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Waterfowl Population Status, 2000

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Waterfowl

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WATERFOWL POPULATION STATUS, 2000

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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 2000-2001 hunting season.

Cover art: Mottled Duck, by Adam Grimm, winner of the 2000-2001 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, 49 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 Khristi A. Wilkins, Pamela R. Garrettson, Evan G. Cooch, and Graham W. Smith. The authors compiled information from the numerous sources to provide an assessment of the status of waterfowl populations.

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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 41.8 ± 0.7 million birds. This was similar (P=0.12) to last year's record high estimate of 43.4 ± 0.7 million birds, and 27% above the long-term (i.e., 1955-99) average (P<0.01). Mallard (*Anas platyrhynchos*) abundance was 9.5 ± 0.3 million, which is 12% below (P<0.01) the 1999 estimate of 10.8 ± 0.3 million and 27% above the long-term average (P<0.01). Blue-winged (*Anas discors*) and green-winged teal (*Anas crecca)* abundances were both at record high levels this spring. Blue-winged teal abundance was 7.4 ± 0.4 million, which was similar to last year's estimate of 7.1 ± 0.4 million (P=0.61) and 69% above the long-term average (P<0.01). Green-winged teal abundance was 3.2 ± 0.2 million, 80% above the long-term average (P<0.04) and 21% higher than last year (P=0.03). Gadwall (*Anas strepera*; 3.2 ± 0.2 million, +100%), northern shovelers (*Anas clypeata*; 3.5 ± 0.2 million, +73%), and redheads (*Aythya americana*; 0.9 ± 0.1 million, +50%) were all above their long-term averages (P<0.01), while northern pintails (*Anas acuta*; 2.9± 0.2 million, -33%) and scaup (*Aythya marila* and *A. affinis* combined; 4.0 ± 0.2 million, -25%) remained below their long-term averages (P<0.01). American wigeon (*Anas americana*) and canvasback (*Aythya valisineria*) estimates were similar to those of last year (P ³0.42) and to long-term averages (P>0.07). May conditions in the traditional survey area were generally drier than last year. The estimate of May ponds in Prairie Canada and the U.S. combined was 3.9 ± 0.1 million, down 41% from 1999 and 20% below the long-term average (P<0.01). The eastern survey area comprises strata 51-56 and 62-69. The 2000 total duck population estimate for the eastern survey area was 3.2 ± 0.3 million birds. This was essentially identical to last year's total duck estimate of 3.2 ± 0.2 million birds. Abundances of individual species were similar to last year, with the exception of scoters (*Melanitta* spp.; 182 ± 59 thousand, +288%, P=0.03) and green-winged teal (202 ± 29 thousand, -52%, P<0.01)). The total duck fall flight index for 2000 is 90 million birds. This is 13 percent lower than last year's record fall flight. Because of additions to the survey area for which we do not have production information, we propose to stop calculating the traditional fall-flight index for total ducks in the future. The Service may consider other alternatives to provide a reflection of duck abundance in the fall. The midcontinent mallard fall flight is predicted to be 11.3 million mallards, 16.2% lower than that of last year (P<0.01).

This report summarizes the most recent information about the status of North American duck populations and their habitats 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 at the time 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 northcentral 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, an area of approximately 0.7 million sq. miles. Within the eastern area this year, data from strata 63-69 (encompassing all or parts of New Brunswick, Nova Scotia, Prince Edward Island, Newfoundland, Labrador, and Quebec) are being reported for the first time, representing an additional 0.5 million square miles of survey coverage in the East. These new areas have been surveyed since 1996, with the exception of stratum 69 in 1997. Because of the addition of new survey areas, duck species estimates in the East published here are not the same as those published in earlier reports.

In Prairie Canada and the northcentral 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 since 1996 in the eastern survey area, 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 northcentral U.S. are only available 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. Habitat-condition information was primarily supplied by biologists in the survey areas. However, much ancillary

weather information was obtained from one serial publication and two Internet sites, referenced at the end of this document.

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 estimates of the number of duck broods (brood index) and the number of ponds. Because ground counts are not conducted concurrently with aerial surveys, estimates of the numbers of duck broods and ponds are not corrected for visibility bias. The coefficients of variation for the May pond estimates are used to estimate the precision of the July pond counts.

Total Duck Species Composition

In the traditional survey area, total ducks excludes scoters (*Melanitta* spp.), eiders (*Somateria* and *Polysticta* spp.), oldsquaws (*Clangula hyemalis*) mergansers (*Mergus* and *Lophodytes* spp.), and wood ducks (*Aix sponsa*). This is because the traditional survey area does not cover a large portion of their breeding range. However, this is not the case in the eastern survey area. Therefore, in the East, total duck species composition has been redefined to include scoters and mergansers, because they are important breeding species in this survey area. Canvasbacks, redheads, and ruddy ducks (*Oxyura jamaicensis*) have been 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 previously. Wood ducks are also not included in the total duck estimate for the East; even though this species breeds over much of the eastern survey area, their wooded habitats limit their detection from the air.

Fall-flight indices

Total ducks: The fall-flight index of total ducks is based on information from the breeding population and production surveys in the traditional survey area and breeding population estimates from six states – California, Colorado, Minnesota, Nebraska, Wisconsin, and Wyoming. However, this year, Wyoming and Colorado did not conduct a breeding waterfowl survey. Wyoming has discontinued its large-scale waterfowl surveys; Colorado will continue its survey next year. For these two states, long-term averages were used to estimate 2000 abundances. This index is calculated using base production rates that represent the relative recruitment potential from each survey area. For regions encompassing parts of Canada and the northcentral U.S. (strata 21-50), production rates are adjusted annually using production indices. Constant values are used for production in Alaska (strata 1-11), portions of northern Canada (strata 12-18, 20, and 75-77), and states conducting cooperative surveys because year-specific production information is not available. Recent analyses suggest that base production rates used historically are too high given our current knowledge of changes in duck abundance and survival. Because production surveys are not conducted annually throughout all areas and no corrections for visibility bias are calculated, the accuracy and precision of the fall-flight estimates are unknown. Therefore the fall-flight index may be of marginal utility.

The fall-flight has historically only been calculated from the traditional survey area. However, geographical coverage of the survey was expanded in the 1990s to include all of eastern Canada. Species compositions that are included in the computation of total duck numbers differ among the areas, reflecting different geographical ranges of the species. Production information is currently not available from the expanded survey area. Because of these changes, we propose to stop calculating the traditional fall-flight index for total ducks in the future. The number no longer reflects our current knowledge, nor is it used explicitly to guide management decisions. The Service may consider other alternatives to provide a reflection of duck abundance in the fall.

Mallards: Mallard fall-flight indices predict the size of the fall population originating from the midcontinent region of North America. For management purposes, the mid-continent population is comprised of mallards originating from the traditional survey areas, as well as Michigan, Minnesota, and Wisconsin. The 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 fall age ratio is predicted using the relationship between fall age ratios, breeding population, and May pond numbers. The fall-flight index represents a weighted average of the fall flights predicted by the four alternative models of mallard population dynamics, using current model probabilities as weights. The 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

1999 in Review

Last year was generally warm – the third warmest on record in Canada and second warmest in the U.S. Canada also experienced a fairly wet year in 1999 – the fifth wettest on record. Only northern Alberta was drier than normal. The U.S. experienced above-normal precipitation in the Plains and both coasts, and below-normal precipitation in the Southwest, parts of Oregon and Idaho, and much of southern Texas.

The winter of 1998-1999 was again one of the warmest on record for much of the United States and Canada.

Temperatures were above normal in almost all regions of Canada. Temperatures in the U.S. were well above average from the Northern Plains to the Northeast, and above average in western and southwestern states. Alaska experienced extreme cold from January through early February, with record low temperatures set in many parts of the state. Canada experienced near-normal precipitation on average, but variability among regions was high. The prairie provinces, Ontario, Quebec, and the Maritimes were drier than normal, while British Columbia and the Northwest Territories were wetter than average. The winter of 1998-1999 was warmer and drier than usual across southern Ontario and southern Quebec. Although precipitation was average for the U.S. as a whole, the Pacific Northwest received record amounts of rain and snow, while much of the East returned to drought conditions.

The spring of 1999 was very cool in the West, due to the La Niña weather pattern. This delayed snowmelt and the arrival of spring by 1-2 weeks in Alaska, British Columbia, Washington and Oregon. Duck breeding-habitat conditions in the traditional survey area were generally good to excellent. An early, warm spring and copious precipitation resulted in abundant ponds and excellent nesting cover in most of the Dakotas, northern Saskatchewan, the Northwest Territories, and western Ontario. In contrast, southern and central Alberta, central Saskatchewan, and western Montana were dry, and an early spring limited nesting habitat. In Alaska, spring was as much as 2 weeks late. The estimated number of May ponds in Prairie Canada and the northcentral U.S. was 6.7 million in 1999 (Appendix D). This estimate was 46% greater than that of 1998 and 37% above the long-term average ($P<0.01$). Pond numbers in Prairie Canada were 53% above those of 1998 ($P<0.01$) and 12% above the long-term average ($P=0.09$). Pond numbers in the U.S. were +38% over 1998 and +94% over the long-term average ($P<0.01$).

While the prairies had generally abundant water last May, much of the eastern survey area was entering a drought. Large portions of the eastern survey area were relatively dry, especially Maine, parts of the Atlantic Provinces, southern Quebec, and southern Ontario. The northern portions of the eastern survey area were in good-to-excellent condition for breeding, but had little suitable brood-rearing habitat.

In 1999, the estimate of total ducks (excluding scoters, eiders, oldsquaws, mergansers, and wood ducks) in the traditional survey area was 43.4 million birds. This record-high estimate was +11% above the 1998 estimate and 32% above the long-term average ($P<0.01$). In the eastern survey area, the estimate of total ducks was 3.2 million, which was unchanged from that of 1998 and the 1996-98 average ($P>0.37$).

In the prairies, the summer of 1999 was warm and wet. The July Production and Habitat Survey indicated that the total number of July ponds was 5.2 million, the largest on record. This was 24% greater than the previous year and 95% above the long-term average ($P<0.01$). The estimate for Prairie Canada was not different from the 1999 estimate, but was 62% above the long-term average ($P<0.01$). The number of July ponds in the northcentral U.S. was a record high (2.4 million), and was 80% greater than 1999 and 174% above the long-term average ($P<0.01$). The number of broods counted in Prairie Canada was 30% above the long-term average in Prairie Canada and the northcentral U.S. combined. In the eastern survey area, the drought worsened. The Mid-Atlantic region experienced its worst drought since the mid-1960s, and a number of states instituted water restrictions. Temperatures were normal to above-normal across most of the U.S. and Canada.

In much of the U.S. and Canada, conditions remained warmer than average in the fall of 1999 and winter of 1999-2000. The Maritimes, northern Ontario, and much of the northeastern U.S. received much needed rain in the fall. Precipitation was low in Alberta, Saskatchewan, southwestern Nunavut, northern Quebec. The midwestern U.S. remained very dry, with drought conditions continuing to expand westward into the central and northern plains. In contrast to these dry conditions, numerous heavy storms resulted in above-normal precipitation in southeastern and south-central Alaska, and along the Pacific Northwest coast throughout the late fall and early winter.

2000 Breeding Habitat Conditions, Populations, and Production

OVERALL HABITAT AND POPULATION STATUS

March was warm across most of Canada and the U.S., suggesting an early spring. In fact, the spring of 2000 and January-May period were the warmest on record for the U.S. These seasonally high temperatures contributed to worsening drought conditions in parts of the Southeast, Midwest, and Southwest. The northeastern U.S., however, received above-average precipitation, helping to make up for the moisture deficit from the previous summer's drought. This year in the traditional survey area, conditions were much drier than during the previous 6 years. These dry conditions are reflected in the estimates of May ponds (Prairie Canada and U.S. combined). This year's estimate was 3.9 ± 0.1 million ponds, down 41% from 1999 ($P<0.01$) and 20% below the 1974-99 average ($P<0.01$) (Fig. 1, Table 1, Appendix D). The number of ponds in Prairie Canada was 2.4 ± 0.1 million, 37% below that of last year and 30% below the long-term average ($P<0.01$). The number of ponds in the northcentral U.S. was 1.5 ± 0.1 million, 46% below that of 1999 ($P<0.01$) and similar to ($P=0.95$) the long-term average. Habitat conditions ranged from poor in much of Alberta, parts of Montana, and western Saskatchewan to fair-to-good in most other areas. Only portions of northern Manitoba and

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

			Change from 1999			Change from LTA	
Survey Area	1999	2000	%	*P*	LTA[a]	%	*P*
Prairie Canada							
S. Alberta	716	553	-23	0.071	741	-25	<0.001
S. Saskatchewan	2535	1404	-45	<0.001	2019	-30	<0.001
S. Manitoba	611	466	-24	0.008	690	-33	<0.001
Subtotal	3862	2422	-37	<0.001	3450	-30	<0.001
Northcentral U.S.							
Montana and Western Dakotas	672	429	-36	0.001	540	-21	0.001
Eastern Dakotas	2170	1095	-50	<0.001	978	+12	0.221
Subtotal	2842	1524	-46	<0.001	1518	0	0.947
Grand Total	6704	3947	-41	<0.001	4953	-20	<0.001

[a] Long-term average. Prairie Canada, 1961-1999; northcentral U.S. and Grand Total, 1974-99.

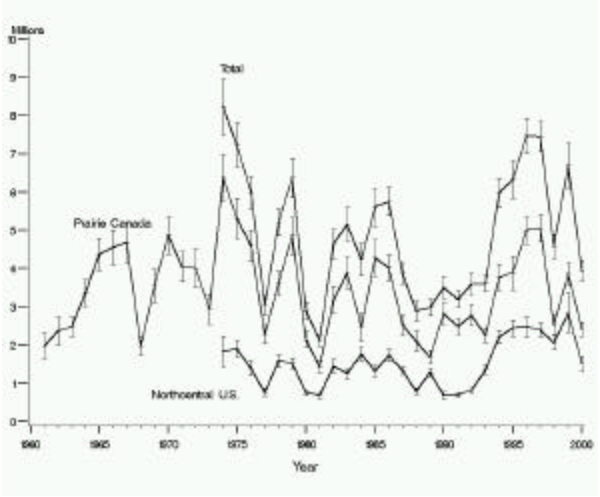


Figure 1. Number of ponds in May and 95% confidence intervals for Prairie Canada and the northcentral U.S.

the Dakotas had excellent habitat conditions. In Alaska, a significant cooling trend resulted in ice breakup 2-3 weeks later than normal. In this area, late springs generally result in lower production.

Winter and spring also were warm and dry in the eastern survey area. A seemingly early spring cooled down markedly, especially in Labrador, Newfoundland, and eastern Quebec. In these easternmost regions, spring was 2-3 weeks behind normal. Water levels in lakes and ponds in southwestern Ontario, Maine, Nova Scotia, and New Brunswick were higher this year than last year, when the East was entering a drought. However, drier-than-normal conditions persisted in southern Ontario and southern Quebec. In southwest Ontario, Maine, and the Atlantic Provinces, heavy thunderstorms in May caused severe flooding and may have destroyed nests. Overall, habitat conditions in the east were generally good, with the exception of some areas of southern Ontario and southern-central Quebec, where low water levels resulted in fair-to-poor habitat conditions. This year, the outlook for production in the East generally is good.

In 2000, the estimated breeding population of all ducks (excluding scoters, eiders, oldsquaws, mergansers, and wood ducks) in the traditional survey area was 41.8 ± 0.7 million birds (Table 2). This was similar (P=0.12) to last year's record estimate of 43.4 ± 0.7 million birds, 27% above the long-term (1955-99) average (P<0.01), and the fourth highest total-duck estimate since 1955. Approximately 59% of the ducks were found in the prairie-pothole region (strata 26-49), a percentage similar to that which occurred during the 1970s (60%) when wetland and upland conditions in this region were considered good. Total-duck numbers increased over 1999 estimates and were above long-term averages in Alaska-Yukon Territory-Old Crow Flats and the eastern Dakotas. Numbers decreased from last year in central and northern Alberta-northeastern British Columbia-NorthwestTerritories, southern Saskatchewan, and Montana-western Dakotas (P<0.01), and were below the long-term average in southern Alberta (P<0.01). The 2000 total-duck population estimate for the eastern survey area (excluding canvasbacks, redheads, ruddy ducks, eiders, oldsquaw and wood ducks) was 3.2 ± 0.3 million birds (Table 2). This was similar to last year's total duck estimate of 3.2 ± 0.2 million birds. In other areas where surveys are conducted and measures of precision for estimates are provided (northeastern U.S., Wisconsin, Michigan, California, Washington, and British Columbia), total duck abundances were similar to those of 1999 (P≥0.10) and their long-term averages (P≥0.31; Table 2, Appendix E). Of the states that do not have measures of precision for total-duck estimates, Minnesota's estimate increased over last year, while Nebraska's decreased (Appendix E).

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 9.5 ± 0.3 million, which is 12% below last year's estimate of 10.8 ± 0.3 million (P<0.01) estimate and 27% above the long-term average (P<0.01) (Table 3). Mallard numbers were significantly below levels in two regions of the traditional survey area - central and northern Alberta-northeastern British Columbia and southern Manitoba (P≤0.01), and below the long-term average in southern Alberta (P<0.01). However, mallards were well above long-term averages in Alaska-Yukon Territory-Old Crow Flats, Montana-western Dakotas, and the eastern Dakotas (P<0.01). In other areas where surveys are conducted and measures of precision for estimates are provided (the same states as above, as well as Minnesota), mallard abundances were similar to those of 1999 (P≥0.11) and their long-term averages (P≥0.26), with the exception of Wisconsin, where mallard abundance increased over 1999 levels (P=0.02; Table 3, Appendix E). In Nebraska, where measures of precision are unavailable, mallard numbers decreased from those in 1999 (Appendix E).

Blue-winged and green-winged teal abundances were both at their highest levels since the survey was started in 1955. Blue-winged teal abundance was 7.4 ± 0.4 million. This was similar to last year's estimate of 7.1 ± 0.4 million (P=0.61), and 69% above the long-term average (P<0.01). Green-winged teal abundance was 3.2 ± 0.2 million, 80% above the long-term average (P<0.04) and 21% higher than last year (P=0.03). Green-winged teal was the only duck species whose estimates differed from that of 1999. Gadwall (3.2 ± 0.2 million, +100%), northern shovelers (3.5 ± 0.2 million, +73%), and redheads (0.9 ± 0.1 million, +50%) all were above their long-term averages (P<0.01), while northern pintails (2.9± 0.2 million, -33%) and scaup

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

Region	1999	2000	Change from 1999 %	Change from 1999 *P*	LTA[b]	Change from LTA %	Change from LTA *P*
Traditional Survey Area							
Alaska - Yukon Territory - Old Crow Flats	5185	6727	+30	<0.001	3260	+106	<0.001
C. & N. Alberta - N.E. British Columbia - Northwest Territories	8316	6900	-17	0.001	7306	-6	0.170
N. Saskatchewan - N. Manitoba - W. Ontario	3839	3468	-10	0.239	3554	-2	0.732
S. Alberta	3315	3485	+5	0.507	4482	-22	<0.001
S. Saskatchewan	9687	7665	-21	<0.001	7423	+3	0.370
S. Manitoba	1682	1486	-12	0.110	1544	-4	0.518
Montana and Western Dakotas	2505	1726	-31	<0.001	1622	+6	0.251
Eastern Dakotas	8907	10382	+17	0.014	3841	+170	<0.001
Total	43436	41838	-4	0.125	33033	+27	<0.001
Eastern Survey Area	3214	3204	0	0.981	3043	+5	0.661
Other Regions							
British Columbia[c]	8	8	-6	0.787	7	+4	0.868
California	825	625	-24	0.101	671	+7	0.352
Michigan	650	746	+15	0.543	741	+1	0.970
Northeastern U.S.[d]	1521	1926	+29	0.478	1356	+42	0.312
Washington	200	144	-28	0.970	163	-12	0.800
Wisconsin	434	770	+77	<0.010	366	+110	[e]

[a] Excludes eiders, oldsquaws, wood ducks, scoters, and mergansers in traditional survey area; excludes eiders, oldsquaws, wood ducks, redhead, canvasbacks and ruddy ducks in eastern survey area; species composition for other regions varies.
[b] Long-term average. Traditional survey area=1955-1999; eastern survey area=1996-1999; 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 DE, CT, MD, MA, NH, NJ, NY, PA, RI, VT, and VA.
[e] Not estimable from current survey.

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

Region	1999	2000	Change from 1999 %	Change from 1999 *P*	LTA [a]	Change from LTA %	Change from LTA *P*
Traditional Survey Area							
Alaska - Yukon Territory - Old Crow Flats	713	770	+8	0.510	305	+153	<0.001
C. & N. Alberta - N.E. British Columbia - Northwest Territories	2041	1288	-37	<0.001	1106	+16	0.135
N. Saskatchewan - N. Manitoba - W. Ontario	1151	1049	-9	0.529	1178	-11	0.291
S. Alberta	1032	833	-19	0.158	1150	-28	<0.001
S. Saskatchewan	2529	2267	-10	0.202	2113	+7	0.257
S. Manitoba	514	368	-29	0.013	372	-1	0.902
Montana and Western Dakotas	689	622	-10	0.478	502	+24	0.049
Eastern Dakotas	2137	2273	+6	0.562	726	+213	<0.001
Total	10806	9470	-12	0.003	7450	+27	<0.001
Eastern Survey Area	281	212	-24	0.172	330	-36	0.005
Other Regions							
British Columbia [b]	1	1	-15	0.204	1	-7	0.594
California	534	443	-17	0.418	420	-5	0.734
Michigan	419	345	-18	0.452	434	-17	0.264
Minnesota	316	318	-3	0.980	206	+55	[d]
Northeastern U.S. [c]	880	758	-14	0.114	754	+1	0.942
Washington	86	48	-45	0.980	56	-14	0.620
Wisconsin	222	368	+66	0.020	141	+160	[d]

[a] Long-term average. Traditional survey area=1955-1999; eastern survey area=1996-1999; 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 DE, CT, MD, MA, NH, NJ, NY, PA, RI, VT, and VA.
[d] Value for test statistic was not available.

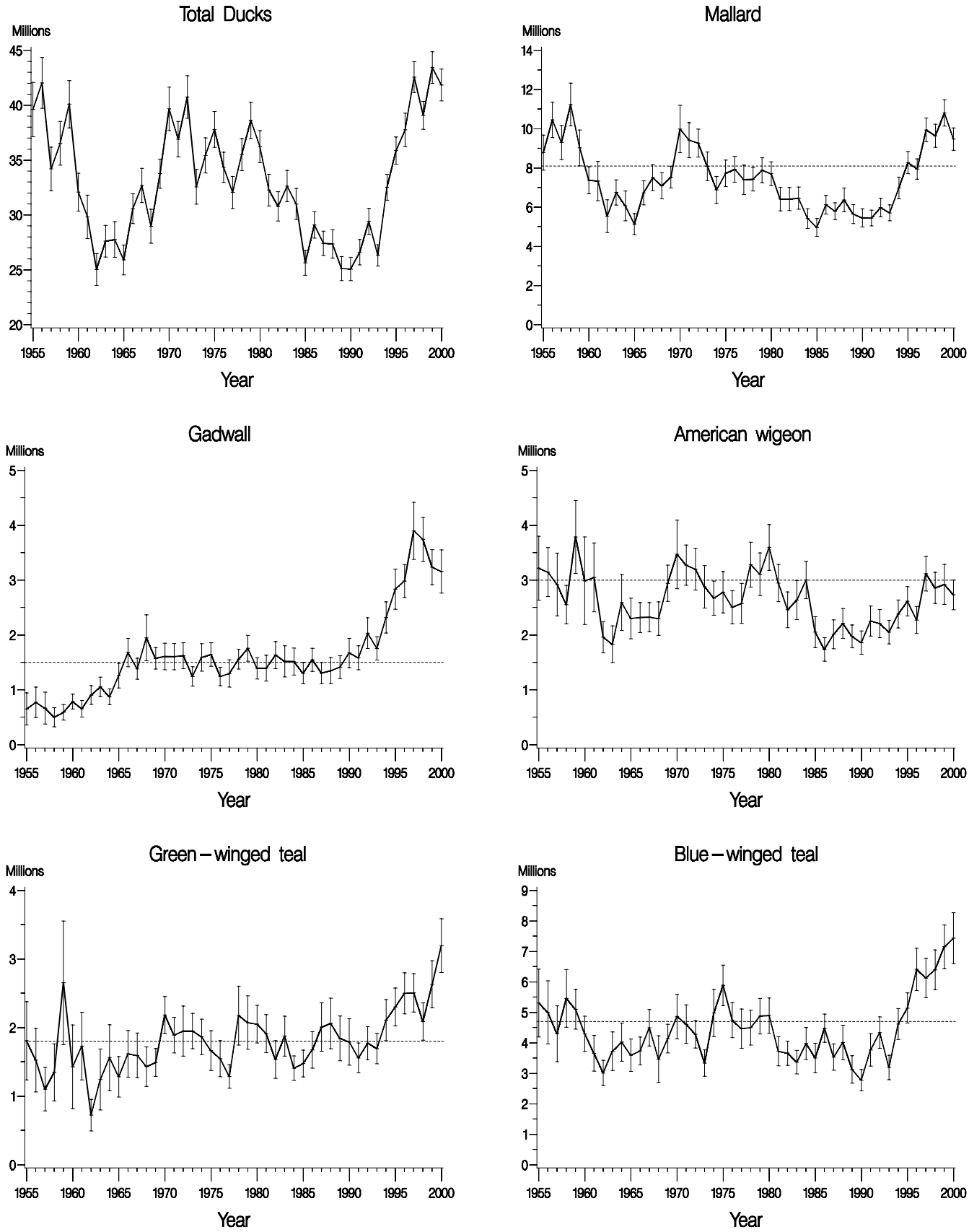
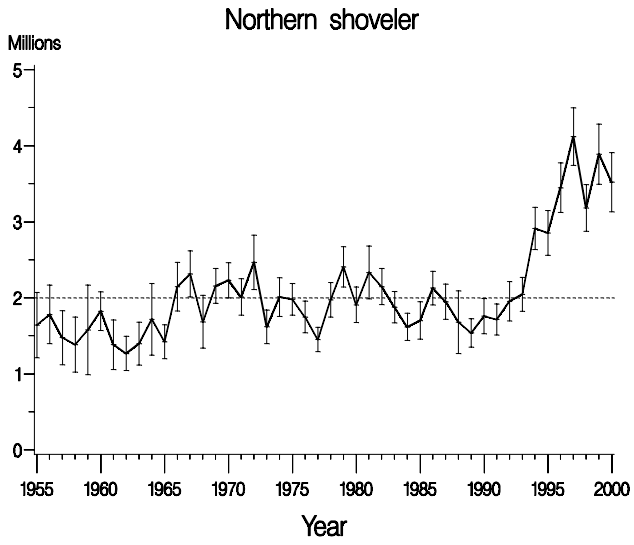
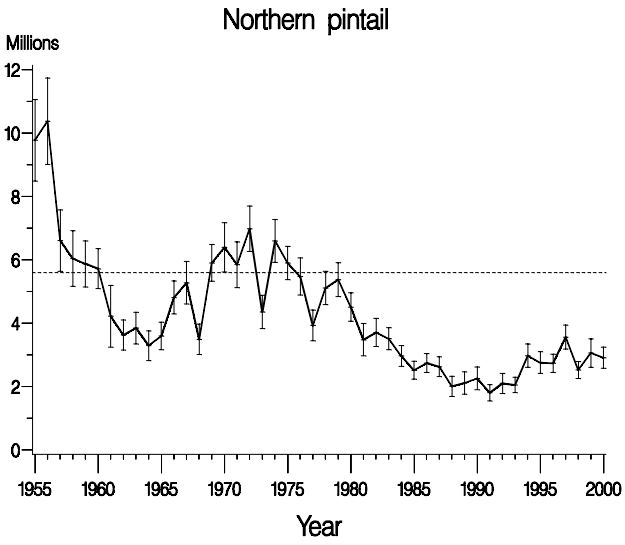
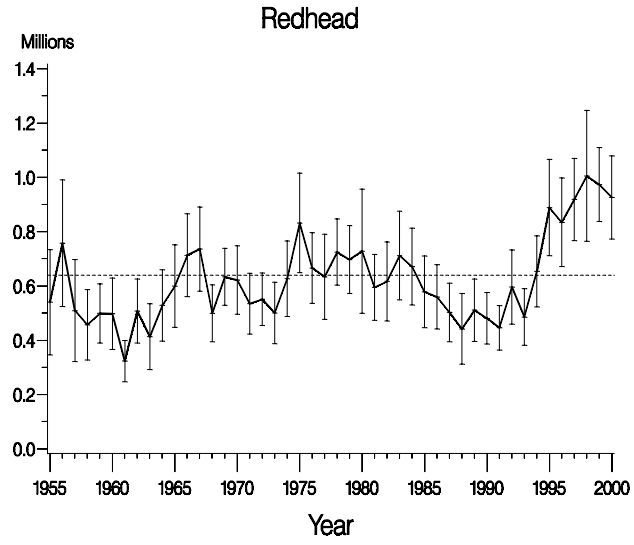
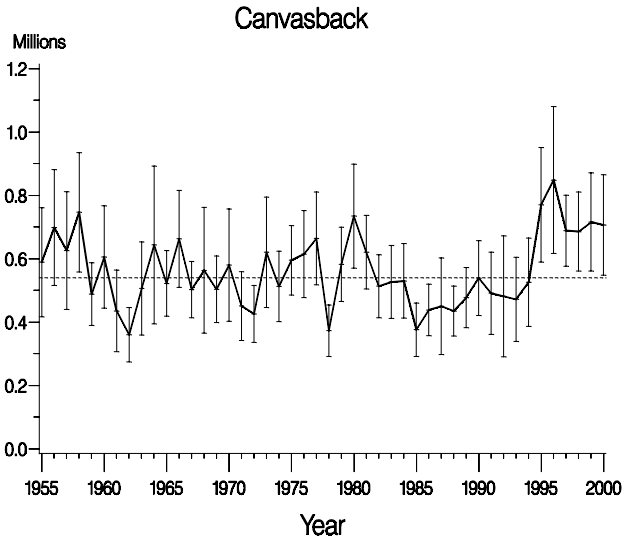


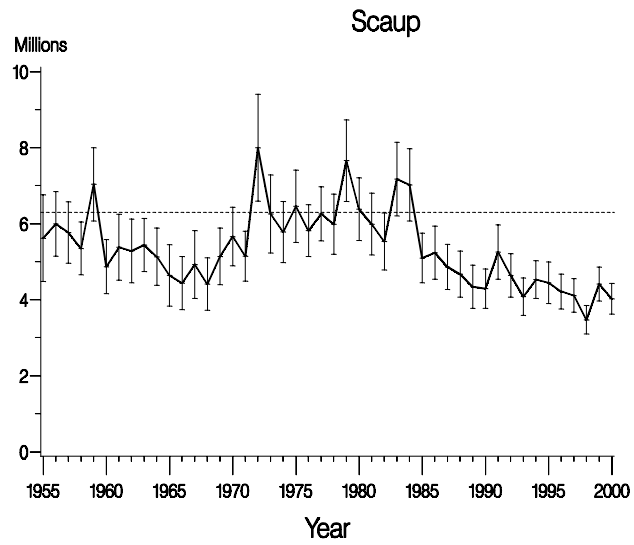
Fig. 2. Breeding population estimates, 95% confidence intervals, and North American Waterfowl Management Plan population goal (dashed line) for selected species for the traditional survey area (strata 1–18, 20–50, 75–77).











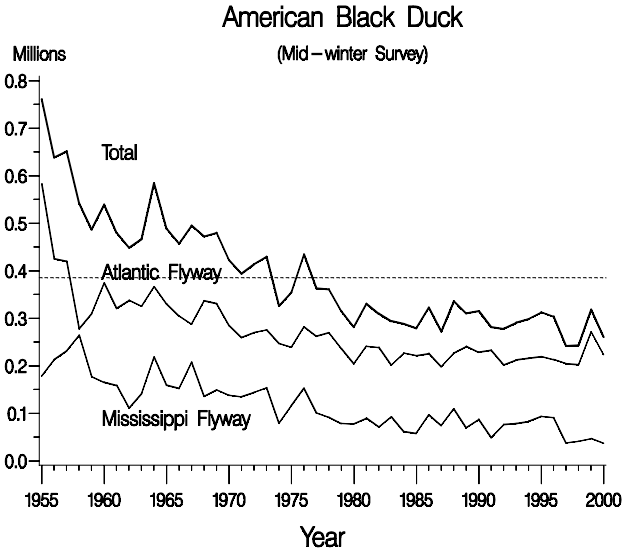


Fig. 2 (continued).

(4.0 ± 0.2 million, -25%) remained below their long-term averages ($P<0.01$). Half of the continental pintail population was found in the Alaska-Yukon Territory-Old Crow region, indicating a possible overflight from the prairies, which generally results in poor pintail reproduction. American wigeon and canvasback estimates were similar to those of last year ($P\geq0.42$) and to long-term averages ($P>0.07$). Shovelers and redheads were both at their third highest levels since 1955.

Annual breeding population estimates for 10 principal species in the eastern survey area are provided in Table 6 and Appendix G. Abundances of individual species in the eastern survey area were similar to last year, with the exception of scaup (116 ± 32 thousand, +296%, $P=0.01$), scoters (182 ± 59 thousand, +288%, $P=0.03$), and green-winged teal (202 ± 29 thousand, -52%, $P<0.01$)).

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 ducks decreased in both flyways from 1999 counts. Over both flyways, 260,000 black ducks were estimated from mid-winter inventories. This represents a decrease of 18% from 1999 (318,000), and a decrease of 10% from the 1990-99 mean (288,000). In the Atlantic Flyway, the mid-winter estimate decreased 18% from 271,000 in 1999 to 223,000 in 2000. This is, however, still 2% above the 1990-99 mean (220,000). In the Mississippi Flyway, the mid-winter estimate decreased 21% from 47,000 in 1999 to 37,000 in 2000; which is still 46% below the most recent 10-year mean (68,000). In the eastern survey area, the 2000 estimate for black ducks (397,000) was unchanged from the 1999 estimate (489,000) or the 1996-99 average (507,000; Table 6).

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 at low abundances 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 index of regional populations of the species. Trends suggest that numbers of wood ducks increased 4-6% per year over the long-term (1966-99) and short-term (1980-99). Specifically, in the Atlantic Flyway, the BBS indicates a 5.8% annual increase in wood ducks over the long-term and a 5.5% annual increase over the short-term ($P<0.01$). In the Mississippi Flyway, the BBS indicates a 5.0% annual increase over the long-term and a 4.4% annual increase over the short-term ($P<0.01$; J. Sauer, USGS/ BRD, unpubl. data).

Weather and habitat conditions during the summer months can influence waterfowl production. Throughout June, much of the prairies received heavy rains. Areas receiving abundant precipitation included parts of Saskatchewan (except for the very dry west-central part of the province), Manitoba, northern and central Alberta, southeastern Montana, and North Dakota. In many areas, this precipitation increased breeding habitat quantity and quality relative to May conditions, especially for late nesting species, and enhanced brood-rearing habitats. However, heavy rains in northern Saskatchewan and northern Manitoba may have caused flooding and loss of nests; the outlook for production actually deteriorated in northern Manitoba due to flooding. In southern Saskatchewan and Montana, improved habitat conditions did not help production, because either the birds had already left the area by the time the rains came (Saskatchewan) or most of the rain soaked into the ground (Montana). In general, July habitat conditions were much improved over May conditions in most of the prairies, with the exceptions of South Dakota and southern Alberta. However, habitat improvements probably did not improve production in southern Saskatchewan, Montana, northern Saskatchewan, or northern Manitoba.

Results of the July Production Survey indicate that the number of ponds in Prairie Canada and the northcentral U.S. combined was 3.9 ± 0.1 million ponds (Fig. 3, Table 4). This, the fourth highest historical estimate for the region, was 26% below last year's record high estimate of 5.2 ± 0.3 million ponds, and 37% above the long-term average. The number of July ponds in Prairie Canada was 2.5 ± 0.1 million. This was unchanged from last year's estimate of 2.8 ± 0.1 million but 48% above the long-term average. The number of July ponds in the northcentral U.S. was 1.4 ± 0.1 million, the third highest historical estimate for the region. This was 42% below last year's record high estimate of 2.4 ± 0.2 million, and 48% above the long-term average. The number of broods in the northcentral U.S. and Prairie Canada combined was 12% below last year's estimate, but 25% above the long-term average. The number of broods in Prairie Canada and the

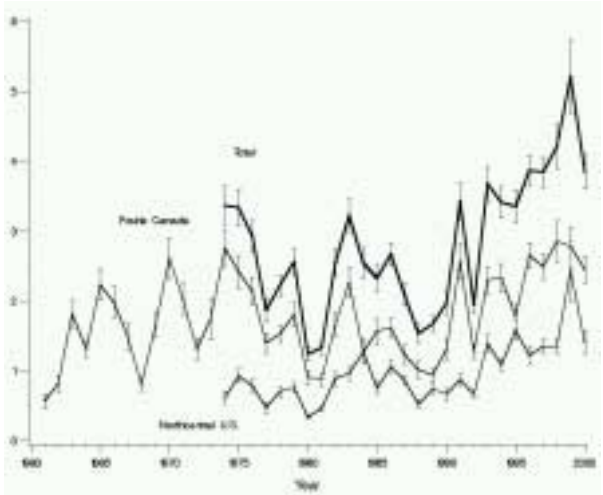


Figure 3. Number of ponds in July and 95% confidence intervals for Prairie Canada and the northcentral U.S.

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

			Change from 1999			Change from LTA	
Survey Area	1999	2000	%	*P*	LTA[a]	%	*P*
Prairie Canada							
S. Alberta	793	409	-48	<0.001	479	-15	0.122
S. Saskatchewan	1697	1438	-15	0.075	947	+52	<0.001
S. Manitoba	286	604	+111	<0.001	317	+91	<0.001
Subtotal	2776	2451	-12	0.061	1743	+41	<0.001
Northcentral U.S.							
Montana and Western Dakotas	609	484	-21	0.072	400	+21	0.037
Eastern Dakotas	1823	917	-50	<0.001	548	+67	<0.001
Subtotal	2432	1402	-42	<0.001	948	+48	<0.001
Grand Total	5208	3852	-26	<0.001	2779	+39	<0.001

[a] Long-term average. Prairie Canada, 1961-1999; northcentral U.S. and Grand Total, 1974-99.

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

			Change from 1999			Change from LTA	
Species	1999	2000	%	*P*	LTA[a]	%	*P*
Mallard	10806	9470	-12	0.003	7450	+27	<0.001
Gadwalll	3235	3158	-2	0.766	1576	+100	<0.001
American wigeon	2920	2733	-6	0.420	2647	+3	0.545
Green-winged teal	2631	3194	+21	0.034	1776	+80	<0.001
Blue-winged teal	7149	7431	+4	0.615	4399	+69	<0.001
Northern shoveler	3890	3521	-9	0.192	2041	+73	<0.001
Northern pintail	3058	2908	-5	0.600	4320	-33	<0.001
Redhead	973	926	-5	0.652	618	+50	<0.001
Canvasback	716	707	-1	0.935	560	+26	0.072
Scaup (greater and lesser combined)	4412	4026	-9	0.209	5383	-25	<0.001
Total[b]	43436	41838	-4	0.125	33033	+27	<0.001

[a] Long-term average (1955-1999).
[b] Includes black duck, ring-necked duck, goldeneye, bufflehead, and ruddy duck, excludes scoter, eider, oldsquaw, 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 1999			Change from Average	
Species	1999	2000	%	*P*	1996-99 Average	%	*P*
Mergansers	290	400	+38	0.100	520	-23	0.185
Mallard	281	212	-24	0.172	330	-36	0.005
American Black Duck	489	397	-19	0.218	507	-22	0.086
American Wigeon	121	42	-66	0.112	65	-36	0.337
Green-winged teal	422	202	-52	0.001	342	-41	0.002
Blue-winged teal	45	20	-56	0.264	30	-34	0.378
Ring-necked duck	453	619	+37	0.112	511	+21	0.219
Goldeneye (common & Barrow's)	920	947	+3	0.941	567	+67	0.244
Bufflehead	71	49	-30	0.368	47	+5	0.862
Scoters	47	182	+288	0.028	80	+128	0.097
Total [a]	3214	3204	0	0.981	3043	+5	0.661

[a] Includes above species and gadwall, northern shovelers, northern pintail, and scaup. Excludes eiders, oldsquaws, wood ducks, redhead, canvasback, and ruddy duck.

northcentral U.S. were 10% and 5% below last year's estimates, respectively. Brood estimates in Prairie Canada were 37% below the long-term average, while counts were 134% above the long-term average in the northcentral U.S.

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 regions, 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 at http://migratorybirds.fws.gov/reports/reports.html. Some of the habitat information that follows was taken from these reports.

Southern Alberta: The fall, winter, and spring in southern Alberta (strata 26-29) received below-normal precipitation in most areas, except for western portions of strata 26 and 27. Low amounts of spring precipitation and below-average mountain snowpack resulted in below-normal runoff in this region. The Aspen Parklands was the only area in this region that was in good condition for breeding waterfowl – the rest of the area was in fair-to-poor condition. May ponds were 25% below the long-term average ($P<0.01$), but similar to last year ($P=0.07$) when conditions also were fairly dry. Low numbers of wetlands resulted in ducks crowding on remaining wetlands. Total ducks in southern Alberta were below the long-term average (-22%, $P<0.01$) but similar to 1999 levels ($P=0.51$), as were mallards (-28%). Northern pintails (-76%) also were below their long-term average ($P<0.01$), although they increased (+64%) from 1999 ($P=0.03$). All other species were unchanged from either 1999 levels or their long-term averages in this region. June precipitation in southern Alberta was below normal, and July habitat conditions remained fair to poor. July pond counts were 48% below the 1999 estimate and similar to the long-term averages. The July brood index was down 29% from 1999 and 56% below the long-term average.

Southern Saskatchewan: In southern Saskatchewan (strata 30-35), precipitation for the late summer and fall of 1999 was well below normal for most of the region. Below-normal winter precipitation and above-normal winter temperatures continued to negatively impact wetland conditions. Conditions improved somewhat during April and May, when normal precipitation occurred across much of this region, but this was not enough to make up for the moisture deficit incurred over the previous fall, winter, and early spring. The number of May ponds was 45% below 1999 and 30% below the long-term average ($P<0.01$). Fewer ponds resulted in crowded conditions for birds on available water bodies. The total duck population estimate was 21% below last year ($P<0.01$), but unchanged from the long-term average ($P=0.37$). Mallard, green-winged teal, and canvasback abundances were unchanged from last year and their long-term averages ($P>0.08$). Gadwall (-37%), shoveler (-30%), and pintail (-47%) levels differed from 1999 levels ($P<0.01$). Wigeon (-44%), blue-winged teal (+35%), shoveler (+47%), pintail (-64%), redhead (+73%), and scaup (-38%) abundances differed from their long-term averages ($P<0.05$). Throughout June and July, most of southern Saskatchewan received needed rain. Although localized flooding in the southernmost part of the Province was probably detrimental to renesting ducks, overall, habitat conditions for nesting and production were much better in July than they were in May. July pond counts in this region were higher than May pond counts. This count was unchanged from the 1999 estimate and 52% above the long-term average. However, it appears that the rain and improved conditions came too late to benefit most waterfowl, especially in areas that were dry in May. Thus, even though habitat conditions generally improved over the summer, only average production is expected. The number of broods in July was 10% above the 1999 estimate, but 27% below the long-term average for this region.

Southern Manitoba: Southern Manitoba (strata 25, 36-40) was much drier this May than it had been in the previous 6 years. Temporary ponds were virtually non-existent, resulting in crowding of ducks on remaining water bodies. Fortunately, abundant rainfall from previous years resulted in permanent wetlands remaining in good condition. Habitat conditions ranged from good to poor, with the poorest conditions in the eastern part of the survey area. Total-duck estimates were unchanged from 1999 or the long-term average ($P>0.11$). Mallards (-29%) and gadwall (-26%) abundances were below 1999 levels ($P<0.04$). Gadwall (+41%) and shoveler numbers (+75%; the second highest historical estimate) were above their long-term averages, while wigeon (-71%), northern pintail (-63%), and scaup (-59%) were below their long-term averages ($P<0.01$). Green-winged teal, blue-winged teal, redhead, and canvasback estimates were unchanged from either 1999 or the long-term average ($P>0.13$). Habitat conditions improved throughout the summer, as several inches of rain fell throughout southern Manitoba in June. Wetland water levels increased over those in May, and some temporary ponds appeared. Conditions were improved in the south, but remained dry in the north. July pond counts were at their second highest recorded levels for this region. The number of ponds in July was 111% higher than the number last year, and 91% above the long-term average. The July brood estimate was 37% below last year's estimate, and 31% below the long-term average.

Montana and western Dakotas: In Montana (strata 41-42) and the western Dakotas (strata 43-44), conditions were generally drier than those of 1999. In Montana, an overall

lack of snow cover and the resulting low spring runoff, in combination with little moisture through the spring, resulted in lower water levels in most ponds and reservoirs. Mild conditions did permit early vegetation growth where moisture was available, mainly in the western Dakotas. In this survey area, May ponds were down 36% from 1999 levels and 21% below the long-term average ($P<0.01$). Total ducks were 31% below the 1999 estimate ($P<0.01$), and unchanged from the long-term average ($P=0.25$). Blue-winged teal (-57%) and shoveler (-62%) abundances were below 1999 estimates ($P<0.01$). Mallards (+24%), gadwall (+55%), and pintail (-41%) estimates all differed from their long-term averages ($P<0.05$). Wigeon, green-winged teal, redheads, canvasback, and scaup were all similar to 1999 estimates and their long-term averages ($P>0.10$). June and July brought rain to many areas of this region. The rain improved water conditions in the western Dakotas somewhat, but helped little in Montana because in most regions of the state, the rain simply soaked into the dry ground or ran off into streams and creeks. Western South Dakota had excellent nesting cover and extensive emergent vegetation in July. This, coupled with the summer rains, is expected to result in above-average production from this area. The rest of this region did not experience much improvement in habitat conditions from May, and should experience average-to-below-average production. The number of ponds in July was similar to last year's record high estimate, but 22% above the long-term average. The July brood estimate was 19% below last year's estimate, but 24% above the long-term average.

Eastern Dakotas: In the eastern Dakotas (strata 45-49), fall, winter, and early spring were unusually warm and dry. Cool April temperatures delayed emergence of vegetation, however warm May temperatures, which prompted vegetation growth, combined with residual vegetation and Conservation Reserve Program acres resulted in sufficient nesting cover in most of the region. Although much needed moisture came to the area in April and May, soil moisture was low and temporary and seasonal ponds were rare in May. The number of May ponds was 50% below that of 1999 ($P<0.01$), and unchanged from the long-term average ($P=0.22$). Total ducks in the eastern Dakotas were a record high of 10.4 million birds. This was an increase of 17% from last year and 170% above the long-term average ($P<0.01$). The combination of fewer ponds and more ducks resulted in crowded conditions for birds on the available water bodies. This condition was most pronounced in the southern half of South Dakota. The mallard estimate this year was a record high 2.3 million. This was similar to last year's estimate of 2.1 million. Gadwall (1.7 million) and blue-winged teal (4.2 million) estimates also were at record high levels. Wigeon was at its second highest historical level, while shovelers and redheads were at their third highest levels. While only gadwall (+39%) and blue-winged teal (+30%) abundances differed from 1999 levels ($P<0.03$), estimates for several species differed from their long-term averages ($P<0.01$). Mallards (+213%), gadwall (+312%), wigeon (+138%), blue-winged teal (+209%), shoveler (+114%), redhead (+101%), and scaup (+166%) were all above their respective long-term averages, while only pintail (-26%) was below its long-term average ($P<0.01$). Green-winged teal and canvasback were unchanged from either 1999 or long-term averages ($P>0.20$). Similar to most prairie areas, the eastern Dakotas received rain in June and July. June rains were extraordinarily heavy in some parts of North Dakota (15-20 inches in one localized area), resulting in limited flooding. Although some flooding did occur, detrimental impacts to nesting/brooding waterfowl were considered insignificant. July habitat conditions were maintained or improved in many areas. This was especially true in the northern half of the survey unit, which offered very good brood rearing conditions. Production from most of this area is expected to be well above average. The number of ponds in July was 50% below the record high count of 1999, but 67% above the long-term average. The 2000 brood estimate was 246% above the long-term average for this region, and was a new record high.

Northern Saskatchewan, northern Manitoba, and western Ontario: In northern Saskatchewan and northern Manitoba (strata 21-25) and western Ontario (stratum 50), conditions were generally fair to good. In western Ontario, a warm and dry winter and spring resulted in somewhat low water levels in May. An early spring coupled with average water conditions resulted in fair-to-good nesting-habitat conditions this year. The total-duck estimate was unchanged from either 1999 or the long-term average ($P\geq0.24$). Scaup were below 1999 levels (-46%, $P<0.01$). Gadwall (-58%), wigeon (-45%), pintail (-65%), and scaup (-52%) estimates were below long-term averages ($P<0.01$). Mallard, green-winged teal, blue-winged teal, shoveler, redhead, and canvasback abundances were unchanged from either 1999 or long-term averages ($P>0.06$), although green-winged teal were at their second highest level. During late spring and early summer, considerable precipitation occurred across much of northern Saskatchewan and Manitoba. Water levels in lakes were high, with shoreline vegetation often flooded. Streams were bank-full, and beaver ponds were full. Habitat appeared excellent for brood survival in most areas, although some nests and broods may have been flooded. The high water may have had unknown impacts on nest success and subsequent brood survival. Forest fires, usual for this time of year, were almost non-existent. Overall, the outlook for production in this region is good.

Northern Alberta, northeastern British Columbia, and Northwest Territories: In northern Alberta, northeastern British Columbia, and the Northwest Territories (strata 13-

18, 20, 75-77), winter was mild. Spring came early through most of the southern portion of the unit, but was delayed during late April and May with low temperatures, rain, and often snow. May breeding- habitat conditions were fairly dry, and much drier than last year. Water conditions improved to the north, although spring was late in the northern part of the survey area. For the second year in a row, the Athabasca Delta was extremely dry, with many of the sloughs, sedge meadows and shallow portions of lakes being completely dry. The number of total ducks decreased 17% (P<0.01) compared to 1999, but was similar to the long-term average (P=0.14). Mallards (-37%), wigeon (-31%), redheads (-73%), and scaup (-24%) decreased from 1999 levels (P<0.03). Gadwall (+159%) and green-winged teal (+73%) increased, while wigeon (-23%), pintail (-46%), redheads (-32%), and scaup (-41%) decreased from their long-term averages (P<0.04). Blue-winged teal, shoveler, and canvasback estimates were unchanged from either 1999 or their long-term averages (P>0.26). Considerable rain received during May and June in the southern two-thirds of northern Alberta and all of northeastern British Columbia improved brood-rearing habitat conditions markedly. Summer rains recharged ponds and drainage basins, resulting in good quality brood-rearing habitat. The exception again was the Athabasca Delta, which was drier in July than it had been during May and June. However, it is unclear if the summer rains in the southern part of the survey area came in time to help production from late nesting or renesting ducks.

Alaska and Old Crow Flats, Yukon Territory: In Alaska and Old Crow Flats (strata 1-12), a potentially early spring stalled, resulting in spring being up to 2 weeks late in northern and western strata. However, a record high 6.7 million birds were found in the area this spring. This is 30% above the 1999 estimate and 106% above the long-term average (P<0.01). Green-winged teal (+39%) increased from 1999 levels (P<0.01), and pintails increased above their long-term average (+63%; P<0.01). This was the only region where pintails were above their long-term average. Half of the estimated continental pintail population was found in this region, indicating a possible overflight from the prairies. Mallard (+153%; the second highest historical estimate for this area), wigeon (+157%; also the second highest historical estimate for this region), green-winged teal (+226%; a record high for the region), shoveler (+300%), and scaup (+35%) were also above long-term averages (P<0.01). Abundances of canvasback were unchanged from either 1999 or their long-term averages (P>0.20), although canvasbacks were at their second highest level in this region. The generally late spring suggests that production will be below average from this region as a whole this year.

Eastern Survey Area: Breeding waterfowl habitat conditions in the eastern survey area (strata 51-56 and 62-69) were generally improved over those of last year. In March, spring appeared to have arrived several weeks early. But in April, many areas cooled down markedly, especially Labrador, Newfoundland, and eastern Quebec. In these easternmost regions, spring was 2-3 weeks later than normal. Water levels in southwestern Ontario, Maine, Nova Scotia, and New Brunswick are higher this year than last year, when the east was entering a drought. However, it was still drier than normal in the more southern regions of Ontario and Quebec. In southwest Ontario, Maine, and the Atlantic Provinces, heavy thunderstorms in May caused severe flooding and probably flooded out many nests. The estimate of total ducks was unchanged from 1999 and the 1996-99 average. Green-winged teal decreased below 1999 levels (-52%), while scoters increased (+288%; P<0.03). Only mallards and green-winged teal changed from the 1996-99 average, decreasing 36% and 41%, respectively (P<0.01). Overall, habitat conditions in the East are generally good, with the exception of some areas of southern Ontario and southern/central Quebec, where low water levels resulted in fair to poor habitat conditions. Production in the east is expected to be good this year.

Other areas: The number of ducks observed in British Columbia's annual survey were similar to last year, but the cold and wet spring following a warm and wet winter probably delayed migration to breeding areas and resulted in reduced breeding activity in 1999. Duck numbers observed during spring surveys were similar to those of last year. The Pacific Northwest experienced heavy precipitation the previous year but conditions were normal this past winter. Washington duck numbers were down this year. Mallard numbers declined 45% from last year and were 14% below the 1979-99 long-term average; while total duck numbers were 28% below last year and 12% below the long-term average. Fall, winter and spring precipitation was normal to above normal in most of California and nesting habitat for this year was average to good. Duck production is expected to be higher than last year and average to good production should occur. Mallard numbers declined 17% from last year and were 5% below the long-term average. Total duck numbers in California declined 24% from last year and were 7% below the long-term average. Much of the western U.S. experienced below normal precipitation last winter and this spring. Conditions in Nevada were dry and duck production will reflect this. Colorado experienced a hot, dry spring and several wild fires, reflecting the dry conditions, occurred. Duck production is expected to be average to below average. Conditions were also dry in Wyoming and it is likely ducks production will be down. In Nebraska conditions were substantially drier than last year, with a 38% decline in water areas counted in the annual aerial survey. The estimated breeding duck population in the Nebraska Sandhills declined 28% from last year; mallard numbers declined 33%. Conditions in

the Lake States were warm and dry early this spring, but large amounts of rain fell during the breeding season in Minnesota, Wisconsin and Michigan. Pond numbers decreased 32% in Minnesota compared to 1999 and were 18% below the 1968-99 long-term average. However, mallard numbers were unchanged (+1%) and total ducks increased 14% from last year. Extensive rains in May and June made up for the dry winter and early spring but caused flooding in southern Wisconsin. The number of mallards surveyed in the late April - early May Wisconsin annual survey were at record numbers, having increased 66% from last year and were 160% above the long-term (27 years) average. The total duck estimate, another record, increased 77% from last year and was 110% above the long-term average. Brood habitat in July in southern Wisconsin was excellent. In Michigan, mallard numbers declined 18% from last year and were 17% below the 1992-99 long-term average. However, total duck numbers increased 15% from last year and were 1% above the long-term average. Last year, the mid-Atlantic states experienced a drought; conditions this spring were normal. Some New England areas had above-normal amounts of precipitation this spring. Mallard numbers in the Atlantic Flyway's plot survey declined 14% from last year but remain 50% above the 1989-99 long-term average. Total duck numbers increased 26% from last year and were 42% above the long-term average.

Fall-flight indices

Total ducks: The total duck fall flight is predicted to be 90 million birds. This is about 13% lower than last year's record predicted fall flight of over 100 million birds. However, this fall flight index does not contain information from our eastern survey areas, because surveys in those areas are relatively new and do not provide information on production. The total duck fall flight is predicted to be smaller from both Prairie Canada and the northcentral U.S., whereas the fall flight from Alaska should be larger than last year. In eastern areas, nesting conditions were generally favorable, and the fall flight should be similar to or perhaps larger than that of last year.

Mallard: The size of the midcontinent mallard population, which is comprised of mallards from the traditional survey area, as well as Michigan, Minnesota, and Wisconsin, was 10.5 million birds (Fig. 4). This was 11% lower than that of 1999 (11.8 million) ($P<0.01$). This year, the weights associated with the midcontinent mallard population models reflect increased support for the hypothesis of strongly density-dependent reproduction. Thus, the 2000 midcontinent-mallard fall-flight estimate of 11.3 million birds is predicted to be lower ($P<0.01$) than the 1999 estimate of 13.1 million birds.

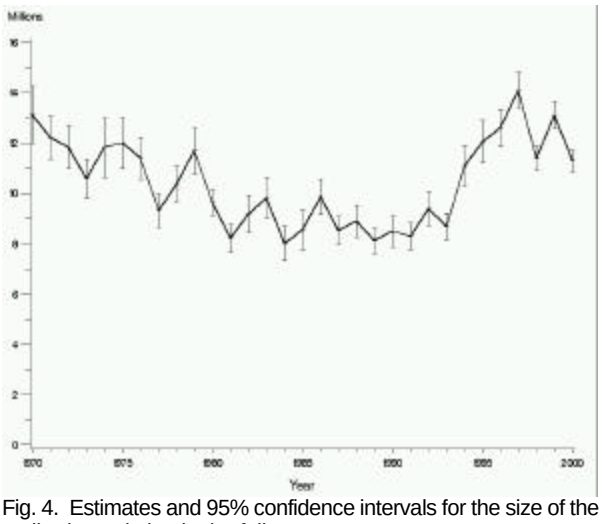


Fig. 4. Estimates and 95% confidence intervals for the size of the mallard population in the fall.

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STATUS OF GEESE AND SWANS

Abstract: Most goose and swan populations in North America remain numerically sound and the size of most fall flights will be similar to or increased from last year. Nine of the 29 populations of geese and swans we report on appear to have increased (≥+10%) since last year, 7 appear to have decreased (≤-10%), 9 appear to have changed little, and no comparisons were possible for the remaining 4. Some of the annual variation likely reflects differences in the timing of surveys. Of the 24 populations for which data spanning at least 10 years were available, 13 have exhibited a significant increasing trend (5 of 7 of *Anser* populations, 2 of 2 swan populations, and 6 of 15 *Branta* populations), 1 showed evidence of a significant decline (1 of 7 *Anser* populations), while 10 appeared stable (9 of 15 *Branta* populations, 1 of 7 *Anser* populations). As in previous years, forecasts for production of young in 2000 varied regionally based largely on spring weather and habitat conditions. Generally, spring phenology was later than normal in northern Quebec, the Hudson Bay Lowlands, the Central and Western Arctic, the high Arctic, and the north slope and interior of Alaska, and this should lead to less-than-average production for geese nesting there. Along the west coast of Alaska, seasons were slightly later than normal but average to above-average production is expected for geese and swans nesting in those areas. For temperate-zone breeding geese, nesting conditions are generally good. Although parts of the prairies are drier this year than last, higher than normal precipitation over the past several years means that permanent and semi-permanent ponds are still readily available for brood-rearing. Conditions through most of the west are average to above average, though low water levels are expected to limit goose production in British Columbia. Habitat conditions for nesting geese were excellent east of the Mississippi River due to average to above average precipitation.

This report summarizes information regarding the status and expected fall flights of goose and swan populations in North America. Information was compiled from a broad geographic area and is intended to assist managers in regulating sport harvests. We have relied on the most widely-accepted designations for various goose populations, but they may differ from other published information. Each of the 27 goose populations described herein is solely or predominantly comprised of a single species, but several populations contain more than one subspecies. This report also contains information concerning the status of 2 populations of tundra swans (*Cygnus columbianus*).

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 (*Branta canadensis*) populations nest in southern Canada and the northern U.S. Few breeding population surveys exist for geese, and sizes of most populations are estimated from surveys conducted on migration and wintering areas. The production of most goose populations can only be predicted qualitatively, based on habitat conditions and nesting phenology. In the Arctic, production is heavily dependent on the extent and duration of snow-cover, which can limit availability of nest sites and food resources. In general, goose production will be better than average if nesting begins by late May in western and central portions of the Arctic and the southern Hudson Bay lowlands, and by early June in the eastern Arctic. Production throughout the Arctic usually is poor if nesting is delayed much beyond 15 June. However, severe weather after hatching, and significant predation in some areas (both during nesting and post-hatching), can significantly influence production in many Arctic breeding colonies. For populations that nest farther south, recruitment rates are less variable and annual production is more dependent on the size and age-structure of the breeding population, which is a function of many factors, including breeding performance and recruitment from the preceding year, and body condition at the start of nesting.

METHODS

Unlike those for ducks, population estimates for geese generally are not derived from coordinated annual surveys, but are obtained primarily from surveys conducted during fall and winter by federal, state, and provincial biologists, with additional spring survey data provided by universities and various government agencies. Where appropriate (i.e., when estimates are based on a formal sampling scheme), 95% confidence intervals are presented with population estimates. Such estimates are available for only a few populations. Average population growth rates for the last 10 years were determined by regressing the natural logarithm of survey counts on year; the slope coefficient was tested for equality to zero (*t*-test). One-year change in population size was estimated by differencing 1999 and 2000 population estimates (Appendix J and K); where possible, the significance of the change was assessed with a *z*-test, using the sum of sampling variances for the 2 estimates.

Habitat conditions during the 2000 breeding season were assessed using weather data and reports from field biologists. The portion of North America covered by snow or ice in early June was determined from weekly on-line reports (Northern Hemisphere Snow and Ice Boundary summaries) prepared by the National Oceanic and Atmospheric Administration. This analysis provides general information but does not always provide reliable assessments of local conditions. Forecasts for production were based on information from various waterfowl surveys and from interviews with field biologists.

RESULTS AND DISCUSSION

Conditions in the Arctic and Subarctic

Overall, conditions in the arctic were poor for breeding geese, as snow and ice cover and cold weather persisted later than normal. The notable exceptions were southern and western Alaska. Onset of spring was average on the Copper River Delta

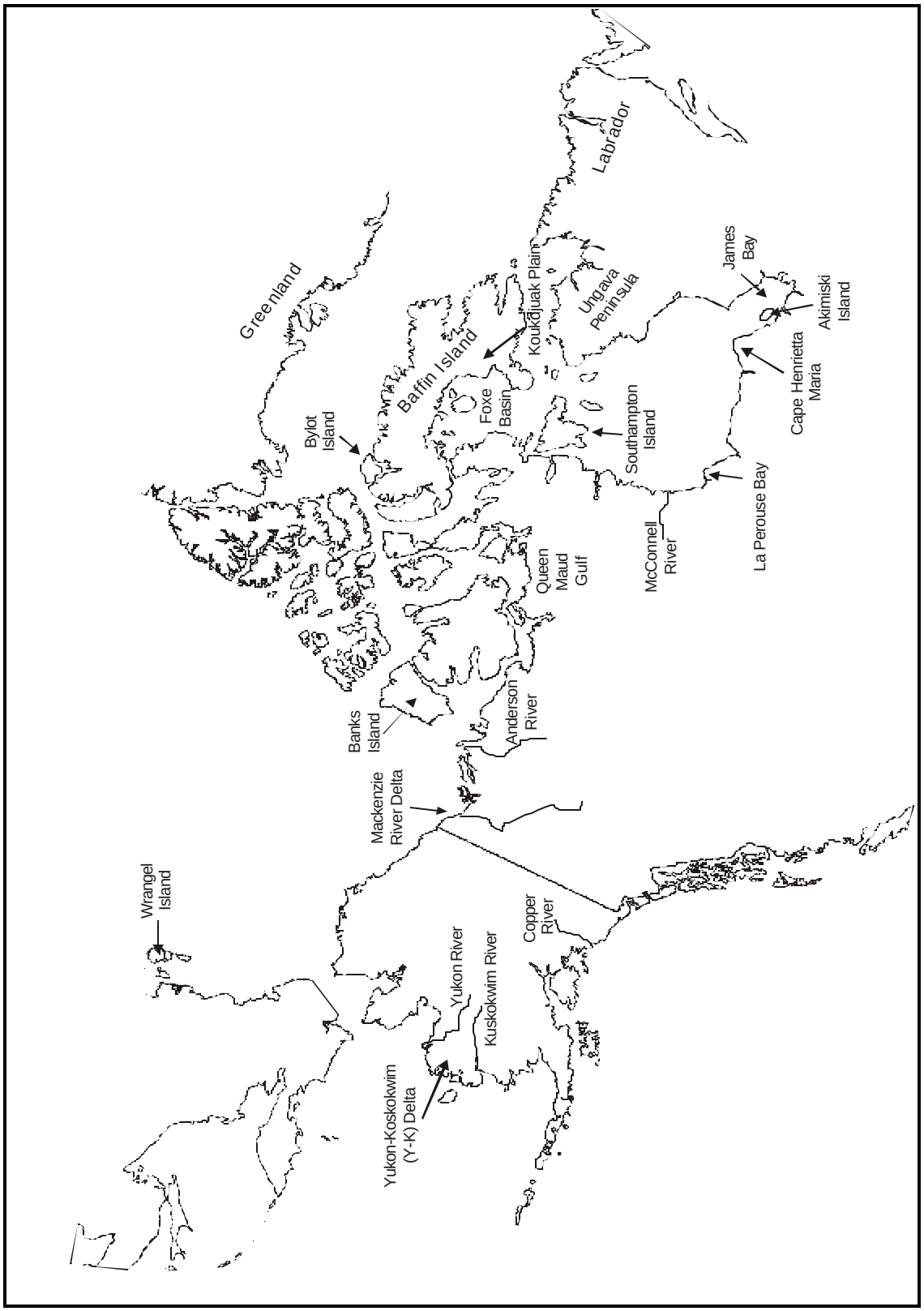

Fig. 1. Important goose nesting areas in Arctic and sub-Arctic areas of North America

in Alaska, and later than average in the eastern, central, and western Arctic and the remainder of Alaska. Based on information from the National Oceanic and Atmospheric Administration (NOAA), snow and ice coverage in early-June 2000 was similar to last year in the central and western Canadian Arctic, and more extensive in northern Quebec, northern Labrador, on the northern and western coasts of Alaska (Fig. 2).

Field biologists in Alaska reported that spring weather was about 2 weeks later than normal for the North Slope, 1-2 weeks later than average on the Yukon-Kuskokwim (Y-K) Delta, and approximately 1 week later than average in most interior regions. Ice breakup off the Y-K Delta was late, similar to 1999, which was the latest since 1977. However, snow cover on the Y-K Delta was low in late spring, and tundra habitat opened up quickly, making for good nesting conditions overall. Flooding was localized and generally not a threat to nests. The Copper River Delta experienced an early and warm spring. Field biologists in the western Canadian Arctic reported a late spring, which made for poor nesting conditions. Near Queen Maud Gulf in the Central Canadian Arctic, biologists reported that spring phenology was late. On Bylot Island, a thick winter snowpack that persisted until mid-June delayed nesting. Conditions were delayed on the Koukdjuak Plains on Baffin Island. Across the Hudson Bay Lowland, atypically warm March temperatures melted much of a light winter snow accumulation, but temperatures cooled in April and early May, and many rivers and lakes refroze. Very cold and wet conditions persisted through the beginning of July in the La Perouse Bay region. In the western James Bay region, conditions were also cool and wet, but less so. In northern Quebec and Laborador, spring thaw was later than normal.

Conditions in Southern Canada and the United States

Conditions conducive to a successful breeding season vary less from year to year in mid-latitude areas of North America than in the Arctic. Wetland numbers decreased relative to last year over much of south-central Canada this spring, while conditions in much of the upper Midwest and southern Prairies were considered good for staging Arctic-breeding geese and nesting Canada geese. Breeding conditions south of the Great Lakes and in the eastern and mid-Atlantic states were reported to be average or above average due to regular precipitation. In most western states good breeding conditions were reported.

Status of Canada Geese

Atlantic Population (AP).--AP Canada geese nest throughout much of Quebec, especially along Ungava Bay, the eastern shore of Hudson Bay, and on the Ungava Peninsula. The AP winters from New England to South Carolina, but the largest concentration occurs on the Delmarva Peninsula (Fig. 3). On the Ungava Peninsula, there were approximately 93,230 (73,924-112,536) breeding pairs in 2000; this is 20% greater, but not statistically different ($P>0.2$) from last year's estimate (Fig. 4).

The rate of change in the number of breeding pairs since 1990 is not statistically different from a stable population ($0.05<P<0.1$). The total population estimate of 641,668 (473,627-809,709) in June 2000 is 50% higher than the 1999 estimate ($0.05<P<1.0$). The estimate of total population contains geese from several populations, and should be interpreted with caution. Flocks of molt migrants and groups of non-breeding geese (almost twice as many as 1999) were especially numerous along the Hudson Bay coast. Nesting was delayed due to cold weather, and clutch sizes are very low, with many nests

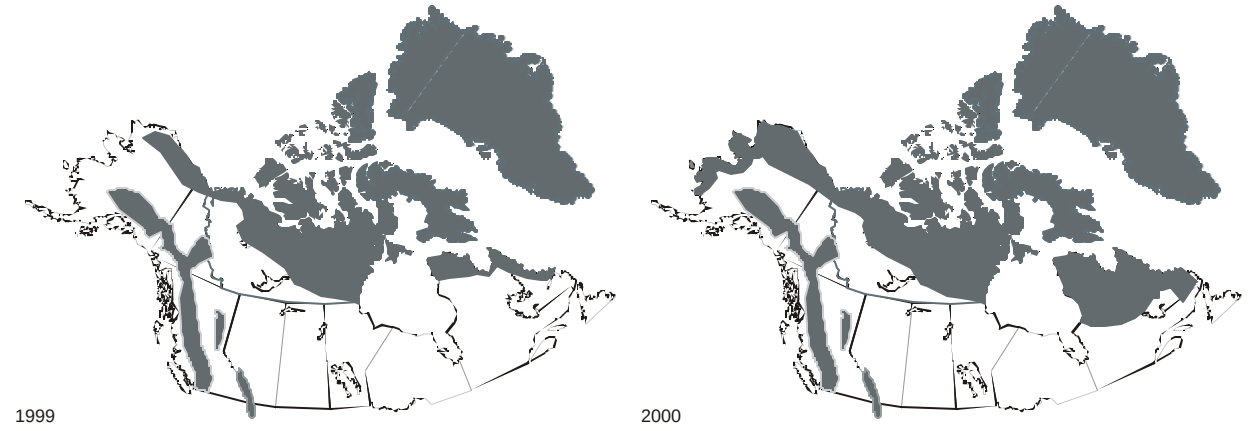

Fig. 2. The extent of snow and ice cover in North America for 2-4 June, 1999 and 3-5 June, 2000. The figures were reproduced from reports prepared by the National Oceanic and Atmospheric Administration.

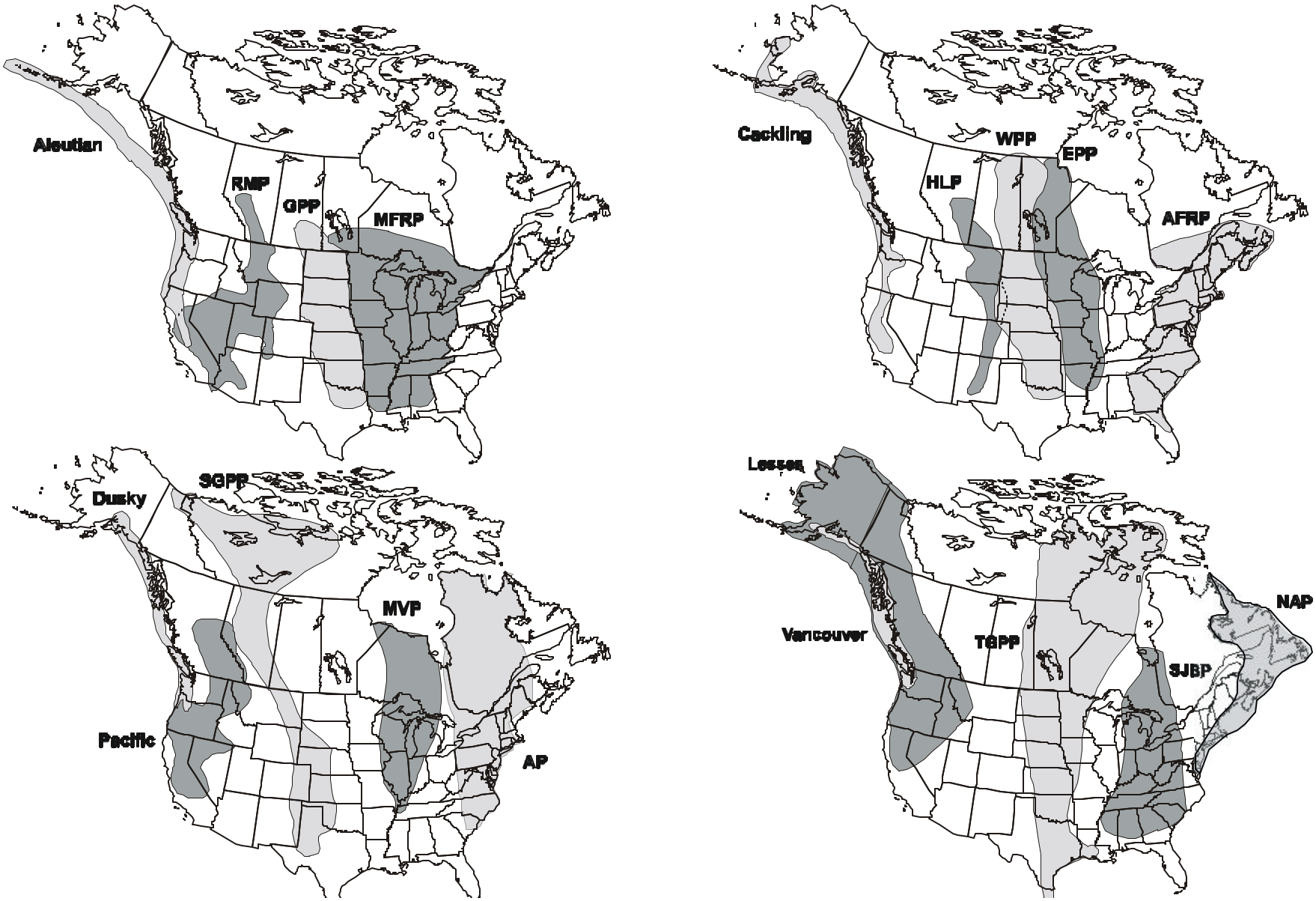

Fig. 3. Approximate ranges of Canada goose populations in North America. Population names are abbreviated as in text.

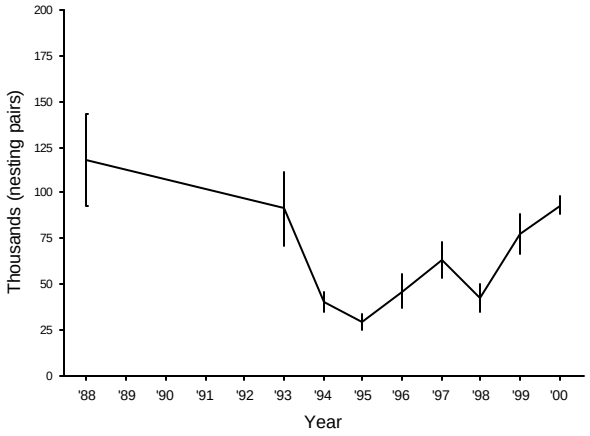

Fig. 4. Estimated number of breeding pairs (and 95% confidence intervals) in the Atlantic Population of Canada Geese in northern Quebec.

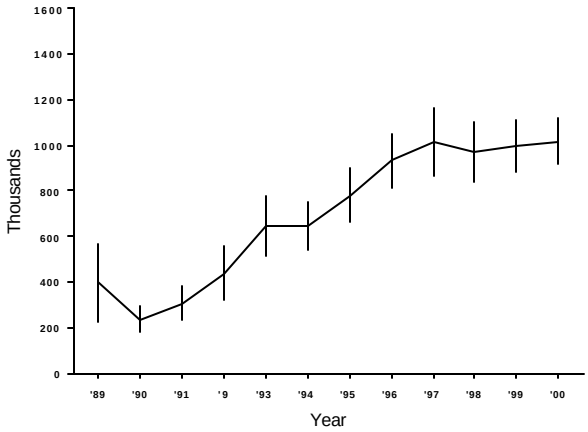

Fig. 5. Estimated size (and 95% confidence intervals) of the Atlantic Flyway Resident Population of Canada geese during spring.

having only 1 or 2 eggs. At a study site near the Polmond River, approximately 1/3 of nests were depredated or abandoned. Poor gosling production is expected along the Hudson Bay coast, though somewhat better conditions were reported on the Ungava Bay side of the Ungava Penninsula. In the boreal forest, where Canada geese are counted as part of the annual Breeding Waterfowl and Habitat survey, the number of breeding pairs was down by 29% from last year's record high count. A fall flight similar to last year's is expected.

North Atlantic Canada Geese (NAP) Geese in this population nest in Newfoundland and Labrador, and generally mix during winter with AP Canada Geese (although the distribution is more coastal than AP Canada geese). The timing of the breeding pair survey in Laborador (strata 67) this spring was not optimal. The count was too early and most birds were observed in small flocks rather than pairs. The total count was down 15% from 1999, but the monitoring effort for determining the status of this population needs improvement. Fall flight forecasts for this population are not possible without further information.

Atlantic Flyway Resident Population (AFRP).-- This population occurs in southern Quebec, the southern Maritime provinces, and all states of the Atlantic Flyway (Fig. 3). In the spring of 2000, there were 1,015,920 (817,303-1,214,537) Canada geese in the northeastern United States (Fig. 5), which is similar ($P>0.9$) to the previous year's estimate. These estimates have increased ($P<0.001$) an average of 12% per year since 1990. In most areas, field biologists expect production to be average or better than average. Overall, production should be similar to last year's, considering the size of the spring population and anticipated recruitment.

Southern James Bay Population (SJBP).-- This population nests on Akimiski Island in James Bay and in the adjacent lowlands to the south and west. The SJBP winters from southern Michigan to Mississippi, Alabama, Georgia, and South Carolina (Fig. 3). There were 89,100 (68,668-109,460) Canada geese counted on the breeding range during surveys on May 20-22, a count 35% lower than the 1999 estimate ($P<0.01$, Fig. 6). There was no trend in the size of the total population over the last 10 years ($P>0.05$). In 2000 there were 27,847 (24,340-31,354) breeding pairs, which is 48% lower ($P<0.01$) than the 1999 estimate. Estimates of non-breeders decreased by 28% from 1999 estimates on Akimiski Island and by 75% on the mainland. Survey timing was optimal on both Akimiski Island and the mainland; no broods were observed during the survey (Canada geese become more secretive when they have a young brood, and the estimated number of breeding pairs on the mainland may be biased low if the survey is conducted during hatching), but low light contrast conditions may have contributed to the low numbers of geese observed (23,149) on Akimiski Island. The nesting season on Akimiski Island was slightly later than usual. With a decrease in the breeding

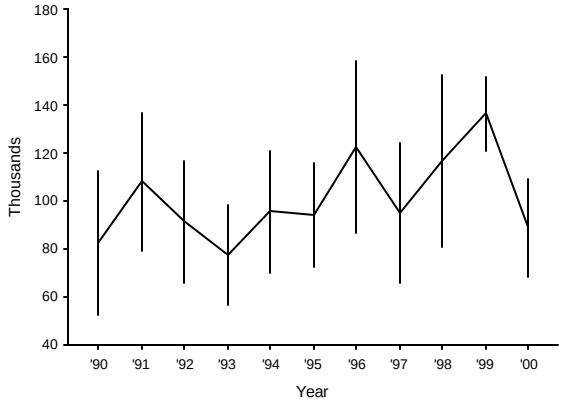

Fig. 6. Estimated size (and 95% confidence intervals) of the Southern James Bay Population of Canada geese during spring.

population and forecasts for fair recruitment, the fall flight probably will be lower than that of last year.

Mississippi Valley Population (MVP).--The principal nesting range of this population is in northern Ontario, especially in the coastal lowlands west of James Bay and south of Hudson Bay. MVP Canada geese concentrate in the fall in southeastern Wisconsin and winter primarily in Illinois and southern Wisconsin in warmer years (Fig. 3). Snow melt was early this year over much of the breeding range; however, a severe storm the first week of May likely caused widespread nest losses along the Hudson Bay coast due to abandonment and flooding. Surveys conducted on the breeding range during 26-28 May indicated 1,054,807 (667,039-1,442,575) geese, which is 9% higher, but not statistically different ($P>0.5$) from the 1999 estimate (Fig. 7). There were 146,836 non-breeders observed, almost three times higher than average, but this estimate likely was inflated by large flocks of molt migrants. In 2000, there were 185,865 (150,183-221,547) nests, which is 23% lower ($P<0.05$) than the 1999 estimate. The fall-flight forecast for 2000 do not appear to be significantly larger than during the previous 10 years, excluding 1998. No trend ($P>0.5$) in the size of the spring population since 1990, and no trend ($P>0.5$) in numbers of nests over the last 10 years was detected Despite a slight increase in the spring population, biologists predict gosling production of 240,578, 23% lower than last year, and a fall flight of 1,295,385, similar to the forecast for 1999.

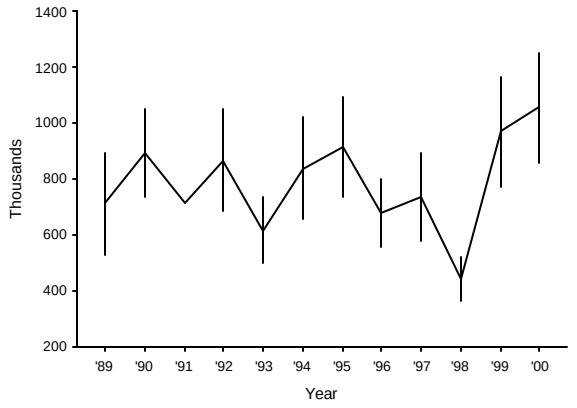

Fig. 7. Estimated size (and 95% confidence intervals) of the Mississippi Valley Population of Canada geese during spring.

Mississippi Flyway Giant Population (MFGP).--These birds have been reestablished in many states of the Mississippi Flyway, and represent a significant portion of Canada geese occurring there (Fig. 3). This population has been monitored with spring surveys for the past 8 years. The preliminary population estimate was 1,509,933,

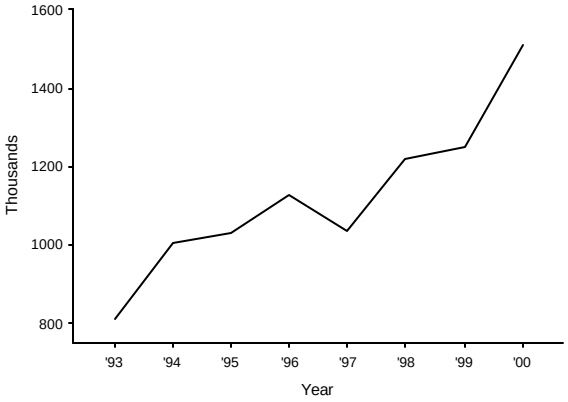

Fig. 8. Estimated size of the Mississippi Flyway Population of Giant Canada geese during spring.

which is 21% greater than the 1999 estimate (Fig. 8). Biologists reported that conditions were favorable to extremely favorable for nesting geese throughout their breeding range. Another large fall flight is expected.

Eastern Prairie Population (EPP).—These geese nest in the Hudson Bay Lowlands of Manitoba and primarily winter throughout Missouri (Fig. 3). The breeding population estimate of 275,000 (236,300-313,700) in 2000 is 33% larger ($P<0.01$) than the estimate from 1999 (Fig. 9). There has been no trend ($P>0.1$) in the spring estimate over the last 10 years. Calculation of population estimates has been revised to reflect a revised range (a western boundary of 97ºW instead of 99ºW), and the exclusion of large (n>15) groups of geese in the interior portions of the range because they are thought to be giant Canada Goose molt migrants. To reflect this change, the EPP population objective was changed from 300,000 to 200,000. In addition, regulation recommendations will be based on an objective of 145,000 birds observed as singles and pairs. For 2000, the singles and pairs estimate was 130,038

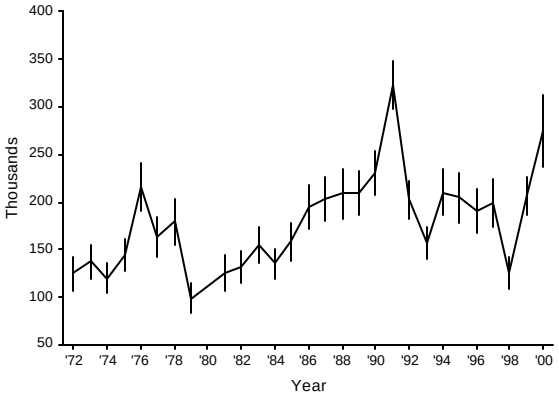

Fig. 9. Estimated size of the Eastern Prairie Population of Canada geese estimated from breeding ground surveys.

(110,693-149,383), similar to 1999, and within the threshold range for recommending "average" hunting regulations for the EPP. Spring phenology was delayed compared to 1998 and 1999 due to greater snowfall and later ice breakup. Coastal flooding also delayed nesting until early June in some areas. Biologists at Cape Churchill reported a low nest density, along with delayed nesting, lower than average clutch sizes, and poor nest success. Low nesting effort in the Cape Churchill area may reflect continued deterioration of local breeding conditions, generally thought to be caused by excessive grubbing and grazing by lesser snow geese nesting in the area. Despite a higher population size in 2000, below-average production should result in a fall flight smaller than that of 1999.

Western Prairie Population/Great Plains Population (WPP/GPP).--The WPP is composed of large Canada geese that nest in eastern Saskatchewan and western Manitoba. The GPP is the result of restoration efforts in Saskatchewan, North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, and Texas. In winter, geese from these 2 breeding populations are found with other Canada geese along the Missouri River in South Dakota, and on reservoirs from southwestern Kansas to Texas. The fall and winter ranges of the WPP and GPP overlap (Fig. 3) and separate counts of the 2 populations are not available from existing surveys. During the January 2000 survey, 594,700 WPP/GPP geese were counted, which is 27% greater than the 1999 index (Fig. 10). A positive trend was detected for this population over the last 10 years ($P<0.01$). Spring surveys conducted principally for ducks in the Dakotas, Saskatchewan, and Manitoba in 2000 indicated 847,139 (723,089-971,189) Canada geese in this area, which is not significantly different (+7%; $P>0.5$) than last year's estimate. Habitat conditions during the nesting period were generally fair in southern Manitoba and Saskatchewan and good in the Dakotas. In particular, southwestern Manitoba and Saskatchewan were drier than last year, but semi-permanent and permanent wetlands still retain water and should be suitable for brood-rearing. However, the population of WPP/GPP remains well above objective levels. Production of WPP/GPP Canada geese should be at least average and their fall flight should be similar to or larger than that of last year.

Tall Grass Prairie Population (TGPP).--This population nests on Baffin (particularly on the Great Plain of the Koukdjuak), Southampton, and King William islands, and on the mainland along the McConnell and Maguse rivers. The range on the mainland extends west and north to the Queen Maud Gulf. TGPP Canada geese winter mainly in Oklahoma, Texas, and northeastern Mexico. These geese mix with other Canada geese on wintering areas, making it difficult to estimate the size of the population (Fig. 3). Based on the Central Flyway survey in January 2000, this population contained 295,662 geese, a decrease of 49% from 1999 (Fig. 11; note that prior 1999, estimates include both Central and Mississippi Flyways). During the most recent 10-year period (including the 1999 estimate), no trend ($P>0.05$) was detected in numbers of TGPP geese in the winter survey. Spring weather on Baffin and Southampton Island was poor, and nesting was delayed. On the western Hudson Bay, north to the McConnell River, nesting was late, and initial brood sizes were below average. Although productivity was low in 2000, it was not a complete failure. With poor breeding outlook and a smaller January population index, the fall flight will likely be smaller than last year's, and contain relatively few young of the year.

Short Grass Prairie Population (SGPP).--This population nests on Victoria and Jenny Lind islands and on the mainland from Queen Maud Gulf to the Mackenzie River and south into northern Alberta. These geese winter in southeastern Colorado, northeastern New Mexico, and the Oklahoma and Texas panhandles (Fig. 3). In January 2000, 200,021 SGPP geese were counted, which is

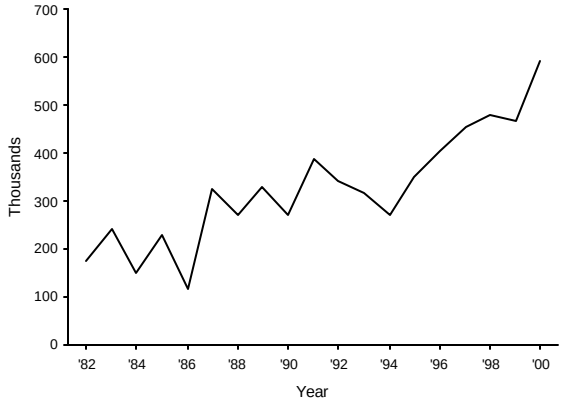

Fig. 10. Size of the WPP/GPP populations of Canada geese estimated from winter surveys.

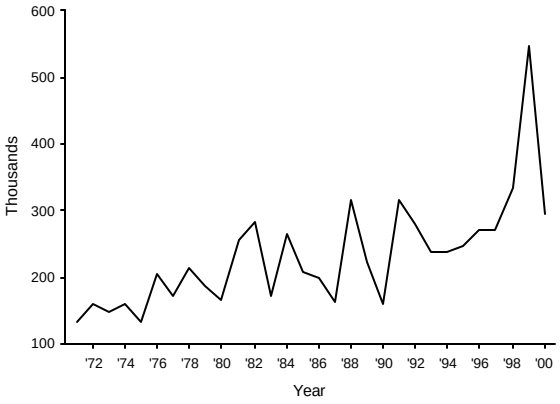

Fig. 11. Size of the TGPP population of Canada geese estimated from winter surveys.

approximately half of last year's count (Fig. 12). However, no trend was detected in these counts over the last 10 years ($P>0.05$). Similarly, breeding surveys conducted principally for ducks in the western part of the Northwest Territories and northern Alberta (strata 13-20, and 75-77) provide no evidence ($P>0.5$) of a trend in numbers of Canada geese in this area since 1990. This spring's estimate of 230,446 (164,772-296,119) was 10% below, but not statistically different from the 1999 breeding population estimate ($P>0.5$). Initial snow melt was early in northern Alberta and the Northwest Territories, but snow, rain and cold weather resumed in April and May, and spring was two weeks later than normal on the McKenzie Delta. In early spring water levels were generally lower than average, but wetlands were recharged by late spring rains. Near Queen Maud Gulf and Walker Bay, it was a late year, and nest-initiation dates were later than average. Biologists in these areas predict that production will be below average. Based on a small January population estimate, lower numbers of breeding birds estimated in May surveys, and the probability of below-average production, the fall flight probably will be reduced compared to last year.

Hi-Line Population (HLP).--These large Canada geese nest in southeastern Alberta, southwestern Saskatchewan, eastern Montana and Wyoming, and in north-central Colorado. They winter in north-central Colorado and in central New Mexico (Fig. 3). The January 2000 survey of this population resulted in an estimate of 270,730 geese, which more than twice last year's estimate (Fig. 13). Based on results from January surveys, the number of HLP geese has increased ($P<0.05$) an average of 7% per year since the beginning of the survey, but no trend was detected over the past 10 years. An estimate of the spring population was obtained for areas in Saskatchewan, Alberta, and Montana that were surveyed principally for

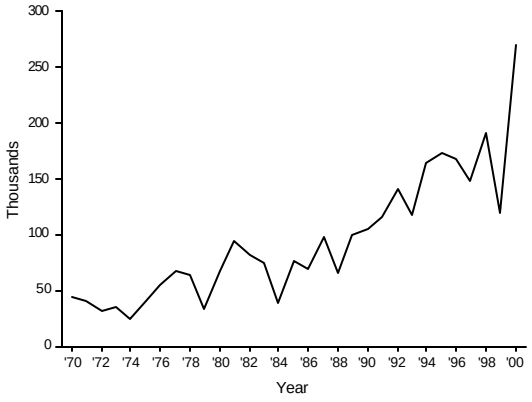

Fig. 13. Size of the Hi-Line population of Canada geese estimated from winter surveys.

ducks, and the 2000 spring estimate of 279,291 (210,891-347,691) is 42% larger ($P<0.05$) than the 1999 estimate. The spring population estimate has increased ($P=0.05$) approximately 4% per year since 1990. Overall, habitat conditions were fair to poor over most of the breeding range of the HLP and production should be at or slightly below average. The fall flight of HLP geese should be smaller than that of last year.

Rocky Mountain Population (RMP).--These Canada geese nest in southern Alberta, the inter-mountain regions of Utah, Idaho, Nevada, Colorado, and Wyoming, and in western Montana. They winter mainly in central and southern California, Arizona, Nevada, Colorado, Utah, Idaho, and Montana (Fig. 3). In January 2000, 102,340 geese were counted, a count 11% lower than the 1999 estimate (Fig. 14). Results of January surveys provided no evidence ($P>0.05$) of a significant short-term trend in the size of the RMP during 1990-2000, although overall numbers have increased since this survey began ($P<0.05$;

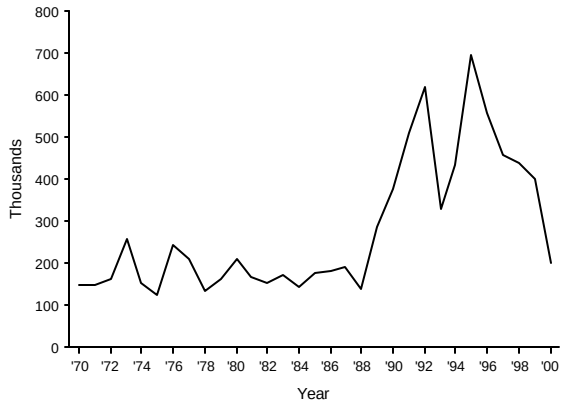

Fig. 12. Size of the SGPP population of Canada geese estimated from winter surveys.

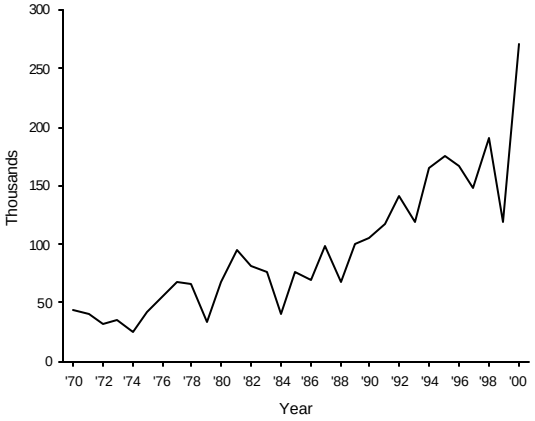

Fig. 14. Size of the RMP population of Canada geese estimated from winter surveys.

Fig. 14). By contrast, spring surveys, conducted principally for ducks in southern Alberta, southwestern Saskatchewan, and Montana, produced an estimate of 165,101 (106,726-223,476), which was 67% higher than the estimate for 1999 ($P=0.05$). Spring estimates have increased by approximately 6% per year since 1990 ($P<0.05$). Biologists report that nesting conditions in Utah and Nevada were generally good, and production from these areas is expected to be average to above average. Wetland conditions in Alberta and Montana were generally worse than last year, and biologists expect fair to good production. Based on little change in the population, and a variable outlook for production, a fall flight similar to last year's is expected.

Pacific Population (PP).—This population nests and winters west of the Rocky Mountains (Fig. 3). Biologists in California report that the number of nesting pairs is down, and production is expected to be slightly below average. Winter and spring precipitation was average to above average in most locations. Numbers of geese in Nevada and Washington were similar to last year, and above long-term averages. In Washington, indices to nesting are similar to last year, but in British Columbia low nesting effort and dry conditions predict poor production. Production was expected to be average to above average in Nevada. The size of the fall flight can not be reliably predicted without more complete information.

Dusky Canada Geese.--The Copper River Delta in southeastern Alaska is the only known nesting area of this relatively small population. These geese winter principally in the Willamette Valley of western Oregon (Fig. 3). The size of the population is estimated through observations of marked geese during December and January. In January 2000, the population estimate was 15,459 (10,639-20,278), which is 15% higher, but not significantly different ($P=0.5$) than the estimate from the previous winter (Fig. 15). Preliminary results from a spring survey of Dusky geese on the Copper River Delta indicated that the number of singles and pairs, and total birds are similar to last year's numbers, and the lowest recorded in the 15 years of the survey. Only small numbers of Dusky geese were observed in a surveys of the Bering Glacier area. However, field biologists reported good nesting conditions at the Copper River, and dusky nesting success appears way above average. Though spring numbers are low, good production could produce a fall flight larger than last year's.

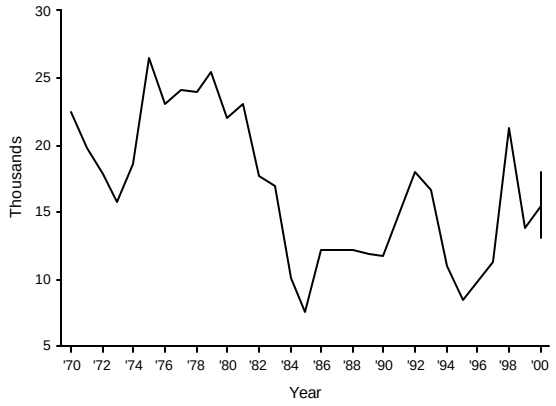

Fig. 15. Size of the Dusky Canada goose population estimated from winter surveys.

Cackling Canada Geese.--Cackling Canada geese nest along the Bering Sea coast of the Yukon-Kuskokwim Delta. They winter in Oregon and northern California (Fig. 3). The calculated 1999 fall count (based on the spring Yukon Delta breeding pairs survey) was 210,440 geese. This is 8% larger than the index from autumn 1998. The number of cackling geese estimated using this index has been increasing ($P< 0.01$) an average of 10% per year from 1990-2000 (Fig. 16). Results of the spring survey on the Yukon-Kuskokwim Delta indicated that the number of breeding pairs and total birds were statistically similar to 1999 numbers, decreasing by 2% and 3%, respectively. Preliminary data from the Yukon Delta Nest Plot Survey suggest a slightly earlier average hatch date than 1999, and an average clutch size consistent with the long-term average. River ice breakup on the Y-K Delta was late this year, but snow cover was light, and tundra habitat cleared quickly. Biologists report average to good nesting effort for Cackling Canada Geese, and the fall flight for this population should be similar to or slightly higher than last year.

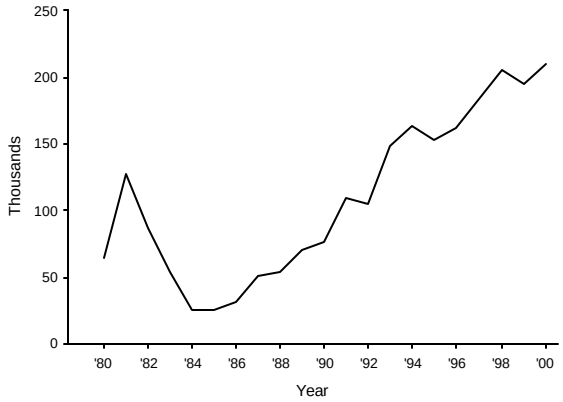

Fig. 16. Size of the Cackling Canada goose population estimated from winter surveys.

Lesser Canada Geese.--These geese nest throughout much of Alaska and winter in Washington, Oregon, and California (Fig. 3). During the winter, lesser Canada geese

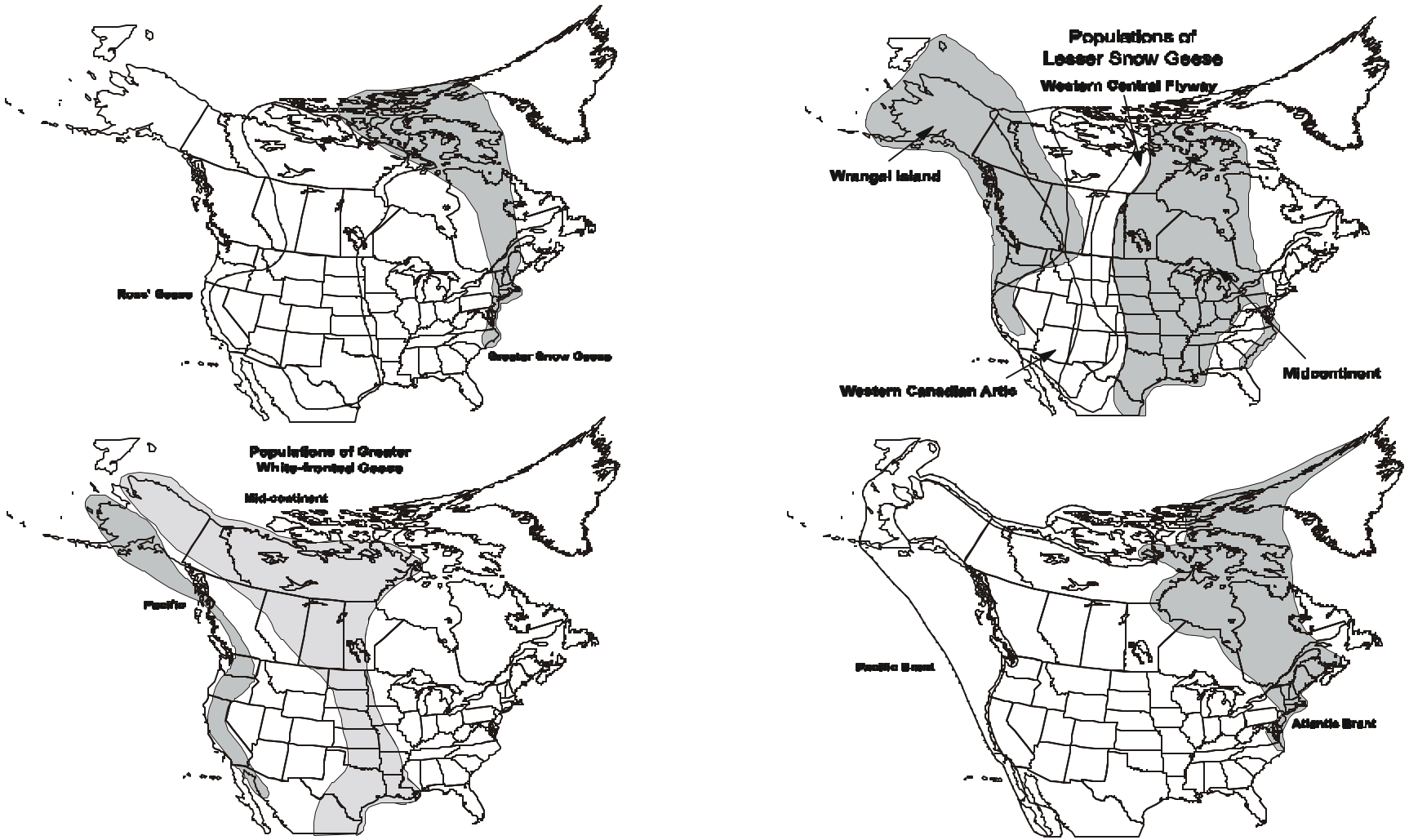

Fig. 17. Approximate ranges of selected goose populations in North America.

mix with other Canada geese and no reliable estimates of population size are available. Across much of the interior of Alaska and the North Slope, conditions appeared to be approximately 1-2 weeks later than usual, though phenology on the central and western portions of the North Slope was close to normal by mid June. The areas east of the Coleville and Sagavankirktok Rivers were very late, with snow, ice and melt-water cover into mid June. Overall, conditions should be poor to fair for nesting lesser Canada geese, and a fall flight than last year's is predicted.

Aleutian Canada Geese (ACG).—Aleutian Canada geese (*Branta canadensis leucopareia*) are thought to have historically bred from near Kodiak Island, Alaska, to the Kuril Islands in Asia, and wintered in Japan, and from British Columbia to northern Mexico, but currently only breed on the Aleutian Islands, and winter along the Pacific coast to central California. This population declined precipitously in the early 1900's, primarily due to the introduction of Arctic (*Alopex lagopus*) and red (*Vulpes vulpes*) foxes to its nesting islands. The Aleutian Canada goose was federally listed as endangered in 1967, and a formal recovery program begun in 1974. When the recovery program began, the population numbered approximately 800 birds. Currently listed as threatened under the Endangered Species Act, this sub-species has increased in overall numbers and breeding distribution, and in 1999, was proposed for removal from special protection. An indirect population estimate based on observations of neck-banded birds in Modesto, California 1999-2000 was 33,496 (27,073-39,918), 17% greater than, but statistically similar (P>0.2) to the estimate for 1998-1999. Information on breeding ground conditions is not available, so it is not possible to give a fall flight prediction.

Status of Greater Snow Geese (GRTR)

These geese (*Anser caerulescens)* nest principally around northern Foxe Basin, northern Baffin, Bylot, Axel Heiberg, and Ellesmere islands, and Greenland. They winter along the mid-Atlantic coast from New Jersey to North Carolina (Fig. 17). The number of greater snow geese counted in mid-winter was 464,781, a 24% increase over 1999. Midwinter counts have increased an average of 13% per year over the past 10 years (*P*<0.005). By contrast, biologists conducting the 2000 photographic survey of spring staging in the St. Lawrence Valley reported 577,300 geese, a preliminary estimate subject to change (Fig. 18). This estimate is 28% below last year's record high. This decrease was expected due to the timing of spring hunts in relation to survey timing, and due to very poor recruitment in 1999. On Bylot Island, where the largest known colony nests, median nest initiation (15 June) was later than normal, with significantly reduced nesting effort (10% vs. more than 50% in 1998), very heavy snow cover (85% in late May) and cold conditions. However, biologists reported a mean clutch size (3.7) near the long-term mean of 3.74. For those birds nesting, good success is expected due to mild June weather, and large numbers of lemmings, which provide alternate prey for predators. From laying through incubation, nest predation was low, around 10%. Nonetheless, lower-than-average production of young from Bylot Island is anticipated due to poor nesting effort and delayed nesting. The breeding output of greater snow geese should be below the long-term average, but higher than the record low level of 1999. With the currently high population level, a large fall flight is expected, but it will contain a relatively small proportion of young geese.

Status of Lesser Snow Geese

Mid-Continent Population (MCP).--This population nests primarily in colonies along the southern and western shores of Hudson Bay and on Southampton and Baffin Islands (Fig. 17). During the January 2000 survey, 2,397,319 'light' geese (primarily lesser snow geese, with

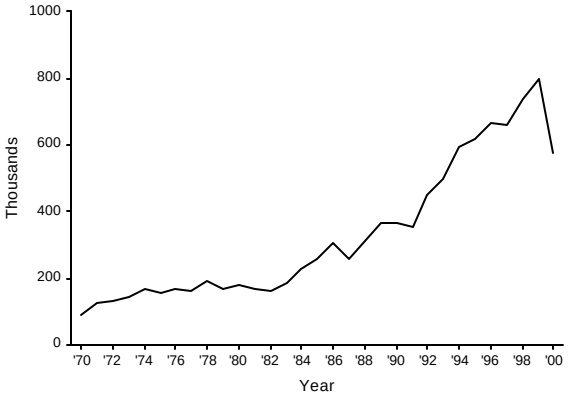

Fig. 18. Size of the Greater Snow goose population estimated from spring surveys.

some Ross' geese) were counted, which is slightly lower than last year's count (Fig. 19). The winter index has increased an average of 5% per year during the last 10 years, with a significant positive trend since surveys began (*P<0.01*). Throughout much of their range, lesser snow goose nesting has been delayed, and low production is expected. The small Akimiski Island colony was similar to its 1999 size, but these numbers are less than half those observed in 1996. Biologists suggest this may reflect increased nesting inland on freshwater marshes. Nesting was marginally later than usual and clutch sizes slightly smaller than average. The post-hatching period has been cool and very wet, and below average production is expected for this colony. The Cape Henrietta Maria colony

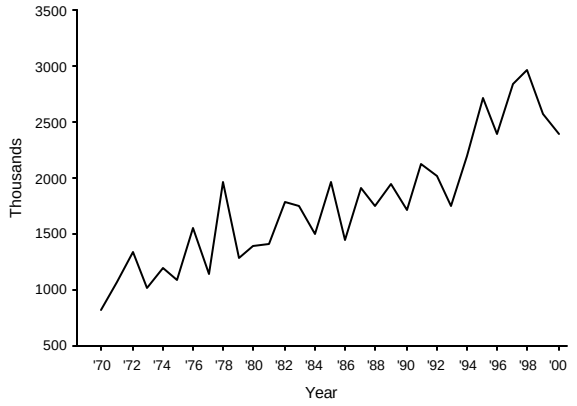

Fig. 19. Size of the Mid-Continent 'light' goose (Lesser Snow Geese + Ross Geese) population estimated from winter surveys.

had fewer nesting pairs overall than in previous years, and currently has half its 1996 numbers. Heavy snowfall in mid May, followed by rain, flooded much of this colony, and clutch sizes were below average. At La Perouse Bay, nesting was very late and disrupted due to cold, wet weather, delayed snow melt, and a return to winter-like conditions in late May. Only about one-third of the pairs at La Perouse Bay attempted to nest. Clutch sizes were low (about 3 eggs), and production was further reduced due to heavy avian predation pressure. Due to delayed plant growth, and heavy grubbing pressure on snow-free areas, little food was available for goslings. These factors point to low production and a low juvenile-adult ratio from the LPB-Churchill Region. Further north along the west coast of the Hudson Bay the mean hatch date of 11 July was one of the latest ever recorded, and there were reports of geese laying eggs in the snow. Large numbers of flying birds observed suggests reduced nesting effort. Productivity on the west Hudson Bay is much lower than normal, but is not a complete failure. Spring was late on Southampton and Baffin islands, which are important nesting areas, and late and heavy snowfall may have adversely affected nesting on Baffin Island. Poor nesting conditions throughout the breeding range of MCP snow geese suggests their fall flight will be reduced compared to last year's predictions, with low juvenile-adult ratios. Nonetheless, this population remains very large, with numbers more than twice as high as management objective levels.

Western Central Flyway Population (WCFP).--This population, consisting primarily of snow geese, but with significant proportions of Ross geese, breeds in the western Canadian Arctic, with large nesting colonies at Queen Maude Gulf and on Banks Island. These geese stage in the 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. 17). 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, 137,500 geese were counted in January 2000; this count is 42% smaller than the previous year's index (Fig. 20). However, the U.S. counts for the WCFP of snow (and Ross) geese have shown a slight increasing trend over the past 10 years ($P=0.05$). The population estimate for the entire range (U.S. and Mexico) was 255,970, which is 19% lower than the last comparable survey that was conducted in 1996, and nearly the same as the estimate for 1993 survey. Biologists on the nesting range near the Queen Maud Gulf reported that nesting was later than normal and average clutch size was below normal. Although nest densities were down, the overall extent of the colony (20 X 20 km) is larger than ever. Below-average production is predicted. On Banks Island, spring was late and nesting was delayed, as it also was at

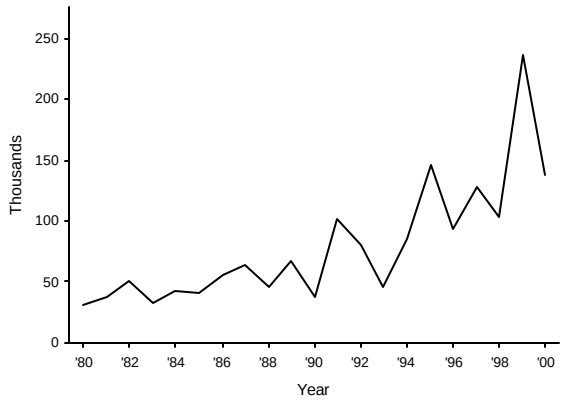

Fig. 20. Size of the Western Central Flyway Population of 'light' goose (Lesser Snow Geese an Ross Geese) population estimated from winter surveys.

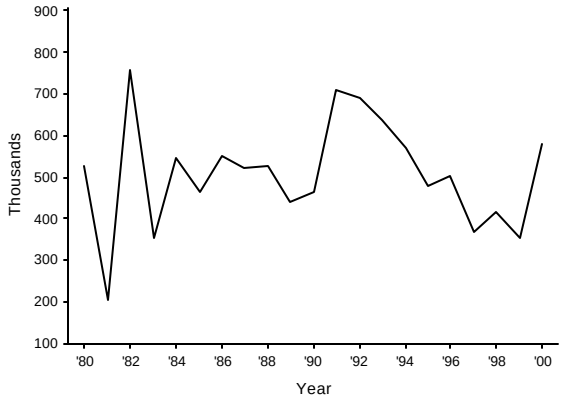

Fig. 21. Size of the Western Arctic-Wrangel Island (Pacific Flyway) Central Flyway Population of Lesser Snow Geese estimated from winter surveys.

the Anderson River and Kendall Island bird sanctuaries, the two mainland colonies. Few nests were observed. Overall, below-average recruitment is predicted, and the fall flight will likely be lower than that of last year due to the decreased number of adult geese reported in the winter survey, and poor production throughout their nesting range.

Western Arctic - Wrangel Island Population (WAWI).--Most of the snow geese in the Pacific Flyway originate from nesting colonies in the Western Arctic (WA; Banks Island, in the Anderson and Mackenzie River deltas, on Jenny Lind Island, and in the western Queen Maud Gulf region) and Wrangel Island (WI) off the north coast of Russia. The WA segment of the population winters in central and southern California, New Mexico, and Mexico, while the WI segment winters in the Puget Sound area of Washington and in northern and central California (Fig. 17). Possible interchange of individuals between the two breeding sites may occur in overlapping wintering ranges in California. The number of snow geese wintering in the Pacific Flyway was estimated at 579,000 individuals, which is 63% larger than the count for 1999 (Fig. 21). This population has been characterized by large apparent shifts in abundance (for example, from 204K to 760K between 1980 and 1981). However, the Pacific Flyway snow goose population is notable, as it is the only population of light geese which has declined over the past 10 years ($P = 0.056$). Segregating total counts between the WA and WI segments is not possible because WA and WI snow geese mix with other "white geese" in the Pacific Flyway during winter. Biologists monitoring a large nesting colony on Banks Island reported a late spring, and below-average production (see narrative for WCFP snow geese). At smaller colonies near the Anderson River and on Kendall Island production likely will be low due to the relative lateness of spring melt and low nesting efforts. The number of geese nesting at Anderson River was well below historic values. The estimated number of nesting geese at Kendall Island was below the long-term average for this colony. By contrast, conditions on Wrangel Island were good. The total spring population was 95,000, with an estimated 25,000 nests and an average clutch size of 3.5. Predator numbers appeared low, and nest success was estimated at 88%. Russian biologists estimated 75,000 goslings would be produced on the island, and 5,000 on the mainland. Though production from the segment of Pacific Flyway population breeding in the western Canadian Arctic is expected to be below average, good production from Wrangel Island birds should produce a fall flight greater than last year.

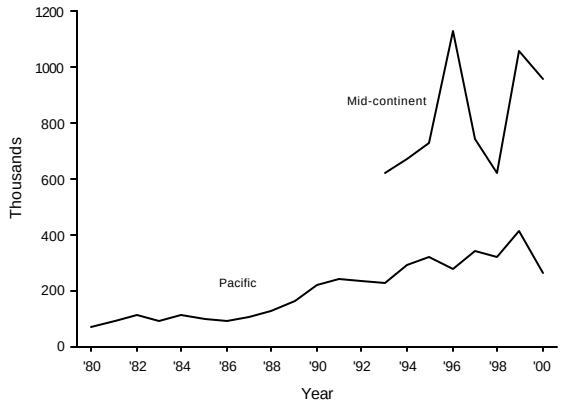

Fig. 22. Size of the Mid-Continent and Pacific populations of greater white-fronted geese estimated from winter surveys.

Status of Ross' Geese

Most Ross' geese (*Chen rossii)* nest in the Queen Maud Gulf area, but some nest on Banks Island and along the western coast of Hudson Bay. Ross geese are represented in 3 different populations of 'light' geese (MC, WCFP, and WAWI), and winter in northern and central California, New Mexico, Mexico, and along the Gulf Coast of Texas (Fig. 17). No annual estimate of wintering-population size is available. However, both the MCP and WCFP populations of 'light' geese in which Ross geese are found have increased significantly over the last 10 years. In addition, periodic surveys in breeding and wintering areas suggest steady increases in the number of Ross' geese since the mid-1960's. Preliminary estimates from Canadian biologists suggest approximately 1 million Ross' geese in North America. Field biologists expect below average production from the Queen Maud Gulf, and from the western Hudson Bay, but the relative size of the fall flight can not be predicted without an annual index to the size of the breeding population.

Status of Greater White-fronted Geese

Pacific Population (PP).--These geese (*Anser albifrons)* nest in western Alaska, primarily in the Yukon-Kuskokwim Delta, and most winter in the Central Valley of California (Fig. 17). An index to this population is derived from a fall survey conducted on staging and wintering areas in the Pacific Flyway. The 1999 fall index was 265,980, a decrease of 36% compared to last year (Fig. 22). Numbers of PP white-fronted geese in the fall survey have steadily increased ($P<0.05$) during the last 10 years. On the Yukon-Kuskokwim Delta this spring, spring thaw was about 1-2 weeks later than normal, but biologists report normal nesting effort. Spring surveys conducted here revealed 11% fewer pairs and 4% fewer total birds than last year. However, like the fall population count, indices from the Delta have generally increased over the last 10 years. Preliminary numbers from the Yukon Delta Nest Plot Survey suggest slightly earlier hatch dates and slightly larger clutch sizes than in 1999. Based on the size

of the spring population and good nesting conditions, an average production year is predicted.

Mid-Continent Population (MCP).--Birds from this population nest across a broad region of the western and central Arctic that extends from northwestern Alaska to the Foxe Basin. They concentrate in southern Saskatchewan during the fall, and most spend the winter in Texas or Louisiana (Fig. 17). This population was formerly divided into eastern and western segments. In 1999, 963,100 were counted during the autumn, which is 9% lower than the 1998 estimate (Fig. 22). There was no evidence of a trend in this population over the last 8 years. Biologists on the North Slope of Alaska reported that spring phenology was later than normal this year and they anticipate below-average production. In the western Canadian Arctic, field biologists expect that production will also be below average. Overall, the fall flight is expected to be average to below average; the size of the spring population decreased relative to last year, and breeding success likely will be poor.

Status of Brant

Atlantic Brant (ATLB).--Most of this population of brant (*Branta bernicla)* nests in the eastern Arctic and winters along the Atlantic Coast from Massachusetts to North Carolina (Fig. 17). The January 2000 estimate of brant in the Atlantic Flyway was 157,200, which is 8% less than the 1999 estimate (Fig. 23), but 11% higher than the 10-year average. No trend was detected ($P>0.5$) in the size of this population over the most recent 10-year period. The late spring in much of the eastern arctic points toward poor brant production, and the fall flight should be lower than that of last year.

Pacific Brant (PACB).--These geese nest from Melville and Banks Islands to the Queen Maud Gulf, and west along the coastal mainland to western Alaska and Wrangel Island. They migrate as far south as Baja California and the west coast of Mexico (Fig. 17). The survey in January 2000 in the Pacific Flyway and Mexico resulted in a count of 135,000 brant, which is 5% higher than the previous year's index (Fig. 23). No trend was evident in the number of brant counted over the last 10 years ($P>0.5$). Weather and habitat conditions on the Yukon-Kuskokwim Delta were later than average. Spring phenology on the North Slope of Alaska was 1-2 weeks later than average this year but nesting conditions were good, nonetheless. Biologists reported good nesting effort in the large colonies on the Yukon-Kuskokwim delta, as twice as many nests were recorded compared to last year. The estimate of nest numbers at the Tutakoke River was particularly high. However, near the Anderson and Mackenzie deltas, brant production will likely be low due to the late spring. The fall flight likely will be similar to that of 1999, with a breeding population similar to last year, but with a mixed outlook for recruitment, depending on the nesting area.

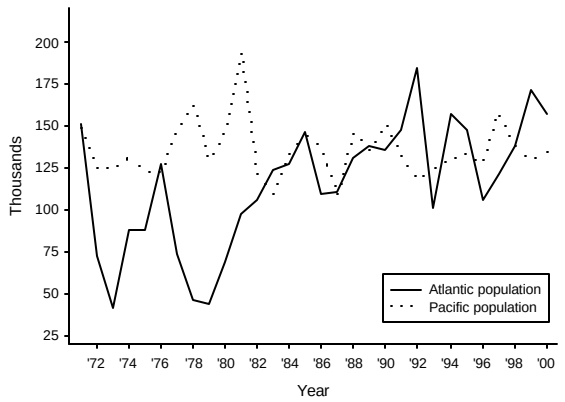

Fig. 23. Size of the Atlantic and Pacific populations of brant estimated from winter surveys.

Status of Emperor Geese

The breeding range of the emperor goose (*Chen canagica)* is restricted to coastal areas of the Bering Sea, with the largest concentration on the Yukon-Kuskokwim Delta in Alaska. Emperor geese migrate relatively short distances and winter primarily in the Aleutian Islands (Fig. 24). Since 1981, emperor geese have been surveyed annually on spring staging areas in southwestern Alaska. This year's count was 62,600 geese, which is 38% higher than the previous year's index (Fig. 25). The 3-year moving average is now 52,288 geese. No trend was detected ($P>0.5$) in the number of geese counted during this survey over the last 10 years. Spring breeding pairs and total bird indices for the Yukon-Kuskokwim Delta breeding pairs surveys were lower, but statistically similar to last year's value (-22% and -19%, respectively). Preliminary data from nest plot surveys on the Yukon-Kuskokwim Delta suggest no change in emperor goose nesting effort in the survey area from last year, despite a slightly earlier (4-5 days) average hatch date compared to 1999. Mean clutch size was similar to the long-term average. The fall flight of emperor geese probably will be similar to that of last year due to a smaller population this spring, and average to good nesting conditions.

Status of Tundra Swans

Western Population.--The Western Population of tundra swans (*Cygnus columbianus)* nests 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. 24). The January 2000 estimate of 89,620 swans is 25% smaller than the 1999 estimate (Fig. 26). However, this population has been increasing at an average rate of 6% per year since

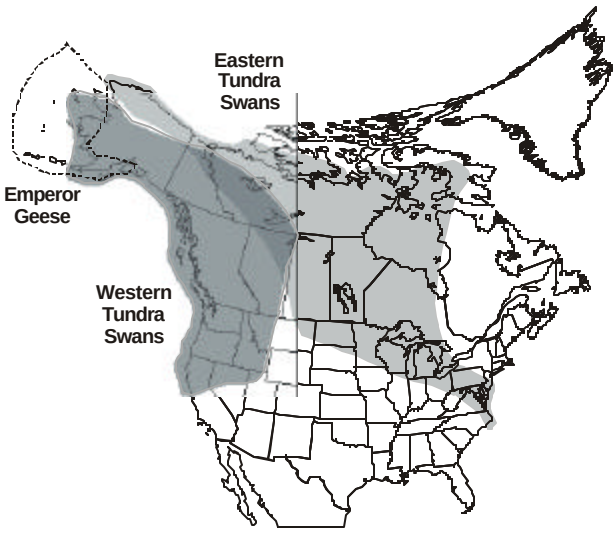

Fig. 24. Approximate range of the Emperor goose, and eastern and western swan populations in North America.

1990 (P<0.03). An assessment of western tundra swans also was available from aerial surveys conducted in spring on the Yukon-Kuskokwim Delta. Numbers of breeding pairs on the Delta were similar (-4%) to last year's estimates. Total birds increased by 17%. Preliminary data from nest-plot surveys on the Yukon-Kuskokwim Delta indicated a substantially earlier hatch date, but an average clutch size nearly 0.5 eggs below the long-term average. Weather conditions on the Delta this spring were later than average, but should not substantially affect production. Fall flight should be similar to last year's.

Eastern Population.--The Eastern Population of tundra swans nests from the Seward Peninsula of Alaska to the northeast shore of Hudson Bay and Baffin Island. These birds spend winters in coastal areas from Maryland to North Carolina (Fig. 24). The January 2000 estimate was 103,080 swans, 5% lower than last year's estimate (Fig. 26). However this population has increased by an average 5% per year over the last 10 years (P <0.05). Spring temperatures were below average across much of the central and western Canadian Arctic, and nesting conditions were particularly poor on Baffin Island. On the North Slope of Alaska, snow melt was much later than normal, particularly in the eastern portions. Overall, below-average production is expected, and the fall flight will be lower than last year's.

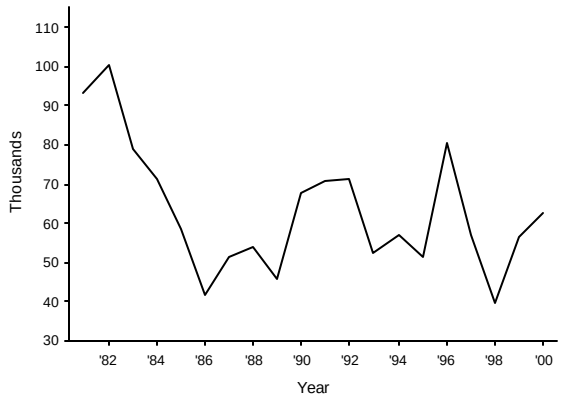

Fig. 25. Size of the Emperor goose population estimated from May surveys.

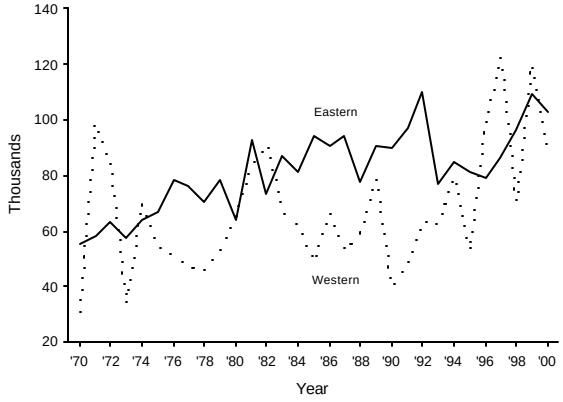

Fig. 26. Size of the Eastern and Western populations of tundra swans estimated from winter surveys.

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

Alaska and Yukon Territory (Old Crow Flats): B. Conant, J. Hodges, and D. Groves

Northern Alberta, Northeastern British Columbia, and Northwest Territories: C. Ferguson and P. Corr [d]

Northern Saskatchewan and Northern Manitoba: F. Roetker and S. Sheffield

Southern and Central Alberta:

Air	E. Buelna and A. Davenport
Ground	D. Duncan [a], P. Pryor [a], K. Froggatt [b], B. Ilnicki [c], E. Hofman [b], S. Barry [a], R. Russell [b], K. Kaczanowski [c], I. McFarlane [c], M. Barr [c], B. Peers [c], R. Hunka [c], M. Johnson [a], J. Gonek [a], B. Meagher [a], J. Heese [a], G. Yanicki [b], D. High [b]

Southern Saskatchewan:

Air	P. Thorpe, R. Bentley, R. King, and H. Bell
Ground	D. Nieman [a], J. Smith [a], K. Warner [a], A. Williams [a], M. Collingwood [a], M. Hosegood [a], M. Nieman [c], P. Nieman [a], C. Park [a], J. Peterson, D. Caswell [a], R. Bazin [a], P. Rakowski [a], M. Schuster [a], D. Pisiak [b], J. Caswell [a], M. Van Osh [c], F. Baldwin [a], J. Galbraith [a], M. Blanchard [a]

Southern Manitoba:

Air	R. King, and H. Bell
Ground	R. Bazin [a], D. Caswell [a], P. Rakowski [a], M. Schuster [a], D. Pisiak [b], J. Caswell [a], M. Van Osh [c], F. Baldwin [b], J. Galbraith [b], M. Blanchard [b]

Montana and Western Dakotas

Air	J. Voelzer and K. Bollinger
Ground	A. Arnold [d], P. Garrettson, and V. Griego

Central and Eastern Dakotas

Air	J. W. Solberg and M.S. Laws
Ground	G.T. Allen, M.A. Ellingson, M.L. Gutowski, and M.L. Meade

Northern Quebec: J. Wortham and M. Francke

New York, Eastern Ontario, and Southern Quebec: J. Goldsberry and M. Koneff

Central and Western Ontario: W. Butler, D. Holtby [b] and M. Koneff

Maine and Maritimes: J. Bidwell and M. Drut

British Columbia: A. Breault [b], P. Watts [d], and over 25 participants from the Candian Wildlife Service, Ducks Unlimited Canada, British Columbia Wildlife Branch, Canadian Parks Service, and private organizations

California:

Air	D. Yparraguirre [b] and M. Adolf [b]
Ground	D. Loughman [d], P. Lauridson [d], G. Yarris [d], and J. Laughlin [d]

Colorado: J. Gammonley

Michigan: R. Matthews [d], G. Belyea [b], J. Robison [b], E. Flegler [b], J. Niewoonder [b], E. Kafcas [b], A. Karr [b], T. Gierman [b], B. Scullon [b], and B. Aldrich [b]

Appendix A. Continued.

Minnesota
- Air: D. Stoltman [b] and J. Lawrence [b]
- Ground: S. Kelly, J. Artmann, S. Lewis, R. Papasso, T. Rondeau, E. Rozowski, R. Schuldt, M. Soler, K. Svendsgaard, L. Wolff, S. Zodrow, D. Haugen, J. Mattsson, K. Moos, B. Olson, P. Soler, N. Tyler

Nebraska
- Air: D. Benning [d] and N. Lyman [b]
- Ground: W. Cater [b] and E. Wehland [b]
- Data Analysis: M. Vrtiska [b]

Nevada: N. Saake [b]

Northeastern U.S.
- Data Analysis: H. Heussman [b] and J. Sauer
- Connecticut: Staff from the CT Department of Environmental Protection, Wildlife Division
- 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], and D. Webster [b]

Washington: M. Monda [b]

Wisconsin
- Data Analysis: J. Berguist [b], R. Gatti [b], and K. Thiede [b]
- Air: L. Waskow [b], B. Bacon [b], R. McDonough [b], C. Milestone [b], and P.Samerdyke [b]
- Ground: K. Belling [b], T.Bahti [b], J. Cole [b], G. Dahl [b], G. Dunsmoor [b], D. Evenson [b], B. Hill [b], J. Huff [b], K. Jonas [b], M. Kastler [b], D. Kuhaupt [b], T. Meacham [b], K. Morgan [b], A. Nelson [b], K. Thiede [b], J. Varro [b], M. Verdon [b], P. David [b], D. North [b], S. White [b], N. Brown, A. Kitchen, M. Madel, B. Peterson, J. Trick, D. Trudeau, G. VanVreede, C. Cook [d], and T. Cook [d]

Wyoming: L. Roberts [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 status of geese and swans.

Coordinated Flyway-wide Surveys: K. Gamble, T. Moser, J. Peterson, R. Raftovich, J. Serie, D. Sharp, R. Trost

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

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

North Atlantic Population of Canada Geese: J. Serie

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

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

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

Mississippi Flyway Population Giant Canada Geese: J. Berquist[b], E. Flegler[b], D. Graber[b], M. Hartman[b], M. Kraft[b], J. Lawrence[b], D. Luukkonen, R. Pritchert[b], and G. Zenner[b]

Eastern Prairie Population of Canada Geese: D. Andersen[d], K. Dickson[a], R. Foster, M. Gillespie[b], D. Humburg[b], S. Maxson[b], D. Rusch[d], and P. Telander[b]

Western Prairie and Great Plains Populations of Canada Geese: J. Gabig[b] and M. Kraft[b]

Tall Grass Prairie Population of Canada Geese: R. Alisauskas[a], R. Case[b], A. Didiuk[a], K. Dickson[a], and R. Kerbes[a]

Short Grass Prairie Population of Canada Geese: K. Dickson[a] , and J. Hines[a]

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

Rocky Mountain Population of Canada Geese: T. Aldrich[b], J. Dubovsky, J. Gammonley[b] , J. Hansen[b], T. Hinz[b], J. Herbert[b], L. Roberts[b], N. Saake[b], M. Szymczak[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], and N. Saake[b]

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

Lesser Canada Geese: B. Conant, R. King, R. Oates, and M. Spindler

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

Aleutian Canada Geese: R. Trost

Greater Snow Geese: A Bechet[d], G. Gauthier[d], J. Hughes[a], J. Giroux[d], and A. Reed[a]

Mid-Continent Population of Lesser Snow Geese: A.Didiuk[a], K. Dickson[a], R. Foster, M. Gillespie[b], D. Humburg[b], R. Rockwell[d], and P. Telander[b]

Appendix B. Continued.

Western Central Flyway Population of Lesser Snow Geese: R. Alisauskas[a], J. Bredy[d], K. Dickson[a], R. Kerbes[a], S. Slattery[d], and K. Warner[a]

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

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

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

Mid-Continent Population of Greater White-Fronted Geese: K. Abraham[b], R. Alisauskas[a], R. Case[b], K. Dickson[a], J. Hines[a], R. Kerbes[a], R.Rockwell[d], R. Trost, and K. Warner[a]

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

Atlantic Brant: K. Dickson[a], M. Mallory[a], A. Reed[a]

Emperor Geese: T. Bowman, C. Dau, B. Eldridge, R. King, E. Mallek, 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: J. Hines[a] and R. Oates

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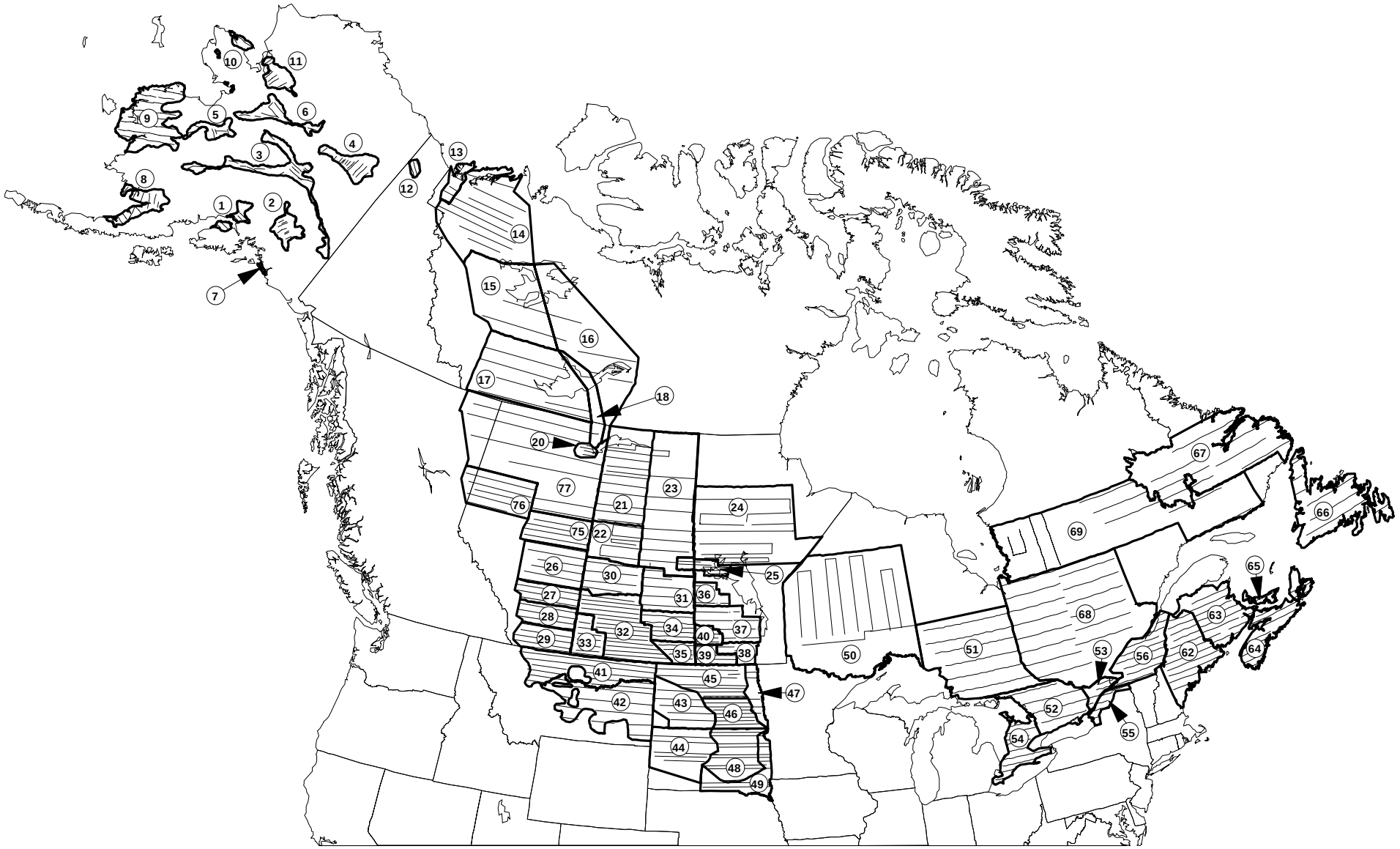
[a]Canadian Wildlife Service
[b]State, Provincial, or Tribal Conservation Agency
[c]Ducks Unlimited - Canada
[d]Other organization
All others - U.S. Fish and Wildlife Service



Appendix C. Transects and strata for areas of the Breeding Waterfowl and Habitat Survey.

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	15224.5	99.9	3946.9	138.6

[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	795.8	535.6	142.8	60.1	643.0	338.8	1062.4	314.8	132.3	38.9
1997	8.1	0.6	824.3	514.9	107.5	51.9	779.4	445.8	953.0	407.4	128.3	26.1
1998	9.2	1.1	686.3	360.5	89.1	44.8	945.5	445.3	739.6	368.5	155.7	43.4
1999	8.3	0.8	824.6	534.5	101.0	50.2	649.5	419.5	716.5	316.4	251.2[d]	81.1
2000	7.8	0.6	625.4	443.4			745.5	345.4	815.3	318.1	178.8	54.3

[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] Results are not comparable to earlier estimates due to major changes in survey methodology in 1999.

Appendix E. Continued.

	Nevada		Northeastern US[e]		Oregon		Washington		Wisconsin		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							326.5	94.9	293.0	115.0
1974	17.1	0.7							320.4	97.5	318.0	122.0
1975	14.5	0.6							414.2	110.7	283.0	65.0
1976	13.6	0.6							279.4	73.6	276.0	69.0
1977	16.5	1.0							231.8	59.4	305.0	71.0
1978	11.1	0.6							240.8	79.5	323.0	77.0
1979	12.8	0.6					98.6	32.1	322.6	95.2	310.0	72.0
1980	16.6	0.9					113.7	34.1	284.3	137.7	306.0	103.0
1981	26.9	1.6					148.3	41.8	464.4	116.0	307.0	79.0
1982	21.0	1.1					146.4	49.8	233.6	95.0	299.0	67.0
1983	24.3	1.5					149.5	47.6	235.0	111.8	306.0	103.0
1984	24.0	1.4					196.3	59.3	249.4	95.4	585.0	114.0
1985	24.9	1.5					216.2	63.1	262.9	95.1	288.0	64.0
1986	26.4	1.3					203.8	60.8	332.1	158.8	356.0	73.0
1987	33.4	1.5					183.6	58.3	369.7	137.9	340.0	80.0
1988	31.7	1.3					241.8	67.2	275.0	129.4	408.0	98.0
1989	18.8	1.3	1144.8	589.9			162.3	49.8	397.6	160.0	266.0	85.0
1990	22.2	1.3	1042.3	665.1			168.9	56.9	394.6	154.7	382.0	88.0
1991	14.6	1.4	1849.2	779.2			140.8	43.7	415.5	162.9	330.0	74.0
1992	12.4	0.9	1090.2	562.2			116.3	41.0	538.2	256.1	313.0	98.0
1993	14.1	1.2	1198.4	683.1			149.8	55.0	346.0	171.2	196.0	77.0
1994	19.2	1.4	1348.1	853.1	391.3	82.8	123.9	52.7	525.1	276.6	353.6	89.6
1995	17.9	1.0	1441.2	862.8	282.2	63.6	147.3	58.9	572.2	217.5	494.9	104.4
1996	26.4	1.7	1432.3	848.5	417.4	101.1	163.3	61.6	677.3	292.1	589.0	99.9
1997	25.3	2.5	1404.9	795.1	472.4	113.8	172.8	67.0	381.3	172.9	617.0	125.1
1998	27.9	2.1	1443.8	775.1	425.1	123.5	185.3	79.0	427.5	165.9	824.1	131.4
1999	29.9	2.3	1520.8	879.7	593.5	121.9	200.2	86.2	434.4	221.6	740.8	124.8
2000			1925.8	757.8			143.6	47.7	769.8	367.5	f	

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

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

Appendix G. Breeding population estimates and standard errors (in thousands) for the 10 most abundant species of ducks in the eastern survey area, 1990-2000[a].

	Mergansers		Mallards		American black duck		American wigeon		Am. green-winged teal		Blue-winged teal		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

[a] Maine estimates were included beginning in 1995. Quebec, Newfoundland, Labrador, Prince Edward Island, New Brunswick, and Nova Scotia 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	814.2	62.0				
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	1272.6	56.0	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	2776.2	144.5	2432.0	227.3	5208.2	269.3
2000	2450.8	95.9	1401.5	82.1	3852.4	126.3

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

Appendix I. Canada goose population indices (in thousands) during 1969-2000. Population names as abreviated in text.

Year	Population												
	AP[a,b]	AFRP[a]	SJBP[a]	MVP[a]	MFGP[a]	EPP[a,h,j]	WPP/GPP[c]	TGPP[c]	SGPP[d]	HLP[d]	RMP[d]	Dusky[d]	Cackling[e]
1969/70									151.2	44.2	25.8	22.5	
1970/71								133.2	148.5	40.5	25.4	19.8	
1971/72						124.6		160.9	160.9	31.4	36.6	17.9	
1972/73						137.5		148.4	259.4	35.6	37.1	15.8	
1973/74						119.8		160.5	153.6	24.5	42.8	18.6	
1974/75						144.2		133.5	123.7	41.2	46.7	26.5	
1975/76						216.4		203.7	242.5	55.6	51.6	23.0	
1976/77						163.7		171.3	210.0	67.6	54.3	24.1	
1977/78						179.6		215.5	134.0	65.1	59.0	24.0	
1978/79						99.3		187.6	163.7	33.8	62.9	25.5	
1979/80								165.9	213.0	67.3	78.1	22.0	64.1
1980/81						125.4		257.7	168.2	94.4	94.7	23.0	127.4
1981/82						131.7	175.0	284.7	156.0	81.9	64.3	17.7	87.1
1982/83						155.0	242.0	171.8	173.2	75.9	68.2	17.0	54.1
1983/84						135.4	150.0	264.9	143.5	39.5	55.5	10.1	26.2
1984/85						158.3	230.0	207.0	179.1	76.4	90.3	7.5	25.8
1985/86						194.6	115.0	198.2	181.0	69.8	68.3	12.2	54.4[i]
1986/87						203.0	324.0	163.2	190.9	98.1	71.5		51.4[i]
1987/88	118.0					209.0	272.1	315.8	139.1	66.8	71.4	12.2	63.9[i]
1988/89		396.0		712.0		210.0	330.3	224.2	284.8	100.1	73.9	11.8	74.6[i]
1989/90		236.6	82.4	893.2		231.7	271.0	159.0	378.1	105.9	102.4	11.7	90.3[i]
1990/91		305.7	108.1			211.6	390.0	315.5	508.5	116.6	86.7		88.9[i]
1991/92		439.2	91.6	866.5		202.4	341.9	280.4	620.2	140.5	115.7	18.0	97.8[i]
1992/93	91.3	646.8	77.3	617.8		157.3	318.0	238.7	328.2	118.5	74.7[f]	16.7	120.3[i]
1993/94	40.1	647.5	95.7	838.1		210.6	272.5	236.8	434.1	164.3	77.3	11.0	137.7[i]
1994/95	29.3	779.2	94.0	915.8		204.4	352.5	247.8	697.8	174.4	91.8	8.5	164.3[i]
1995/96	46.1	932.6	123.0	678.8		190.2	403.3	270.3	561.2	167.5	117.0		195.8[i]
1996/97	63.2	1013.3	95.1	735.9	967.0	199.2	453.4	272.3[g]	460.7	148.5	98.5	11.2[h]	157.1[i]
1997/98	42.2	970.1	117.1	444.0	1359.2[h]	125.8	482.3	335.3[g]	440.6	191.0	105.4	21.3[h]	193.3[i]
1998/99	77.5	999.5	136.6	969.5	1390.2[i]	206.6	467.2	548.2[g]	403.2	119.5	114.4	13.8[h]	195.5[i]
1999/2000	93.2	1015.9	89.1	1054.8	1509.9	275.0	594.7	295.7	200.0	270.7	102.3	15.5[h]	210.4[i]

[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 November
[f] Survey incomplete
[g] Survey was incomplete in Mississippi Flyway
[h] Indirect or preliminary estimate
[i] Revised population index - accounting for indicated breeding pairs (R. Trost *pers. comm.*)
[j] Estimates revised in 2000 to account for boundary change and to exclude large groups (D. Humburg *pers.comm.*)

Appendix J. Population indices (in thousands) for snow geese, greater white-fronted geese, brant, emperor geese, and tundra swans during 1969-99. Population names abbreviated as in text.

Year	Snow Geese				White-fronted Geese		Brant		Emperor	Tundra Swans	
	GRTR[a]	MCP[b]	WCFP	WAWI	MCP[c]	PP[c]	ATLB[d]	PACB[d]	Geese[a]	Western[d]	Eastern[d]
1969/70	89.6	818.7						141.7		31.0	55.0
1970/71	123.3	1067.3					151.0	149.2		98.8	58.2
1971/72	134.8	1331.8					73.0	124.8		82.8	63.4
1972/73	143.0	1025.3	11.7				41.0	125.0		33.9	57.2
1973/74	165.0	1189.7	16.3				88.0	130.7		69.7	64.2
1974/75	153.8	1096.9	26.4				88.0	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				74.0	147.0		47.3	76.2
1977/78	192.6	1967.0	31.1				46.0	162.9		45.6	70.3
1978/79	170.1	1285.5	29.4				44.0	129.4		53.5	78.6
1979/80	180.0	1387.7	30.5	528.1		73.1	69.0	146.4		65.2	63.7
1980/81	170.8	1406.3	37.6	204.2		93.5	97.0	194.2	93.3	83.6	93.0
1981/82	163.0	1794.0	50.0	759.9		116.5	106.0	121.0	100.6	91.3	73.1
1982/83	185.0	1755.5	33.4	354.1		91.7	124.0	109.3	79.2	67.3	87.0
1983/84	225.4	1494.4	43.0	547.6		112.9	127.0	133.4	71.2	61.9	81.1
1984/85	260.0	1973.1	41.4	466.3		100.2	146.0	144.8	58.8	48.8	94.3
1985/86	303.5	1449.3	55.4	549.8		93.8	110.0	136.2[e]	42.0	66.2	90.9
1986/87	255.0	1913.8	63.6	521.7		107.1	111.0	108.9	51.7	52.8	94.5
1987/88		1750.5	46.2	525.3		130.6	131.0	147.0	53.8	59.2	77.4
1988/89	363.2	1956.1	67.6	441.0		161.5	138.0	135.2	45.8	78.7	90.6
1989/90	368.3	1724.3	38.2	463.9		218.8	135.4	151.6	67.6	40.1	89.7
1990/91	352.6	2135.8	100.9	708.5		240.8	147.7	131.7	70.9	47.6	97.4
1991/92	448.1	2021.9	80.0	690.1		236.5	184.8	117.7	71.3	63.7	110.1
1992/93	498.4	1744.2	45.1	639.3	622.9	230.9	100.6	124.4	52.5	62.6[f]	76.6
1993/94	591.4	2200.8	84.9	569.2	676.3	295.1	157.2	130.0	57.3	79.4	84.5
1994/95	616.6	2725.1	146.4	478.2	727.3	324.8	148.2	133.7	51.2	52.9[f]	81.3
1995/96	669.1	2398.1	93.1	501.9	1129.4	277.5	105.9	126.9	80.3	98.1	79.0
1996/97	657.5	2850.9	127.2	366.3	742.5	344.1	121.5	157.9	57.1	122.5	86.1
1997/98	695.6	2977.2	103.5	416.4	622.2	319.0	138.0	138.4	39.7	70.5	96.5
1998/99	803.4	2575.7	236.4	354.3	1058.3	413.1	171.6	129.2	54.6	119.8	109.0
1999/2000	577.3[g]	2397.3	137.5	579.0	963.1	266.0	157.2	135.0	62.6	89.6	103.1

[a] Surveys conducted in spring

[b] Surveys conducted in December until 1998; in 1999 a January survey replaced the January count

[c] Surveys conducted in autumn

[d] Surveys conducted in January

[e] Beginning in 1986, counts of brant in Alaska are included in the total

[f] Survey was incomplete

[g] Preliminary estimate