

# Waterfowl

*Population Status, 2001*



# WATERFOWL POPULATION STATUS, 2001

July 20, 2001

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 2001-2002 hunting season.

## ACKNOWLEDGEMENTS

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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  $36.1 \pm 0.6$  [SE] million birds. This was 14% below ( $P < 0.001$ ) last year's estimate of  $41.8 \pm 0.7$  million birds, but still 9% above the long-term (1955-2000) average ( $P < 0.001$ ). Mallard (*Anas platyrhynchos*) abundance was  $7.9 \pm 0.2$  million, which is 17% below ( $P < 0.001$ ) the 2000 estimate of  $9.5 \pm 0.3$  million and similar to the long-term average ( $P = 0.08$ ). Blue-winged teal (*Anas discors*) abundance was  $5.8 \pm 0.3$  million, which was 23% below last year's estimate of  $7.4 \pm 0.4$  million ( $P = 0.001$ ), but 29% above the long-term average ( $P = 0.001$ ). Green-winged teal (*Anas crecca*) abundance was  $2.5 \pm 0.2$  million, 39% above the long-term average ( $P < 0.001$ ) but 21% lower than last year ( $P = 0.007$ ). Gadwall (*Anas strepera*;  $2.7 \pm 0.1$  million, +66%) and northern shovelers (*Anas clypeata*;  $3.3 \pm 0.2$  million, +60%), were above their long-term averages ( $P \leq 0.04$ ), while northern pintails (*Anas acuta*;  $3.3 \pm 0.3$  million, -23%) and scaup (*Aythya marila* and *A. affinis* combined;  $3.7 \pm 0.2$  million, -31%) remained below their long-term averages ( $P < 0.01$ ). Redheads (*Aythya americana*;  $0.7 \pm 0.07$  million) were 23% below 2000 numbers ( $P = 0.04$ ), and similar to their long-term average ( $P = 0.22$ ). American wigeon (*Anas americana*;  $2.5 \pm 0.1$  million) and canvasback (*Aythya valisineria*;  $0.6 \pm 0.05$  million) estimates were similar to those of last year ( $P \geq 0.19$ ) and to long-term averages ( $P > 0.22$ ). Habitat conditions in May in the traditional survey area were generally wetter than last year, but varied considerably among areas. The estimate of May ponds in Prairie Canada and the U.S. combined was  $4.6 \pm 0.1$  million, up 18% from 2000, but not statistically different from the long-term average ( $P = 0.07$ ). The eastern survey area comprises strata 51-56 and 62-69. The 2001 total duck population estimate for the eastern survey area was  $3.3 \pm 0.3$  million birds, similar to last year's total duck estimate of  $3.2 \pm 0.3$  million birds. Abundances of individual species were similar to last year, with the exception of ring-necked ducks (*Aythya collaris*;  $0.35 \pm 0.04$  million, -43%,  $P = 0.001$ ) and buffleheads (*Bucephala albeola*;  $0.10 \pm 0.02$  million, +93%,  $P = 0.05$ ). The mid-continent mallard fall flight is predicted to be 10.5 million mallards, 6% lower than that of last year ( $P = 0.02$ ).

This section 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 available when this report was written. Future analyses may yield slightly different results as databases are updated and new analytical procedures become available.

## METHODS

### Breeding Population and Habitat Survey

Federal, provincial, and state agencies conduct surveys each spring to estimate the size of breeding populations and to evaluate the condition of the habitats. These surveys are conducted using fixed-wing aircraft and encompass principal breeding areas of North America, and cover over 2.0 million square miles. The traditional survey area (strata 1-18, 20-50, and 75-77) is comprised of parts of Alaska, Canada, and the 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, covering an area of approximately 0.7 million square miles.

In Prairie Canada and the north-central U.S., estimates of ducks and ponds seen from the air are corrected annually for visibility bias by conducting ground counts. In the northern portions of the traditional survey area and the eastern survey area, duck estimates are corrected using visibility rates derived from a comparison of airplane and helicopter counts. Annual estimates of duck abundance are available since 1955 for the traditional survey area and for all strata in the eastern survey area since 1996, although portions of the eastern survey area have been surveyed since 1990. In the traditional survey area, estimates of pond abundance in Prairie Canada are available since 1961, whereas estimates for the north-central U.S. are available only since 1974. Several provinces and states also conduct breeding waterfowl surveys using various methods; some have survey designs that allow calculation of measures of precision for estimates of duck abundance. Information about habitat conditions was supplied primarily by biologists in the survey areas. However, much ancillary weather information was obtained from 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 indices of duck brood and pond numbers. Ground counts are not conducted concurrently with July aerial surveys, so indices of duck broods and ponds are not corrected for visibility bias. The coefficients of variation for May pond estimates are used to estimate the precision of July pond counts.

### **Total Duck Species Composition**

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

### **Mallard Fall-flight Index**

Mallard fall-flight indices predict the size of the fall population originating from the mid-continent region of North America. For management purposes, the mid-continent population is comprised of mallards originating from the traditional survey area, as well as Michigan, Minnesota, and Wisconsin. Indices are based on the mallard models used for Adaptive Harvest Management, and consider breeding population size, habitat conditions, adult summer survival, and projected fall age ratio (young/adult). The projected fall age ratio is predicted from a model that depicts how the age ratio varies with changes in spring population size and pond abundance. The fall-flight index represents a weighted average of the fall flights predicted by the four alternative models of mallard population dynamics used in adaptive harvest management (U. S. Fish and Wildlife Service

2001), using current model probabilities as weights. Fall flight indices provided in this report may differ from those published previously because model weights change each year based on a comparison of model predictions and observed population size.

## **RESULTS AND DISCUSSION**

### **2000 in Review**

Most of Canada and the U.S. experienced warm temperatures in March, and spring phenology was early. The January-May period of 2000 was the warmest on record for the U.S. as a whole. 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 alleviate the moisture deficit from the previous summer's drought. In the spring of 2000 in the traditional survey area, conditions were much drier than during the previous 6 years. These dry conditions were reflected in the estimates of May ponds (Prairie Canada and U.S. combined). The estimate was  $3.9 \pm 0.1$  [SE] million ponds, down 41% from 1999 ( $P < 0.01$ ) and 20% below the 1974-99 average ( $P < 0.01$ , Appendix D). Ponds in Prairie Canada numbered  $2.4 \pm 0.1$  million, 37% below 1999 and 30% below the 1955-99 average ( $P < 0.01$ ). The pond estimate for the north-central U.S. was  $1.5 \pm 0.1$  million, 46% below that of 1999 ( $P < 0.01$ ) and similar ( $P = 0.95$ ) to 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 the Dakotas had excellent habitat conditions. In Alaska, a significant cooling trend resulted in ice breakup 2-3 weeks later than normal.

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-like conditions arrived 2-3 weeks behind normal. Water levels in lakes and ponds in southwestern Ontario, Maine, Nova Scotia, and New Brunswick were higher than in 1999, when the East suffered a drought. Drier-than-normal conditions persisted in southern Ontario and southern Quebec, while southwest Ontario, Maine, and the Atlantic Provinces experienced heavy thunderstorms and severe flooding during May. Overall, habitat conditions in the east were generally good, with the exception of some areas of southern Ontario and south-central Quebec.

In 2000, the estimated breeding population of all ducks (excluding scoters, eiders, long-tailed ducks, mergansers, and wood ducks) in the traditional survey area was  $41.8 \pm 0.7$  million birds (Table 2).

This was similar ( $P=0.12$ ) to the 1999 record estimate of  $43.4 \pm 0.7$  million birds, was 27% above the long-term (1955-99) average ( $P<0.01$ ), and was 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 of the 1970s (60%) when wetland and upland conditions in this region were considered good. The 2000 total-duck population estimate for the eastern survey area (excluding canvasbacks, redheads, ruddy ducks, eiders, long-tailed ducks and wood ducks) was  $3.2 \pm 0.3$  million birds (Table 2). This was similar to the 1999 estimate of  $3.2 \pm 0.2$  million birds.

Throughout much of June 2000, 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, in other areas, production was likely reduced due to flooding and subsequent nest loss. In southern Saskatchewan and Montana, improved habitat conditions did not help production, because either the birds had already left the area before the onset of abundant rainfall (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.

Results of the July Production Survey indicated that the index of July ponds in Prairie Canada and the north-central U.S. combined was  $3.9 \pm 0.1$  million ponds. Although this was the fourth highest recorded estimate for the region, it was 26% below the 1999 record-high estimate of  $5.2 \pm 0.3$  million ponds, but 39% above the long-term average. The number of July ponds in Prairie Canada was  $2.5 \pm 0.1$  million. This was unchanged from the 1999 index of  $2.8 \pm 0.1$  million, but 41% above the long-term average. The number of July ponds in the north-central U.S. was  $1.4 \pm 0.1$  million, the third highest index for the region. This was 42% below the 1999 record high estimate of  $2.4 \pm 0.2$  million, and 48% above the long-term average. The number of broods in the north-central U.S. and Prairie Canada combined was 12% below the 1999 index, but 25% above the long-term average. The number of broods in Prairie Canada and the north-central U.S. were 10% and 5% below 1999 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 north-central U.S.

## **2001 Breeding Habitat Conditions, Populations, and Production**

### *Overall Habitat and Population Status*

Spring weather was generally warmer than normal across Canada, and temperatures were at or slightly below normal in most of the northern U.S. However, precipitation and habitat conditions in the traditional survey area were variable. The estimate of May ponds (north-central U. S. and Prairie Canada combined) increased 18% ( $4.6 \pm 0.1$  million,  $P=0.001$ ) compared to 2000, but not statistically different from the long-term average (-6 %,  $P=0.07$ ). The May pond estimate for prairie Canada was  $2.7 \pm 0.1$  million, 13% higher than the 2000 estimate, but 20% below the long-term average ( $P<0.001$ ). For the north-central U. S. the estimate was  $1.9 \pm 0.09$  million ponds, 24% greater than last year, and 25% above the long-term average. Continued drought produced fair-to-poor conditions in most of Alberta, central and southern Saskatchewan, and eastern Montana. By contrast, North and South Dakota generally had good-to-excellent water conditions, with the best conditions in the eastern portions of these states, and drier conditions to the west. Southern Manitoba and extreme southeastern Saskatchewan have had higher-than-normal water conditions for the past two years, and this residual water, together with above-normal precipitation due to an early, snowy winter, produced excellent habitat for breeding ducks. Average to above-average precipitation also made for excellent wetland conditions across most of northern Manitoba and Saskatchewan. Record drought and poor wetland conditions were the rule in Alberta, with the exception of the northernmost areas, which had above-average winter and spring precipitation. Good conditions for breeding ducks prevailed in the Northwest Territories, except for a small northern area that was rated only fair due to late breakup of ice on wetlands that reduced available breeding habitat for early-nesting species. In Alaska, breeding conditions depend largely on the timing of spring, as wetland conditions are less variable than on the prairies. Although winter temperatures were mild, spring was late, and waterfowl production will likely be below average to the north and west, and average to the south and east. Overall, conditions were good in the traditional survey area, and average to above-average waterfowl production is expected.



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

Survey Area	2000	2001	Change from 2000		LTA <sup>a</sup>	Change from LTA		
			%	<i>P</i>		%	<i>P</i>	
<b>Prairie Canada</b>								
S. Alberta	553	426	-23	0.032	736	-42	<0.001	
S. Saskatchewan	1404	1536	+9	0.277	2004	-23	<0.001	
S. Manitoba	466	786	+69	<0.001	685	+15	0.089	
Subtotal	2422	2747	+13	0.031	3425	-20	<0.001	
<b>Northcentral U.S.</b>								
Montana and Western Dakotas	429	346	-19	0.040	536	-35	<0.001	
Eastern Dakotas	1095	1548	+41	<0.001	982	+58	<0.001	
Subtotal	1524	1893	+24	0.006	1518	+25	<0.001	
<b>Grand Total</b>	<b>3947</b>	<b>4640</b>	<b>+18</b>	<b>0.001</b>	<b>4916</b>	<b>-6</b>	<b>0.071</b>	

<sup>a</sup>Long-term average. Prairie Canada, 1961-2000; northcentral U.S. and Grand Total, 1974-2000.

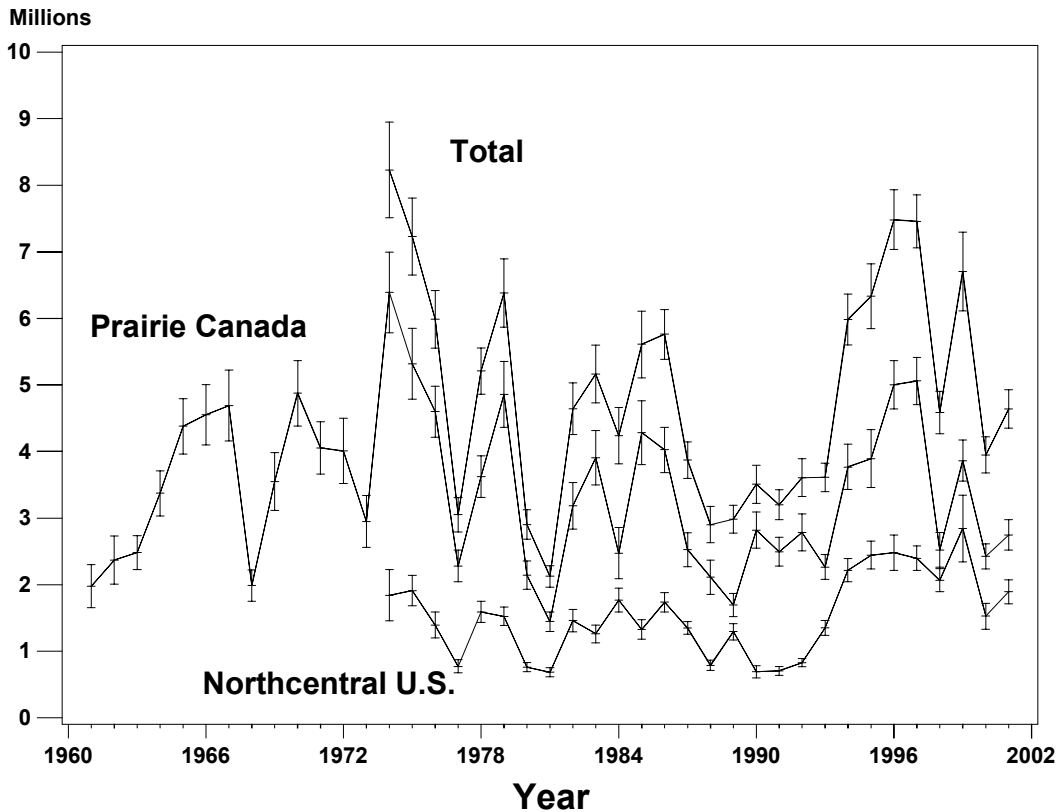


Figure 1. Number of ponds in May and 95% confidence intervals for Prairie Canada and the Northcentral U.S.

In the eastern survey area, conditions for breeding ducks were variable but generally good. Southern Ontario and northern New York enjoyed an early spring and normal precipitation. With wetland basins nearly full, the outlook for breeding ducks was good. Spring-like weather also came early in Quebec, with good-to-excellent habitat in the central and northern portions. However, southern Quebec was drier, and conditions there ranged from fair to poor. In Maine and the Maritime provinces spring-like weather was late, with lower-than-normal temperatures, but above-average precipitation, and habitat conditions were rated good throughout the region. Overall, eastern habitats were in good condition, with average to above-average waterfowl production expected.

In 2001, the estimated breeding population of all ducks (excluding scoters, eiders, long-tailed ducks, mergansers, and wood ducks) in the traditional survey area was  $36.1 \pm 0.6$  million birds (Table 2), 14% below ( $P = 0.001$ ) last year's estimate of  $41.8 \pm 0.7$  million birds, but 9% above the long-term (1955-2000) average ( $P < 0.001$ ). Approximately 60% of these ducks were found in the prairie-pothole region (strata 26-49), the same percentage recorded during the 1970s, which is the historical benchmark for good wetland conditions in this region. Total duck numbers increased compared to the 2000 estimate ( $P = 0.02$ ) and was above the long-term average in Southern Manitoba ( $P = 0.007$ ). Estimates decreased compared to last year and were below long-term averages in central and northern Alberta-northeastern British Columbia-Northwest Territories, northern Saskatchewan-northern Manitoba-western Ontario, southern Saskatchewan and southern Alberta, ( $P < 0.05$ ). The 2001 total-duck population estimate for the eastern survey area (excluding canvasbacks, redheads, ruddy ducks, eiders, long-tailed ducks and wood ducks) was  $3.3 \pm 0.2$  million birds (Table 2). This was similar to last year's total duck estimate of  $3.2 \pm 0.3$  million birds. In some other areas where surveys are conducted, measures of precision for estimates are provided (northeastern U.S., Wisconsin, Michigan, California, Washington, and British Columbia). Total duck abundances were similar to last year's estimates in the northeastern U. S., California, British Columbia and Michigan ( $P \geq 0.08$ ). Total ducks in California and Michigan were more than 25% below their long-term averages ( $P < 0.01$ ; Table 2, Appendix E). Of the states without measures of precision for total-duck numbers, Minnesota's estimate decreased compared to last year's estimate, while Nebraska's increased (Appendix E). In Nevada, total ducks decreased over

2000 levels, and in Washington, total duck numbers increased.

Trends in abundances and annual breeding population estimates for 10 principal duck species from the traditional survey area are provided in Figure 2, Table 5, and Appendix F. The dashed lines in the species graphs in Figure 2 represent the population goal of the North American Waterfowl Management Plan for the traditional survey area. Mallard abundance was  $7.9 \pm 0.3$  million, which is 17% below last year's estimate of  $9.5 \pm 0.3$  million ( $P < 0.01$ ) estimate and similar to the long-term average ( $P = 0.08$ ) (Table 3). Mallard numbers were significantly below 2000 levels in three regions of the traditional survey area - central and northern Alberta-northeastern British Columbia, northern Saskatchewan -northern Manitoba-western Ontario, southern Saskatchewan, and Montana-western Dakotas ( $P \leq 0.05$ ), and were below long-term averages ( $P < 0.01$ ) in northern Saskatchewan - northern Manitoba-western Ontario, southern Saskatchewan and southern Alberta. However, mallards were well above long-term averages in Alaska-Yukon Territory-Old Crow Flats, and the eastern Dakotas ( $P < 0.001$ ). In other areas where surveys are conducted and measures of precision for estimates are provided (the same states as for total ducks, as well as Minnesota), mallard abundances were similar to those of 2000 ( $P \geq 0.46$ ), with the exception of Wisconsin, where mallard abundance decreased by 55% from 2000 levels ( $P < 0.01$ ; Table 3, Appendix E). State-specific mallard populations did not differ from long-term averages, except in Michigan (-27%,  $P = 0.01$ , Table 3, Appendix E). In Nebraska and Washington, where measures of precision are unavailable, mallard abundance increased compared to that of last year, while mallards in Nevada decreased (Appendix E).

Blue-winged teal abundance was  $5.8 \pm 0.3$  million, 23% below last year's estimate of  $7.4 \pm 0.4$  million ( $P = 0.001$ ), but still 29% above the long-term average ( $P < 0.001$ ). Green-winged teal abundance was  $3.2 \pm 0.2$  million, 39% above the long-term average ( $P < 0.001$ ), but 21% lower than last year ( $P = 0.007$ ). Gadwall ( $2.7 \pm 0.1$  million, +66%) and northern shovelers ( $3.3 \pm 0.2$  million, +60%) were above their long-term averages ( $P < 0.01$ ), while northern pintails ( $3.3 \pm 0.3$  million, -23%) and scaup ( $3.7 \pm 0.2$  million, -31%) remained below their long-term averages ( $P < 0.001$ ). American wigeon and canvasback estimates were similar to those of last year ( $P \geq 0.19$ ) and to long-term averages ( $P \geq 0.31$ ).

Annual breeding population estimates for 10 principal species in the eastern survey area are provided in Table 6 and Appendix G. Abundances

Table 2. Total duck breeding<sup>a</sup> population estimates (in thousands).

Region	2000	2001	Change from 2000		Change from LTA		
			%	<i>P</i>	LTA	2000	2001
<b>Traditional Survey Area</b>							
Alaska - Yukon Territory - Old Crow Flats	6727	6427	-4	0.449	3335	+93	<0.001
C. & N. Alberta - N.E. British Columbia - Northwest Territories	6900	5489	-20	<0.001	7297	-25	<0.001
N. Saskatchewan - N. Manitoba - W. Ontario	3468	2656	-23	0.014	3552	-25	<0.001
S. Alberta	3485	2521	-28	<0.001	4460	-43	<0.001
S. Saskatchewan	7665	6442	-16	0.001	7429	-13	<0.001
S. Manitoba	1486	1793	+21	0.016	1543	+16	0.007
Montana and Western Dakotas	1726	1588	-8	0.271	1625	-2	0.692
Eastern Dakotas	10382	9261	-11	0.049	3983	+133	<0.001
Total	41838	36177	-14	<0.001	33224	+9	<0.001
<b>Eastern Survey Area</b>	3204	3337	+4	0.757	3075	+9	0.351
<b>Other Regions</b>							
British Columbia <sup>c</sup>	8	7	-5	0.847	8	-2	0.917
California	625	478	-23	0.078	666	-28	0.001
Michigan	746	540	-28	0.151	741	-27	0.014
Northeastern U.S. <sup>d</sup>	1926	1393	-28	0.349	1403	-1	0.913
Wisconsin	770	543	-29	<0.010	542	<+1	<sup>e</sup>

<sup>a</sup> Excludes eider, long-tailed duck, wood duck, scoter, and merganser in traditional survey area; excludes eider, long-tailed duck, wood duck, redhead, canvasback and ruddy duck in eastern survey area; species composition for other regions varies.

<sup>b</sup> Long-term average. Traditional survey area=1955-2000; eastern survey area=1996-2000; years for other regions vary (see Appendix E).

<sup>c</sup> Index to waterfowl use in prime waterfowl producing regions of the province.

<sup>d</sup> Includes all or portions of DE, CT, MD, MA, NH, NH., NY, PA, RI, VT, and VA.

<sup>e</sup> Not estimable from current survey.

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

Region	2000	2001	Change from 2000		Change from LTA		
			%	<i>P</i>	LTA	2000	2001
<b>Traditional Survey Area</b>							
Alaska - Yukon Territory - Old Crow Flats	770	718	-7	0.489	315	+128	<0.001
C. & N. Alberta - N.E. British Columbia - Northwest Territories	1288	979	-24	0.029	1110	-12	0.103
N. Saskatchewan - N. Manitoba - W. Ontario	1049	603	-42	0.001	1175	-49	<0.001
S. Alberta	833	744	-11	0.386	1143	-35	<0.001
S. Saskatchewan	2267	1650	-27	<0.001	2117	-22	<0.001
S. Manitoba	368	446	+21	0.141	371	+20	0.090
Montana and Western Dakotas	622	463	-26	0.035	504	-8	0.381
Eastern Dakotas	2273	2301	+1	0.897	759	+203	<0.001
Total	9470	7904	-17	<0.001	7494	+5	0.078
<b>Eastern Survey Area</b>	212	286	+35	0.153	306	-7	0.661
<b>Other Regions</b>							
British Columbia <sup>b</sup>	1	1	-5	0.778	1	-11	0.323
California	443	365	-18	0.316	423	-14	0.266
Michigan	345	295	-15	0.461	406	-27	0.012
Minnesota	318	321	+1	0.960	209	+53	<sup>d</sup>
Northeastern U.S. <sup>c</sup>	758	808	+7	0.481	754	+7	0.328
Wisconsin	368	164	-55	<0.010	543	<+1	<sup>d</sup>

<sup>a</sup> Long-term average. Traditional survey area=1955-2000; eastern survey area=1996-2000; years for other regions vary (see Appendix E).

<sup>b</sup> Index to waterfowl use in prime waterfowl producing regions of the province.

<sup>c</sup> Includes all or portions of DE, CT, MD, MA, NH, NH, NY, PA, RI, VT, and VA.

<sup>d</sup> Value for test statistic was not available.

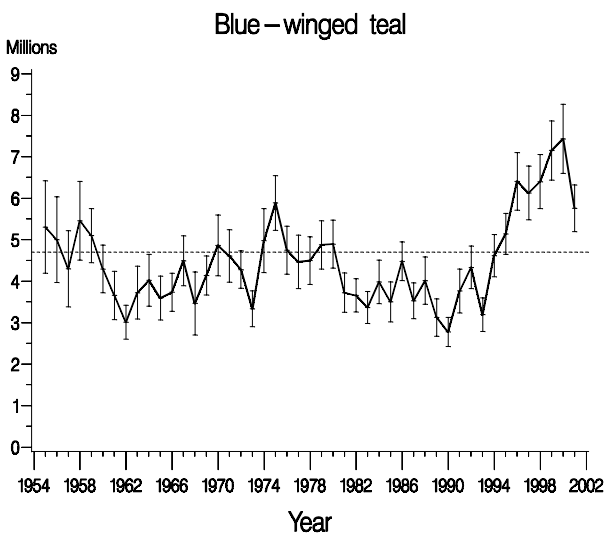
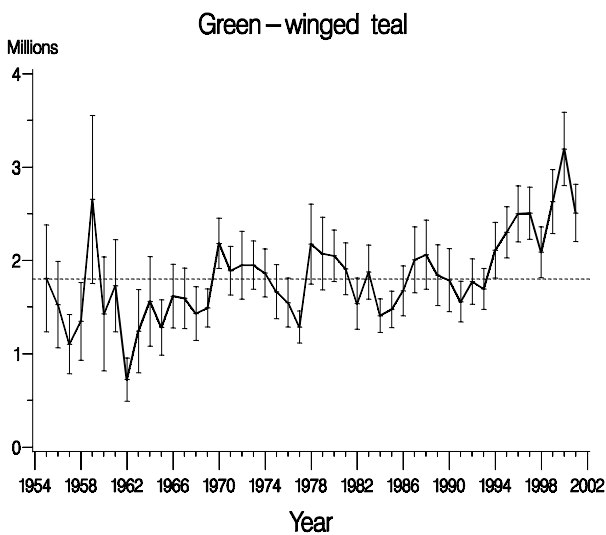
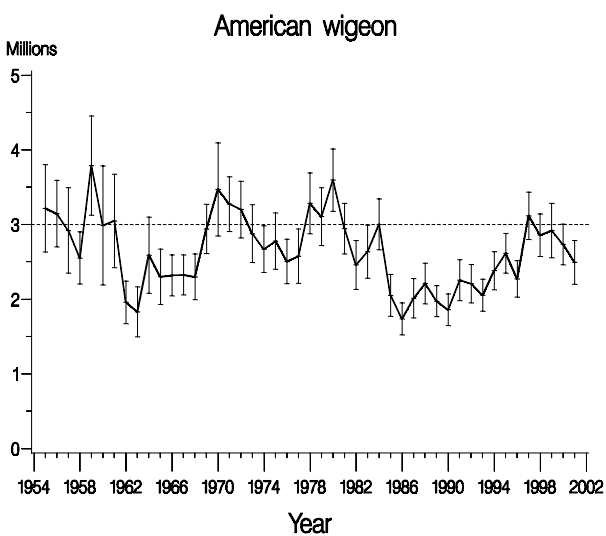
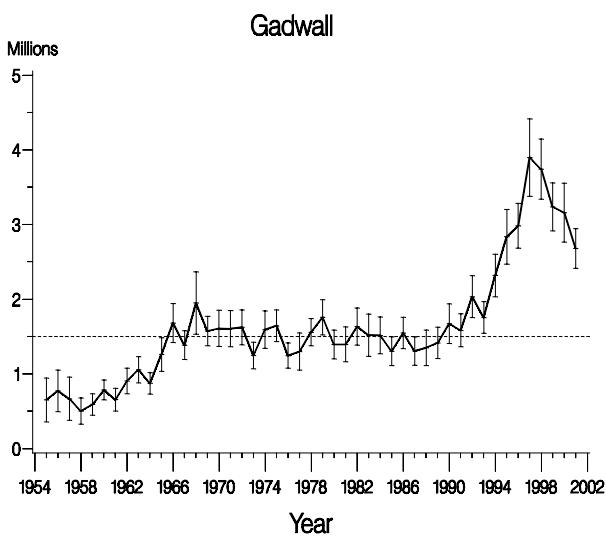
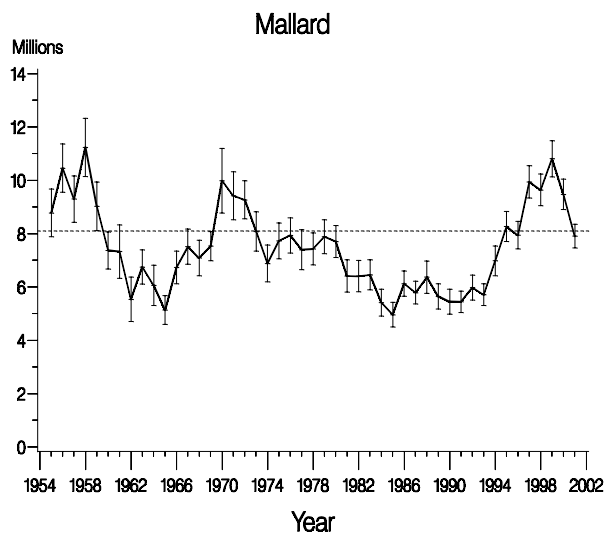
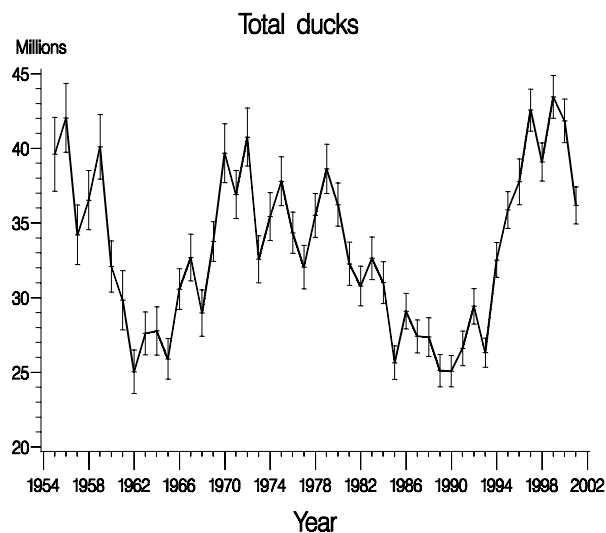


Fig. 2. Breeding population estimates, 95% confidence intervals, and North American Waterfowl Management Plan population goal (dashed line) for selected species for the traditional survey area (strata 1-18, 20-50, 75-77).

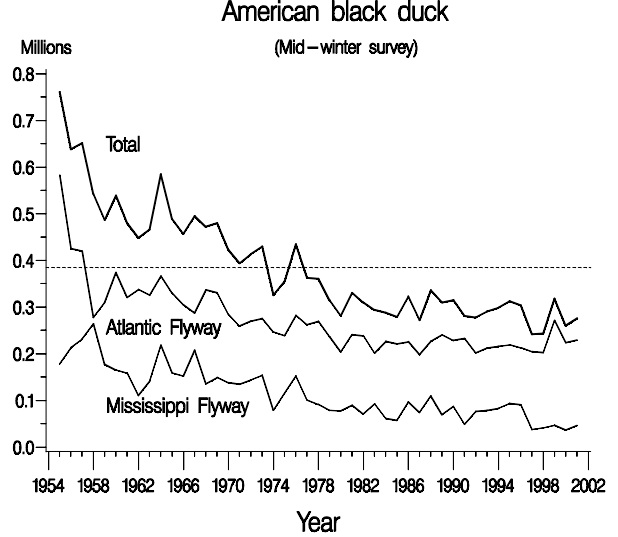
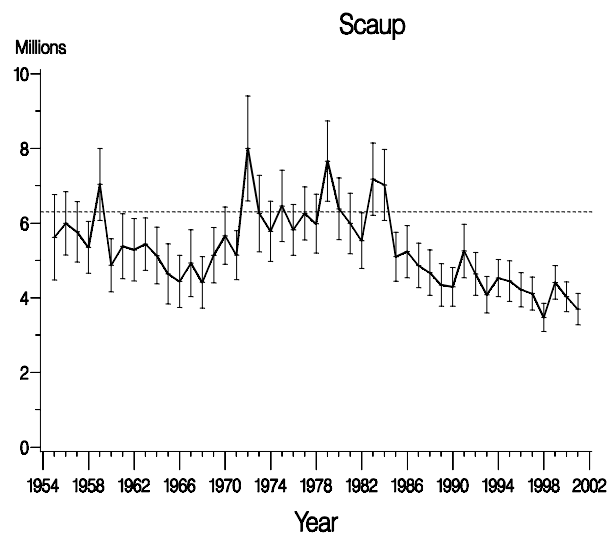
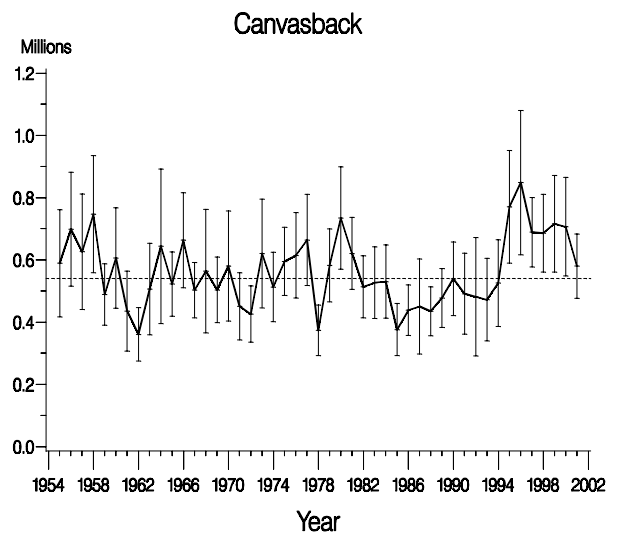
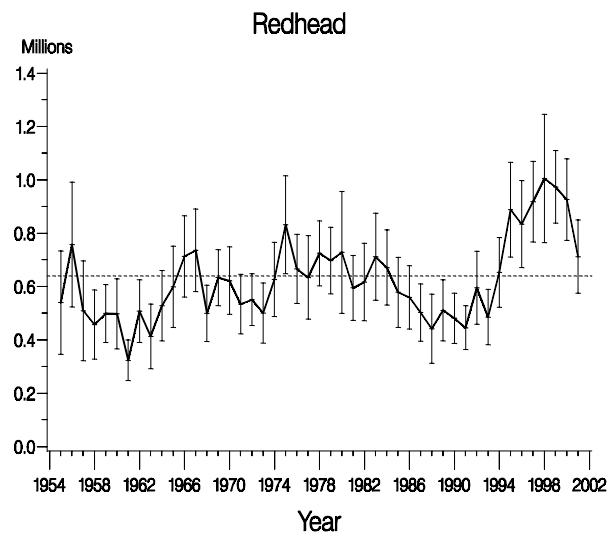
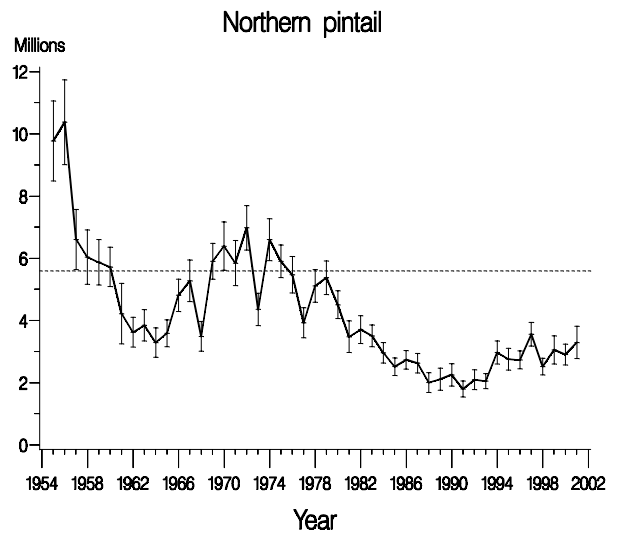
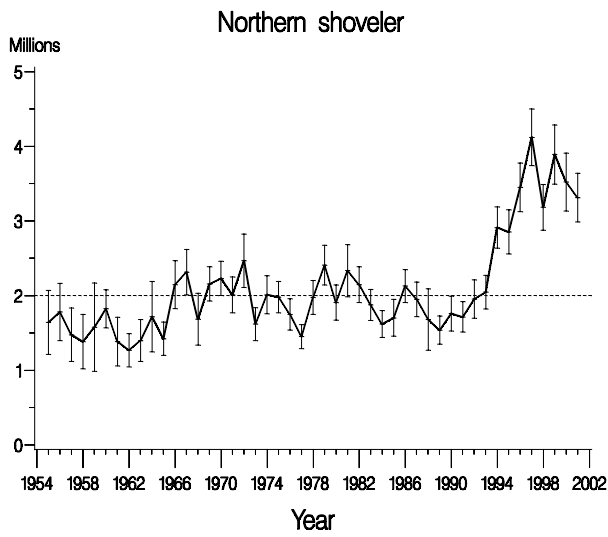


Fig. 2 (continued).

of individual species were similar to those of last year, with the exception of ring-necked ducks ( $0.35 \pm 0.04$  million,  $P=0.001$ ) and buffleheads ( $0.10 \pm 0.02$  million,  $P=0.05$ ). Buffleheads ( $P=0.03$ ), goldeneyes ( $P=0.08$ ), and lesser scaup ( $P=0.08$ ) were above their 1996-2000 averages in the east. Green-winged teal ( $P=0.03$ ) and ring-necked ducks ( $P=0.002$ ) were below their 1996-2000 averages, and all other species were similar to their long-term averages ( $P>0.14$ ).

The status of the American black duck (*Anas rubripes*) has been monitored primarily by mid-winter surveys conducted in January in states of the Atlantic and Mississippi Flyways. The trend in the winter index for the total population is depicted in Figure 2. Mid-winter counts suggested that black duck abundance in both flyways combined was similar to 2000 counts. Over both flyways, 270,000 black ducks were estimated from mid-winter inventories. This is 4% higher than the 2000 index (260,000), and 9% less than the 1991-2000 mean (287,000). In the Atlantic Flyway, the mid-winter index was similar to last year's, up slightly from 223,000 in 2000 to 229,700, similar to the 1991-2000 mean (223,900). In the Mississippi Flyway, the mid-winter estimate increased 26% from 37,000 in 2000 to 46,400, which is still 27% below the most recent 10-year mean (63,200). In the eastern survey area, the 2000 estimate for breeding black ducks (422,000) was similar to the 2000 estimate (397,000) and the 1996-2000 average (485,000).

Trends in wood duck populations are monitored by the North American Breeding Bird Survey (BBS), a series of roadside routes surveyed during May and June each year. Wood ducks are encountered 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 3-6% per year over the long-term (1966-2000) and short-term (1980-2000). Specifically, in the Atlantic Flyway, the BBS indicates a 5.5% annual increase in wood ducks over the long-term and a 4.9% annual increase over the short-term ( $P<0.001$ ). In the Mississippi Flyway, the BBS indicates a 4.2% annual increase over the long-term and a 3.3% annual increase over the short-term ( $P\leq 0.05$ ; J. Sauer, U. S. Geological Survey/Biological Resources Division, unpubl. data).

Weather and habitat conditions during the summer months can influence waterfowl production. Good wetland conditions increase renesting and brood survival. Throughout June, much of the prairies received abundant precipitation, including Saskatchewan (except for the very dry west-central

part of the province), Manitoba, southeastern Montana, and North and South Dakota. In many areas, precipitation and moderate temperatures increased or maintained breeding habitat quantity and quality relative to May conditions, especially for late nesting species, and enhanced brood-rearing habitats. In Montana, improved habitat conditions did not help production, because rains came too late for nesting ducks. In general, July habitat conditions were similar to May conditions in much of the prairies, with the exceptions of southern Alberta and northeastern Montana, where continued drought made conditions worse. However, excellent habitat in the northern prairie provinces likely will not lead to high production there, as low breeding-pair counts in these regions suggest there were few birds there to take advantage of these good nesting conditions.

Results of the July Production Survey indicate that the number of ponds in Prairie Canada and the north-central U.S. combined was  $2.9 \pm 0.09$  million ponds (Fig. 3, Table 4). This was 26% below last year's estimate of  $3.9 \pm 0.1$  million ponds ( $P<0.001$ ), and similar to the long-term average ( $P=0.74$ ). The number of July ponds in Prairie Canada was  $1.8 \pm 0.07$  million. This was 25% below last year's estimate of  $2.5 \pm 0.1$  million ( $P<0.001$ ) but similar to the long-term average ( $P=0.47$ ). The number of July ponds in the north-central U.S. was  $1.0 \pm 0.06$  million. This was 26% below last year's estimate of  $1.4 \pm 0.08$  million, and similar to the long-term average ( $P=0.48$ ). The number of broods in the north-central U.S. and Prairie Canada combined was 11% lower than last year's estimate, but 15% above the long-term average. The number of broods in Prairie Canada and the North-central U.S. were 9% above and 19% below last year's estimates, respectively. Brood indices in Prairie Canada were 33% below the long-term average, while brood counts were 81% above the long-term average in the north-central U.S. The brood index in the Canadian boreal forest was 10% lower than last year's, and 31% below the long-term average.

#### *Regional Habitat and Population Status*

A description of habitat conditions, populations, and production for each of 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.

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

Survey Area	2000	2001	Change from 2000		LTA <sup>a</sup>	Change from LTA		
			%	<i>P</i>		%	<i>P</i>	
<b>Prairie Canada</b>								
S. Alberta	409	311	-24	0.022	477	-35	<0.001	
S. Saskatchewan	1438	941	-35	<0.001	959	-2	0.841	
S. Manitoba	604	587	-3	0.762	324	+81	<0.001	
Subtotal	2451	1838	-25	<0.001	1760	+4	0.470	
<b>Northcentral U.S.</b>								
Montana and Western Dakotas	484	226	-53	<0.001	403	-44	<0.001	
Eastern Dakotas	917	805	-12	0.217	562	+43	0.007	
Subtotal	1402	1032	-26	<0.001	965	+7	0.478	
<b>Grand Total</b>	<b>3852</b>	<b>2870</b>	<b>-26</b>	<b>&lt;0.001</b>	<b>2819</b>	<b>+2</b>	<b>0.740</b>	

<sup>a</sup>Long-term average. Prairie Canada, 1961-2000; northcentral U.S. and Grand Total, 1974-2000.

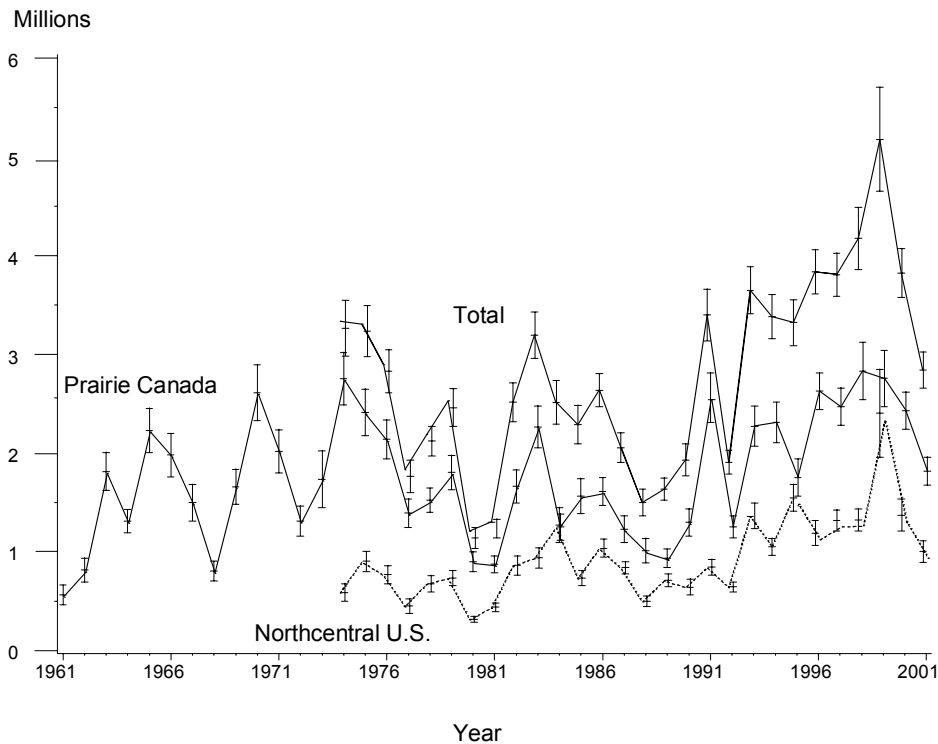


Figure 3. Number of ponds in July and 95% confidence intervals for Prairie Canada and the Northcentral U.S.



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

Region	2000	2001	Change from 2000		LTA <sup>a</sup>	Change from LTA	
			%	<i>P</i>		%	<i>P</i>
Mallard	9470	7904	-17	<0.001	7494	+5	0.078
Gadwall	3158	2679	-15	0.048	1610	+66	<0.001
American wigeon	2733	2494	-9	0.240	2649	-6	0.307
Green-winged teal	3194	2509	-21	0.007	1806	+39	<0.001
Blue-winged teal	7431	5757	-23	0.001	4465	+29	<0.001
Northern shoveler	3521	3314	-6	0.423	2073	+60	<0.001
Northern pintail	2908	3296	+13	0.220	4289	-23	<0.001
Redhead	926	712	-23	0.041	624	+14	0.218
Canvasback	707	580	-18	0.189	563	+3	0.756
Scaup (greater and lesser combined)	4026	3694	-8	0.264	5353	-31	<0.001
<b>Total<sup>b</sup></b>	<b>41838</b>	<b>36177</b>	<b>-14</b>	<b>&lt;0.001</b>	<b>33224</b>	<b>+9</b>	<b>&lt;0.001</b>

<sup>a</sup> Long-term average (1955-2000).

<sup>b</sup> Includes black duck, ring-necked duck, goldeneye, bufflehead, and ruddy duck. Excludes scoter, eider, long-tailed duck, merganser, and wood duck.

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

Region	2000	2001	Change from 2000		LTA	Change from LTA <sup>b</sup>	
			%	<i>P</i>		%	<i>P</i>
Mergansers	400	429	+7	0.729	496	-14	0.435
Mallard	212	286	+35	0.153	306	-7	0.661
American Black Duck	397	422	+6	0.730	485	-13	0.271
American Wigeon	42	77	+86	0.192	61	+28	0.442
Green-winged teal	202	220	+9	0.671	314	-30	0.032
Lesser Scaup	116	204	+75	0.371	41	+392	0.080
Ring-necked duck	619	353	-43	0.001	533	-34	0.002
Goldeneye (common & Barrow's)	947	1032	+9	0.820	643	+61	0.075
Bufflehead	49	95	+93	0.054	47	+100	0.029
Scoters	182	179	-2	0.963	100	+78	0.137
<b>Total</b>	<b>3204</b>	<b>3337</b>	<b>+4</b>	<b>0.757</b>	<b>3075</b>	<b>+9</b>	<b>0.351</b>

<sup>a</sup> Includes gadwall, northern shoveler, northern pintail, and scaup. Excludes eider, long-tailed duck, wood duck, redhead, canvasback, and ruddy duck.

<sup>b</sup> Long-term average from 1996.

*Southern Alberta:* The fall, winter, and spring, southern Alberta (strata 26-29) received below-normal precipitation in most areas. Environment Canada reported average-to-slightly above-average temperatures for the November 2000 to April 2001 period. In May, temperatures were near normal and precipitation was generally below average throughout most of the region. Areas near the Milk River along the Montana border were in poor condition. Most of the prairie portions of the southern part of the province were in fair to poor condition. The Aspen Parklands of east-central were generally in fair condition, while the area in a 20 mile radius around Edmonton and Red Deer was in good condition. May ponds were 42% below the long-term average ( $P<0.001$ ), and 23% below last year ( $P<0.001$ ) when conditions also were fairly dry. Low numbers of wetlands again resulted in ducks crowding on remaining wetlands. Total-duck abundance in southern Alberta was below the long-term average (-43%,  $P<0.001$ ) and below 2000 levels (-28%,  $P<0.001$ ). Mallards (-35%), northern pintails (-92%), gadwall (-17%), American wigeon (-41%), blue-winged teal (-42%), redheads (-55%), and canvasbacks (-52%) were below their long-term averages ( $P<0.05$ ). June precipitation in southern Alberta was below normal, and condition of most habitats remained fair-to-poor as of July. July pond counts were 24% below the 2000 estimate, and 35% below the long-term mean. The July brood index was similar to 2000 mean, and 56% below the long-term mean.

*Southern Saskatchewan:* Another below-average year for precipitation has resulted in poor-to-fair upland and wetland habitat conditions across most of the Southern Saskatchewan (Strata 30-35) survey area. The majority of the survey area received below-average precipitation during the late summer and fall of 2000. However, the north-central and northeast areas received well-below average precipitation and whereas central portions of the region received well-above-average precipitation. Winter precipitation ranged from average in the southeast, below average in the central and northeast parts of the survey area, and far below average in the west. Conditions did not improve in April and May, and the ephemeral, temporary, and seasonal wetlands that are normally abundant during the spring survey were notably absent. Normal temperatures predominated across Southern Saskatchewan from late summer through October 2000. November and December were characterized by below-average temperatures, and late winter and spring were characterized by average to above-

average temperatures. The total duck population estimate for southern Saskatchewan decreased 16% from the 2000 estimate, and was 13% below the long-term mean. Some dabbling duck species also decreased. The 2001 mallard population estimate decreased 27% from the 2000 estimate and dropped below the long-term mean for the first time since 1994 ( $P<0.001$ ). The northern pintail estimate remained 47% below the long-term mean ( $P<0.001$ ), while the American wigeon estimate was the lowest since 1990 and 61% below the long-term mean ( $P<0.001$ ). Although the diving duck population estimate was down 15% compared to the 2000 estimate, individual species estimates were not different from long-term averages. As of July, habitat conditions in southern Saskatchewan had not improved. Generally, only artificial, permanent and large semi-permanent wetlands remained available for brood-rearing. Many dry basins in croplands have been cultivated, as much of the province experienced record to near-record drought. The July pond count was 35% lower than the 2000 index and similar to the long-term average. The July brood index was similar to that of 2000, but 22% below the long-term average for this region.

*Southern Manitoba:* Wetland conditions in Southern Manitoba (stratum 25, strata 36-40) were generally very good. Water levels and residual nesting cover were excellent in west-central and southwestern Manitoba, as high water levels in 2000 prevented tillage close to wetlands. On many semi-permanent wetlands, increases in emergent vegetation due to 3 years of high water provided good nesting habitat for diving ducks. Total-duck estimates were 21% higher than in 2000, and 16% above the long-term average ( $P<0.01$ ). Mallard, gadwall, blue-winged teal, northern shoveler, American wigeon, canvasback and redhead abundances did not differ from 2000 levels ( $P\geq 0.1$ ). Gadwall (+75%) and shoveler numbers (+95%) were well above their long-term averages, while American wigeon (-73%), northern pintail (-63%), green-winged teal (-41%) and scaup (-49%) were below their long-term averages ( $P<0.01$ ). However, northern pintail numbers increased by 117% ( $P=0.01$ ) over the 2000 estimate. Intermittent rainfall during June resulted in generally excellent brood-rearing wetland conditions as of July. July pond counts were at the third highest level recorded for this region. The July pond count for this region was similar to last year's, and 81% above the long-term average. The July brood index was 44% higher than last year's and similar to 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 in 2000. Continued drought in Montana resulted in poor wetland conditions. In the western Dakotas, water levels were better, and conditions were fair to good. Grassland cover on lands enrolled in the Conservation Reserve Program was plentiful, though spring grass growth was slightly later than normal. May ponds were down 19% from 2000 levels ( $P=0.04$ ) and 35% below the long-term average ( $P<0.01$ ). The number of total ducks was not different from the 2000 estimate ( $P=0.27$ ) or the long-term average ( $P=0.69$ ). Mallards decreased by 26% ( $P=0.04$ ) since 2000, but did not differ from the long-term average. Gadwall (+113%) were above their long-term average, and blue-winged teal (-40%) and northern pintail abundances (-43%) were below long-term averages ( $P<0.001$ ). All other species were similar to 2000 estimates and their long-term averages ( $P>0.10$ ). Rainfall in June and July improved water conditions in the western Dakotas but helped little in Montana. In most of Montana the rain arrived too late to aid production, which will be minimal. Despite the rain, Montana remains very dry, particularly north of the Missouri River. Minimal late nesting was reported throughout the survey area, but brood-rearing conditions were good in much of the western Dakotas, where fair to good production is expected. The number of ponds in July was 53% below last year's estimate, and 44% below the long-term average. The July brood index was 25% below last year's, and slightly below (-7%) the long-term average.

Eastern Dakotas: In the eastern Dakotas (strata 45-49), early fall was warm and dry, especially in northwestern North Dakota, and the southern two-thirds of South Dakota. Late-fall rains improved wetland conditions across the region. Winter precipitation was above normal in South Dakota, and below normal in North Dakota, so that by the breeding season, wetland conditions were generally good to excellent across the region. The best conditions were found in eastern South Dakota, and were drier to the northwest; the poorest conditions were in northwest North Dakota. May ponds were 41% higher than in 2000 ( $P<0.001$ ), and 58% above the long-term average ( $P<0.001$ ). The total duck estimate in the eastern Dakotas was 9.3 million birds, 11% lower ( $P=0.05$ ) than last year's record high estimate of 10.4 million birds, but still 133% above the long-term average ( $P<0.001$ ). The mallard estimate this year was a record high 2.3 million, and is 203% above the long-term average. Gadwall (1.1 million, -38%) and blue-winged teal (3.2 million, -

24%) estimates were down significantly from last year's record high levels, but remained above their long-term averages ( $P<0.001$ ). Northern shoveler (+39%) northern pintail (+93%) and canvasback (+191%) numbers all were above 2000 levels ( $P\leq 0.02$ ), and their long-term averages. Mallards (+203%) and scaup (+85%) were above their respective long-term averages, but unchanged from last year ( $P>0.26$ ). Both states experienced cool temperatures and good precipitation through the first 3 weeks of June, but temperatures increased and there was little precipitation in late June and early July. Nonetheless, semi-permanent and permanent wetlands were full and some seasonal wetlands remained, providing good brood-rearing habitat in most areas. July pond numbers were 12% lower than in 2000, but 43% above the long-term average. The 2001 brood index was 166% above the long-term average for this region, and 18% below last year's 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 good-to-excellent for breeding waterfowl. Winter precipitation was average in most of northern Saskatchewan and average to above-average in most of northern Manitoba. However, breeding duck numbers declined in the region; the total-duck estimate was 23% below that of 2000, and 25% below the long-term average ( $P<0.02$ ). Scaup (-56%), gadwall (-47%), wigeon (-62%), pintail (-78%), mallard (-49%), blue-winged teal (-46%), and redheads (-72%), were all well below long-term averages ( $P\leq 0.03$ ). Only green-winged teal and northern shoveler numbers were similar to long-term averages ( $P>0.87$ ). Conditions continued to look ideal across much of northern Saskatchewan and Manitoba as of July. Water levels in lakes were high, but there was little flooding. Streams and beaver ponds were full. Habitat appeared excellent for brood survival in most areas. Although nesting and brood-rearing conditions were excellent, because of low breeding pair numbers, the outlook for production in this region is only good.

Northern Alberta, Northeastern British Columbia, and Northwest Territories: Conditions were variable in northern Alberta, northeastern British Columbia, and the Northwest Territories (strata 13-18, 20, 75-77). In the southern regions of the survey area, conditions were very dry, especially around Lesser Slave Lake, and conditions were poor. Further north into Alberta and northeastern British Columbia conditions improved, as this area received normal winter and

spring precipitation, and this area was fair to good for breeding waterfowl. Northern Alberta and the Northwest Territories had above-average winter and spring precipitation, and wetland conditions there were excellent. The number of total ducks decreased 20% ( $P < 0.001$ ) compared to 2000, and was 25% below the long-term average ( $P < 0.001$ ). Mallards (-24%) and green-winged teal (-42%) decreased from 2000 levels ( $P < 0.03$ ). Gadwall (+179%) were above their long-term average, while wigeon (-22%), blue-winged teal (-56%), Northern pintail (-56%), and scaup (-46%) were below long-term averages ( $P < 0.05$ ). Northern shoveler and canvasback estimates did not differ from either 2000 estimates or their long-term averages ( $P > 0.35$ ). Late rain improved conditions in the southern portion of northern Alberta, but came too late to improve duck production. Summer rains kept ponds and drainage basins full, resulting in good quality brood-rearing habitat, but low breeding pair numbers means production will be below average.

Alaska and Old Crow Flats, Yukon Territory: In Alaska and Old Crow Flats (strata 1-12), breeding conditions depend largely on the timing of spring phenology, because wetland conditions are less variable than on the prairies. Although winter temperatures were mild, spring-like weather arrived late. Below-average waterfowl production was expected to the north and west, with average production expected to the south and east. Total duck numbers were similar to 2000, were the second highest count on record, and remained 93% above the long-term average ( $P < 0.001$ ). Green-winged teal were recorded at a record high abundance. All species estimates were unchanged compared to 2000 levels ( $P > 0.15$ ). Mallards (+128%), American wigeon (+141%), green-winged teal (+238%), Northern shovelers (+196%), Northern pintails (+58%), and scaup (+26%) all were above their long-term averages ( $P \leq 0.03$ ). Canvasback abundance was similar to the long-term average ( $P > 0.9$ ). The generally late spring suggests that production will be below-average or average from this region this year.

Eastern Survey Area: Breeding waterfowl habitat conditions in the eastern survey area (strata 51-56 and 62-69) were variable but generally good. Southern Ontario and northern New York enjoyed an early spring, and with wetland basins nearly full, the outlook for breeding ducks is good. Spring-like weather was also early in Quebec, with good-to-excellent habitat in the central and northern portions. However, southern Quebec was drier, and conditions there ranged from fair to poor. In Maine and the Maritime provinces warm

weather came late, with lower than normal temperatures, but above-average precipitation. Habitat conditions were rated good throughout the region. The estimate of total ducks was unchanged from 2000 and the 1996-2000 average. Ring-necked ducks decreased below their 2000 level (-43%), while buffleheads increased (+93%;  $P = 0.05$ ). Ring-necked ducks (-34%), and green-winged teal (-30%) were below the 1996-2000 average, while buffleheads were 100% higher than average ( $P < 0.03$ ). Overall, eastern habitats were in good condition, with average to above-average production expected.

Other areas: The number of ducks observed in British Columbia's annual survey were similar to that observed last year, but breeding habitat conditions were below average, and worse than the previous two years. A cold and dry spring meant poor wetland conditions and late arrival of early-nesting species. The Pacific Northwest generally experienced normal levels of fall, winter and spring precipitation during 1998-2000, but conditions were dry this past winter. The Washington total duck breeding index was 165,000, up from 143,600 last year. Mallard numbers went from 48,000 last year to 63,000 in 2001. Fall, winter and spring precipitation was normal in most of California and nesting habitat for this year was average to below average. Duck production is expected to be average to below average. A lower than average fall flight is expected. Total duck and mallard numbers remained unchanged from last year, but total ducks were 28% below the long-term average. Mallard numbers were similar to the long-term average. Conditions in the western U.S. were variable, generally good in mid-western states such as Nebraska and Minnesota, becoming drier to the west. In Nebraska, conditions were substantially wetter than last year, with a 119% increase in water areas counted in the annual aerial survey. The estimated breeding duck population in the Nebraska Sandhills increased 26% from last year; in particular many diver species exhibited dramatic increases over 2000. Mallards, gadwalls and blue-winged teal all increased by more than 25% relative to 2000. Conditions in Nevada were dry; spring weather was about 2 weeks later than normal, and poor duck production was expected. Conditions were also dry in Wyoming and it is likely duck production will be fair-to-poor. The Lake States received abundant rain, and conditions were generally good in Minnesota, Wisconsin and Michigan. Pond numbers decreased 49% in Minnesota compared to 2000, and were 23% above the 1968-2000 average. Mallard, blue-winged teal and total duck numbers were unchanged compared to 2000, but blue-winged teal were at their lowest

levels since 1983. Wisconsin total duck numbers and mallards were down from 2000 levels by 29% and 55%, respectively. In Michigan, mallard numbers were similar to last year's, but were 27% below the 1992-2000 long-term average. Total duck numbers did not differ from last year's level, and were 27% below the long-term average. In the Mid-Atlantic state, winter and spring temperatures were normal to above-normal. Winter precipitation was below normal, but normal to above normal in spring. In New England, weather patterns were similar, except that winter temperatures were below normal. Total duck and mallard numbers from the Atlantic Flyway's plot survey were similar to the 2000 estimates ( $P \geq 0.34$ ) and to the long-term averages ( $P \geq 0.34$ ).

### Mallard Fall-flight index

The size of the midcontinent mallard population, which is comprised of mallards from the traditional survey area, Michigan, Minnesota, and Wisconsin, was 8.7 million birds (Fig. 4). This was 18% lower than that of 2000 (10.5 million,  $P < 0.01$ ). This year, the weights associated with the midcontinent mallard population models reflect continued support for the hypothesis of strongly density-dependent reproduction. Thus, the 2001 mid-continent mallard fall-flight estimate of 10.5 million birds is predicted to be lower ( $P = 0.02$ ) than the 2000 estimate of 11.2 million birds.

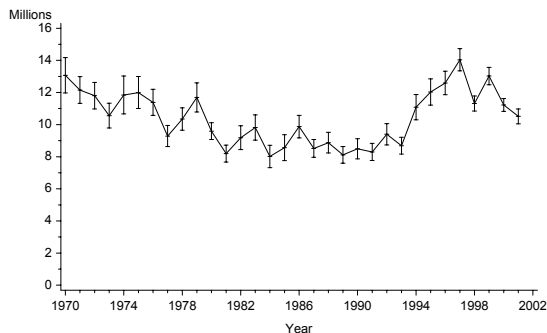


Fig. 4. Estimates and 95% confidence intervals for the size of the mallard population in the fall.

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# STATUS OF GEESE AND SWANS

**Abstract:** We provide information on the population status and productivity of 30 populations of North American Canada geese (*Branta canadensis*), brant (*B. bernicla*), snow geese (*Chen caerulescens*), Ross's geese (*C. rossii*), emperor geese (*C. canagicus*), white-fronted geese (*Anser albifrons*) and tundra swans (*Cygnus columbianus*). Conditions for nesting geese in Arctic areas ranged from poor in the west to excellent in the east. The Yukon-Kuskokwim Delta, the North Slope, the Mackenzie and Anderson River Deltas, and islands of the western Arctic all experienced delayed snowmelt which likely reduced goose and swan productivity. In the central Arctic, spring phenology was near average. In much of the eastern Arctic, the Hudson Bay Lowlands, and Ungava Peninsula, phenology appeared to be earlier than average and nesting conditions for geese and swans generally were favorable. Of the 27 populations for which current estimates were available, 6 exhibited declines of more than 10% from previous annual estimates. Ten populations (4 resident populations of Canada geese, cackling Canada geese, Western Central Flyway light geese, greater snow geese, both white-fronted goose populations and western tundra swans) displayed significant positive trends, and only Short Grass Prairie Canada geese exhibited a significant negative trend over the most recent 10-year period. Forecasts for production of young in 2001 varied regionally, but generally will be reduced in the western areas and improved in the eastern portions of North America.

This section summarizes information regarding the status and expected fall flights of goose and tundra swan populations in North America. Information was compiled from a broad geographic area and is provided to assist managers in regulating harvest. We have used the most widely-accepted nomenclature for various waterfowl populations, but they may differ from other published information. Many of the 30 goose populations described herein are comprised of more than one subspecies and some light goose populations contain lesser snow geese and Ross's geese.

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

## METHODS

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

Habitat conditions during the 2001 breeding season were assessed using climate data and reports from field biologists. The portion of North America covered by snow or ice in early June was determined from Northern Hemisphere Snow and Ice Boundary summaries prepared by the National Oceanic and Atmospheric Administration (<http://hpssd1en.wwb.noaa.gov/sab/snow/archive/nhem>). These reports provide general information but may not provide reliable assessment for all locations. Forecasts of productivity were based on information from various waterfowl surveys and interviews with field biologists.

## RESULTS AND DISCUSSION

### Conditions in the Arctic and Subarctic

Breeding ground conditions for northern-nesting geese and swans generally improved from west to east across



Fig. 1. Important Arctic and sub-arctic nesting areas of North American geese.

the Arctic and subarctic in 2001. Biologists report that spring phenology was late in northwestern Alaska, the Mackenzie Delta, and islands of the western Arctic. In the Queen Maud Gulf of the central Arctic, spring phenology was near average, but the nesting period was unusually cold and wet. On Southampton Island, southern Baffin Island, and the Ungava Peninsula, spring breakup was earlier than average and conditions for waterfowl were excellent. However, the eastern high Arctic experienced heavy winter snowfall and nesting phenology there may be slightly delayed. Spring conditions in southeastern Alaska were near normal although a late storm affected geese at the Copper River Delta. Subarctic areas around Hudson and James Bays also thawed early and nesting conditions were good. Heavy winter snowfall and a cold spring delayed nesting on insular Newfoundland. The snow and ice cover graphic (Fig. 2, provided by the National Oceanic and Atmospheric Administration) indicates more extensive coverage in portions of Alaska and the central Arctic, and less coverage in northern Quebec. (Fig. 2). More specific information for each population follows.

### Conditions in Southern Canada and the United States

Conditions influencing goose productivity vary less from year to year in mid-latitude areas of North America than in the Arctic. Given adequate wetland numbers and the absence of flood events these southern-nesting populations are reliably productive. Wetland numbers in the eastern portions of the Traditional Survey Area and much of mid-latitude North America remain above average, however western portions of the continent are

experiencing drought conditions. A cool late spring may have reduced productivity in the Atlantic Flyway.

### Status of Canada Geese

*North Atlantic Population (NAP):* NAP Canada geese nest in Newfoundland and Labrador. They generally mix during winter with AP and AFRP Canada geese, although NAP have a more coastal distribution than these other populations.

A total of 129,300 (69,300-189,200) Canada geese were estimated during the 2001 BPHS in NAP range (strata 66 and 67), down 26% from last year ( $P=0.38$ ). There is no trend in this estimate since surveys were initiated in 1996 ( $P=0.15$ ). The 2001 BPHS estimate of indicated pairs (singles plus pairs) was 57,800, essentially unchanged from 2000 (58,000). The indicated pair estimate showed no trend from 1996-2001 ( $P=0.34$ ). A wet winter and cold spring may have delayed nesting on insular Newfoundland where geese were concentrated along the coast during the BPHS. Nesting studies here indicated reproductive effort was delayed compared to prior years. A NAP fall flight smaller than last year is expected.

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

AP surveys indicated a total spring population of 637,000 (470,500-803,400) geese in 2001, 1% lower than last year ( $P=0.96$ , Fig. 4). The survey estimate of 146,700 (114,900-178,400) breeding pairs in 2001 is 57% higher than last year ( $P=0.05$ ).

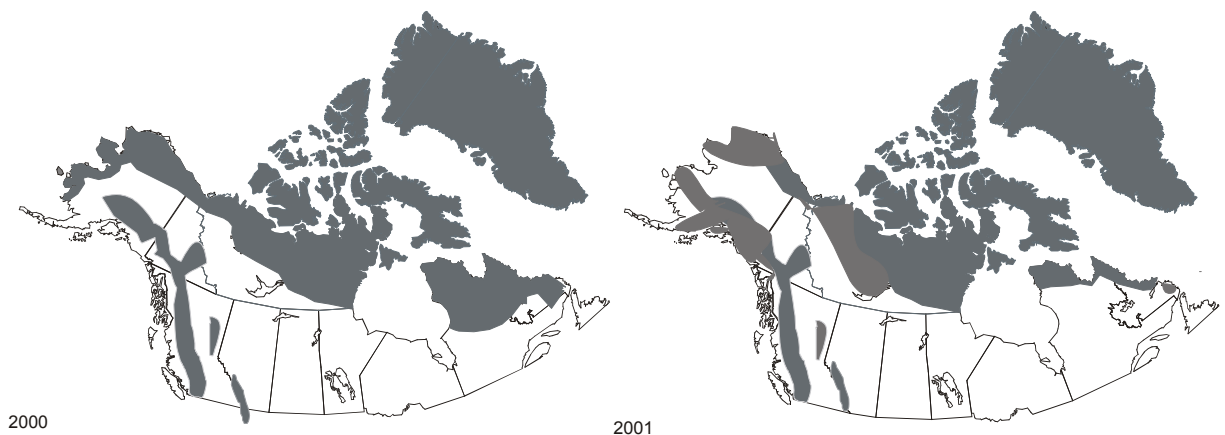


Fig. 2. The extent of snow and ice cover in North America for 3-5 June, 2000 and 3 June, 2001. The figures were produced from reports prepared by the National Oceanic and Atmospheric Administration.



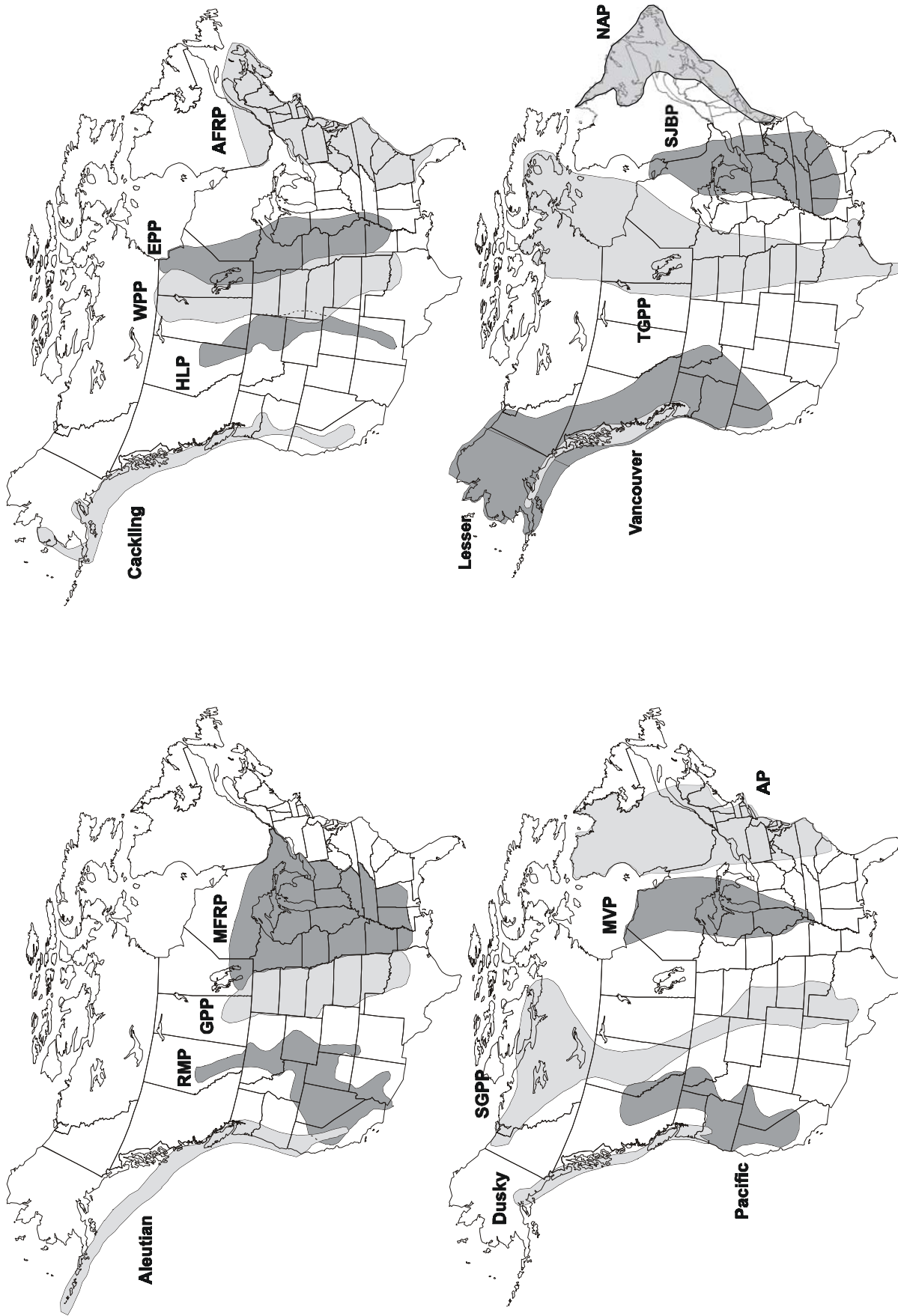


Fig. 3. Approximate ranges of Canada goose populations in North America. Population names are abbreviated as in text.

The breeding pair estimate has shown no trend since 1993 ( $P=0.12$ ). However, this population has made a rapid recovery since reaching a low of 29,000 breeding pairs in 1995. Since 1995, when hunting seasons were closed, the breeding pair estimate has increased an average of 23% per year ( $P = 0.003$ ). Nesting conditions appeared favorable with very little snow present at the time of survey and a high proportion of breeding pairs observed as singles (females likely on nests). Ground studies indicated nesting was earlier than normal near Puvimutuq, Quebec and biologists expected high nest success and good production. Nest density increased nearly 100% from last year near Kuujuaq, Quebec. A fall flight larger than last year is expected.

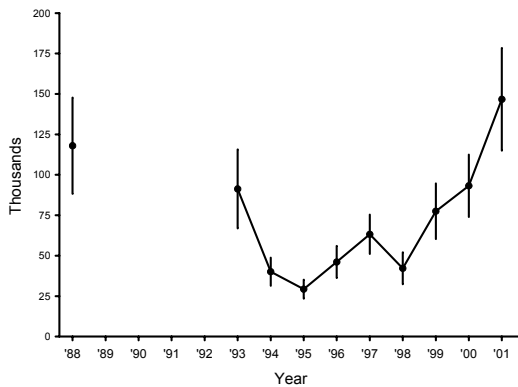


Fig. 4. Estimated number of breeding pairs (and 95% confidence intervals) of Atlantic Population Canada Geese in northern Quebec.

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

Spring surveys in 2001 estimated there were 1,011,300 (817,300-1,214,500) Canada geese in the northeastern United States (Fig. 5), similar ( $P>0.95$ ) to the previous year's count. These estimates have increased an average of 8% per year since 1991 ( $P<0.001$ ). A cold wet spring in the northeast may have delayed nesting by about a week but little flooding of nest sites occurred. A large fall flight, similar to last year is expected.

**Southern James Bay Population (SJBP):** This population nests on Akimiski Island and in the Lowlands to the west and south of James Bay. The

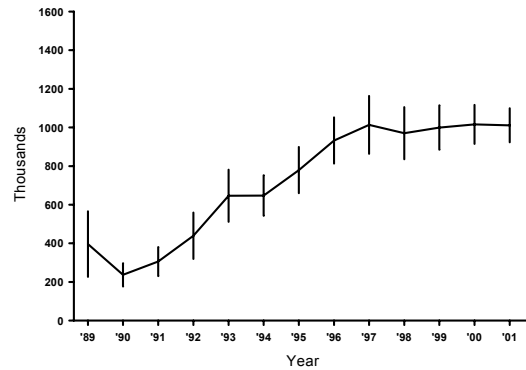


Fig. 5. Estimated number (and 95% confidence intervals) of Atlantic Flyway Resident Population Canada geese during spring.

SJBP winters from southern Michigan to Mississippi, Alabama, Georgia, and South Carolina (Fig. 3).

Breeding ground surveys indicated a spring population of 102,700 (74,800-130,600) Canada geese in 2001, 15% higher than last year ( $P=0.43$ , Fig. 6). There is no trend in this estimate since 1992 ( $P=0.19$ ). In 2001 there were 34,150 (25,100-43,200) breeding pairs, which is 12% lower ( $P=0.39$ ) than last year. Survey timing was good and molt migrants likely were not a factor in this year's survey. Winter snowfall in the Hudson Bay Lowlands was relatively light, April-May temperatures were mild, and spring snowmelt was early. On Akimiski Island, nesting phenology was the second earliest, on record and indices of gosling production were among the highest recorded since ground studies began in 1993. High winds and precipitation occurred in the Hudson Bay Lowlands 1-2 weeks after hatch and may have impacted gosling survival. With a higher total population and good productivity a larger fall flight than last year is expected.

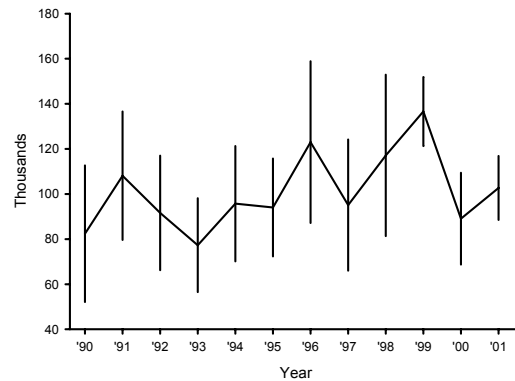


Fig. 6. Estimated number (and 95% confidence intervals) of Southern James Bay Population Canada geese during spring.

**Mississippi Valley Population (MVP):** The principal nesting range of this population is in northern Ontario, especially in the Lowlands west of James Bay and south of Hudson Bay. MVP Canada geese primarily concentrate during fall and winter in Wisconsin and Illinois (Fig. 3).

Breeding ground surveys conducted in May 2001 indicated a total population of 468,600 (388,300-548,800) Canada geese, a 56% decline ( $P=0.04$ ) from last spring (Fig. 7). There is no trend in this estimate since 1992 ( $P=0.59$ ). The number of coastal non-breeders present in 2001 was estimated from the previous 10-year average. Biologists estimated there were 176,600 (151,900-201,200) nests in 2001, 5% fewer than in 2000 ( $P=0.67$ ). There is no 10-year trend for numbers of MVP nests ( $P=0.23$ ). The MVP breeding grounds experienced light winter snowfall and relatively early spring, similar to the SJBP range. At a new MVP study area, spring phenology was early and goose productivity was higher than previously observed at other MVP sites. Although gosling production will be only slightly reduced, biologists predict a fall flight much smaller than last year due to the smaller number of non-breeding geese.

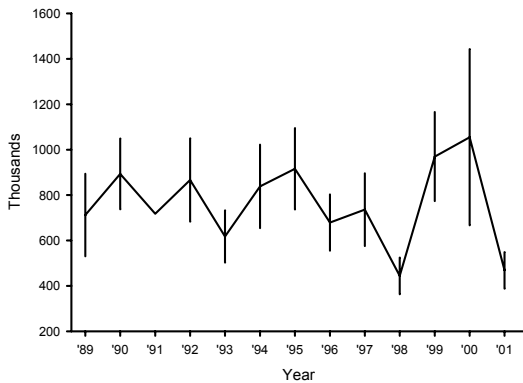


Fig. 7. Estimated number (and 95% confidence intervals) of Mississippi Valley Population Canada geese during spring.

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

This population has been monitored with spring surveys since 1993. In 2001, the preliminary population estimate was 1,371,100, which is 8% lower than the 2000 estimate (Fig. 8). These

estimates have increased an average of 6% per year since 1993 ( $P<0.001$ ). Biologists reported that conditions in Manitoba were very good for production, but flooding and wet brood-rearing periods may have reduced production in southern Minnesota, Iowa, and Missouri. Other areas expected good production and another large fall flight is expected.

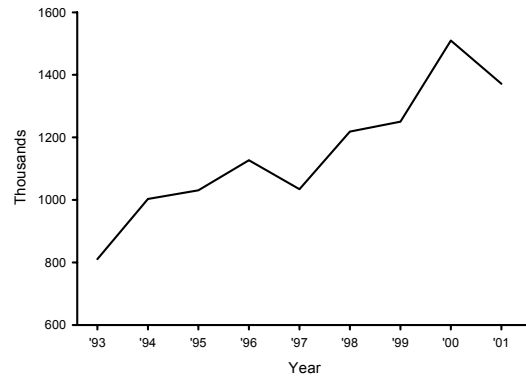


Fig. 8. Estimated number of Mississippi Flyway Giant Population of Canada geese during spring.

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

The spring 2001 estimate of EPP geese was 215,400 (187,000-243,800), 22% lower than in 2000 ( $P = 0.01$ , Fig. 9). There has been no trend ( $P=0.46$ ) in the spring estimate over the last 10 years. The 2001 estimate for singles and pairs was 122,200

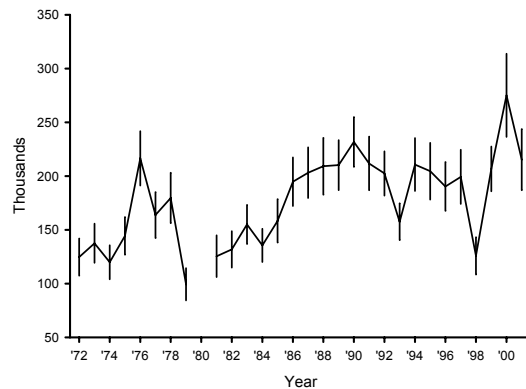


Fig. 9. Estimated number (and 95% CI) of Eastern Prairie Population Canada geese during spring.

(105,000-139,500), 6% lower ( $P=0.56$ ) than last year. Spring phenology was earlier in 2001 than in 2000. Nesting studies near Cape Churchill indicated an earlier than average nesting season, and well-above average nest densities, mean clutch size, and nest success. Researchers also reported a large increase in nesting snow geese on the Cape Churchill study area and south to the Broad River. Biologists expect a fall flight similar in size to last year but which contains a higher proportion of young geese.

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

These 2 populations are managed jointly and surveyed during winter. During the 2001 MWS survey, 682,700 WPP/GPP geese were counted, 15% more than the 2000 estimate (Fig. 10). This index has increased an average 9% per year since 1992 ( $P<0.001$ ). A 2001 index of the spring population in a portion of WPP/GPP range from the BPHS was 558,700. The BPHS estimates have increased an average of 12% per year since 1992 ( $P<0.001$ ). Habitat conditions during the nesting period were very good in western Manitoba and eastern Saskatchewan. States in GPP range indicated production should be average to above average in 2001. The WPP/GPP remains well

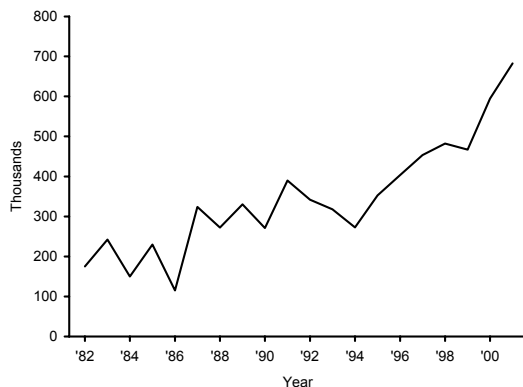


Fig. 10. Estimated number of Western Prairie Population/Great Plains Population Canada geese during winter.

above objective levels and a fall flight larger than last year is expected.

**Tall Grass Prairie Population (TGPP):** TGPP small Canada geese nest on Baffin (particularly on the Great Plain of the Koukdjuak), Southampton, and King William Islands, north from the Maguse and McConnell Rivers on the Hudson Bay coast, and west to the Queen Maud Gulf. TGPP Canada geese winter mainly in Oklahoma, Texas, and northeastern Mexico (Fig. 3). These geese mix with other Canada geese on wintering areas, making it difficult to estimate the size of the population.

During the 2001 MWS in the Central Flyway 149,100 TGPP geese were tallied, a decrease of 50% from 2000 (Fig. 11). There has been no trend in the Central Flyway count during 1992-2001 ( $P=0.82$ ). Spring breakup was early during 2001 on Southampton Island, and expected to be early on Baffin Island and the northwest coast of Hudson Bay. Previous fall surveys conducted on Baffin Island suggest an increasing or stable population. Little information on TGPP geese was available at this writing, but based on early spring phenology biologists expect good production. However, considering decreases in winter indices from the Central Flyway, the fall flight likely will be reduced from last year.

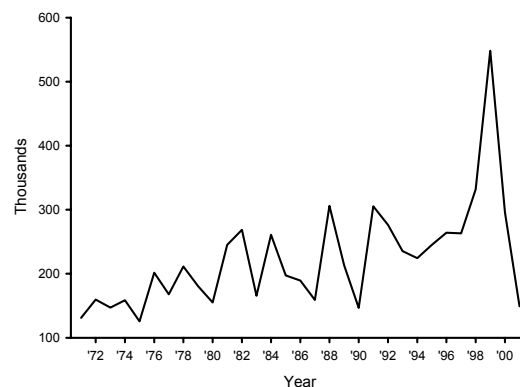


Fig. 11. Estimated number of Tall Grass Prairie Population Canada geese during winter in the Central Flyway.

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

During the 2001 MWS, biologists counted 164,100 SGPP Canada geese, 18% lower than in 2000 (Fig. 12). This index has declined 11% per year since 1992 ( $P=0.03$ ). A portion of the SGPP breeding range in the Northwest Territories is covered by the BPHS (strata 13-18). The 2001 BPHS estimated 116,600 (78,300-155,000) SGPP geese, a 110% increase from 2000 ( $P=0.01$ ). This estimate showed no trend since 1992 ( $P=0.22$ ). Spring phenology in the central Queen Maud Gulf was near normal, but the nesting period was cold and snowy which may reduce nesting success. Further north and west to Victoria Island, Kent Peninsula, and the Mackenzie Delta, spring phenology was delayed and production likely was depressed. However, nesting conditions to the south, in the boreal portions of SGPP range appeared favorable. Based on a reduced January population estimate and poor conditions over most of the northern nesting range, a fall flight smaller than last year is expected.

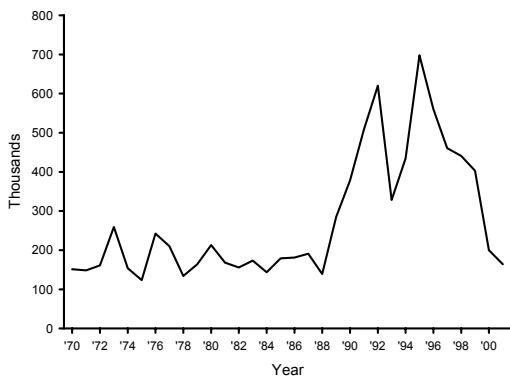


Fig. 12. Estimated number of Short Grass Prairie Population Canada geese during winter.

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

The 2001 MWS indicated a total HLP population of 252,900 geese, which is 7% below last year's estimate (Fig. 13). The MWS estimate has increased an average of 7% per year since 1992 ( $P=0.05$ ). An estimate of the spring population was obtained from the 2001 BPHS in areas of Saskatchewan, Alberta, and Montana. The BPHS estimate was 252,800, 9% lower than the previous year ( $P=0.56$ ). This

population estimate has increased 6% per year since 1992 ( $P=0.002$ ). Nesting conditions were poor to fair throughout much of the breeding range. Production was reduced due to drought in most areas, and to spring storms and flooding in Colorado. The fall flight of HLP geese is expected to be reduced from that of last year.

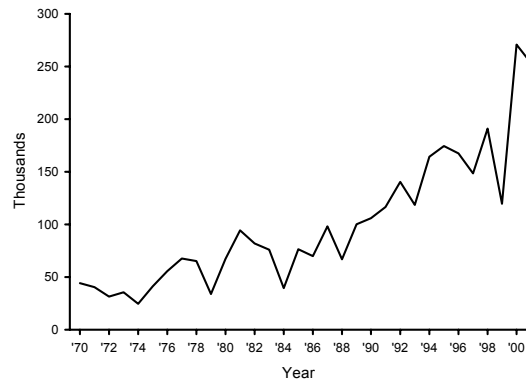


Fig. 13. Estimated number of Hi-Line Population Canada geese during winter.

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

During the 2001 MWS, 110,600 geese were counted, an 8% increase from the previous year (Fig. 14). There is no trend in MWS estimates since

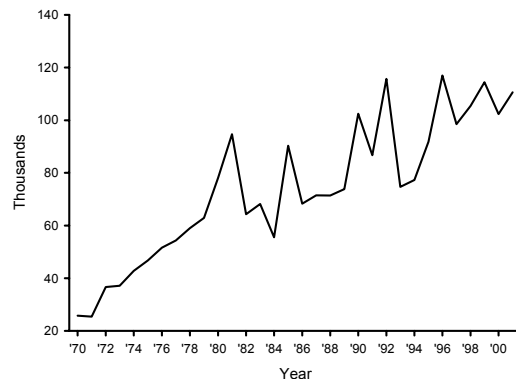


Fig. 14. Estimated number of Rocky Mountain Population Canada geese during winter.

1992. The estimate of spring population derived from the BPHS in 2001 was 161,400, 3% lower than last year ( $P=0.92$ ). The BPHS estimate has increased 7% per year during the last 10 years ( $P=0.02$ ). Most RMP breeding areas are experiencing drought, but low snowpack also reduces spring flooding in inter-mountain areas. Biologists expect near average production in most areas and a large fall flight similar to last year.

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

Wetland abundance in the range of the PP has been reduced due to prolonged drought. The drought has reduced nesting potential for some geese but also eliminated the nest destruction caused by flooding. In California, the 2001 estimate of breeding geese declined 26% from 2000, but the estimate of production declined only 14%. In Nevada, production in 2001 was expected to be reduced due to the dry conditions. However, nesting indices in Washington this spring were 10% higher than last year and production was expected to be average to above-average in Montana and Oregon. The size of the fall flight can not be reliably predicted without more information.

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

The size of the population is estimated through observations of marked geese during December and January. The 2000-01 population estimate was 17,300 (12,000-22,600), which is 11% higher, but not significantly different ( $P=0.62$ ) than the estimate from the previous winter (Fig. 15). There was no trend in these estimates during 1991/92-2000/01 ( $P=0.63$ ). Preliminary results from the 2001 spring survey of the Copper River Delta indicated the index of total Dusky geese, and singles and pairs increased roughly 15% from last year's indices, which were the lowest recorded in the 15 years of the survey. Although nesting phenology appeared average, a late snow storm during nesting caused substantial nest abandonment. However, re-nesting effort was high and second nests appeared to have very good nest success, likely because more advanced foliage provided better concealment from predators. A fall flight similar to, or slightly improved from last year is expected.

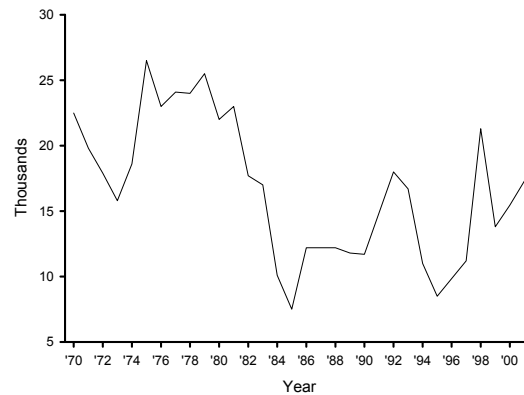


Fig. 15. Estimated number of dusky Canada geese during winter.

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

The population index for this population was a fall estimate from 1979-84. Since 1985 the index has been a predicted fall population derived from spring surveys on the Yukon Delta. The fall 2000 index was 211,900, less than 1% greater than 1999. This index of cackling Canada geese has increased an average of 8% per year since 1991 ( $P < 0.001$ , Fig. 16). In the coastal zone of the Yukon-Kuskokwim Delta in spring 2001, total cackling geese increased 13%, and single and paired geese were unchanged (+1%) from 2000. Spring nesting phenology was later than recent years on the Delta and nesting effort in study plots was reduced by about 38% from last year. In addition, nest success was reduced

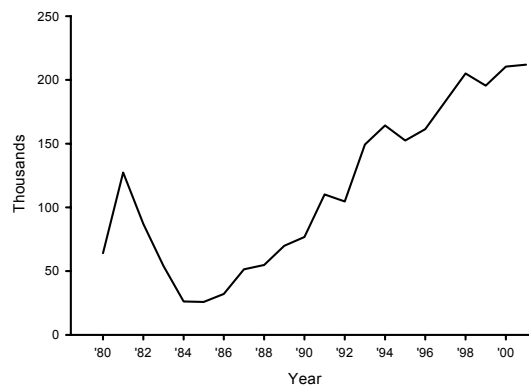
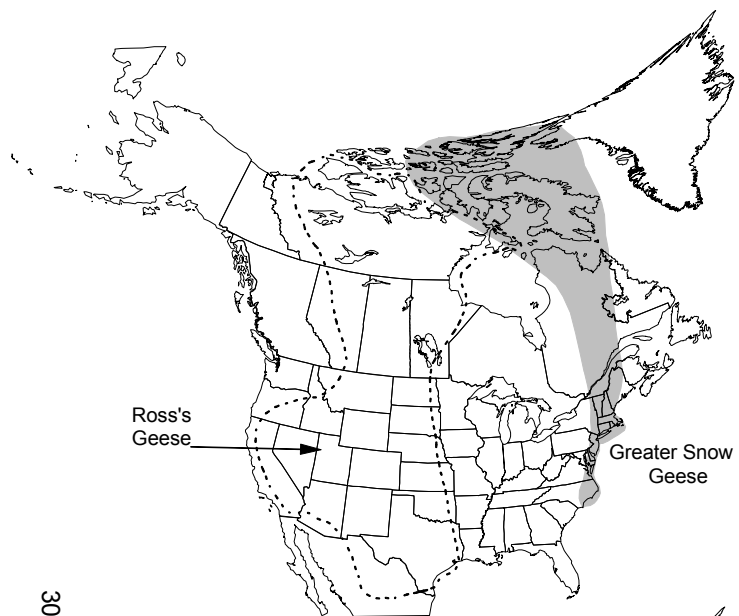
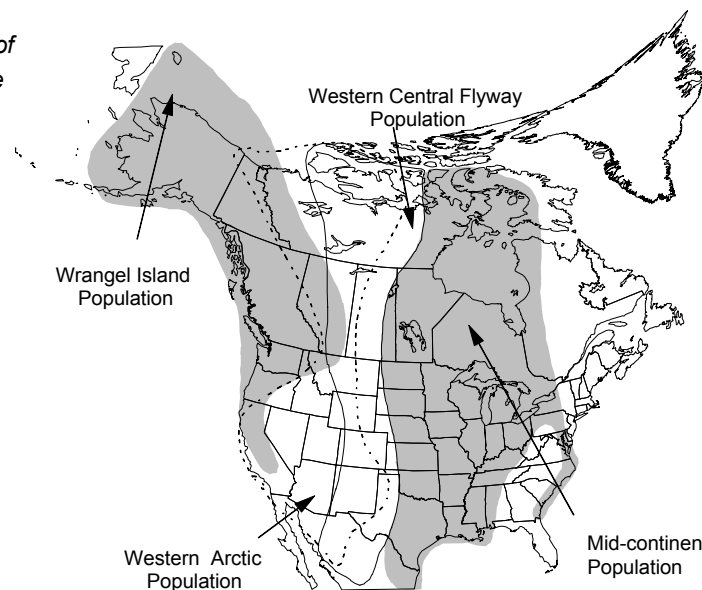


Fig. 16. Number of cackling Canada geese estimated from fall and spring surveys.

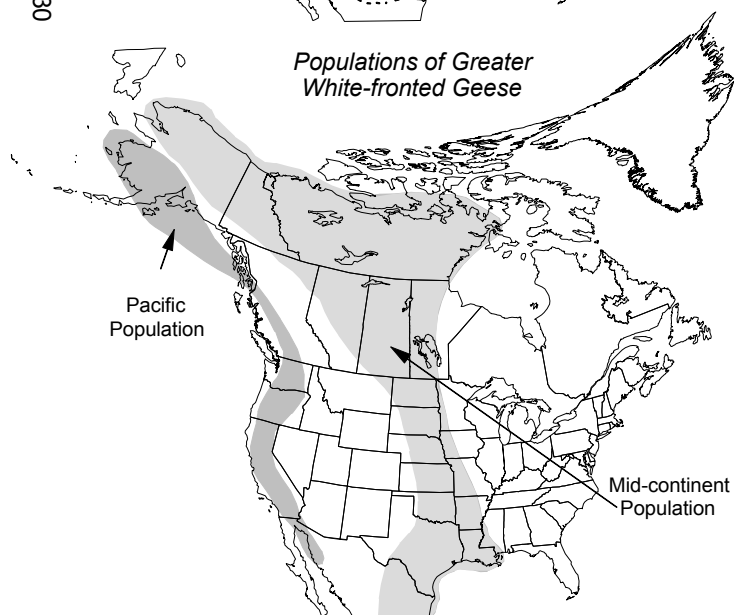


*Populations of Light Geese*



30

*Populations of Greater White-fronted Geese*



*Populations of Brant*



by high fox predation and major flooding in the coastal zone. A fall flight smaller than last year is expected.

**Lesser Canada Geese:** This population nests throughout much of interior and south-central Alaska and winters in Washington, Oregon, and California (Fig. 3). Throughout the year, lesser Canada geese mix with other Canada geese and no reliable estimate of population size is available.

Spring breakup was late throughout western and northwestern Alaska but areas to the southeast experienced near normal spring phenology. Eventually spring temperatures rose quickly and caused substantial flooding along several interior rivers. The estimated number of Canada geese within lesser Canada goose population range from the 2001 BPHS (strata 1-6, 8-12) was 272,500, 14% higher than last year but showing no trend since 1992 ( $P=0.79$ ). A fall flight similar to last year is expected.

**Aleutian Canada Geese (ACG):** These geese currently breed only on the Aleutian Islands although historically they nested from near Kodiak Island, Alaska, to the Kuril Islands in Asia. They now winter along the Pacific Coast to central California. This population declined precipitously in the early 1900s, primarily due to the introduction of foxes to its nesting islands. The Aleutian Canada goose was federally listed as endangered in 1967. When the recovery program began in 1974, the population numbered approximately 800 birds. Currently the population is estimated at nearly 30,000 and the population was delisted in March 2001.

An indirect population estimate based on observations of neck-banded birds in Modesto, California 2000-01 was 29,800, 11% lower than, but

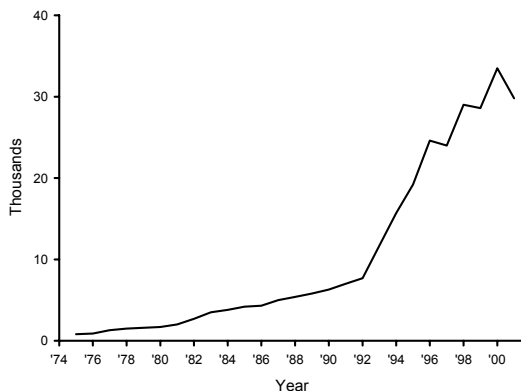


Fig. 18. Number of Aleutian Canada geese estimated from winter estimates and mark-resight methods.

statistically similar ( $P=0.50$ ) to last year's estimate (Fig. 18). Information on breeding ground conditions is not available, so it is not possible to provide a fall flight prediction.

## Status of Light Geese

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

**Ross's Geese:** Most Ross's geese nest in the Queen Maud Gulf region, but some nest along western coast of Hudson Bay and Southampton, Baffin, and Banks Islands. Ross's geese are represented in 3 different populations of light geese (MCP, WCFP, and WAWI) and primarily winter in California, New Mexico, Mexico, and Texas with increasing numbers in Louisiana (Fig. 17).

Periodic photo-inventories and annual surveys in the Queen Maud Gulf indicate the spring Ross's goose population is increasing rapidly and has exceeded 800,000 geese in recent years. Annual estimates of total wintering population size are not available, but surveys on major wintering areas indicate increases in range and proportion of Ross's geese. The largest colony in the Queen Maud Gulf is at Karrak Lake. Researchers determined the nesting population there has grown at 10% per year from 1993-2000 ( $P=0.02$ ). Spring phenology at Karrak Lake was near normal in 2001, but the nesting and hatching period was colder and wetter than normal. These conditions may reduce gosling production and biologists expect average to slightly below average production from the Queen Maud Gulf. Nesting conditions for Ross's geese in areas of range expansion were generally favorable (poor on Banks Island, but good on the Hudson Bay coast and Southampton Island). Although production will likely be similar to last year, the size of the fall flight cannot be predicted without an annual index to the size of the breeding population.

**Mid-continent Population (MCP):** This population, including lesser snows and increasing numbers of Ross's geese, nests along the west coast of Hudson Bay and on Southampton and Baffin Islands (Fig. 17). These geese winter primarily in eastern Texas, Louisiana, and Arkansas.



During the 2001 MWS, biologists counted 2,341,300 light geese, about 2% fewer than last year (Fig. 19). The MWS index for the MCP has declined for the last 3 years and no longer exhibits a 10-year trend ( $P=0.11$ ). The timing of spring breakup was favorable for MCP geese across most of their range. On Southampton Island spring phenology was estimated to be 2 weeks earlier than average. South Baffin Island had fewer spring blizzards than usual and an early spring breakup. Areas of the Hudson Bay Lowlands from La Perouse Bay to Cape Henrietta Maria also experienced spring weather very favorable to geese. This year biologists observed a substantial increase in the usually low number of snow goose nests between Cape Churchill and the Broad River on the Hudson Bay coast. Indices of breeding snow geese at the Cape Henrietta Maria colony increased to 129,000 in 2001, up 47% from last year. Snow geese also reestablished a small nesting colony west of Winisk, Ontario and the number of nests increased at the small colony on Akimiski Island. Although spring phenology was beneficial to nesting geese and plant growth in the Hudson Bay Lowlands, periodic high winds and precipitation events during the brood-rearing period may have reduced gosling survival. Early spring phenology throughout much of the MCP breeding range suggests the fall flight will be larger than produced by last year's poor production.

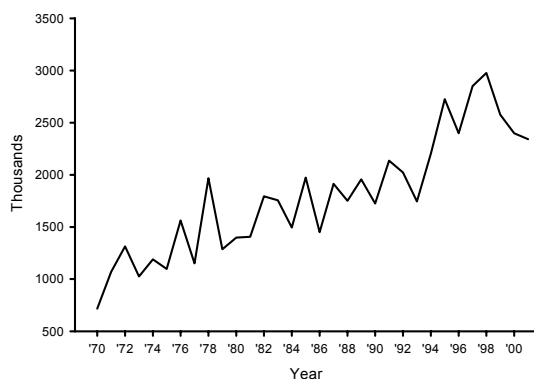


Fig. 19. Estimated number of Mid-continent Population light geese (lesser snow and Ross's geese) during winter.

**Western Central Flyway Population (WCFP):** This population is comprised primarily of snow geese but includes a substantial proportion of Ross's geese. WCF geese breed in the central and western Canadian Arctic, with large nesting colonies near

the Queen Maud Gulf and on Banks Island. These geese stage in fall in eastern Alberta and western Saskatchewan and spend the winter in southeastern Colorado, New Mexico, the Texas Panhandle, and the northern highlands of Mexico (Fig. 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, 105,800 geese were counted in January 2001, 23% fewer than last year (Fig. 20). These MWS estimates have increased 8% per year since 1992 ( $P=0.07$ ). Biologists working near Karrak Lake in the Queen Maud Gulf region reported that spring phenology was near average but the nesting and hatching period was colder and wetter than usual. These conditions may reduce gosling production and biologists expect average to slightly below average production from the Queen Maud Gulf. Breeding conditions deteriorated to the west. At Sachs Harbor on Banks Island, spring breakup was the latest recorded since 1960. Snow goose nesting phenology on Banks Island was delayed and biologists estimated a smaller than normal proportion of geese attempted to nest. Biologists also report delayed and reduced nesting effort at the Anderson River and Kendall Island colonies. Production likely will be poor from western areas and near average in eastern areas. Despite a lower winter index in 2001, a fall flight similar to last year's fall flight (with poor production) is expected.

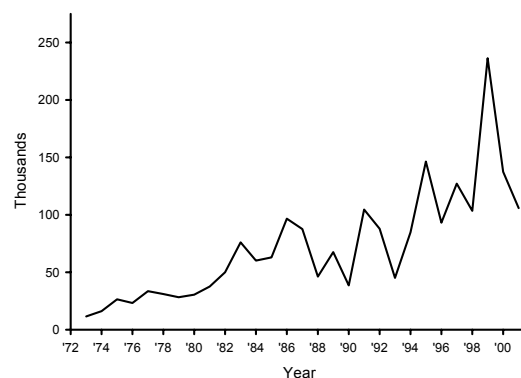


Fig. 20. Estimated number of Western Central Flyway Population light geese during winter.

**Western Arctic/Wrangel Island Population (WAWI):** Most of the snow geese in the Pacific Flyway originate from nesting colonies in the western and central Arctic (WA: Banks Island, the

Anderson and Mackenzie River Deltas, Jenny Lind Island, the western Queen Maud Gulf region) or Wrangel Island (WI), located off the northern coast of Russia. The WA segment of the population winters in central and southern California, New Mexico, and Mexico; the WI segment winters in the Puget Sound area of Washington and in northern and central California (Fig. 17). Winter ranges overlap in California and interchange of individuals between the two breeding sites may occur. Separate winter counts for the WA and WI segments are not obtainable because of commingling with each other and other light geese.

The number of snow geese in the Pacific Flyway in fall of 2000 was estimated at 656,800 individuals, which is 13% larger than estimated in 1999 (Fig. 21). There is no trend in this estimate during fall 1991-2000 ( $P=0.36$ ). Biologists working at nesting colonies on Banks Island, Kendall Island, and the Anderson River reported a late spring breakup and delayed nesting, and predicted below-average production. On Wrangel Island the total spring population was estimated at 105,000, 11% higher than last year. Biologists estimated 25,000 nests were present with an average clutch size of 3.6 eggs, both similar to last year. Although production from the WI should be similar to last year, anticipated poor production from the proportionately larger WA population should result in a reduced fall flight of the WAWI this year.

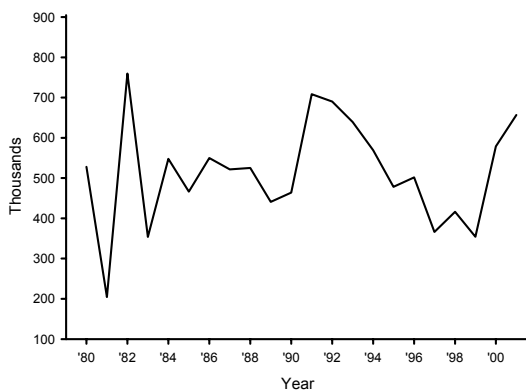


Fig. 21. Estimated number of Western Arctic/Wrangel Island Population of light geese during winter.

**Greater snow geese:** This subspecies nests principally on Bylot, Axel Heiberg, Ellesmere, and Baffin Islands, and on Greenland. They winter along the Atlantic coast from New Jersey to North Carolina (Fig. 17).

The preliminary estimate from the spring 2001 photographic survey of greater snow geese in the St. Lawrence Valley was 690,300. The 2001 estimate was 15% below last year's final and record high estimate of 813,900 geese (Fig. 22). Spring estimates of greater snow geese have increased an average of 6% per year since 1992 ( $P<0.001$ ). The number of snow geese counted during the 2001 MWS in the Atlantic Flyway was 280,200, a 40% decrease from the previous survey. Midwinter counts have increased an average of 6% per year during 1992-2001 ( $P=0.05$ ). The largest known greater snow goose colony is on Bylot Island. Winter snowfall on Bylot was above average. However, spring snowmelt progressed rapidly and median nest initiation was 13-14 June, just 2-3 days later than average. Remaining snow may have limited the availability of nest sites. Nest densities in 2001 were similar to last year but not as high as in peak years of 1997 and 1998. Nest success and conditions at hatch were favorable. Biologists expect good production from this colony. A fall flight similar to last year is expected.

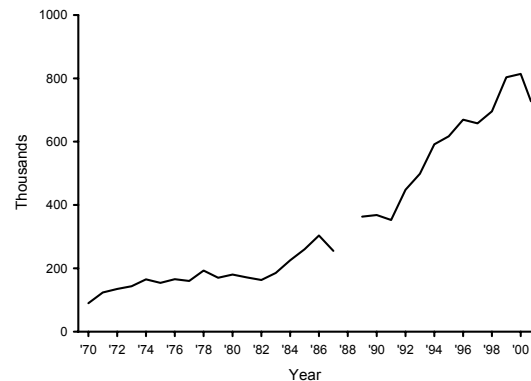


Fig. 22. Estimated number of greater snow geese during spring.

### Status of Greater White-fronted Geese

**Pacific Population (PP):** These geese primarily nest in the Yukon-Kuskokwim Delta of Alaska and winter in the Central Valley of California (Fig. 17).

The population index for this population was a fall estimate 1979-99. Beginning in 2000 the population index has been a predicted fall population derived from spring surveys on the Yukon Delta. The 2000 index is 307,000, an increase of 15% from the fall 1999 estimate (Fig. 23). Spring surveys indicated total white-fronts and breeding pairs increased 27%

and 46%, respectively, from last year's survey. Spring survey estimates have increased an average of 10% per year from 1992-2001 ( $P < 0.001$ ). Spring phenology on the Delta was delayed but nesting surveys indicated a slight increase in nesting effort from last year. High nest predation rates by an unusually high number of foxes in coastal areas and the late spring likely reduced production. Based on a higher fall estimate but reduced production, a fall flight similar to last year is expected.

**Mid-continent Population (MCP):** These white-fronted geese nest across a broad region from central and northwestern Alaska across the central Arctic to the Foxe Basin. They concentrate in southern Saskatchewan during the fall and winter in Texas, Louisiana, and Mexico (Fig. 17).

In the fall of 2000, 1,067,600 MCP geese were counted in Saskatchewan and Alberta, an increase of 11% from the 1999 estimate (Fig. 23). This population estimate has increased 6% per year during 1992-2000 ( $P = 0.07$ ). Spring phenology on MCP breeding grounds varied from late in northern and interior Alaska and the Mackenzie and Anderson River Deltas to near average in the Queen Maud Gulf. Flooding along interior Alaska river systems, and a cold nesting period in the Queen Maud Gulf likely reduced production in those areas. A fall flight similar to last year is expected.

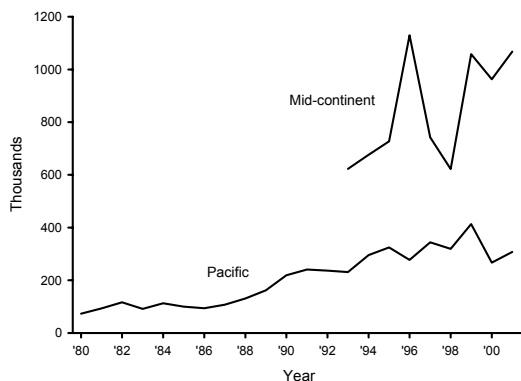


Fig. 23. Estimated number of Mid-continent and Pacific Populations of greater white-fronted geese during fall.

## Status of Brant

**Atlantic Brant (ATLB):** Most of this population nests on islands of the eastern Arctic. These brant winter along the Atlantic Coast from Massachusetts to North Carolina (Fig. 17).

The 2001 MWS estimate of brant in the Atlantic Flyway was 145,300, 8% less than last year's estimate (Fig. 24). No trend was detected ( $P = 0.72$ ) in this estimate over the most recent 10-year period. Spring breakup in 2001 was early in the eastern Arctic; up to 2 weeks earlier than average on Southampton Island. The advanced phenology is expected to increase production on the northern breeding grounds of brant. A larger fall flight than last year is expected.

**Pacific Brant (PACB):** These brant nest across Alaska's Yukon-Kuskokwim Delta and North Slope, Banks Island, other islands of the western and central Arctic, the Queen Maud Gulf, and Wrangel Island. They winter as far south as Baja California and the west coast of Mexico (Fig. 17).

The 2001 MWS in the Pacific Flyway and Mexico resulted in a count of 124,700 brant, 8% lower than the previous year's count (Fig. 24). No trend was evident in this estimate during 1992-2001 ( $P = 0.37$ ). Spring breakup was later than recent years on the Yukon-Kuskokwim Delta, and later than average on the North Slope, Banks Island, and likely much of the Pacific Brant's breeding range. Brant nest density and success were reduced substantially in the 5 Yukon Delta colonies. Nest success was reduced by an unusually high fox population and by major flooding in the coastal zone during mid-June. A fall flight smaller than last year is expected.

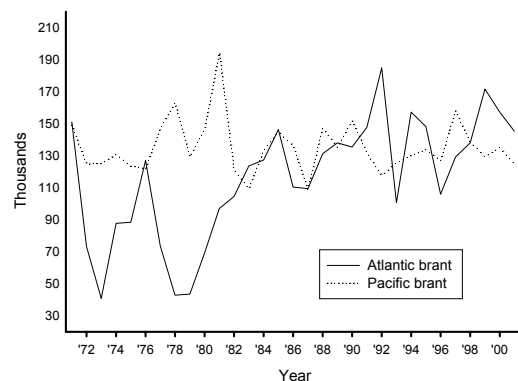


Fig. 24. Estimated number of Atlantic and Pacific populations of brant during winter.

**Western High Arctic Brant (WHA):** This recently recognized population of brant nest on the Parry Islands of the Northwest Territories. The population stages in fall at Izembek Lagoon Alaska. They predominantly winter in Padilla,

Samish, and Fidalgo Bays of Washington and near Boundary Bay, British Columbia, although some individuals have been observed as far south as Mexico. Breast and belly plumage of WHA brant are predominantly gray, intermediate between Atlantic brant and black brant, but other color morphs have been captured in molting flocks on breeding areas. The development of a management plan and monitoring program are underway for this newly designated population.

### Status of Emperor Geese

The breeding range of the emperor goose is restricted to coastal areas of the Bering Sea, with the largest concentration on the Yukon-Kuskokwim Delta in Alaska. Emperor geese migrate relatively short distances and primarily winter in the Aleutian Islands (Fig. 26). Since 1981, emperor geese have been surveyed annually on spring staging areas in southwestern Alaska.

The spring 2001 survey estimate was 84,400 geese, 35% higher than last year's count (Fig. 25). The 3-year running average is now 67,200 geese. No trend was detected in the number of geese counted during 1992-2001 ( $P=0.75$ ). Spring indices of breeding pairs and total birds collected from the 2001 Yukon-Kuskokwim Delta coastal survey increased 36% and 74%, respectively, from last spring. Spring breakup and nesting phenology were later than in recent years on the Yukon-Kuskokwim Delta. Emperor goose nest densities were reduced by 60% from last year and nest destruction rates were high due to an abnormally large fox population. A fall flight smaller than last year is expected.

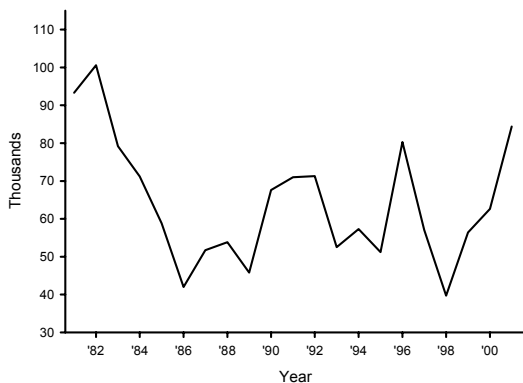


Fig. 25. Estimated numbers of emperor geese present during May surveys.

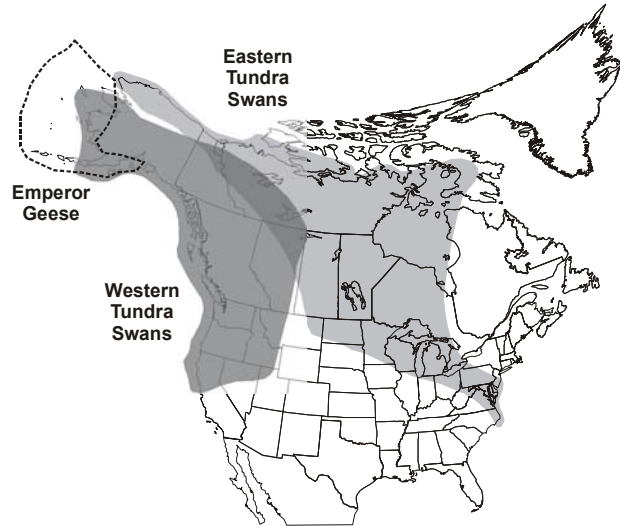


Fig. 26. Approximate range of the Emperor goose, and eastern and western swan populations in North America.

### Status of Tundra Swans

*Western Population:* These swans nest along the coastal lowlands of western Alaska, particularly between the Yukon and Kuskokwim Rivers. They winter primarily in California, Utah, and the Pacific Northwest (Fig. 26).

The 2001 MWS estimate of 90,300 swans was essentially unchanged (+1%) from the 2000 estimate (Fig. 27). However, this population index has been increasing at an average rate of 5% per year since 1992 ( $P=0.09$ ). The spring 2001 estimates of total swans, breeding pairs, and nests on the Yukon-Kuskokwim Delta declined 16%, 14%, and 29%, respectively, from last spring. Spring breakup in western Alaska in 2001 was later than in recent years and results of nest plots surveys indicate nesting effort was reduced by about 10% from last year. A fall flight smaller than last year is expected.

*Eastern Population:* Eastern Population tundra swans nest from the Seward Peninsula of Alaska to the northeast shore of Hudson Bay and Baffin Island. These birds winter in coastal areas from Maryland to North Carolina (Fig. 26)

During the 2001 MWS, 98,200 eastern tundra swan were observed, 5% lower than last year (Fig. 27). During the last 10 years there has been no trend in this estimate ( $P=0.25$ ). In the western portion of this population's breeding range spring phenology was delayed and swan production likely will be reduced. Indices of tundra nesting swans in Alaska (strata 8-11) in 2001 increased 13% from last year, but the number of swans observed with nests

declined to about 50% of average. East of the Queen Maud Gulf, spring phenology was early and nesting conditions should be good. Overall, a fall flight similar to last year is expected.

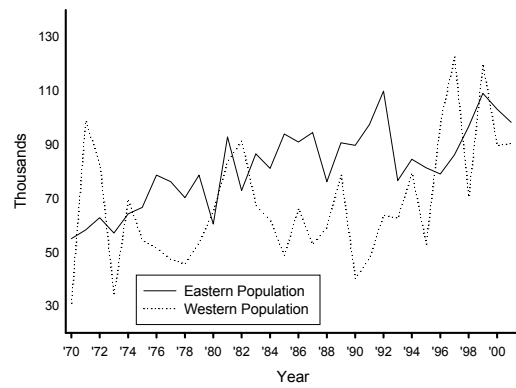


Fig. 27. Estimated numbers of the Eastern and Western Populations of tundra swans during winter.

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

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**Alaska and Yukon Territory (Old Crow Flats):** B. Conant and D. Groves

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**Northern Saskatchewan and Northern Manitoba:** F. Roetker and J. Kreilich Jr.

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Ground D. Duncan<sup>a</sup>, P. Pryor<sup>a</sup>, K. Froggatt<sup>b</sup>, S. Barry<sup>a</sup>, E. Hofman<sup>b</sup>, R. Russell<sup>b</sup>, B. Peers<sup>c</sup>, T. Matthews<sup>c</sup>, M. Johnson<sup>a</sup>, L. Crowe<sup>a</sup>, C. Procter<sup>a</sup>, J. Spens<sup>b</sup>, S. Witham<sup>c</sup>, M. Barr<sup>c</sup>

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Ground D. Nieman<sup>a</sup>, J. Smith<sup>a</sup>, K. Warner<sup>a</sup>, C. Downie<sup>a</sup>, M. Hosegood<sup>a</sup>, C. Lévesque<sup>a</sup>, P. Nieman<sup>a</sup>, C. Park<sup>a</sup>, A. Williams<sup>a</sup>, D. Caswell<sup>a</sup>, M. Schuster<sup>a</sup>, P. Rakowski<sup>a</sup>, D. Pisiak<sup>b</sup>, M. Van Osch<sup>c</sup>, M. Blanchard<sup>a</sup>, J. Galbraith<sup>a</sup>, F. Baldwin Jr.<sup>a</sup>, A. Dupuis<sup>a</sup>, B. Carles<sup>b</sup>

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Air J. Voelzer and R. Bentley  
Ground A. Arnold<sup>d</sup> and V. Griego

**Central and Eastern Dakotas**

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Ground G.T. Allen, M. Ellingson<sup>b</sup>, P.R. Garrettson, F. Prellwitz

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**Central and Western Ontario:** W. Butler, B. Fisher, D. Holtby<sup>b</sup>, J. Drahota, and B. Raftovich

**Maine and Maritimes:** J. Bidwell and M. Drut

**British Columbia:** A. Breault<sup>b</sup>, P. Watts<sup>d</sup>, and 22 participants from the Canadian Wildlife Service, Ducks Unlimited Canada, British Columbia Wildlife Branch, Canadian Parks Service, private organizations

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**Michigan:** A. Karr<sup>b</sup>, B. Lercel<sup>b</sup>, B. Rogers<sup>b</sup>, B. Scullon<sup>b</sup>, B. Rudolph<sup>d</sup>, D. Luukkonen<sup>d</sup>, E. Flegler<sup>b</sup>, E. Kafkas<sup>b</sup>, G. Souillere<sup>b</sup>, J. Robison<sup>b</sup>, J. Niewoonder<sup>b</sup>, R. Matthews<sup>d</sup>, S. Whitcomb<sup>b</sup>, S. Chadwick<sup>b</sup>, T. Oliver<sup>b</sup>, T. German<sup>b</sup>

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Ground S. Kelly, J. Artmann, B. Ehlers, R. Johnson, R. Papasso, T. Rondeau, P. Soler, K. Svendsgaard, W. Bringer, L. Dooley, H. Gee, C. Hanson, N. Jerstad, J. Kelley, G. Tischer, S. Zodrow

**Nebraska**

Air D. Benning<sup>d</sup> and N. Lyman<sup>b</sup>  
Ground R. Woods<sup>b</sup>, M. Vrtiska<sup>b</sup>, N. Lyman<sup>b</sup>, D. Benning<sup>d</sup>  
Data Analysis M. Vrtiska<sup>b</sup> and H. Taira<sup>b</sup>

**Nevada** N. Saake<sup>b</sup>

Appendix A. Continued.

---

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New Jersey: T. Nichols<sup>b</sup>, P. Castelli<sup>b</sup>, J. Ziemba<sup>b</sup>, J. Garris<sup>b</sup>, J. Mangino<sup>b</sup>, L. Widjeskog<sup>b</sup>, D. Wilkinson<sup>b</sup>, T. Walker, B. Willard, M. Canale<sup>b</sup>  
New York: Staff of the NY State Department of Environmental Conservation  
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Vermont: D. Sausville<sup>b</sup>, J. Mlcuch<sup>b</sup>, B. Crenshaw<sup>b</sup>

**Washington:** D. Kraege<sup>b</sup>

**Wisconsin**

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Ground: B. Bacon<sup>b</sup>, K. Belling<sup>b</sup>, T. Bahti<sup>b</sup>, J. Cole<sup>b</sup>, G. Dahl<sup>b</sup>, G. Dunsmoor<sup>b</sup>, D. Evenson<sup>b</sup>, R. Gatti<sup>b</sup>, B. Hill<sup>b</sup>, J. Huff<sup>b</sup>, K. Jonas<sup>b</sup>, M. Kastler<sup>b</sup>, M. Lehner<sup>b</sup>, K. Morgan<sup>b</sup>, A. Nelson<sup>b</sup>, J. Skelton<sup>b</sup>, M. Verdon<sup>b</sup>, P. David<sup>b</sup>, D. North<sup>b</sup>, S. White<sup>b</sup>, A. Kitchen, J. Ruwaldt, J. Trick, G. VanVreede

**Wyoming** L. Roberts<sup>b</sup>

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<sup>a</sup> Canadian Wildlife Service

<sup>b</sup> State, Provincial, or Tribal Conservation Agency

<sup>c</sup> Ducks Unlimited - Canada

<sup>d</sup> Other organization

All others – U.S. Fish and Wildlife Service

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

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

**Atlantic Population of Canada Geese:** W. Harvey<sup>b</sup>, L. Hindman<sup>b</sup>, J. Hughes<sup>a</sup>, A. Reed<sup>a</sup>, and J. Rodrigue<sup>a</sup>

**North Atlantic Population of Canada Geese:** M. Bateman<sup>a</sup> and J. Serie

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

**Southern James Bay Population of Canada Geese:** K. Abraham<sup>b</sup>, D. Fillman<sup>b</sup>, J. Leafloor<sup>b</sup>, K. Ross<sup>a</sup>, and L. Walton<sup>b</sup>

**Mississippi Valley Population of Canada Geese:** K. Abraham<sup>b</sup>, J. Berquist<sup>b</sup>, D. Fillman<sup>a</sup>, J. Leafloor<sup>b</sup>, K. Ross<sup>a</sup>, and L. Walton

**Mississippi Flyway Population Giant Canada Geese:** S. Barry<sup>b</sup>, J. Berquist<sup>b</sup>, E. Flegler<sup>b</sup>, D. Graber<sup>b</sup>, M. Hartman<sup>b</sup>, M. Kraft<sup>b</sup>, J. Lawrence<sup>b</sup>, D. Luukkonen<sup>b</sup>, R. Marshalla<sup>b</sup>, R. Pritchert<sup>b</sup>, E. Warr, and G. Zenner<sup>b</sup>

**Eastern Prairie Population of Canada Geese:** D. Andersen<sup>d</sup>, R. Foster, M. Gillespie<sup>b</sup>, D. Humburg<sup>b</sup>, S. Maxson<sup>b</sup>, B. Lubinski, R. Nack, and P. Telander<sup>b</sup>

**Western Prairie and Great Plains Populations of Canada Geese:** M. Kraft<sup>b</sup>, M. O'Meilia<sup>b</sup>, M. Vritiska<sup>b</sup>

**Tall Grass Prairie Population of Canada Geese:** R. Case<sup>b</sup>, D. Caswell<sup>a</sup>, K. Dickson<sup>a</sup>, R. Kerbes<sup>a</sup>, and M. Mallory<sup>a</sup>

**Short Grass Prairie Population of Canada Geese:** R. Alisaukas<sup>a</sup>, K. Dickson<sup>a</sup>, J. Hines<sup>a</sup>, and D. Nieman<sup>a</sup>

**Hi-Line Population of Canada Geese:** A. Didiuk<sup>a</sup>, J. Dubovsky, J. Gammonley<sup>b</sup>, J. Hansen<sup>b</sup>, K. Lungle<sup>b</sup>, L. Roberts<sup>b</sup>, and S. Tessman<sup>b</sup>

**Rocky Mountain Population of Canada Geese:** T. Aldrich<sup>b</sup>, J. Dubovsky, T. Sanders<sup>b</sup>, T. Hinz<sup>b</sup>, J. Herbert<sup>b</sup>, K. Lungle<sup>b</sup>, L. Roberts<sup>b</sup>, N. Saake<sup>b</sup>, and G. Will<sup>b</sup>

**Pacific Population of Canada Geese:** A. Breault<sup>a</sup>, B. Bales<sup>b</sup>, C. Feldheim<sup>b</sup>, T. Hinz<sup>b</sup>, D. Kraege<sup>b</sup>, N. Saake<sup>b</sup>, and D. Yparraguirre

**Dusky Canada Geese:** B. Eldridge, M. Drut, T. Fondell, B. Lamed, D. Logan<sup>d</sup>, M. Naughton, R. Oates, D. Robertson, T. Rothe<sup>b</sup>, and R. Trost

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

**Cackling Canada Geese:** M. Anthony<sup>d</sup>, T. Bowman, C. Dau, B. Eldridge, R. Oates, B. Platte, D. Marks, B. Stehn, and R. Trost

**Aleutian Canada Geese:** M. Drut, R. Trost

**Greater Snow Geese:** A. Bechet<sup>d</sup>, K. Dickson<sup>a</sup>, A. Fontaine<sup>a</sup>, G. Gauthier<sup>d</sup>, J. Giroux<sup>d</sup>, J. Hughes<sup>a</sup>, M. Mallory<sup>a</sup>, and A. Reed<sup>a</sup>

**Mid-continent Population Light Geese:** K. Abraham<sup>b</sup>, D. Caswell<sup>a</sup>, K. Dickson<sup>a</sup>, R. Foster, M. Gillespie<sup>b</sup>, D. Humburg<sup>b</sup>, M. Mallory<sup>a</sup>, R. Rockwell<sup>d</sup>, K. Ross<sup>a</sup>, and P. Telander<sup>b</sup>



Appendix B. Continued.

**Western Central Flyway Population Light Geese:** R. Alisauskas<sup>a</sup>, J. Bredy<sup>d</sup>, D. Caswell<sup>a</sup>, K. Dickson<sup>a</sup>, R. Kerbes<sup>a</sup>, P. Latour<sup>a</sup>, and D. Warner<sup>a</sup>

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

**Ross's Geese:** R. Alisauskas<sup>a</sup>, K. Dickson<sup>a</sup>, R. Kerbes<sup>a</sup>, D. Warner<sup>a</sup>, and K. Warner<sup>a</sup>

**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:** R. Alisauskas<sup>a</sup>, R. Case<sup>b</sup>, B. Conant, K. Dickson<sup>a</sup>, J. Hines<sup>a</sup>, R. Kerbes<sup>a</sup>, E. Malleck, D. Nieman<sup>a</sup>, M. Spindler, and K. Warner<sup>a</sup>

**Pacific Brant:** R. Anthony<sup>d</sup>, R. Oates, and R. King

**Atlantic Brant:** K. Dickson<sup>a</sup>, M. Mallory<sup>a</sup>, A. Reed<sup>a</sup>

**Western High Arctic Brant:** D. Kraege<sup>b</sup>, R. Trost

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

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

**Eastern Population of Tundra Swans:** J. Fischer, J. Hines<sup>a</sup>, B. Larned, and R. Oates

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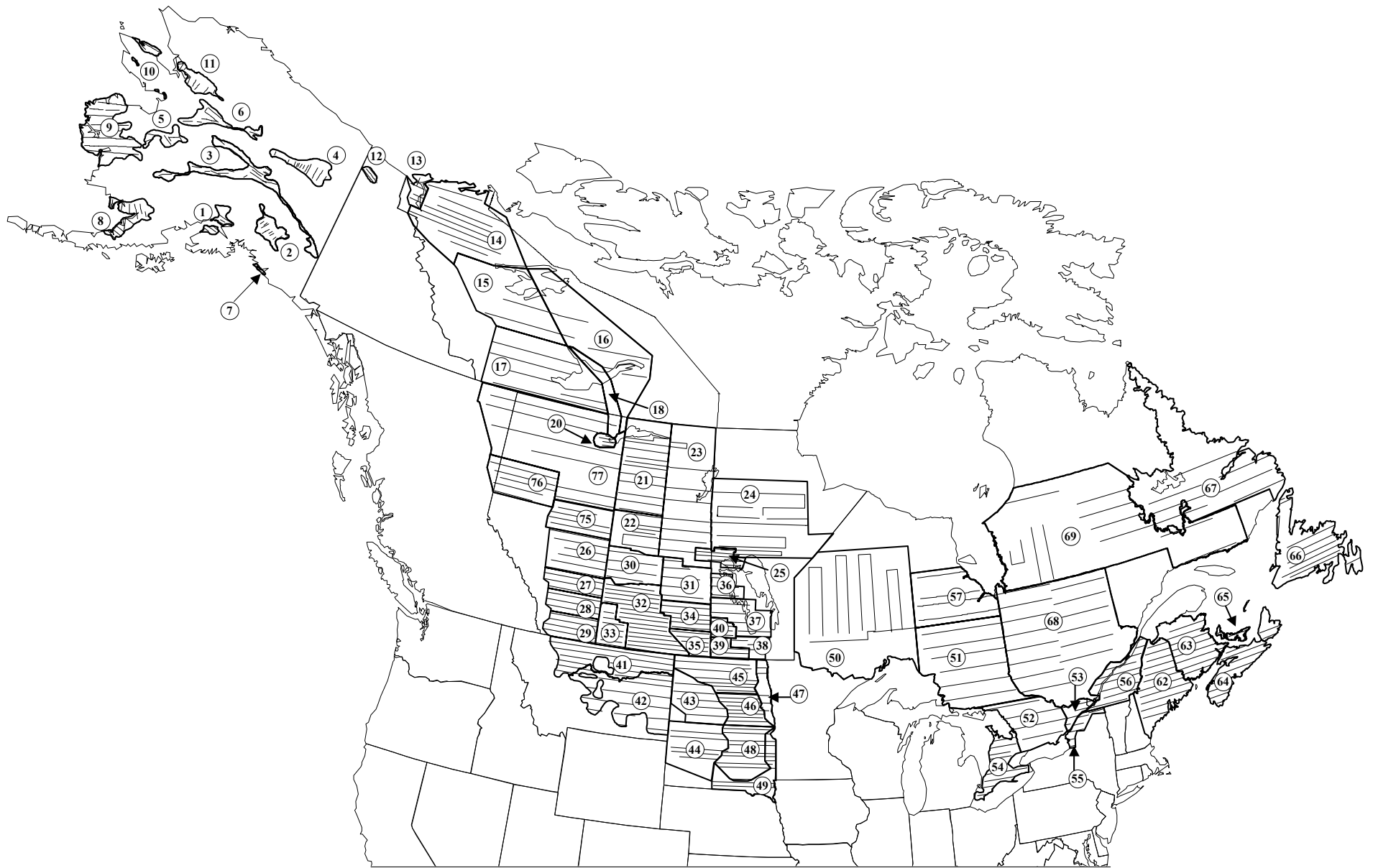
<sup>a</sup>Canadian Wildlife Service

<sup>b</sup>State, Provincial, or Tribal Conservation Agency

<sup>c</sup>Ducks Unlimited - Canada

<sup>d</sup>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.

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

<sup>a</sup> No comparable survey data available for the northcentral U.S. during 1961-73.

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

Year	British Columbia <sup>b</sup>		California		Colorado		Michigan		Minnesota		Nebraska	
	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 <sup>d</sup>	81.1
2000	7.8	0.6	625.4	443.4			745.5	345.4	815.3	318.1	178.8	54.3
2001	7.4	0.6	477.7	365.4	26.5 <sup>d</sup>	11.8	539.7	294.8	761.3	320.6	225.3	69.2

<sup>a</sup> Species composition for the total duck estimate varies by region.

<sup>b</sup> Index to waterfowl use in prime waterfowl producing areas of the province.

<sup>c</sup> Blanks denote that the survey was not conducted, results were not available, or survey methods changed.

<sup>d</sup> First year of survey after major changes in survey methodology. Hence, results from earlier years are not comparable.

Appendix E. Continued.

Year	Nevada		Northeastern US <sup>e</sup>		Oregon		Washington		Wisconsin		Wyoming		
	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	26.1	2.1	1925.8	757.8			143.6	47.7	769.8	367.5		f	
2001	22.2	2.0					164.8	62.6	542.8	164.3			

<sup>e</sup> Includes all or portions of Delaware, Connecticut, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, and Virginia.

<sup>f</sup> 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).

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

Appendix F. Continued.

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

Appendix G. Breeding population estimates and standard errors (in thousands) for the 10 most abundant species of ducks in the eastern survey area, 1990-2001 <sup>a</sup>.

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

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



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

Year	Prairie Canada		Northcentral U.S. <sup>a</sup>		Total	
	$\hat{N}$	$\hat{SE}$	$\hat{N}$	$\hat{SE}$	$\hat{N}$	$\hat{SE}$
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
2001	1837.9	73.0	1031.7	56.5	2869.7	92.3

<sup>a</sup> No comparable survey data available for the northcentral U.S. during 1961-73.

Appendix I. Canada goose population indices (in thousands) during 1969-2001. Population name abbreviations follow text.

Year	Population												
	AP <sup>a,b</sup>	AFRP <sup>a</sup>	SJBP <sup>a</sup>	MVP <sup>a</sup>	MFGP <sup>a</sup>	EPP <sup>a</sup>	WPP/GPP <sup>c</sup>	TGPP <sup>c,g</sup>	SGPP <sup>d</sup>	HLP <sup>d</sup>	RMP <sup>d</sup>	Dusky <sup>d</sup>	Cackling
1969/70									151.2	44.2	25.8	22.5	
1970/71								131.1	148.5	40.5	25.4	19.8	
1971/72						124.7		159.6	160.9	31.4	36.6	17.9	
1972/73						137.6		147.2	259.4	35.6	37.1	15.8	
1973/74						119.9		158.5	153.6	24.5	42.8	18.6	
1974/75						144.4		125.6	123.7	41.2	46.7	26.5	
1975/76						216.5		201.5	242.5	55.6	51.6	23.0	
1976/77						163.8		167.9	210.0	67.6	54.3	24.1	
1977/78						179.7		211.3	134.0	65.1	59.0	24.0	
1978/79						99.4		180.5	163.7	33.8	62.9	25.5	
1979/80								155.2	213.0	67.3	78.1	22.0	64.1 <sup>e</sup>
1980/81						125.5		244.9	168.2	94.4	94.7	23.0	127.4 <sup>e</sup>
1981/82						131.8	175.0	268.6	156.0	81.9	64.3	17.7	87.1 <sup>e</sup>
1982/83						155.1	242.0	165.5	173.2	75.9	68.2	17.0	54.1 <sup>e</sup>
1983/84						135.6	150.0	260.7	143.5	39.5	55.5	10.1	26.2 <sup>e</sup>
1984/85						158.4	230.0	197.3	179.1	76.4	90.3	7.5	25.8 <sup>e</sup>
1985/86						194.8	115.0	189.4	181.0	69.8	68.3	12.2	54.4 <sup>i</sup>
1986/87						203.2	324.0	159.0	190.9	98.1	71.5		51.4 <sup>i</sup>
1987/88	118.0					209.2	272.1	306.1	139.1	66.8	71.4	12.2	63.9 <sup>j</sup>
1988/89		396.0		712.0		210.2	330.3	213.0	284.8	100.1	73.9	11.8	74.6 <sup>j</sup>
1989/90		236.6	82.4	893.2		231.8	271.0	146.5	378.1	105.9	102.4	11.7	90.3 <sup>j</sup>
1990/91		305.7	108.1	717.7		211.8	390.0	305.1	508.5	116.6	86.7		88.9 <sup>j</sup>
1991/92		439.2	91.6	866.5		202.5	341.9	276.3	620.2	140.5	115.7	18.0	97.8 <sup>i</sup>
1992/93	91.3	646.8	77.3	617.8	810.9	157.5	318.0	235.3	328.2	118.5	74.7 <sup>f</sup>	16.7	120.3 <sup>i</sup>
1993/94	40.1	647.5	95.7	838.1	1002.9	210.8	272.5	224.2	434.1	164.3	77.3	11.0	137.7 <sup>j</sup>
1994/95	29.3	779.2	94.0	915.8	1030.6	204.6	352.5	245.0	697.8	174.4	91.8	8.5	164.3 <sup>i</sup>
1995/96	46.1	932.6	123.0	678.8	1132.4	190.4	403.3	264.0	561.2	167.5	117.0		195.8 <sup>i</sup>
1996/97	63.2	1013.3	95.1	735.9	1038.7	199.3	453.4	262.9	460.7	148.5	98.5	11.2 <sup>h</sup>	157.1 <sup>i</sup>
1997/98	42.2	970.1	117.1	444.0	1212.7	125.9	482.3	331.8	440.6	191.0	105.4	21.3 <sup>h</sup>	193.3 <sup>i</sup>
1998/99	77.5	999.5	136.6	969.5	1234.1	206.7	467.2	548.2	403.2	119.5	114.4	13.8 <sup>h</sup>	195.5 <sup>i</sup>
1999/2000	93.2	1015.9	89.1	1054.8	1497.4	275.1	594.7	295.7	200.0	270.7	102.3	15.5 <sup>h</sup>	210.4 <sup>i</sup>
2000/2001	146.7	1011.3	102.7	468.6	1371.3 <sup>h</sup>	215.4	682.7	149.1	164.1	252.9	110.6	17.3 <sup>h</sup>	211.9 <sup>i</sup>

<sup>a</sup> Surveys conducted in spring

<sup>b</sup> Number of breeding pairs

<sup>c</sup> Surveys conducted in December until 1998; in 1999 a January survey replaced the December count

<sup>d</sup> Surveys conducted in January

<sup>e</sup> Surveys conducted in November

<sup>f</sup> Survey incomplete

<sup>g</sup> Only TGPP counted in Central Flyway range are included

<sup>h</sup> Indirect or preliminary estimate

<sup>i</sup> Revised population index - accounting for indicated breeding pairs (R. Trost, personal communication)

Appendix J. Population indices (in thousands) for light geese, greater white-fronted geese, brant, emperor geese, and tundra swans during 1969-2001. Population names abbreviated as in text.

Year	Light geese				White-fronted geese		Brant		Emperor Geese <sup>a</sup>	Tundra swans	
	GRTR <sup>a</sup>	MCP <sup>b</sup>	WCFP	WAWI	MCP <sup>c</sup>	PP <sup>c</sup>	ATLB <sup>d</sup>	PACB <sup>d</sup>		Western <sup>d</sup>	Eastern <sup>d</sup>
1969/70	89.6	717.0						141.7		31.0	55.0
1970/71	123.3	1070.1					151.0	149.2		98.8	58.2
1971/72	134.8	1313.4					73.2	124.8		82.8	62.8
1972/73	143.0	1025.3	11.6				40.8	125.0		33.9	57.1
1973/74	165.0	1189.8	16.2				87.7	130.7		69.7	64.2
1974/75	153.8	1096.6	26.4				88.4	123.4		54.3	66.6
1975/76	165.6	1562.4	23.2				127.0	122.0		51.4	78.6
1976/77	160.0	1150.3	33.6				73.6	147.0		47.3	76.2
1977/78	192.6	1966.4	31.1				42.8	162.9		45.6	70.2
1978/79	170.1	1285.7	28.2				43.5	129.4		53.5	78.6
1979/80	180.0	1398.1	30.5	528.1		73.1	69.2	146.4		65.2	60.4
1980/81	170.8	1406.7	37.6	204.2		93.5	97.0	194.2	93.3	83.6	92.8
1981/82	163.0	1794.0	50.0	759.9		116.5	104.5	121.0	100.6	91.3	72.9
1982/83	185.0	1755.4	76.1	354.1		91.7	123.5	109.3	79.2	67.3	86.5
1983/84	225.4	1494.5	60.1	547.6		112.9	127.3	133.4	71.2	61.9	81.1
1984/85	260.0	1973.0	63.0	466.3		100.2	146.3	144.8	58.8	48.8	93.9
1985/86	303.5	1449.3	96.6	549.8		93.8	110.4	136.2 <sup>e</sup>	42.0	66.2	90.9
1986/87	255.0	1913.8	87.6	521.7		107.1	109.4	108.9	51.7	52.8	94.4
1987/88		1750.5	46.2	525.3		130.6	131.2	147.0	53.8	59.2	76.2
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	38.6	463.9		218.8	135.4	151.6	67.6	40.1	89.7
1990/91	352.6	2135.8	104.6	708.5		240.8	147.7	131.7	71.0	47.6	97.4
1991/92	448.1	2021.9	87.8	690.1		236.5	184.8	117.7	71.3	63.7	109.8
1992/93	498.4	1744.2	45.1	639.3	622.9	230.9	100.6	124.4	52.5	62.6 <sup>f</sup>	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 <sup>f</sup>	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	129.1	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	96.6
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	813.9	2397.3	137.5	579.0	963.1	266.0	157.2	135.0	62.6	89.6	103.1
2000/2001	690.3 <sup>g</sup>	2341.3	105.8	656.8	1067.6	307.6 <sup>h</sup>	145.3	124.7	84.4	90.3	98.2

<sup>a</sup> Surveys conducted in spring

<sup>b</sup> Surveys conducted in December until 1997/98; surveys since 1998/99 were conducted in January

<sup>c</sup> Surveys conducted in autumn

<sup>d</sup> Surveys conducted in January

<sup>e</sup> Beginning in 1986, counts of brant in Alaska were included in the total

<sup>f</sup> Survey was incomplete

<sup>g</sup> Preliminary estimate

<sup>h</sup> Revised population index - accounting for indicated breeding pairs (R. Trost, personal communication)