flight similar to last year is expected**.**

Mid-continent Population (MCP): These white-fronted geese nest across a broad region from central and northwestern Alaska across the central Arctic to the Foxe Basin. They concentrate in southern Saskatchewan during the fall and winter in Texas, Louisiana, and Mexico (Fig. 19).

During the fall 2001 survey in Saskatchewan and Alberta, biologists counted 712,300 MCP geese, a decrease of 17% from the 2000 count (Fig. 25). These population estimates have increased an average of 3% per year during 1992-2001 (*P*=0.22). Spring phenology on MCP breeding grounds was early in northern Alaska and the Mackenzie and Anderson River Deltas, and near average in interior Alaska and the Queen Maud Gulf. White-fronts reportedly arrived late to interior Alaska, but despite a heavy snowpack there, only minimal flooding was observed. Although central Arctic white-fronts may have been influenced by cold migration conditions, weather during the nesting period was mild in that region. Production in 2002 is expected to be average to above average for MCP white-fronted geese.

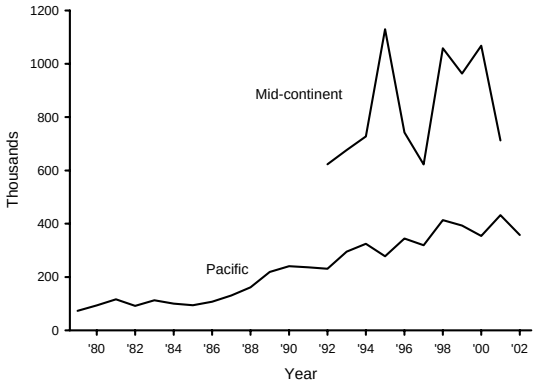

Fig. 25. Estimated number of Mid-continent and Pacific Populations of greater white-fronted geese during fall.

Status of Brant

Atlantic Brant (ATLB): Most of this population nests on islands of the eastern Arctic. These brant winter along the Atlantic Coast from Massachusetts to North Carolina (Fig. 19).

The 2002 MWS estimate of brant in the Atlantic Flyway was 181,600, 25% more than last year's estimate (Fig. 26). These estimates have increased an average of 4% per year for the most

recent 10-year period (*P*=0.05). Spring breakup in 2002 was near average in the eastern Arctic, but brant reportedly arrived late to the breeding grounds. The impacts of poor conditions during migration and late arrival on brant productivity are not yet known.

Pacific Brant (PACB): These brant nest across Alaska's Yukon Delta and North Slope, Banks Island, other islands of the western and central Arctic, the Queen Maud Gulf, and Wrangel Island. They winter as far south as Baja California and the west coast of Mexico (Fig. 19).

The 2002 MWS in the Pacific Flyway and Mexico resulted in a count of 136,200 brant, 9% higher than the previous year's count (Fig. 26). No trend was indicated in these estimates during 1993-2002 (*P*=0.76). Spring breakup was among the earliest on record on the Yukon Delta, earlier than average on the North Slope, and near average on Banks Island. Brant nest density varied among 5 Yukon Delta colonies, from approximately 50% of the average level (Kokechik) to slightly above average (Kigigak and Tutakoke). However, nest success appears to be good due to favorable nesting conditions and more average fox population levels. A fall flight larger than last year is expected.

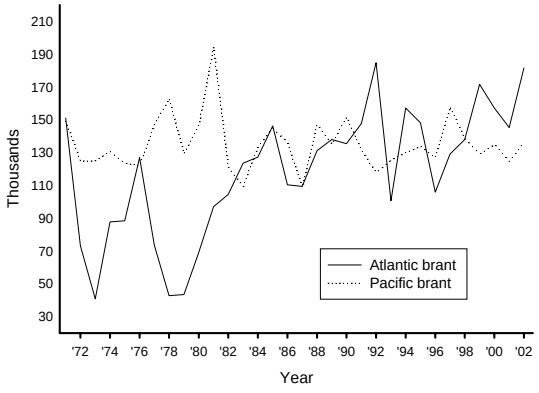

Fig. 26. Estimated number of Atlantic and Pacific Populations of brant during winter.

Western High Arctic Brant (WHA): This recently recognized population of brant nest on the Parry Islands of the Northwest Territories. The population stages in fall at Izembek Lagoon Alaska. They predominantly winter in Padilla, Samish, and Fidalgo Bays of Washington and near Boundary Bay, British Columbia, although some individuals have been observed as far south as Mexico. Breast and belly plumage of WHA brant are predominantly gray, intermediate between Atlantic brant and Pacific brant, but other color morphs have been captured in molting flocks on breeding areas. The development of a management plan and monitoring program are underway for this newly designated population.

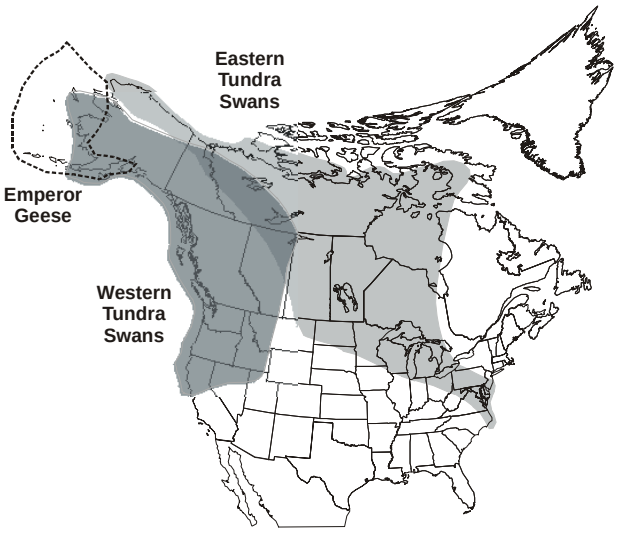

Fig. 27. Approximate range of the Emperor goose, and eastern and western swan populations in North America.

Status of Emperor Geese

The breeding range of the emperor goose is restricted to coastal areas of the Bering Sea, with the largest concentration on the Yukon Delta in Alaska. Emperor geese migrate relatively short distances and primarily winter in the Aleutian Islands (Fig. 27). Since 1981, emperor geese have been surveyed annually on spring staging areas in southwestern Alaska.

The spring 2002 emperor survey estimate was 58,700 geese, 30% lower than last year (Fig. 28). These estimates have increased an average of 2% per year since 1993 (*P*=0.45). Spring indices of breeding pairs and total birds from the Yukon Delta coastal survey decreased 9% and 28% from 2001, respectively. Spring breakup and nesting phenology were among the earliest on record on the Yukon Delta and Emperor goose nest densities increased in 2002. Ideal weather during nesting, low levels of fox predation, and the lack of flooding contributed to good production. A fall flight larger than last year is expected.

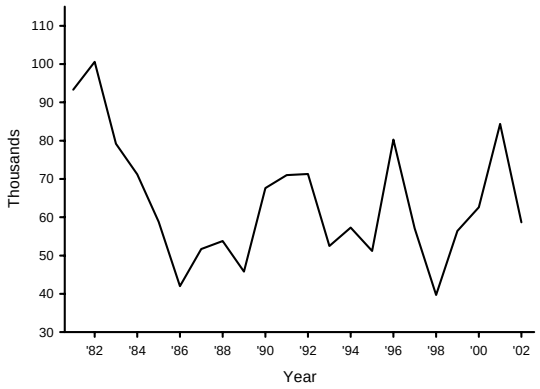

Fig. 28. Estimated numbers of emperor geese present during May surveys.

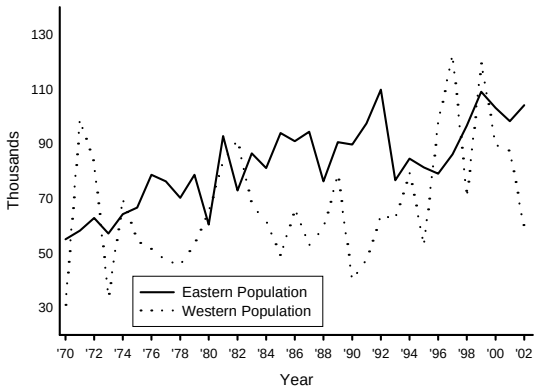

Fig. 29. Estimated numbers of the Eastern and Western Populations of tundra swans during winter.

Status of Tundra Swans

Western Population: These swans nest along the coastal lowlands of western Alaska, particularly between the Yukon and Kuskokwim Rivers. They winter primarily in California, Utah, and the Pacific Northwest (Fig. 27).

The 2002 MWS estimate of 58,700 swans was 33% lower than the 2001 estimate (Fig. 29). These estimates have been increasing at an average rate of 2% per year since 1993 (P=0.63). The 2002 spring estimates of total swans, breeding pairs, and nests on the Yukon Delta were all at record high levels (since estimation started in 1985). Spring breakup in western Alaska was among the earliest on record and production is expected to be good. A fall flight larger than last year is expected.

Eastern Population: Eastern Population tundra swans nest from the Seward Peninsula of Alaska to the northeast shore of Hudson Bay and Baffin Island. These birds winter in coastal areas from Maryland to North Carolina (Fig. 27)

During the 2002 MWS 104,100 eastern tundra swans were observed, 6% more than last year (Fig. 29). During the last 10 years these estimates have increased an average of 4% per year (P<0.01). In the western portion of this population's breeding range, spring phenology was about 1 week early. Indices of nesting tundra swans in the Mackenzie Delta Region in 2002 nearly doubled from the late year of 2001, and production is expected to be average to above average. Near the Queen Maud Gulf and farther east, spring phenology was near average, but the migration of many species was delayed by harsh conditions on staging areas. Overall, a fall flight similar to last year is expected.

Appendix A. Individuals who supplied information on the status of ducks.

Alaska, Yukon Territory, and Old Crow Flats (Strata 1-12): B. Conant and D. Groves

Northern Alberta, Northeastern British Columbia, and Northwest Territories (Strata 13-18, 20, and 77):
C. Ferguson and A. Straughn

Northern Saskatchewan and Northern Manitoba (Strata 21-24): F. Roetker and P.H. Stinson

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

Air	E. Buelna and A. Davenport
Ground	D. Duncan[a], P. Pryor[a], K. Froggatt[b], S. Barry[a], E. Hofman[b], R. Arbuckle[c], L. Crowe[a], R. Hunka[c], T. Matthews[c], M. Nieman[a], B. Peers[c], D. Pisiak[c], C. Procter[a], R. Russell[b], J. Spenst[a], S. Witham[c]

Southern Saskatchewan (Strata 30-35)

Air	P. Thorpe, H. Bell, R. King, and K. Bollinger
Ground	D. Nieman[a], J. Smith[a], K. Warner[a], C. Downie[a], D. Johns[a], P. Nieman[a], C. Park[a], A. Williams[a], D. Caswell[a], J. Caswell[a], J. Leafloor[a], C. Lindgren[c], P. Rakowski[a], M. Schuster[a], F. Baldwin Jr.[a], T. Barney[a], A. Dupuis[a], J. Galbraith[a]

Southern Manitoba (Strata 25 and 36-40)

Air	R. King and K. Bollinger
Ground	G. Ball[b], D. Caswell[a], J. Caswell[a], J. Leafloor[a], C. Lindgren[c], P. Rakowski[a], M. Schuster[a], F. Baldwin Jr.[a], T. Barney[a], A. Dupuis[a], J. Galbraith[a]

Montana and Western Dakotas (Strata 41-44)

Air	J. Voelzer and R. Bentley
Ground	A. Arnold[d] and S. McFall

Central and Eastern Dakotas (Strata 45-49)

Air	J. W. Solberg and S. Thomas
Ground	G.T. Allen, P.R. Garrettson, T. Menard, and F. Prellwitz

Northern Quebec (Strata 68 and 69): J. Wortham and M. Fernandez

New York, Eastern Ontario, and Southern Quebec (Strata 52-56): M. Koneff and C. Kitchens-Hayes

Central and Western Ontario (Strata 50 and 51): W. Butler, and B. Fisher

Maine and Maritimes (Strata 62-67): J. Bidwell and M. Drut

British Columbia: A. Breault[b], P. Watts[d], and 19 participants from the Canadian Wildlife Service, Ducks Unlimited Canada, British Columbia Wildlife Branch, Canadian Parks Service, private organizations

California

Air	D. Yparraguirre[b] and M. Weaver[b]
Ground	D. Loughman[d], J. Laughlin[d], and N. Salvedes[d]

Colorado: J. Gammonley[b]

Michigan: S. Chadwick[b], B. Dybas-Berger[b], E. Flegler[b], E. Kafcas[b], A. Karr[b], B. Lercel[b], R. Matthews[d], J. Niewoonder[b], T. Oliver[b], J. Robison[b], G. Souillere[b], and V. Tuovila[b]

Minnesota

Air	A. Buchert[b] and J. Lawrence[b]
Ground	S. Kelly, J. Artmann, W. Brininger, B. Ehlers, J. Holler, S. Lewis, R. Papasso, T. Rondeau, R. Beam, M. Carlson, D. Hertel, R. Johnson, J. Kelley, B. Russell, R. Schuldt, B. Wehrle, L. Wolff, S. Zodrow

Nebraska

Air	D. Benning[d] and M. Vrtiska[b]
Ground	R. Woods[b], S. Oldenburger[b], R. Walters[b]
Data Analysis	M. Vrtiska[b] and S. Oldenburger[b]

Nevada N. Saake[b]

Appendix A. Continued.

Northeastern U.S.

Data Analysis:	B. Raftovich
Connecticut:	Connecticut Wildlife Division Staff
Delaware:	T. Whittendale [b]
Maryland:	D. Brinker [b], T. Decker [b], T. DeWitt [b], B. Evans [b], C. Harris [b], B. Harvey [b], D. Heilmeier [b], W. Henry [b], R. Hill [b], L. Hindman [b], B. Joyce [b], B. Martin [b], M. Mause [b], B. Perry [b], D. Price [b], G. Timko [b], D. Webster [b]
Massachusetts:	H. Heussman [b] and other Massachusetts Division of Fisheries and Wildlife staff
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New Jersey:	T. Nichols [b], A. Burnett [b], J. Garris [b], B. Kirkpatrick [b], J. Mangino [b], D. Wilkinson [b], J. Ziemba [b], L. Ziemba, N. Zimpfer [b]
New York:	Staff and volunteers of the NY State Department of Environmental Conservation
Pennsylvania:	J. Dunn [b], J. Gilbert [b], I. Gregg [b], K. Jacobs [b]
Rhode Island:	C. Allin [b], C. Brown [b], T. Silvia [d], L. Supprock [b], B. Tefft [b]
Vermont:	T. Appleton, J. Austin [b], D. Blodgett [b], J. Buck [b], P. Hamelin [b], F. Hammond [b], J. Mlcuch [b], K. Royar [b], and D. Sausville [b]
Virginia:	G. Costanzo [b], T. Bidrowski [b], and other staff of the Virginia Department of Game and Inland Fisheries

Washington: D. Kraege [b] and R. Friesz [b]

Wisconsin

Air:	L. Waskow [b], B. Bacon [b], C. Cold [b], C. Milestone [b], and P.Samerdyke [b]
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[a] Canadian Wildlife Service
[b] State, Provincial, or Tribal Conservation Agency
[c] Ducks Unlimited - Canada
[d] Other organization
All others – U.S. Fish and Wildlife Service

Appendix B. Individuals who supplied information on the status of geese and swans.

Coordinated Flyway-wide Surveys: M. Drut, K. Gamble, K. Kruse, J. Peterson, R. Raftovich, J. Serie, D. Sharp, and R. Trost

Information from the Breeding Population and Habitat Survey: see Appendix A

North Atlantic Population of Canada Geese: J. Bidwell, M. Bateman[a], and J. Serie

Atlantic Population of Canada Geese: W. Harvey[b], L. Hindman[b], A. Reed[a], and J. Rodrigue[a]

Atlantic Flyway Resident Population of Canada Geese: C. Allin[b], P. Castelli[b], G. Chasko[b], P. Corr[b], G. Costanzo[b], J. Dunn[b], L. Garland[b], H. Heusmann[b], L. Hindman[b], K. Jacobs[b], W. Lesser[b], P. Merola[b], E. Robinson[b], T. Whittendale[b], and S. Wilson[b]

Southern James Bay Population of Canada Geese: K. Abraham[b], D. Fillman[b], J. Hughes[a], J. Leafloor[a], K. Ross[a], and L. Walton[b]

Mississippi Valley Population of Canada Geese: K. Abraham[b], J. Berquist[b], D. Fillman[a], J. Hughes[a], J. Leafloor[a], K. Ross[a], and L. Walton[b]

Mississippi Flyway Population Giant Canada Geese: S. Barry[b], J. Berquist[b], E. Flegler[b], D. Graber[b], M. Kraft[b], J. Lawrence[b], D. Luukkonen[b], R. Marshalla[b], M. Miller[b], R. Pritchert[b], S. Walter[d], E. Warr[b], and G. Zenner[b]

Eastern Prairie Population of Canada Geese: D. Andersen[d], M. Gillespie[b], D. Humburg[b], B. Lubinski[b], S. Maxson[b], R. Nack[d], and P. Telander[b]

Western Prairie and Great Plains Populations of Canada Geese: M. Kraft[b], D. Nieman[a], M. O'Meilia[b], S. Vaa[b], M. Vritiska[b]

Tall Grass Prairie Population of Canada Geese: R. Case[b], D. Caswell[a], K. Dickson[a], and M. Mallory[a]

Short Grass Prairie Population of Canada Geese: R. Alisauskas[a], K. Dickson[a], J. Hines[a], J. Leafloor[a], and D. Nieman[a]

Hi-Line Population of Canada Geese: J. Dubovsky, J. Gammonley[b], J. Hansen[b], L. Roberts[b], and S. Tessman[b]

Rocky Mountain Population of Canada Geese: T. Aldrich[b], J. Dubovsky, T. Sanders[b], J. Herbert[b], T. Hinz[b], L. Roberts[b], S. Stiver[b], and G. Will[b]

Pacific Population of Canada Geese: A. Breault[a], B. Bales[b], C. Feldheim[b], T. Hinz[b], D. Kraege[b], S. Stiver[b], and D. Yparraguirre[b]

Dusky Canada Geese: M. Drut, B. Eldridge, T. Fondell, B. Grand[d], B. Larned, D. Logan[d], M. Naughton, R. Oates, D. Robertson, T. Rothe[b], and R. Trost

Lesser and Taverner's Canada Geese: B. Conant, E. Mallek, R. Oates, and M. Spindler

Cackling Canada Geese: M. Anthony[d], T. Bowman, C. Dau, B. Eldridge, D. Marks, R. Oates, B. Platte, R. Trost, and B. Stehn,

Aleutian Canada Geese: V. Byrd, M. Drut, and R. Trost

Greater Snow Geese: A. Bechet[d], K. Dickson[a], A. Fontaine[a], G. Gauthier[d], J. Giroux[d], J. Hughes[a], M. Mallory[a], and A. Reed[a]

Mid-continent Population Light Geese: K. Abraham[b], D. Caswell[a], K. Dickson[a], M. Gillespie[b], D. Humburg[b], M. Mallory[a], R. Rockwell[d], K. Ross[a], and P. Telander[b]

Appendix B. Continued.

Western Central Flyway Population Light Geese: R. Alisauskas[a], J. Bredy, D. Caswell[a], K. Dickson[a], R. Kerbes[a], P. Latour[a], and D. Warner[a]

Western Arctic/Wrangel Island Population of Lesser Snow Geese: V. Baranuk[d], S. Boyd[a], J. Bredy, J. Hines[a], D. Kraege[b], and R. Trost

Ross's Geese: R. Alisauskas[a], K. Dickson[a], R. Kerbes[a], D. Warner[a], and K. Warner[a]

Pacific Population of Greater White-Fronted Geese: T. Bowman, C. Dau, B. Eldridge, D. Groves, D. Marks, B. Platte, R. Oates, and B. Stehn

Mid-continent Population of Greater White-fronted Geese: R. Alisauskas[a], R. Case[b], B. Conant, K. Dickson[a], J. Hines[a], R. Kerbes[a], E. Malleck, D. Nieman[a], M. Spindler, and K. Warner[a]

Pacific Brant: R. Anthony[d], T. Bowman, R. Oates, and R. King

Atlantic Brant: P. Castelli[b], K. Dickson[a], G. Gilchrist, M. Mallory[a], A. Reed[a]

Western High Arctic Brant: D. Kraege[b], R. Trost

Emperor Geese: T. Bowman, C. Dau, B. Eldridge, R. King, D. Marks, R. Oates, B. Platte, and B. Stehn

Western Population of Tundra Swans: C. Dau, B. Eldridge, R. Oates, B. Stehn, and R. Trost

Eastern Population of Tundra Swans: C. Dau, J. Fischer, J. Hines[a], B. Larned, and R. Oates

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[a]Canadian Wildlife Service
[b]State, Provincial, or Tribal Conservation Agency
[c]Ducks Unlimited - Canada
[d]Other organization
All others - U.S. Fish and Wildlife Service

Appendix C. Transects and strata for areas of the Breeding Waterfowl and Habitat Survey (Traditional and Eastern).

Appendix D. 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	$\hat{N}$	$\hat{SE}$	$\hat{N}$	$\hat{SE}$	$\hat{N}$	$\hat{SE}$
1961	1977.2	165.4				
1962	2369.1	184.6				
1963	2482.0	129.3				
1964	3370.7	173.0				
1965	4378.8	212.2				
1966	4554.5	229.3				
1967	4691.2	272.1				
1968	1985.7	120.2				
1969	3547.6	221.9				
1970	4875.0	251.2				
1971	4053.4	200.4				
1972	4009.2	250.9				
1973	2949.5	197.6				
1974	6390.1	308.3	1840.8	197.2	8230.9	366.0
1975	5320.1	271.3	1910.8	116.1	7230.9	295.1
1976	4598.8	197.1	1391.5	99.2	5990.3	220.7
1977	2277.9	120.7	771.1	51.1	3049.1	131.1
1978	3622.1	158.0	1590.4	81.7	5212.4	177.9
1979	4858.9	252.0	1522.2	70.9	6381.1	261.8
1980	2140.9	107.7	761.4	35.8	2902.3	113.5
1981	1443.0	75.3	682.8	34.0	2125.8	82.6
1982	3184.9	178.6	1458.0	86.4	4642.8	198.4
1983	3905.7	208.2	1259.2	68.7	5164.9	219.2
1984	2473.1	196.6	1766.2	90.8	4239.3	216.5
1985	4283.1	244.1	1326.9	74.0	5610.0	255.1
1986	4024.7	174.4	1734.8	74.4	5759.5	189.6
1987	2523.7	131.0	1347.8	46.8	3871.5	139.1
1988	2110.1	132.4	790.7	39.4	2900.8	138.1
1989	1692.7	89.1	1289.9	61.7	2982.7	108.4
1990	2817.3	138.3	691.2	45.9	3508.5	145.7
1991	2493.9	110.2	706.1	33.6	3200.0	115.2
1992	2783.9	141.6	825.0	30.8	3608.9	144.9
1993	2261.1	94.0	1350.6	57.1	3611.7	110.0
1994	3769.1	173.9	2215.6	88.8	5984.8	195.3
1995	3892.5	223.8	2442.9	106.8	6335.4	248.0
1996	5002.6	184.9	2479.7	135.3	7482.2	229.1
1997	5061.0	180.3	2397.2	94.4	7458.2	203.5
1998	2521.7	133.8	2065.3	89.2	4586.9	160.8
1999	3862.0	157.2	2842.3	256.8	6704.3	301.1
2000	2422.2	96.1	1524.5	99.9	3946.9	138.6
2001	2747.2	115.6	1893.2	91.5	4640.4	147.4
2002	1439.0	105.0	1281.1	63.4	2720.0	122.7

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

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

	British Columbia [b]		California		Colorado		Michigan		Minnesota		Nebraska	
Year	Total Ducks	Mallards	Total Ducks	Mallards	Total Ducks	Mallards	Total Ducks	Mallards	Total Ducks	Mallards	Total Ducks	Mallards
1955	[c]										101.5	32.0
1956											94.9	25.8
1957											154.8	26.8
1958											176.4	28.1
1959											99.7	12.1
1960					51.1	32.4					143.6	21.6
1961					58.7	32.4					141.8	43.3
1962					72.7	59.4					68.9	35.8
1963					78.0	62.1					114.9	37.4
1964					110.8	64.0					124.8	66.8
1965					111.9	60.2					52.9	20.8
1966					100.8	57.8					118.8	36.0
1967					122.2	69.7					96.2	27.6
1968					145.4	73.3			368.5	83.7	96.5	24.1
1969					138.1	57.5			345.3	88.8	100.6	26.7
1970					114.8	46.5			343.8	113.9	112.4	24.5
1971					121.4	48.3			286.9	78.5	96.0	22.3
1972					94.6	45.0			237.6	62.2	91.7	15.2
1973					112.3	45.2			415.6	99.8	85.5	19.0
1974					129.0	56.9			332.8	72.8	67.4	19.5
1975					156.7	38.2			503.3	175.8	62.6	14.8
1976					142.0	34.6			759.4	117.8	87.2	20.1
1977									536.6	134.2	152.4	24.1
1978					145.1	42.6			511.3	146.8	126.0	29.0
1979					103.2	30.9			901.4	158.7	143.8	33.6
1980					110.7	32.0			740.7	172.0	133.4	37.3
1981					188.4	36.4			515.2	154.8	66.2	19.4
1982					70.2	30.1			558.4	120.5	73.2	22.3
1983					130.6	44.2			394.2	155.8	141.6	32.2
1984					109.9	39.3			563.8	188.1	154.1	36.1
1985									580.3	216.9	75.4	28.4
1986					105.0	42.0			537.5	233.6	69.5	15.1
1987					125.4	62.0			614.9	192.3	120.5	41.7
1988	6.0	0.6			123.1	63.4			752.8	271.7	126.5	27.8
1989	5.5	0.5			122.9	48.2			1021.6	273.0	136.7	18.7
1990	5.9	0.6			131.9	56.5			886.8	232.1	81.4	14.7
1991	7.4	0.7			124.1	49.8			868.2	225.0	126.3	26.0
1992	7.7	0.7	497.4	375.8	101.3	46.6	822.8	360.9	1127.3	360.9	63.4	24.4
1993	7.1	0.6	666.7	359.0	145.6	68.7	667.8	386.5	875.9	305.8	92.8	23.8
1994	7.8	0.6	483.2	311.7	141.3	68.9	698.0	399.9	1320.1	426.5	118.9	17.5
1995	8.7	0.9	589.7	368.5	123.5	54.5	718.7	515.3	912.2	319.4	142.9	42.0
1996	8.3	0.6	843.7[d]	536.7	142.8	60.1	643.0	338.8	1062.4	314.8	132.3	38.9
1997	8.1	0.6	824.3	511.3	107.5	51.9	779.4	445.8	953.0	407.4	128.3	26.1
1998	9.2	1.1	706.8	353.9	89.1	44.8	945.5	445.3	739.6	368.5	155.7	43.4
1999	8.3	0.8	851.0	560.1	101.0	50.2	649.5	419.5	716.5	316.4	251.2[e]	81.1
2000	7.8	0.6	562.4	347.6			745.5	345.4	815.3	318.1	178.8	54.3
2001	7.4	0.6	413.5	302.2	26.5[e]	11.8	539.7	294.8	761.3	320.6	225.3	69.2
2002	8.6	0.5	392.0	265.3			732.5	290.7	1224.1	366.6	141.8	50.6

[a] Species composition for the total duck estimate varies by region.
[b] Index to waterfowl use in prime waterfowl producing areas of the province.
[c] Blanks denote that the survey was not conducted, results were not available, or survey methods changed.
[d] Survey estimates from 1996-2001 do not match those from previous reports because they have been recalculated.
[e] First year of survey after major changes in survey methodology. Hence, results from earlier years are not comparable.

Appendix E. Continued.

	Nevada		Northeastern US[e]		Oregon		Washington		Wisconsin[f]		Wyoming	
Year	Total Ducks	Mallards	Total Ducks	Mallards	Total Ducks	Mallards	Total Ducks	Mallards	Total Ducks	Mallards	Total Ducks	Mallards
1955												
1956												
1957												
1958												
1959	14.2	2.1										
1960	14.1	2.1										
1961	13.5	2.0										
1962	13.8	1.7										
1963	23.8	2.2										
1964	23.5	3.0										
1965	29.3	3.5										
1966	25.7	3.4										
1967	11.4	1.5									246.0	
1968	10.5	1.2									333.0	
1969	18.2	1.4									265.0	
1970	19.6	1.5									382.0	101.0
1971	18.3	1.1									365.0	107.0
1972	19.0	0.9									278.0	90.0
1973	20.7	0.7							364.4	114.5	293.0	115.0
1974	17.1	0.7							336.8	96.0	318.0	122.0
1975	14.5	0.6							437.4	109.0	283.0	65.0
1976	13.6	0.6							326.0	104.0	276.0	69.0
1977	16.5	1.0							277.5	91.5	305.0	71.0
1978	11.1	0.6							238.1	63.7	323.0	77.0
1979	12.8	0.6					98.6	32.1	328.7	82.6	310.0	72.0
1980	16.6	0.9					113.7	34.1	288.9	131.9	306.0	103.0
1981	26.9	1.6					148.3	41.8	516.6	139.9	307.0	79.0
1982	21.0	1.1					146.4	49.8	235.8	82.6	299.0	67.0
1983	24.3	1.5					149.5	47.6	275.0	143.7	306.0	103.0
1984	24.0	1.4					196.3	59.3	256.9	91.0	585.0	114.0
1985	24.9	1.5					216.2	63.1	257.8	76.6	288.0	64.0
1986	26.4	1.3					203.8	60.8	299.8	113.3	356.0	73.0
1987	33.4	1.5					183.6	58.3	364.5	114.3	340.0	80.0
1988	31.7	1.3					241.8	67.2	313.9	158.6	408.0	98.0
1989	18.8	1.3	1144.8	589.9			162.3	49.8	473.6	219.4	266.0	85.0
1990	22.2	1.3	1042.3	665.1			168.9	56.9	410.1	152.0	382.0	88.0
1991	14.6	1.4	1849.2	779.2			140.8	43.7	453.3	181.8	330.0	74.0
1992	12.4	0.9	1090.2	562.2			116.3	41.0	637.8	284.9	313.0	98.0
1993	14.1	1.2	1198.4	683.1			149.8	55.0	376.9	190.4	196.0	77.0
1994	19.2	1.4	1348.1	853.1	391.3	82.8	123.9	52.7	571.9	307.7	353.6	89.6
1995	17.9	1.0	1441.2	862.8	282.2	63.6	147.3	58.9	623.3	241.9	494.9	104.4
1996	26.4	1.7	1432.3	848.5	417.4	101.1	163.3	61.6	737.8	324.9	589.0	99.9
1997	25.3	2.5	1404.9	795.1	472.4	113.8	172.8	67.0	422.5	196.3	617.0	125.1
1998	27.9	2.1	1443.8	775.1	425.1	123.5	185.3	79.0	448.5	175.7	824.1	131.4
1999	29.9	2.3	1520.8	879.7	593.5	121.9	200.2	86.2	487.9	242.2	740.8	124.8
2000	26.1	2.1	1925.8	757.8			143.6	47.7	833.3	415.2	[g]	
2001	22.2	2.0	1392.6	807.5			146.4	50.5	542.7	164.3		
2002	11.7	0.7	1465.7	833.3			133.3	44.7	913.5	372.3		

[e] Includes all or portions of Connecticut, Delaware, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, and Virginia.
[f] These estimates differ from those in previous reports because they have been adjusted to account for the addition of new survey areas.
[g] No longer conducting breeding waterfowl surveys.

Appendix F. Breeding population estimates and standard errors (in thousands) for 10 species of ducks from the traditional survey area (strata 1-18, 20-50, 75-77).

	Mallard		Gadwall		American wigeon		Green-winged teal		Blue-winged teal	
Year	$\hat{N}$	$\hat{SE}$	$\hat{N}$	$\hat{SE}$	$\hat{N}$	$\hat{SE}$	$\hat{N}$	$\hat{SE}$	$\hat{N}$	$\hat{SE}$
1955	8777.3	457.1	651.5	149.5	3216.8	297.8	1807.2	291.5	5305.2	567.6
1956	10452.7	461.8	772.6	142.4	3145.0	227.8	1525.3	236.2	4997.6	527.6
1957	9296.9	443.5	666.8	148.2	2919.8	291.5	1102.9	161.2	4299.5	467.3
1958	11234.2	555.6	502.0	89.6	2551.7	177.9	1347.4	212.2	5456.6	483.7
1959	9024.3	466.6	590.0	72.7	3787.7	339.2	2653.4	459.3	5099.3	332.7
1960	7371.7	354.1	784.1	68.4	2987.6	407.0	1426.9	311.0	4293.0	294.3
1961	7330.0	510.5	654.8	77.5	3048.3	319.9	1729.3	251.5	3655.3	298.7
1962	5535.9	426.9	905.1	87.0	1958.7	145.4	722.9	117.6	3011.1	209.8
1963	6748.8	326.8	1055.3	89.5	1830.8	169.9	1242.3	226.9	3723.6	323.0
1964	6063.9	385.3	873.4	73.7	2589.6	259.7	1561.3	244.7	4020.6	320.4
1965	5131.7	274.8	1260.3	114.8	2301.1	189.4	1282.0	151.0	3594.5	270.4
1966	6731.9	311.4	1680.4	132.4	2318.4	139.2	1617.3	173.6	3733.2	233.6
1967	7509.5	338.2	1384.6	97.8	2325.5	136.2	1593.7	165.7	4491.5	305.7
1968	7089.2	340.8	1949.0	213.9	2298.6	156.1	1430.9	146.6	3462.5	389.1
1969	7531.6	280.2	1573.4	100.2	2941.4	168.6	1491.0	103.5	4138.6	239.5
1970	9985.9	617.2	1608.1	123.5	3469.9	318.5	2182.5	137.7	4861.8	372.3
1971	9416.4	459.5	1605.6	123.0	3272.9	186.2	1889.3	132.9	4610.2	322.8
1972	9265.5	363.9	1622.9	120.1	3200.1	194.1	1948.2	185.8	4278.5	230.5
1973	8079.2	377.5	1245.6	90.3	2877.9	197.4	1949.2	131.9	3332.5	220.3
1974	6880.2	351.8	1592.4	128.2	2672.0	159.3	1864.5	131.2	4976.2	394.6
1975	7726.9	344.1	1643.9	109.0	2778.3	192.0	1664.8	148.1	5885.4	337.4
1976	7933.6	337.4	1244.8	85.7	2505.2	152.7	1547.5	134.0	4744.7	294.5
1977	7397.1	381.8	1299.0	126.4	2575.1	185.9	1285.8	87.9	4462.8	328.4
1978	7425.0	307.0	1558.0	92.2	3282.4	208.0	2174.2	219.1	4498.6	293.3
1979	7883.4	327.0	1757.9	121.0	3106.5	198.2	2071.7	198.5	4875.9	297.6
1980	7706.5	307.2	1392.9	98.8	3595.5	213.2	2049.9	140.7	4895.1	295.6
1981	6409.7	308.4	1395.4	120.0	2946.0	173.0	1910.5	141.7	3720.6	242.1
1982	6408.5	302.2	1633.8	126.2	2458.7	167.3	1535.7	140.2	3657.6	203.7
1983	6456.0	286.9	1519.2	144.3	2636.2	181.4	1875.0	148.0	3366.5	197.2
1984	5415.3	258.4	1515.0	125.0	3002.2	174.2	1408.2	91.5	3979.3	267.6
1985	4960.9	234.7	1303.0	98.2	2050.7	143.7	1475.4	100.3	3502.4	246.3
1986	6124.2	241.6	1547.1	107.5	1736.5	109.9	1674.9	136.1	4478.8	237.1
1987	5789.8	217.9	1305.6	97.1	2012.5	134.3	2006.2	180.4	3528.7	220.2
1988	6369.3	310.3	1349.9	121.1	2211.1	139.1	2060.8	188.3	4011.1	290.4
1989	5645.4	244.1	1414.6	106.6	1972.9	106.0	1841.7	166.4	3125.3	229.8
1990	5452.4	238.6	1672.1	135.8	1860.1	108.3	1789.5	172.7	2776.4	178.7
1991	5444.6	205.6	1583.7	111.8	2254.0	139.5	1557.8	111.3	3763.7	270.8
1992	5976.1	241.0	2032.8	143.4	2208.4	131.9	1773.1	123.7	4333.1	263.2
1993	5708.3	208.9	1755.2	107.9	2053.0	109.3	1694.5	112.7	3192.9	205.6
1994	6980.1	282.8	2318.3	145.2	2382.2	130.3	2108.4	152.2	4616.2	259.2
1995	8269.4	287.5	2835.7	187.5	2614.5	136.3	2300.6	140.3	5140.0	253.3
1996	7941.3	262.9	2984.0	152.5	2271.7	125.4	2499.5	153.4	6407.4	353.9
1997	9939.7	308.5	3897.2	264.9	3117.6	161.6	2506.6	142.5	6124.3	330.7
1998	9640.4	301.6	3742.2	205.6	2857.7	145.3	2087.3	138.9	6398.8	332.3
1999	10805.7	344.5	3235.5	163.8	2920.1	185.5	2631.0	174.6	7149.5	364.5
2000	9470.2	290.2	3158.4	200.7	2733.1	138.8	3193.5	200.1	7431.4	425.0
2001	7904.0	226.9	2679.2	136.1	2493.5	149.6	2508.7	156.4	5757.0	288.8
2002	7503.7	246.5	2235.4	135.4	2334.4	137.9	2333.5	143.8	4206.5	227.9

Appendix F. Continued.

	Northern shoveler		Northern pintail		Redhead		Canvasback		Scaup	
Year	$\hat{N}$	$\hat{SE}$	$\hat{N}$	$\hat{SE}$	$\hat{N}$	$\hat{SE}$	$\hat{N}$	$\hat{SE}$	$\hat{N}$	$\hat{SE}$
1955	1642.8	218.7	9775.1	656.1	539.9	98.9	589.3	87.8	5620.1	582.1
1956	1781.4	196.4	10372.8	694.4	757.3	119.3	698.5	93.3	5994.1	434.0
1957	1476.1	181.8	6606.9	493.4	509.1	95.7	626.1	94.7	5766.9	411.7
1958	1383.8	185.1	6037.9	447.9	457.1	66.2	746.8	96.1	5350.4	355.1
1959	1577.6	301.1	5872.7	371.6	498.8	55.5	488.7	50.6	7037.6	492.3
1960	1824.5	130.1	5722.2	323.2	497.8	67.0	605.7	82.4	4868.6	362.5
1961	1383.0	166.5	4218.2	496.2	323.3	38.8	435.3	65.7	5380.0	442.2
1962	1269.0	113.9	3623.5	243.1	507.5	60.0	360.2	43.8	5286.1	426.4
1963	1398.4	143.8	3846.0	255.6	413.4	61.9	506.2	74.9	5438.4	357.9
1964	1718.3	240.3	3291.2	239.4	528.1	67.3	643.6	126.9	5131.8	386.1
1965	1423.7	114.1	3591.9	221.9	599.3	77.7	522.1	52.8	4640.0	411.2
1966	2147.0	163.9	4811.9	265.6	713.1	77.6	663.1	78.0	4439.2	356.2
1967	2314.7	154.6	5277.7	341.9	735.7	79.0	502.6	45.4	4927.7	456.1
1968	1684.5	176.8	3489.4	244.6	499.4	53.6	563.7	101.3	4412.7	351.8
1969	2156.8	117.2	5903.9	296.2	633.2	53.6	503.5	53.7	5139.8	378.5
1970	2230.4	117.4	6392.0	396.7	622.3	64.3	580.1	90.4	5662.5	391.4
1971	2011.4	122.7	5847.2	368.1	534.4	57.0	450.7	55.2	5143.3	333.8
1972	2466.5	182.8	6979.0	364.5	550.9	49.4	425.9	46.0	7997.0	718.0
1973	1619.0	112.2	4356.2	267.0	500.8	57.7	620.5	89.1	6257.4	523.1
1974	2011.3	129.9	6598.2	345.8	626.3	70.8	512.8	56.8	5780.5	409.8
1975	1980.8	106.7	5900.4	267.3	831.9	93.5	595.1	56.1	6460.0	486.0
1976	1748.1	106.9	5475.6	299.2	665.9	66.3	614.4	70.1	5818.7	348.7
1977	1451.8	82.1	3926.1	246.8	634.0	79.9	664.0	74.9	6260.2	362.8
1978	1975.3	115.6	5108.2	267.8	724.6	62.2	373.2	41.5	5984.4	403.0
1979	2406.5	135.6	5376.1	274.4	697.5	63.8	582.0	59.8	7657.9	548.6
1980	1908.2	119.9	4508.1	228.6	728.4	116.7	734.6	83.8	6381.7	421.2
1981	2333.6	177.4	3479.5	260.5	594.9	62.0	620.8	59.1	5990.9	414.2
1982	2147.6	121.7	3708.8	226.6	616.9	74.2	513.3	50.9	5532.0	380.9
1983	1875.7	105.3	3510.6	178.1	711.9	83.3	526.6	58.9	7173.8	494.9
1984	1618.2	91.9	2964.8	166.8	671.3	72.0	530.1	60.1	7024.3	484.7
1985	1702.1	125.7	2515.5	143.0	578.2	67.1	375.9	42.9	5098.0	333.1
1986	2128.2	112.0	2739.7	152.1	559.6	60.5	438.3	41.5	5235.3	355.5
1987	1950.2	118.4	2628.3	159.4	502.4	54.9	450.1	77.9	4862.7	303.8
1988	1680.9	210.4	2005.5	164.0	441.9	66.2	435.0	40.2	4671.4	309.5
1989	1538.3	95.9	2111.9	181.3	510.7	58.5	477.4	48.4	4342.1	291.3
1990	1759.3	118.6	2256.6	183.3	480.9	48.2	539.3	60.3	4293.1	264.9
1991	1716.2	104.6	1803.4	131.3	445.6	42.1	491.2	66.4	5254.9	364.9
1992	1954.4	132.1	2098.1	161.0	595.6	69.7	481.5	97.3	4639.2	291.9
1993	2046.5	114.3	2053.4	124.2	485.4	53.1	472.1	67.6	4080.1	249.4
1994	2912.0	141.4	2972.3	188.0	653.5	66.7	525.6	71.1	4529.0	253.6
1995	2854.9	150.3	2757.9	177.6	888.5	90.6	770.6	92.2	4446.4	277.6
1996	3449.0	165.7	2735.9	147.5	834.2	83.1	848.5	118.3	4217.4	234.5
1997	4120.4	194.0	3558.0	194.2	918.3	77.2	688.8	57.2	4112.3	224.2
1998	3183.2	156.5	2520.6	136.8	1005.1	122.9	685.9	63.8	3471.9	191.2
1999	3889.5	202.1	3057.9	230.5	973.4	69.5	716.0	79.1	4411.7	227.9
2000	3520.7	197.9	2907.6	170.5	926.3	78.1	706.8	81.0	4026.3	205.3
2001	3313.5	166.8	3296.0	266.6	712.0	70.2	579.8	52.7	3694.0	214.9
2002	2318.2	125.6	1789.7	125.2	564.8	69.0	486.6	43.8	3524.1	210.3

Appendix G. Breeding population estimates and standard errors (in thousands) for the 10 most abundant species of ducks in the eastern survey area, 1990-2002 [a].

	Mergansers		Mallards		American Black Duck		American Wigeon		Am. Green-winged teal		Lesser Scaup		Ring-necked duck		Goldeneye spp.		Bufflehead		Scoter spp.	
Year	$\hat{N}$	$\hat{SE}$	$\hat{N}$	$\hat{SE}$	$\hat{N}$	$\hat{SE}$	$\hat{N}$	$\hat{SE}$	$\hat{N}$	$\hat{SE}$	$\hat{N}$	$\hat{SE}$	$\hat{N}$	$\hat{SE}$	$\hat{N}$	$\hat{SE}$	$\hat{N}$	$\hat{SE}$	$\hat{N}$	$\hat{SE}$
1990	157.5	48.3	208.6	47.7	160.9	33.5	31.0	22.6	47.1	8.6	135.7	56.2	92.1	28.3	73.3	22.2	99.9	22.9	1.9	1.9
1991	263.9	78.6	169.8	34.5	126.0	35.3	45.4	21.8	42.2	14.4	43.5	16.4	158.1	30.2	138.4	44.3	94.1	32.1	6.4	5.3
1992	128.1	24.3	362.2	54.1	160.3	33.1	15.4	9.3	43.8	13.9	65.6	23.2	251.6	62.3	241.0	55.2	59.0	13.7	3.0	2.3
1993	164.9	23.7	333.8	49.7	124.6	25.6	9.4	7.4	47.4	9.9	288.6	235.3	248.1	65.1	90.2	32.6	13.1	3.6	0.0	0.0
1994	358.4	91.8	238.6	28.8	116.3	20.7	18.9	9.6	169.2	24.0	81.9	31.7	163.5	62.6	55.0	17.4	33.4	14.0	18.3	9.7
1995	376.3	89.7	212.6	41.1	234.5	46.6	13.8	7.9	96.2	14.1	62.0	20.5	195.6	51.0	9.2	3.7	26.5	8.8	5.0	4.8
1996	1083.1	279.6	387.6	63.6	562.2	97.1	34.7	17.0	436.2	86.9	38.5	15.1	611.9	98.7	410.3	169.7	50.6	12.5	23.6	10.5
1997	379.1	53.0	287.6	44.8	434.5	63.1	22.5	11.2	211.5	31.3	16.7	7.2	617.6	151.1	220.6	54.8	22.3	6.7	88.9	50.2
1998	327.4	38.8	363.2	71.3	542.1	55.4	83.6	24.6	299.5	81.1	20.1	10.6	361.8	53.8	715.7	124.7	44.6	10.3	159.4	47.1
1999	290.0	39.4	280.8	39.2	488.7	51.3	121.1	45.6	422.4	62.3	44.9	20.5	453.2	76.0	920.0	167.3	70.5	20.8	47.0	17.7
2000	400.0	54.0	212.3	31.3	396.9	53.9	41.7	20.4	201.6	28.7	19.8	9.1	618.8	71.3	946.5	318.7	49.3	11.3	182.1	59.0
2001	428.7	62.8	285.7	40.8	422.0	48.8	77.5	18.2	220.3	33.5	203.5	92.2	352.8	39.6	1032.2	202.4	95.0	20.9	178.6	49.4
2002	815.2	97.9	295.1	38.1	602.8	86.1	86.6	25.5	604.1	129.0	136.1	48.2	416.0	57.8	954.9	209.2	83.6	21.2	314.4	76.4

[a] Maine estimates were included beginning in 1995. Quebec estimates were included beginning in 1996. Therefore, estimates are only comparable within year groups 1990-94, and 1996-present.

Appendix H. Estimated number of July ponds and standard errors (in thousands) in portions of Prairie Canada and the northcentral U.S.

	Prairie Canada		Northcentral U.S.[a]		Total	
Year	$\hat{N}$	$\hat{SE}$	$\hat{N}$	$\hat{SE}$	$\hat{N}$	$\hat{SE}$
1961	562.0	50.9				
1962	738.2	60.9				
1963	1813.2	98.7				
1964	1308.3	60.0				
1965	2231.0	113.9				
1966	1979.2	111.7				
1967	1498.4	94.5				
1968	802.9	50.7				
1969	1658.6	90.6				
1970	2613.3	143.9				
1971	2016.7	112.2				
1972	1312.5	77.8				
1973	1735.5	146.8				
1974	2753.2	136.1	609.6	45.1	3362.8	143.4
1975	2410.1	121.1	922.8	51.6	3332.9	131.7
1976	2137.6	101.6	786.8	46.8	2924.4	111.8
1977	1391.2	74.1	469.4	38.6	1860.6	83.6
1978	1520.3	63.5	697.1	41.4	2217.4	75.8
1979	1803.0	88.7	754.6	38.5	2557.6	96.7
1980	898.8	52.0	336.1	14.3	1234.9	53.9
1981	873.0	43.6	457.6	22.7	1330.6	49.2
1982	1662.0	85.9	882.2	50.3	2544.2	99.5
1983	2264.1	108.8	957.9	51.7	3221.9	120.4
1984	1270.3	90.1	1270.6	67.1	2540.9	112.4
1985	1563.1	91.2	753.5	39.3	2316.5	99.3
1986	1610.0	71.4	1056.9	46.1	2666.9	85.0
1987	1225.7	69.2	858.0	31.0	2083.7	75.8
1988	1009.2	63.8	518.7	26.4	1527.9	69.0
1989	932.4	47.9	731.3	32.8	1663.7	58.0
1990	1297.6	70.5	663.2	42.0	1960.7	82.1
1991	2562.8	127.2	865.0	40.9	3427.8	133.7
1992	1272.4	55.9	664.2	24.8	1936.8	61.2
1993	2292.5	102.6	1384.8	65.4	3677.4	121.7
1994	2329.9	105.7	1079.7	43.2	3409.6	114.2
1995	1773.4	95.3	1576.5	69.6	3350.0	118.0
1996	2648.2	94.2	1218.2	64.9	3866.4	114.3
1997	2489.7	96.5	1347.1	54.1	3836.8	110.6
1998	2850.7	149.0	1353.3	56.8	4203.9	159.5
1999	2047.1	124.3	1036.7	73.8	3083.8	144.6
2000	2450.8	95.9	1401.5	82.1	3852.4	126.3
2001	1837.9	73.0	1031.7	56.5	2869.7	92.3
2002	996.7	118.7	839.6	43.5	1836.3	126.5

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

Appendix I. Population indices (in thousands) for North American Canada goose populations, 1969-2002.

	Canada goose population														
Year	North Atlantic[a,b]	Atlantic[a,b]	Atlantic Flyway Resident[a]	Southern James Bay[a]	Miss. Valley[a]	Miss. Flyway Giant[a]	Eastern Prairie[a]	Western Prairie & Great Plains[c]	Tall Grass Prairie[c,g]	Short Grass Prairie[d]	Hi-line[d]	Rocky Mountain[d]	Dusky[d]	Cackling[e]	Aleutian[h]
1969/70										151.2	44.2	25.8	22.5		
1970/71									131.1	148.5	40.5	25.4	19.8		
1971/72							124.7		159.6	160.9	31.4	36.6	17.9		
1972/73							137.6		147.2	259.4	35.6	37.1	15.8		
1973/74							119.9		158.5	153.6	24.5	42.8	18.6		
1974/75							144.4		125.6	123.7	41.2	46.7	26.5		0.8
1975/76							216.5		201.5	242.5	55.6	51.6	23.0		0.9
1976/77							163.8		167.9	210.0	67.6	54.3	24.1		1.3
1977/78							179.7		211.3	134.0	65.1	59.0	24.0		1.5
1978/79							99.4		180.5	163.7	33.8	62.9	25.5	64.1	1.6
1979/80									155.2	213.0	67.3	78.1	22.0	127.4	1.7
1980/81							125.5		244.9	168.2	94.4	94.7	23.0	87.1	2.0
1981/82							131.8	175.0	268.6	156.0	81.9	64.3	17.7	54.1	2.7
1982/83							155.1	242.0	165.5	173.2	75.9	68.2	17.0	26.2	3.5
1983/84							135.6	150.0	260.7	143.5	39.5	55.5	10.1	25.8	3.8
1984/85							158.4	230.0	197.3	179.1	76.4	90.3	7.5	32.1	4.2
1985/86							194.8	115.0	189.4	181.0	69.8	68.3	12.2	51.4	4.3
1986/87							203.2	324.0	159.0	190.9	98.1	71.5		54.8	5.0
1987/88		118.0					209.2	272.1	306.1	139.1	66.8	71.4	12.2	69.9	5.4
1988/89			396.0		657.8		210.2	330.3	213.0	284.8	100.1	73.9	11.8	76.8	5.8
1989/90			236.6	82.4	825.0		231.8	271.0	146.5	378.1	105.9	102.4	11.7	110.2	6.3
1990/91			305.7	108.1	620.3		211.8	390.0	305.1	508.5	116.6	86.7		104.6	7.0
1991/92			439.2	91.6	782.3		202.5	341.9	276.3	620.2	140.5	115.7	18.0	149.3	7.7
1992/93		91.3	646.8	77.3	547.1	810.9	157.5	318.0	235.3	328.2	118.5	74.7[f]	16.7	164.3	11.7
1993/94		40.1	647.5	95.7	741.2	1002.9	210.8	272.5	224.2	434.1	164.3	77.3	11.0	152.5	15.7
1994/95		29.3	779.2	94.0	796.2	1030.6	204.6	352.5	245.0	697.8	174.4	91.8	8.5	161.4	19.2
1995/96	99.6	46.1	932.6	123.0	593.9	1132.4	190.4	403.3	264.0	561.2	167.5	117.0		134.6	24.6
1996/97	64.4	63.2	1013.3	95.1	650.8	1038.7	199.3	453.4	262.9	460.7	148.5	98.5	11.2[h]	205.1	24.0
1997/98	53.9	42.2	970.1	117.1	370.5	1212.7	125.9	482.3	331.8	440.6	191.0	105.4	21.3[h]	148.6	29.0
1998/99	96.8	77.5	999.5	136.6	860.8	1234.1	206.7	467.2	548.2	403.2	119.5	114.4	13.8[h]	181.4	28.6
1999/00	58.0	93.2	1015.9	89.1	865.2	1497.4	275.1	594.7	295.7	200.0	270.7	102.3	15.5[h]	178.0	33.5
2000/01	57.8	146.7	1011.3	102.7	386.6	1371.3	215.4	682.7	149.1	164.1	252.9	110.6	17.3[h]	186.9	29.8
2001/02	62.0	164.8	966.0	76.3	544.0	1460.0[h]	216.3	710.3	504.7	160.9	217.1	106.0	17.2[h]	136.1	36.8

[a] Surveys conducted in spring
[b] Number of breeding pairs
[c] Surveys conducted in December until 1998; in 1999 a January survey replaced the December count
[d] Surveys conducted in January
[e] Surveys conducted in fall through 1998; from 1999 to present a fall index is predicted from breeding ground surveys (total indicated pairs)
[f] Survey incomplete
[g] Only TGPP counted in Central Flyway range are included
[h] Indirect or preliminary estimate

Appendix J. Population indices (in thousands) for light goose, greater white-fronted goose, brant, emperor goose, and tundra swan populations during 1969-2002.

	Light geese				White-fronted geese		Brant		Emperor geese[a]	Tundra swans	
Year	Greater snow geese[a]	Mid-continent[b]	Western Central Flyway[c]	Western Arctic & Wrangel[d]	Mid-continent[d]	Pacific[e]	Atlantic[c]	Pacific[c, f]		Western[c]	Eastern[c]
1969/70	89.6	717.0						141.7		31.0	55.0
1970/71	123.3	1070.1					151.0	149.2		98.8	58.2
1971/72	134.8	1313.4					73.2	124.8		82.8	62.8
1972/73	143.0	1025.3	11.6				40.8	125.0		33.9	57.1
1973/74	165.0	1189.8	16.2				87.7	130.7		69.7	64.2
1974/75	153.8	1096.6	26.4				88.4	123.4		54.3	66.6
1975/76	165.6	1562.4	23.2				127.0	122.0		51.4	78.6
1976/77	160.0	1150.3	33.6				73.6	147.0		47.3	76.2
1977/78	192.6	1966.4	31.1				42.8	162.9		45.6	70.2
1978/79	170.1	1285.7	28.2			73.1	43.5	129.4		53.5	78.6
1979/80	180.0	1398.1	30.5	528.1		93.5	69.2	146.4		65.2	60.4
1980/81	170.8	1406.7	37.6	204.2		116.5	97.0	194.2	93.3	83.6	92.8
1981/82	163.0	1794.0	50.0	759.9		91.7	104.5	121.0	100.6	91.3	72.9
1982/83	185.0	1755.4	76.1	354.1		112.9	123.5	109.3	79.2	67.3	86.5
1983/84	225.4	1494.5	60.1	547.6		100.2	127.3	133.4	71.2	61.9	81.1
1984/85	260.0	1973.0	63.0	466.3		93.8	146.3	144.8	58.8	48.8	93.9
1985/86	303.5	1449.3	96.6	549.8		107.1	110.4	136.2	42.0	66.2	90.9
1986/87	255.0	1913.8	87.6	521.7		130.6	109.4	108.9	51.7	52.8	94.4
1987/88		1750.5	46.2	525.3		161.5	131.2	147.0	53.8	59.2	76.2
1988/89	363.2	1956.1	67.6	441.0		218.8	138.0	135.2	45.8	78.7	90.6
1989/90	368.3	1724.3	38.6	463.9		240.8	135.4	151.6	67.6	40.1	89.7
1990/91	352.6	2135.8	104.6	708.5		236.5	147.7	131.7	71.0	47.6	97.4
1991/92	448.1	2021.9	87.8	690.1		230.9	184.8	117.7	71.3	63.7	109.8
1992/93	498.4	1744.2	45.1	639.3	622.9	295.1	100.6	124.4	52.5	62.6[g]	76.6
1993/94	591.4	2200.8	84.9	569.2	676.3	324.8	157.2	130.0	57.3	79.4	84.5
1994/95	616.6	2725.1	146.4	478.2	727.3	277.5	148.2	133.7	51.2	52.9[g]	81.3
1995/96	669.1	2398.1	93.1	501.9	1129.4	344.1	105.9	126.9	80.3	98.1	79.0
1996/97	657.5	2850.9	127.2	366.3	742.5	319.0	129.1	157.9	57.1	122.5	86.1
1997/98	695.6	2977.2	103.5	416.4	622.2	413.1	138.0	138.4	39.7	70.5	96.6
1998/99	803.4	2575.7	236.4	354.3	1058.3	393.2	171.6	129.2	54.6	119.8	109.0
1999/00	813.9	2397.3	137.5	579.0	963.1	353.8	157.2	135.0	62.6	89.6	103.1
2000/01	837.4	2341.3	105.8	656.8	1067.6	431.8	145.3	124.7	84.4	87.3	98.2
2001/02	639.3[h]	2696.1	99.9	448.1	712.3	358.0	181.6	136.2	58.7	58.7	104.1

[a] Surveys conducted in spring.
[b] Surveys conducted in December until 1997/98; surveys since 1998/99 were conducted in January.
[c] Surveys conducted in January.
[d] Surveys conducted in autumn.
[e] Surveys conducted in fall through 1998; from 1999 to present a fall index is predicted from breeding ground surveys (total indicated birds).
[f] Beginning in 1986, counts of brant in Alaska were included with remainder of Flyway.
[g] Survey was incomplete.
[h] Preliminary estimate.