U.S. Fish and Wildlife Service

Waterfowl

Population Status, 2003

WATERFOWL POPULATION STATUS, 2003

July 23, 2003

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 2003-2004 hunting season.

Cover art: Snow geese. Ron Lougue, winner of the 2003-2004 Federal Duck Stamp design competition.

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Waterfowl Population and Habitat Information: The information summarized in this report is the result of the efforts of numerous individuals and organizations. Principal contributors include the Canadian Wildlife Service, U.S. Fish and Wildlife Service, state wildlife conservation agencies, provincial conservation agencies from Canada, and Dirección General de Conservación Ecologica de los Recursos Naturales, Mexico. In addition, several conservation organizations, other state and federal agencies, universities, and private individuals provided information or cooperated in survey activities. Some habitat and weather information was taken from the NOAA/USDA Joint Agriculture Weather Facility (www.usda.gov/oce/waob/jawf/), Environment Canada (www1.tor.ec.gc.ca/ccrm/bulletin/), and Waterfowl Population Surveys reports (migratorybirds.fws.gov/-reports/reports.html). Appendix A provides a list of individuals responsible for the collection and compilation of data for the Ducks section of this report. Appendix B provides a list of primary contacts for information included in the Geese and Swans section. We apologize for any contributor we did not acknowledge and thank all participants for their contributions. Without this combined effort, a comprehensive assessment of waterfowl populations and habitat would not be possible.

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

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STATUS OF DUCKS

Abstract: In the Breeding Population and Habitat Survey traditional survey area (strata 1-18, 20-50, and 75-77), the total duck population estimate was 36.2 ± 0.7 (±1 standard error) million birds, 16% above last year's estimate of 31.2 ± 0.5 million birds (P<0.001), and 9% above the 1955-2002 long-term average (P<0.001). Mallard abundance was 7.9 ± 0.3 million birds, similar to last year's estimate of 7.5 ± 0.2 million birds (P=0.220) and to the long-term average (P=0.100). Blue-winged teal were 5.5 ± 0.3 million birds, 31% above last year's estimate of 4.2 ± 0.2 million birds (P=0.001) and 23% above the long-term average (P=0.001). Shovelers (3.6 ± 0.2 million; +56%) and pintails (2.6 ± 0.2 million; +43%) were above their 2002 estimates (P<0.001), while gadwall (2.5 ± 0.2 million), American wigeon (2.6 ± 0.2 million), green-winged teal (2.7 ± 0.2 million), redheads (0.6 ± 0.1 million), canvasbacks (0.6 ± 0.1 million), and scaup (3.7 ± 0.2 million) were unchanged from their 2002 estimates (P=0.149). Gadwall (+55%) and shovelers (+72%) were above their long-term averages (P<0.001). Green-winged teal were at their second highest level since 1955, 46% above their long-term average (P<0.001). Pintails (-39%) and scaup (-29%) remained well below their long-term averages (P<0.001). American wigeon, redheads, and canvasbacks were unchanged from their long-term averages (P=0.582). Total May ponds (Prairie Canada and the north-central U.S.) at 5.2 ± 0.2 million was 91% higher than last year (P<0.001) and 7% above the long-term average (P=0.034). Canadian and U.S. ponds were 3.5 ± 0.2 and 1.7 ± 0.1 million respectively and both above 2002 (+145% and +30%. P<0.001). Canadian ponds were similar to their 1961-2002 average (P=0.297), while U.S. ponds were 10% above their 1974-2002 average (P=0.037). The projected mallard fall flight index was 10.3 ± 0.9 million birds. The eastern survey area was comprised of strata 51-56 and 62-69. The 2003 total-duck population estimate for this area was 3.6 ± 0.3 million birds, 17% lower than last year (4.4 ± 0.3 million birds, P=0.065), but similar to the 1996-2002 average (P=0.266). Individual species estimates were similar to last year and to their 1996-2002 averages, with the exception of mergansers (0.6 ± 0.1 million), which decreased 30% from its 2002 estimate (P=0.035).

This section summarizes the most recent information about the status of North American duck populations and their habitats in order to facilitate development of harvest regulations in the U.S. The annual status of these populations is monitored using a variety of databases, which include estimates of the size of breeding populations, production, and harvest. The data and analyses were the most current available when this report was written. Future analyses may yield slightly different results as databases are updated and new analytical procedures become available.

METHODS

Breeding Population and Habitat Survey

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

In Prairie Canada and the north-central U.S., estimates 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 adjusted using visibility correction factors derived from a comparison of airplane and helicopter counts. For the 2003 eastern survey, these correction factors were updated only in areas where helicopter surveys were flown, strata 62-65, 68, and 69. 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 and in the north-central U.S. since 1974. Several provinces and states also conduct breeding waterfowl surveys using various methods; some have survey designs that allow calculation of measures of precision for their estimates. Information about habitat conditions was supplied primarily by biologists working in the survey areas. However, much ancillary weather information was obtained from agricultural and weather internet sites (see references).

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

The mallard fall-flight index predicts 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. The index is based on the mallard models used for Adaptive Harvest Management, and considers 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 2003).

RESULTS AND DISCUSSION

2002 in Review

Below-average winter and spring precipitation in the prairies and parklands and cold spring temperatures in the East had resulted in generally poorer habitat conditions for breeding waterfowl in 2002 than in 2001. Dry conditions were reflected in pond numbers. Total May ponds (Prairie Canada and the north-central U.S.) were 2.7 ± 0.1 million, which was the second lowest count recorded since this estimate was first calculated in 1974. That value was 41% below the 2001 estimate of 4.6 ± 0.1 million (P< 0.001), and 45% below (P<0.001) the long-term average (4.9 ± 0.1 million). May ponds in Canada (1.4 ± 0.1 million) and the U.S. (1.3 ± 0.1 million) were below 2001 estimates (-48% in Canada and -32% in the U.S; P<0.001) and their long-term averages (-58% in Canada and -16% in the U.S; P<0.001). Canadian May ponds were the lowest recorded since standardized pond counts began in 1961.

In both the traditional and eastern survey areas, most regions entered the spring of 2002 with a water deficit remaining from winter. Spring rains helped recharge wetlands in most of the Northeast, but conditions remained very dry in the West. Western Montana, southern Saskatchewan, and much of southern Manitoba and southern and central Alberta were hardest hit by drought. Fewer ponds available to nesting birds caused crowding on remaining ponds. A bright spot on the prairies was the Dakotas, where permanent wetlands remained in good condition following the wet period of 1993-2001. However, survey results suggested that many prairie-nesting species such as mallards, shovelers, pintails, and blue-winged teal, flew over the prairies and parklands to the boreal forest, where wetland conditions were more stable.

Cold spring temperatures also negatively affected nesting waterfowl in 2002. Winter-like conditions hit the entire surveyed area in early May, when snowstorms and cold temperatures caused birds to halt migration for several weeks. Snow and cold may have caused some nest loss in the prairies and parklands. Spring ice break-up was several weeks late over much of the northern survey areas. Break-up was so late in parts of the Northeast that biologists predicted little nesting activity in these areas. Conditions in northern Canada were generally good, but cold temperatures likely had a negative impact on early nesting species such as mallards, green-winged teal, and pintails. The only region where habitat conditions for breeding waterfowl improved over 2001 was Alaska, due to warmer post-thaw temperatures than the previous year. However, rapid ice melt likely caused flooding of nests in parts of Alaska as well as in Labrador.

Late in the nesting season, water conditions improved in Montana, the western Dakotas, southern Saskatchewan, and southern Alberta. In mid-June, these areas received several inches to a foot or more of rain and/or snow. However, most biologists thought this precipitation came too late to help all but the latest nesting waterfowl.

In the traditional survey area, the total duck population estimate was 31.2 ± 0.5 million birds, 14% below (P<0.001) the 2001 estimate of 36.1 ± 0.6 million birds, and 6% below (P<0.001) the 1955-2001 average. Total duck numbers decreased compared to 2001, but remained above long-term averages in Alaska and the eastern Dakotas (P<0.001). Counts in southern Alberta were unchanged from 2001, but were 47% below the long-term average (P<0.001). Total duck estimates decreased relative to 2001 and were below long-term averages in southern Saskatchewan, southern Manitoba, and in Montana and the western Dakotas ($P\leq$0.037). Perhaps reflecting over-flight of the prairies in favor of the boreal forest, estimates in northern Saskatchewan and Manitoba and western Ontario were up 70% compared to 2001 (P<0.001), and were 27% higher than the long-term average (P<0.001). Counts in central and northern Alberta, northeast British Columbia and the Northwest Territories were also higher than in 2001 (+20%, P=0.003), but slightly below the long-term average (P=0.020) The 2002 total duck population estimate for the eastern survey area was 4.4 ± 0.3 million birds. That estimate was 32% higher than the previous year's (3.3 ± 0.3 million birds, P=0.007), and 41% higher than the 1996-2001 average (P<0.001).

Results of the July Production Survey indicated that the number of ponds in Prairie Canada and the north-central U.S. combined was 1.8 ± 0.1 million ponds. This was 36% below the 2001 estimate of 2.9 ± 0.1 million ponds (P<0.001), and 33% below the long-term average (P<0.001). July ponds in Prairie Canada were at 1.0 ± 0.1 million. This was 46% below the 2001 estimate of 1.8 ± 0.07 million (P<0.001) and 43% below the long-term average (P<0.001). July ponds in the north-central U.S. were estimated at 0.84 ± 0.04 million. This was 19% below previous year's estimate of 1.0 ± 0.06 million (P=0.007), but similar to the long-term average (P=0.299). The number of broods in the north-central U.S. and Prairie Canada combined was 352,600, 35% lower than the 2001 estimate, and 25% below the long-term average. The number of broods in Prairie Canada and the north-central U.S. were 54% and 37% below 2001 estimates, respectively. Brood indices in Prairie Canada were 69% below the long-term average, while brood counts were 12% above the long-term average in the north-central U.S. The brood index in the Canadian boreal forest was 21% higher than the previous year's, but 16% below the long-term average. The late-nesting index, that is, the number of pairs and lone drakes without broods seen during July surveys, was 9% higher than in 2001 but 43% lower than the long-term average, for all areas combined.

2003 Breeding Habitat Conditions, Populations, and Production

Overall Habitat and Population Status

Habitat conditions for breeding waterfowl have greatly improved over last year in most of the prairie survey areas. These improved conditions are reflected in the numbers of ponds counted this year. The estimate of May ponds (U.S. Prairies and Prairie and Parkland Canada combined) of 5.2 ± 0.2 million (Table 1, Figure 1, Appendix D) was 91% higher than last year (P<0.001) and 7% above the long-term average (P=0.034). Numbers of ponds in Canada (3.5 ± 0.2 million) and the U.S. (1.7 ± 0.1 million) were above 2002 estimates (+145% in Canada and +30% in the U.S.; P<0.001). Canadian ponds were similar to the 1961-2002 average (P=0.297), while ponds in the U.S. were 10% above the 1974-2002 average (P=0.037).

Most prairie areas had warm temperatures and abundant rain this spring. Two areas of dramatic improvement over the past several years were south-central Alberta and southern Saskatchewan, where conditions went from poor to good after much needed precipitation relieved several years of drought. Other areas in the prairies also improved over 2002, but to a lesser extent. However, years of drought in parts of the U.S. and Canadian prairies, combined with inten-

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

			Change from 2002			Change from LTA	
Survey Area	2002	2003	%	*P*	LTA[a]	%	*P*
Prairie Canada							
S. Alberta	477	888	+86	<0.001	722	+23	0.008
S. Saskatchewan	635	2143	+238	<0.001	1960	+9	0.185
S. Manitoba	327	491	+50	0.031	679	-28	<0.001
Subtotal	1439	3522	+145	<0.001	3361	+5	0.297
Northcentral U.S.							
Montana and Western Dakotas	347	480	+38	0.001	523	-8	0.136
Eastern Dakotas	934	1188	+27	0.002	1000	+19	0.003
Subtotal	1281	1668	+30	<0.001	1523	+10	0.037
Grand Total	2720	5190	+91	<0.001	4830	+7	0.034

[a]Long-term average. Prairie Canada, 1961-2002; northcentral U.S. and Grand Total, 1974-2002.

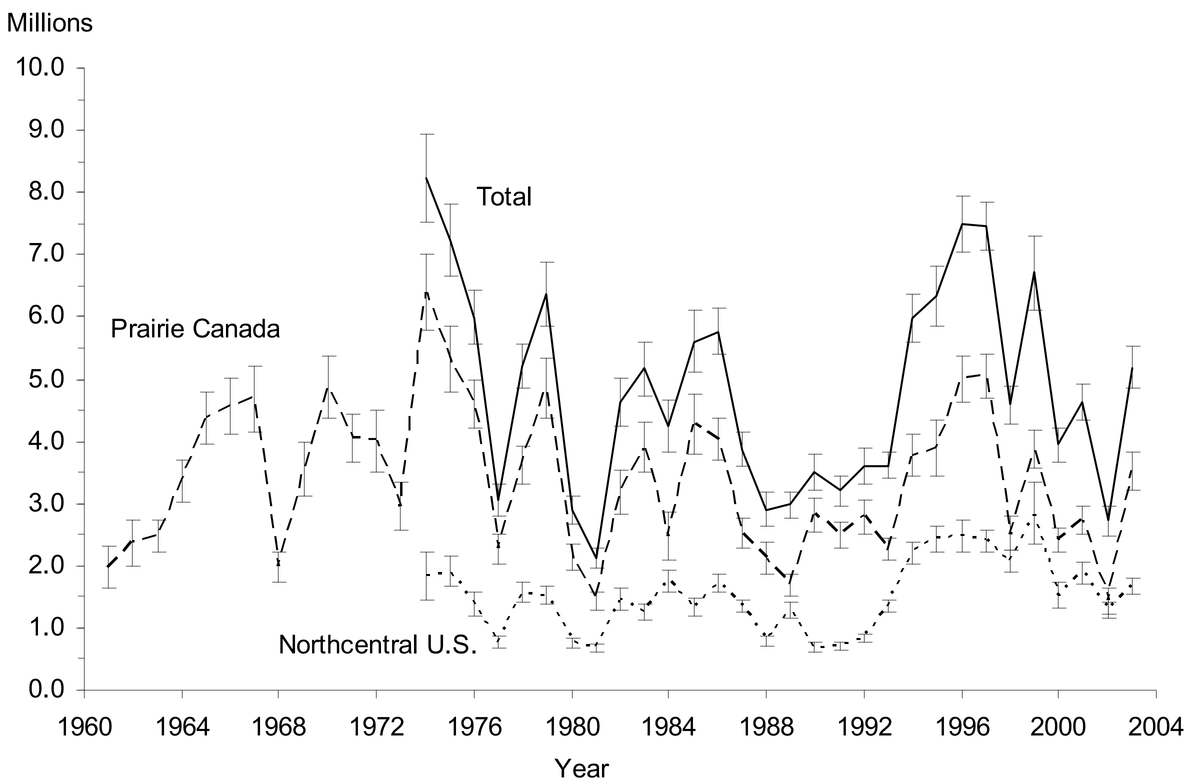

Figure 1. Number of ponds in May and 95% confidence intervals in Prairie Canada and the Northcentral U.S.

sive agricultural practices, have reduced the quality and quantity of residual nesting cover and over-water nesting sites in many regions. This could limit production for both dabbling and diving ducks, if the warm spring temperatures and good moisture of 2003 did not result in rapid growth of new cover. Eastern South Dakota was the one area of the prairies where wetland habitat conditions were generally worse than last year, mostly due to low soil moisture, little winter precipitation, and no significant rains in April. This region received several inches of rain in May, but by then most birds had probably flown to other regions with more favorable wetland conditions.

In the northern part of the traditional survey area, habitat was in generally good condition and most areas had normal water levels. The exception was northern Manitoba, where low water levels in small streams and beaver ponds resulted in overall breeding habitat conditions that were only fair. Warm spring temperatures arrived much earlier this year than the exceptionally late spring last year. However, a cold snap in early May could have hurt early nesting species such as mallards and pintails, particularly in the northern Northwest Territories.

Habitat conditions in the eastern survey area ranged from excellent to fair. In the southern and western part of this survey area, water and nesting cover were plentiful and temperatures were mild this spring. Habitat quality decreased to the north, especially in northern and western Quebec, where many shallow marshes and bogs were either completely dry or reduced to mudflats. Beaver pond habitat was also noticeably less common than normal. To the east in Maine and most of the Atlantic provinces, conditions were excellent, with adequate water, vegetation, and warm spring temperatures.

In the traditional survey area, the total duck population estimate (excluding scoters, eiders, long-tailed ducks, mergansers, and wood ducks) was 36.2 ± 0.7 million birds, 16% above (*P*<0.001) last year's estimate of 31.2 ± 0.5 million birds, and 9% above the 1955-2002 long-term average (*P*<0.001, Table 2, Table 5, Appendix G). In the eastern Dakotas, total duck numbers decreased by 21% compared to last year, but remained 25% above the long-term average (*P*<0.001). Counts in southern Alberta were unchanged from last year, and remained 38% below the long-term average (*P*<0.001). Total duck estimates increased compared to last year in southern Manitoba, Montana and the western Dakotas, southern Saskatchewan, and Alaska (*P*≤0.012) and were above long-term averages in the latter two regions (*P*≤0.001). Counts in central and northern Alberta, northeast British Columbia and the Northwest Territories were similar to last year's but slightly below the long-term average (*P*=0.017, Table 2). Counts in northern Saskatchewan and Manitoba and western Ontario were down 21% from 2002 estimates (*P*=0.003), but unchanged from the long-term average. The 2003 total duck population estimate for the eastern survey area was 3.6 ± 0.3 million birds. This estimate is 17% lower than last year's (4.4 ± 0.3 million birds, *P*=0.065), and similar to the 1996-2002 average (*P*=0.266). The estimate differs from that reported in Wilkins and Otto (2003) due to updating of some visual correction factors. In some other areas where surveys are conducted, measures of precision for estimates are provided (British Columbia, California, northeastern U.S., and Wisconsin). Total duck abundance was similar to last year's estimate and long-term average in British Columbia and the northeastern U.S. (*P*≥0.171). In California, the total duck estimate was up 36% relative to 2002 (*P*=0.030), and was similar to the long-term average. Of the states without measures of precision for total duck numbers, Nevada's estimate increased from 2002, but estimates for Michigan, Minnesota, Nebraska, and Washington all decreased compared to last year.

Trends 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 ± 0.3 million, which is statistically similar to last year's estimate of 7.5 ± 0.2 million (*P*=0.220), and right at the long-term average (*P*=0.100, Tables 3 and 5). Mallard numbers dropped significantly in the eastern Dakotas and in central and northern Alberta, N.E. British Columbia, and the Northwest Territories compared to 2002 (*P*≤0.004). However, numbers in the eastern Dakotas remained well above average, while estimates for central and northern Alberta, N.E. British Columbia, and the Northwest Territories were below the long-term average. In Montana and the western Dakotas, northern Saskatchewan--northern Manitoba--western Ontario and southern Alberta, mallard numbers did not change relative to last year, but were similar to their long term averages in the first two areas, and in southern Alberta, remained well below it (-44%, *P*=0.001). In Alaska, southern Saskatchewan, and southern Manitoba, mallard numbers were up compared to 2002 (*P*≤0.048), but were similar to the long-term average in southern Saskatchewan, well above it in Alaska (*P*<0.001),

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

Region	2002	2003	Change from 2002 %	Change from 2002 *P*	LTA[b]	Change from LTA %	Change from LTA *P*
Traditional Survey Area							
Alaska - Yukon Territory - Old Crow Flats	4961	5705	+15	0.006	3433	+66	<0.001
C. & N. Alberta - N.E. British Columbia - Northwest Territories	6584	6461	-2	0.775	7245	-11	0.017
N. Saskatchewan - N. Manitoba - W. Ontario	4502	3564	-21	0.003	3553	0	0.959
S. Alberta	2364	2696	+14	0.117	4376	-38	<0.001
S. Saskatchewan	3547	9296	+162	<0.001	7327	+27	<0.001
S. Manitoba	1304	1582	+21	0.012	1543	+3	0.650
Montana and Western Dakotas	1334	1731	+30	0.003	1618	+7	0.305
Eastern Dakotas	6585	5190	-21	<0.001	4147	+25	<0.001
Total	31181	36225	+16	<0.001	33243	+9	<0.001
Eastern Survey Area	4399	3635	-17	0.065	3301	+10	0.266
Other Regions							
British Columbia[c]	9	8	-4	0.899	8	+9	0.725
California	392	534	+36	0.030	614	-13	0.177
Northeastern U.S.[d]	1466	1304	-11	0.171	1407	-7	0.241
Wisconsin	913	698	-24	0.060	431	+62	[e]

[a] Excludes eider, long-tailed duck, wood duck, scoter, and merganser in traditional survey area; excludes eider, long-tailed duck, wood duck, redhead, canvasback and ruddy duck in eastern survey area; species composition for other regions varies.
[b] Long-term average. Traditional survey area=1955-2002; eastern survey area=1996-2002; years for other regions vary (see Appendix E).
[c] Index to waterfowl use in prime waterfowl producing regions of the province.
[d] Includes all or portions of CT, DE, MD, MA, NH, NJ, NY, PA, RI, VT, and VA.
[e] Not estimable from current survey.

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

			Change from 2002			Change from LTA	
Region	2002	2003	%	*P*	LTA[a]	%	*P*
Traditional Survey Area							
Alaska - Yukon Territory - Old Crow Flats	667	843	+26	0.036	330	+155	<0.001
C. & N. Alberta - N.E. British Columbia - Northwest Territories	1182	852	-28	0.027	1108	-23	0.004
N. Saskatchewan - N. Manitoba - W. Ontario	1115	1103	-1	0.949	1162	-5	0.679
S. Alberta	793	627	-21	0.147	1128	-44	<0.001
S. Saskatchewan	1213	2111	+74	<0.001	2088	+1	0.880
S. Manitoba	401	505	+26	0.048	374	+35	0.005
Montana and Western Dakotas	428	506	+18	0.257	502	+1	0.938
Eastern Dakotas	1704	1402	-18	0.031	811	+73	<0.001
Total	7504	7950	+6	0.220	7503	+6	0.100
Eastern Survey Area	295	383	+30	0.203	302	+27	0.180
Other Regions							
British Columbia [b]	1	1	-7	0.570	1	-32	<0.001
California	265	337	+27	0.221	386	-13	0.356
Michigan [c]	337	294	-13	0.702	449	-35	0.031
Minnesota	367	281	-23	0.136	217	+29	[e]
Northeastern U.S. [d]	833	732	-12	0.166	764	-4	0.522
Wisconsin	373	276	-26	0.090	173	+60	[e]

[a] Long-term average. Traditional survey area=1955-2002; eastern survey area=1996-2002; years for other regions vary (see Appendix E).
[b] Index to waterfowl in prime waterfowl producing regions of the province.
[c] Estimates do not match those from previous reports because they have been recalculated.
[d] Includes all or portions of CT, DE, MD, MA, NH, NJ, NY, PA, RI, VT, and VA.
[e] Value for test statistic was not available.

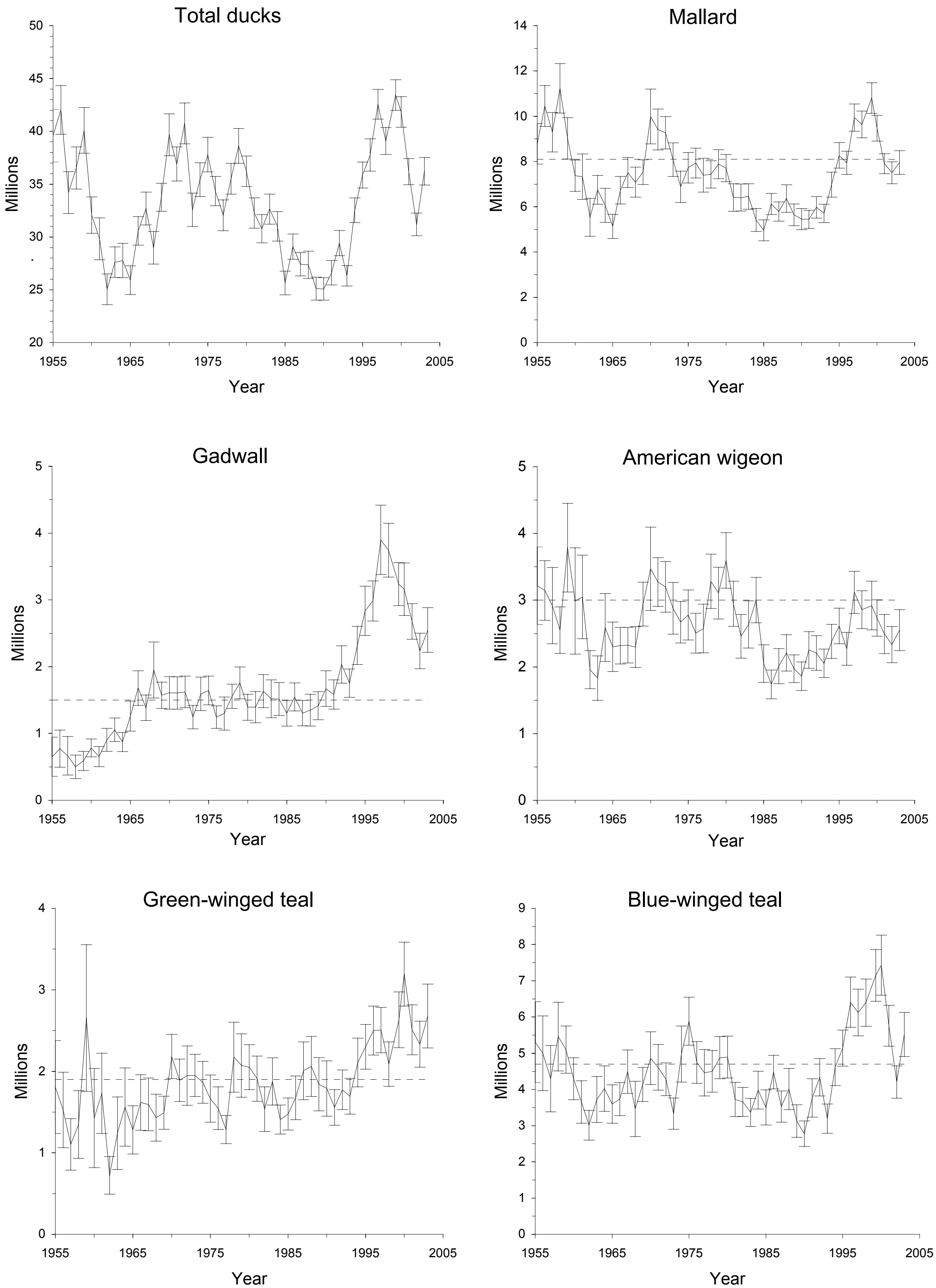

Figure 2. Breeding population estimates, 95% confidence intervals, and North American Waterfowl Management Plan population goal (dashed line) for selected species in the traditional survey area (strata 1-18, 20-50, 75-77).

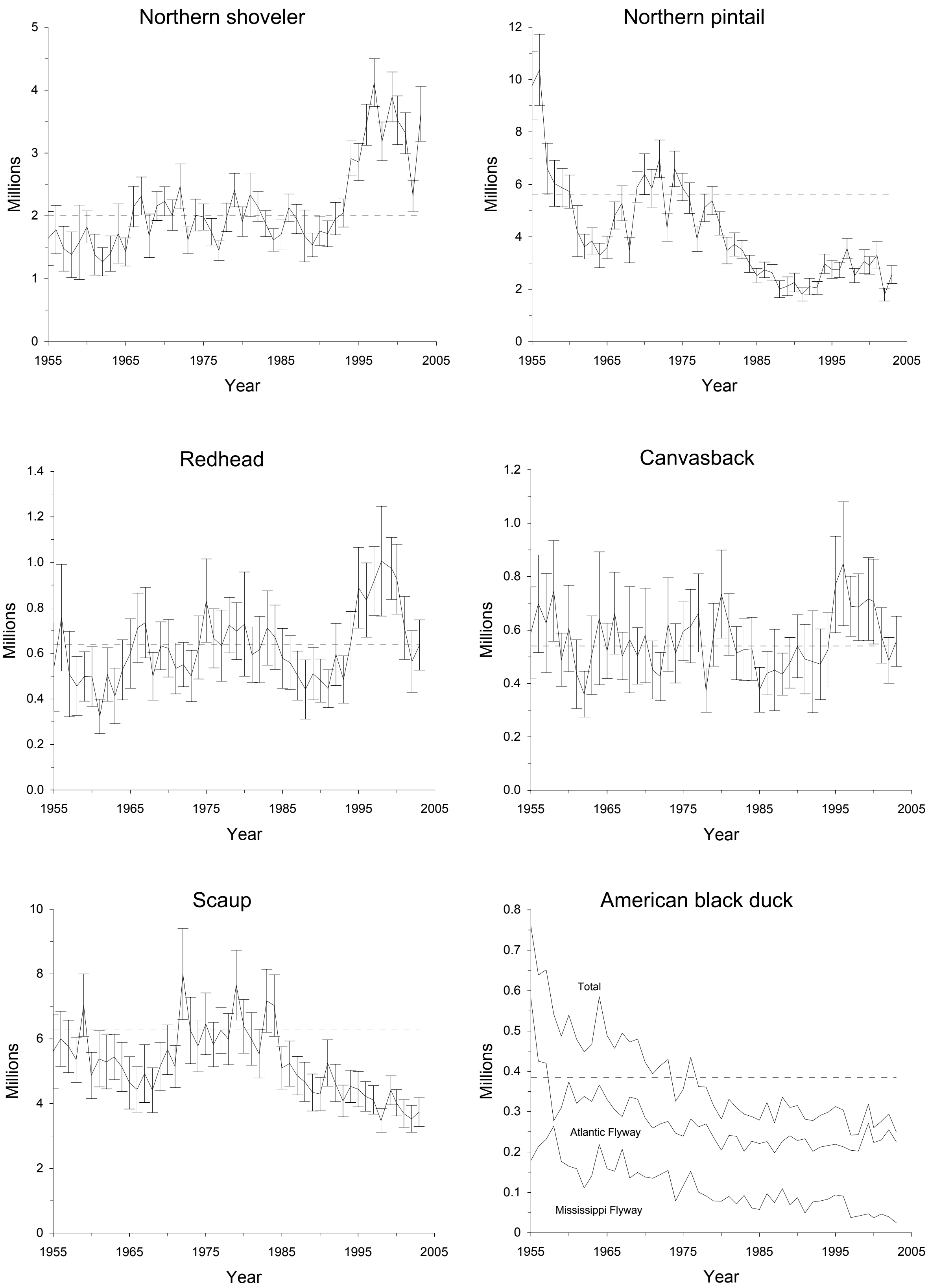

Figure 2 continued.

and below it in southern Manitoba (P=0.005). 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 Michigan and Minnesota), mallard abundance remained unchanged from 2002, with the exception of Wisconsin, where mallards were down 26% (P=0.090). Mallard estimates were below the long-term average in Michigan and British Columbia ($P \leq 0.031$) and similar to it in the northeastern U.S. and California ($P \geq 0.356$). In Nebraska, Nevada and Washington, estimates of precision are unavailable, but mallard counts were down relative to last year's in Nebraska and Washington, and increased in Nevada.

Blue-winged teal abundance was estimated to be 5.5 ± 0.3 million birds, 31% above (P=0.001) last year's estimate of 4.2 ± 0.2 million, and 23% (P=0.001) higher than the 1955-2002 average. Northern shoveler and northern pintail counts were 56% and 43% higher than last year's, respectively (P<0.001). Counts of all of the other 10 most abundant species in the traditional survey area remained unchanged relative to 2002 counts. Gadwall (+55%), green-winged teal (+46%), and northern shovelers (+72%) all remained above their long-term averages (P<0.001), whereas pintail (-39%), and scaup (-29%) numbers remained below long-term averages (P<0.001). Redhead, canvasback, and American wigeon numbers were similar to their long-term averages.

Estimates for most of the 10 principal species in the eastern survey area were similar to 2002 estimates and to long-term averages, with the exception of mergansers (0.6 $\pm$ 0.1 million) which were 30% below their 2002 count (P=0.035) but similar to their long-term average (P=0.635).

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 of black ducks declined relative to 2002 counts in both flyways. Over both flyways, 248,900 black ducks were estimated from mid-winter inventories. This was 15% lower than the 2002 index (294,700), and 11% lower than the 10-year mean (279,800). In the Atlantic Flyway, the mid-winter index of 224,600 was down 12% from 255,300 in 2002, and was similar to the most recent 10-year mean (225,900). In the Mississippi Flyway, the mid-winter estimate decreased 38% from 39,400 in 2002 to 24,300, which is 45% below the 10-year mean (53,900). In the eastern survey area, the 2003 estimate for breeding black ducks (533,000) was down 12%, but was statistically similar to the 2002 estimate (603,000) and the 1996-2002 average (493,000).

Trends in wood duck populations are monitored by the North American Breeding Bird Survey (BBS), a series of roadside routes surveyed during May and June each year. Wood ducks are encountered with low frequency along BBS routes, limiting the amount and quality of available information for analysis (Sauer and Droege 1990). However, the BBS provides the only long-term indices of this species' regional populations. Trend analysis suggests that wood duck numbers increased 4% per year over the long-term (1966-2002, P<0.001)) and 3% over the short-term (1980-2002, P=0.019). Specifically, in the Atlantic Flyway, the BBS indicates a 5.4% annual increase in wood ducks over the long-term (P<0.001) and a 3.6% annual increase over the short-term (P=0.019). In the Mississippi Flyway, the BBS indicates a 3.6% annual increase over the long-term (P<0.001), and a 2.9% annual increase over the short-term (P=0.041, J. Sauer, U. S. Geological Survey/Biological Resources Division, unpublished data).

Weather and habitat conditions during the summer months can influence waterfowl production. Good wetland conditions increase renesting effort and brood survival. July wetland conditions were rated fair to good over most of prairie Canada, the Dakotas and eastern Montana, but poor conditions prevailed in eastern South Dakota, south-central Manitoba, central Saskatchewan, and north-central Montana. However, uniformly good conditions were found in the northern portions of all the prairie provinces, and spring and summer rains made for good to excellent conditions along the border between Saskatchewan and eastern Montana.

Results of the July Production Survey indicate that the number of ponds in Prairie Canada and the north-central U.S. combined was 2.5 ± 0.08 million ponds (Fig. 3, Table 4, Appendix I). This was 35% above last year's estimate of 1.8 ± 0.1 million ponds (P<0.001), and 8% below the long-term average (P=0.082). July ponds in Prairie Canada were at 1.5 $\pm$ 0.06 million. This was 47% above last year's estimate of 1.0 ± 0.1 million (P=0.001) but 16% below the long-term average (P<0.005). July ponds in the north-central U.S. were estimated at 1.0 ± 0.04 million. This was 21% above last year's estimate of 0.84 ± 0.04 million (P=0.002), but similar to the long-term average. The number of broods in the north-central U.S. and Prairie Canada combined was 434,900, 23% higher than last year's estimate, and 7% below the long-term average. The late-nesting index, the number of pairs and lone

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

			Change from 2002			Change from LTA	
Survey Area	2002	2003	%	*P*	LTA[a]	%	*P*
Prairie Canada							
S. Alberta	319	369	+16	0.259	458	-19	0.011
S. Saskatchewan	396	855	+116	<0.001	939	-9	0.343
S. Manitoba	282	241	-14	0.518	343	-30	<0.001
Subtotal	997	1465	+47	0.001	1740	-16	0.005
North-central U.S.							
Montana and Western Dakotas	304	358	+18	0.108	373	-4	0.611
Eastern Dakotas	536	661	+23	0.010	542	+22	0.064
Subtotal	840	1018	+21	0.002	915	+11	0.142
Grand Total	1836	2483	+35	0.001	2714	-8	0.082

[a]Long-term average. Prairie Canada, 1961-2002; north-central U.S. and Grand Total, 1974-2002

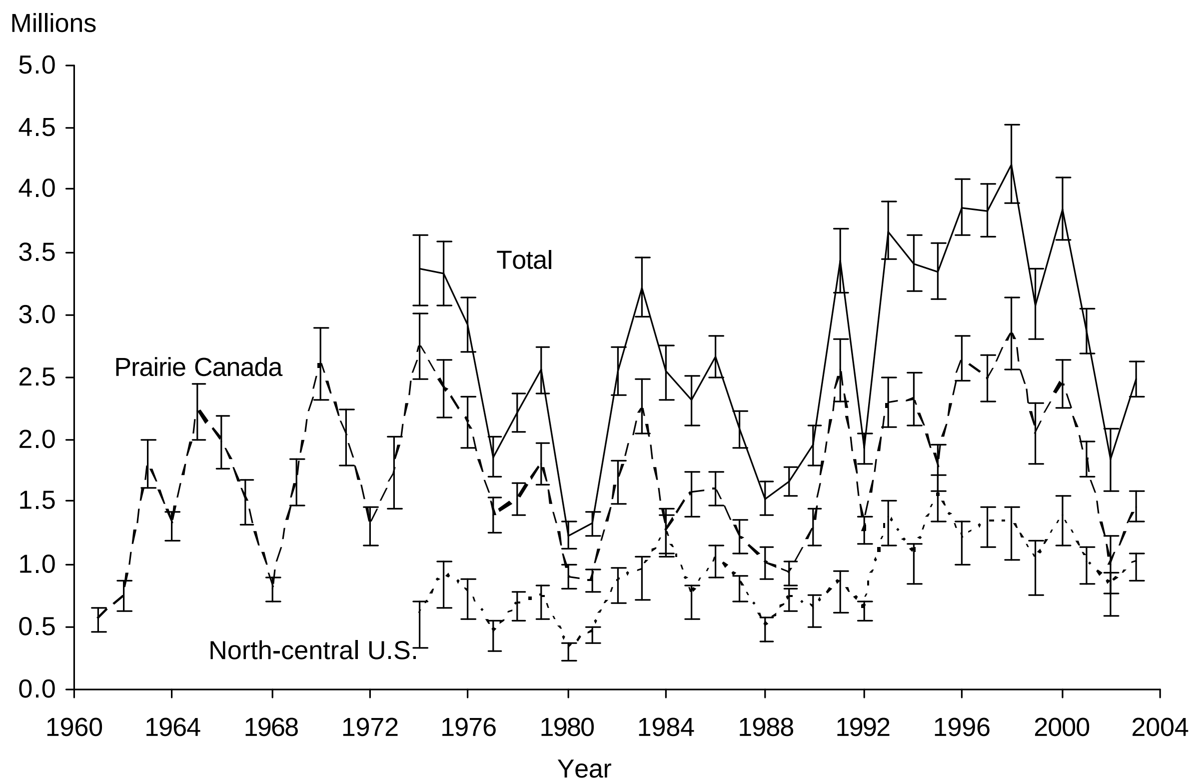

Fig. 3. Number of ponds in July and 95% confidence intervals for Prairie Canada and the north-central U.S.

Table 5. Duck breeding population estimates (in thousands) for the 10 most abundant species in the traditional survey area.

Species	2002	2003	Change from 2002 %	Change from 2002 *P*	LTA [a]	Change from LTA %	Change from LTA *P*
Mallard	7504	7950	+6	0.220	7503	+6	0.100
Gadwall	2235	2549	+14	0.149	1646	+55	<0.001
American wigeon	2334	2551	+9	0.299	2639	-3	0.582
Green-winged teal	2333	2678	+15	0.161	1832	+46	<0.001
Blue-winged teal	4206	5518	+31	0.001	4487	+23	0.001
Northern shoveler	2318	3620	+56	<0.001	2104	+72	<0.001
Northern pintail	1790	2558	+43	<0.001	4216	-39	<0.001
Redhead	565	637	+13	0.420	625	+2	0.838
Canvasback	487	558	+15	0.275	562	-1	0.931
Scaup (greater and lesser combined)	3524	3734	+6	0.495	5281	-29	<0.001
Total ducks [b]	31181	36225	+16	<0.001	33243	+9	<0.001

[a] Long-term average (1955-2002).
[b] Includes black duck, ring-necked duck, goldeneyes, bufflehead, and ruddy duck in addition to species in table. Excludes scoter, eider, long-tailed duck, mergansers, and wood duck.

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

Species	2002	2003	Change from 2002 %	Change from 2002 *P*	LTA [a]	Change from LTA %	Change from LTA *P*
Mergansers (common, red-breasted, & hooded)	815	569	-30	0.035	532	+7	0.635
Mallard	295	383	+30	0.203	302	+27	0.180
American black duck	603	533	-12	0.504	493	+8	0.542
American wigeon	87	79	-9	0.856	67	+18	0.721
Green-winged teal	604	452	-25	0.389	342	+32	0.372
Lesser scaup	136	101	-26	0.507	78	+30	0.383
Ring-necked duck	416	399	-4	0.827	490	-19	0.128
Goldeneye (common & Barrow's)	955	768	-20	0.530	743	+3	0.911
Bufflehead	84	66	-21	0.521	59	+12	0.699
Scoters (surf, black, & white-winged)	314	237	-25	0.447	142	+67	0.171
Total [b]	4399	3635	-17	0.065	3301	+10	0.266

[a] Long-term average (1996-2002).
[b] Includes gadwall, northern shoveler, northern pintail, and scaup in addition to species in table. Excludes eiders, long-tailed duck, wood duck, redhead, canvasback, and ruddy duck.

drakes without broods seen during July surveys, was 17% lower than last year, and 51% lower than the long-term average, for all areas combined. The number of broods in Prairie Canada and the north-central U.S. were 142% and 18% higher than last year's estimates, respectively. Brood indices in Prairie Canada were 24% below the long-term average, while brood counts were 31% above the long-term average in the north-central U.S. The brood index in the Canadian boreal forest was 72% lower than last year's, and 76% below the long-term average. The late-nesting index was down 43% and 30% relative to 2002 in boreal Canada and Prairie Canada, respectively, but up 67% in the north-central U.S. Late nesting indices were below long-term averages by 74% in boreal Canada, by 43% in the north-central U.S., and by 46% in Prairie Canada.

Regional Habitat and Population Status

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

Southern Alberta: Late winter/early spring snowstorms brought some relief from the dry winter experienced in southern Alberta. Precipitation since April 1 was well above (150% to 545%) normal in the prairies and southern Aspen Parklands of southern Alberta. Although much of this moisture soaked directly into the dry soil, improvement in wetland conditions was seen in Strata 26-29, especially along the Milk River Ridge, Brooks and Hanna areas. The high-mountain snow pack provided near normal run-off this spring and early summer. Habitat conditions in the majority of Alberta's prairie and Aspen Parkland regions were rated as fair to poor in the east and good in the central and western portions. Though the very dry soils consumed much of the spring moisture, pond counts were well above last year's. Overall, pond counts and duck numbers were well above last year's figures in southern Alberta. May ponds were up 86% relative to 2002 (P<0.001), and were 23% above the long-term average (P=0.008). Total duck, mallard, gadwall, green-winged teal, blue-winged teal, and scaup estimates did not change relative to 2002, but all remained below long-term averages ($P \leq 0.036$). Northern pintail (+245%, P<0.001) and American wigeon (+70%, P=0.066) numbers increased relative to 2002, but remained below long-term averages (P<0.001). Northern shovelers and canvasbacks increased relative to last year's counts, but shovelers were the only species above the long-term average in southern Alberta (+27%, P=0.053) this year. Redhead numbers remained unchanged from last year's count and from their long-term average. July wetland conditions were rated good in the western portion of the survey area, fair to the east, poor along a portion of the Saskatchewan border, and excellent in a portion of stratum 26. The July pond index was similar to that of 2003, and 19% below the long-term average (P=0.011). The July brood index was up 55% relative to last year's, but remained 58% below the long-term average. The late-nesting index was 29% below last year's, and 44% below the long-term average.

Southern Saskatchewan: Wetland habitat improved from 2002 in the grassland portion of the survey area (strata 32-33) and the majority of the basins in the southwest and central grasslands were full during the May survey. Ephemeral and temporary wetlands were abundant in areas of the southwest and central grasslands. Seasonal wetlands were abundant, and they lasted into July and provided good habitat for broods. The northwest Parklands (stratum 30) were still dry and some areas were worse than 2002. Other areas showed some signs of recovery with water in basins, but all areas had poor habitat for waterfowl nesting and brood rearing. No ephemeral or temporary wetlands were observed and very few seasonal wetlands were seen. Wetland and upland habitat in the northeast Parklands (stratum 31) showed improvement in the southern and eastern portions of the stratum. Northern areas of the stratum were still dry and in poor condition. August and fall rains improved cover before it went dormant; therefore, residual cover used for nesting was good in the southern part of the stratum.

Spring runoff occurred twice in most of the province. Heavy snowfall in early April created a second runoff that filled most dugouts, lakes, and reservoirs in the province and improved conditions early enough to keep ducks in the province. The exception was in the northwest and west-central areas of the survey area, which did not benefit from the early April snowstorm. Central

Saskatchewan bordering Manitoba was much improved relative to 2002.

The May pond estimate was up 238% from last year's extremely low counts ($P<0.001$), and was similar to the long-term average. Total ducks (+162%, +27% LTA), gadwall (+199%, +100% LTA), blue-winged teal (+188%, +60% LTA), northern shovelers (+364%, +134% LTA), and redheads (+186%, +44% LTA) were higher than 2002 estimates ($P<0.001$) and their long-term averages ($P\leq0.070$). Northern pintails (+446%, -20% LTA), and scaup (+68%, -41% LTA) were up relative to 2002 estimates ($P\leq0.067$) but remained below their long-term averages ($P<0.001$). Green-winged teal and canvasbacks were 114% and 166% higher than their 2002 estimates ($P\leq0.002$), respectively, but similar to their long-term averages. American wigeon estimates were unchanged from 2002, and 50% below their long-term average ($P<0.001$).

Thunderstorms were the primary source of precipitation during June and July and the amount received across the province varied widely. The southwest and the west-central areas around Moose Jaw and Swift Current received well-above average precipitation during June. The extreme northwest also received much needed rains and was above average for the month. The northeast, south, southeast, and central portions of the survey area received below-average precipitation during June. The remainder the survey area received average precipitation. Brood habitat dried up in central portions of the survey unit and areas rated as fair for production in May were lowered to poor. The July pond index was 116% above the 2002 estimate ($P<0.001$), and similar to the long-term average. July brood indices were 267% higher than last year's and 7% above the long-term average. The late-nesting index was similar to last year's, but 51% below the long-term average.

Southern Manitoba: The winter of 2002-03 was warm and dry, which did very little to improve the drought conditions of the past several years in southern Manitoba (strata 36-40). However, during late April and into early May, moisture conditions in south-central Manitoba improved rapidly, and many areas had higher water levels than in 2002. These higher water levels and cultivation of wetland margins made for more deep ponds that are favored by divers, but little upland nesting cover for dabblers. Moreover, other areas, namely eastern and central Manitoba, missed much of this precipitation and remained dry throughout the spring. Nonetheless, nesting habitat improved over 2002 and ponds and breeding waterfowl both increased, which boded well for good production.

May pond counts were 50% above the 2002 estimate but remained 28% below the long-term average ($P\leq0.031$). Total duck (+21%), blue-winged teal (+82%), and green-winged teal (+90%) estimates were higher than 2002 estimates ($P\leq0.024$), and unchanged from their long-term averages. Mallard numbers were 26% higher than 2002 estimates ($P=0.048$), and 35% higher than the long-term average ($P=0.005$). Northern shovelers and redheads were similar to 2002 and their long-term averages ($P\geq0.282$). American wigeon, northern pintail, canvasback and scaup estimates were similar to 2002 numbers, but were 76%, 66%, 25% and 65% below their long-term averages, respectively. Gadwall were 29% below the 2002 estimate ($P=0.095$), but remained above the long-term mean (+49%, $P=0.022$). July pond indices were similar to 2002 counts, but were 30% below the long-term average ($P<0.001$). July brood indices were 21% higher than last year and 36% below the long-term average. The late-nesting index was 60% below that of 2002, and 31% below the long-term average.

Montana and Western Dakotas: In Montana (strata 41-42) and the western Dakotas (strata 43-44), May wetland conditions were generally fair to good, with the exception of the western portion of the survey area, which was in poor condition. In Montana, spring rains broke an extended drought in the region, which greened up pastures, but this precipitation failed to improve pond conditions in some areas because it soaked into the dry ground. However, the combination of late April/early May rainfall and extensive sheet water created optimum pintail nesting habitat, especially along the High Line. Residual nesting cover in Montana was sub-optimal due to grazing of Conservation Reserve Program land last year. Average to above average production was predicted in western South Dakota, and average to below average production was predicted in western North Dakota. Overall, May pond counts were up 38% from 2002 ($P<0.001$), and were similar to the long-term average. Total ducks were up 30% relative to 2002 ($P=0.003$) and were at their long-term average. Blue-winged teal (+68%, $P=0.027$) and northern shovelers (+81%, $P=0.025$) were the only species that increased relative to 2002; all other estimates were similar to last year's counts. Blue-winged teal (+62%, $P=0.013$), northern shovelers (+69%, $P=0.018$), green-winged teal (+134%, *P*<0.001), and redheads (+146%, *P*=0.054) were above their long-term averages, while pintails (-56%, *P*<0.001) and American wigeon (-61%, *P*<0.001) remained below them. Canvasbacks, scaup, gadwall and mallards did not differ from their long-term averages.

Brood rearing conditions were good along the Canadian border, in western South Dakota and southeastern Montana, poor in southwestern North Dakota and the westernmost portions of the Montana survey area, and fair throughout the remainder of these four strata. July pond indices were similar to the 2002 estimate and the long-term average. July brood indices were 125% higher than last year and 14% above the long-term average. The late-nesting index was 35% higher than last year's and 22% below the long-term average.

Eastern Dakotas: Most of the glacial drift plain of the eastern Dakotas (strata 45-49) was classed as poor to fair, with the exception of much of stratum 46, where good conditions prevailed. Ephemeral wetlands were absent and larger wetlands, including dugouts and stock ponds, were all in various stages of recession. Light precipitation and warm temperatures in April encouraged vegetation development earlier than last year. As a result, upland grasses, particularly in the Missouri slope region of stratum 49, were in good shape. However, over-water nesting sites were scarce to non-existent and vegetation margins in many wetland basins were degraded. Conditions in the Leola Hills and the Prairie Coteau fared better and were rated "good." Both South and North Dakota received heavy rains in early May. This rain came too late to help nesting birds in South Dakota, but helped later nesting birds in North Dakota. Habitat conditions in eastern North Dakota were highly variable. As in South Dakota, winter provided little precipitation to recharge wetlands. Warm temperatures and small amounts of precipitation arrived in April and triggered vegetation development earlier than last year. During the same period, the northern third of the state had relatively better nesting conditions and they were generally better in North Dakota than in South Dakota. May ponds were 27% above last year's figure (*P*=0.002), and 19% above the long-term average (*P*=0.003). Estimates of total ducks (-21%), mallards (-18%), and gadwall (-21%) were down relative to 2002 figures ($P \leq 0.090$), but remained above long-term averages (*P*<0.001). Blue-winged teal counts were unchanged relative to 2002, but remained 30% above the long-term mean (P=0.018). Northern pintails (-51%, -73% LTA) and redheads (-45%, -32% LTA) were below 2002 estimates ($P \leq 0.006$) and their long-term averages (*P*<0.001). American wigeon and scaup estimates did not differ from last year's, but they remained 71% and 82% above their long-term averages, respectively. Northern shoveler (-28%, *P*=0.051) numbers were down relative to 2002, but they did not differ from their long-term average. Green-winged teal and canvasbacks did not differ significantly from their 2002 estimates or long-term averages. As of July, overall wetland conditions remained stable or improved slightly, and conditions in North Dakota remained better than those in South Dakota. Southeastern South Dakota wetlands were in poor to fair condition, while fair to good brood-rearing conditions prevailed through the rest of the survey area. July pond indices were up 23% compared to 2002 (*P*=0.010) and were 22% above the long-term average (*P*=0.064). July brood indices were 11% lower than last year but 46% above the long-term average. The late-nesting index was 131% higher than in 2002, but 57% below the long-term average.

Northern Saskatchewan, Northern Manitoba, and Western Ontario: In northern Saskatchewan and Manitoba (strata 21-25), a much more normal spring break-up occurred across the region after the exceptionally late break-up of 2002. A wide range of habitat conditions prevailed across northern Saskatchewan in 2003. Dry basins persisted in the southwest portion of the survey area, but conditions improved to the north. Between Cree Lake and Lake Athabasca, conditions were very wet, with flooding along the Otherside River. However, in most areas, habitat conditions were ideal. Most of the smaller riverine habitat was stabilized by beavers, and ideal ponds abounded throughout many drainages. In Manitoba by contrast, water levels tended to be lower. Much lower than average winter and spring precipitation reduced flows in small streams to the point that many beaver ponds there are dry or recessional. The larger river and lake systems are also well below normal levels. The low water in major rivers and lakes should not adversely impact waterfowl nesting; however, the critical conditions that persisted along the small streams and beaver ponds in Manitoba probably limited the production capacity of these typically ideal habitats. Conditions in western Ontario (stratum 50) were rated uniformly good.

Overall, the total duck estimate for the region was 21% below last year's (*P*<0.003) and was right at the long-term average. Northern shovelers (-74%, -77% LTA), blue-winged teal (-41%, -33% LTA) and canvasbacks (-65%, -77% LTA) all decreased compared to 2002 ($P \leq 0.071$), and were below their long-term averages ($P<0.001$). No other species' estimates differed from last year's, but northern pintails, American wigeon and scaup remained 87% ($P<0.001$), 26% ($P=0.077$) and 41% ($P<0.001$) below long-term averages, and green-winged teal were 63% above it ($P=0.010$). Spring and summer precipitation was above average in northern Saskatchewan and below average in northern Manitoba. As of July, in northern Saskatchewan, beaver ponds and streams were in ideal shape for production and the overall outlook was good. However, in northern Manitoba water levels on many lakes and rivers remained low. At the time of this report, July Production Survey information from biologists in this area was unavailable.

Northern Alberta, Northeastern British Columbia, and Northwest Territories: Conditions ranged from fair to good in northern Alberta, northeastern British Columbia, and the Northwest Territories (strata 13-18, 20, 75-77). Northern Alberta received below-normal winter precipitation and was rated fair. Conditions improved to the west, especially from Peace River, AB to Ft. Nelson, BC, and this area was rated good. Early-nesting species may have been set back by a spring cold snap there. Spring was also late in the Athabasca Delta (stratum 20), but shallow lakes and sloughs were open, so conditions were good. Conditions were fair to poor in the west and central Peace Parklands of stratum 76, and fair to poor in the northern Aspen Parklands of stratum 75. Despite the above normal precipitation in April (82% to 246% of normal), conditions declined relative to last year in this region. Conditions were generally good in the Northwest Territories, except along the MacKenzie River, where a late spring lowered production projections to only fair. Mallard (-28%, $P=0.027$) and gadwall (-53%, $P=0.007$) numbers were lower than last year's, but all other species estimates were similar to those of 2002. Total ducks (-11% $P=0.017$), mallards (-23%, $P=0.004$), northern pintails (-57% $P<0.001$), and scaup (-36% $P<0.001$) were all below long-term averages. Northern shovelers (+51%, $P=0.005$), canvasbacks (+63%, $P=0.098$) and gadwall (+73%, $P=0.009$) were higher than their long-term averages for the area. As of July, habitat conditions were rated as good throughout strata 20 and 77. The change from fair to good between May and July was the result of above normal precipitation during the first two weeks of July. However, brood numbers were unexpectedly low in The Athabasca Delta.

Alaska and Old Crow Flats, Yukon Territory: In Alaska and Old Crow Flats and Yukon Territory (strata 1-12), breeding conditions depend largely on the timing of spring phenology, because wetland conditions are less variable than on the prairies. In general, this region experienced an early spring breakup, with the exception of the North Slope. There was very little flooding along major rivers. This combination generally favors waterfowl production, so the majority of the survey area was rated good. However, cool wet weather in north-central Alaska predicted only fair production there. The total duck estimate was 15% higher than last year's ($P=0.006$), and was 66% above the long-term average ($P<0.001$). Most species counts were similar to 2002 estimates and long-term averages with the exception of mallards (+26%, +155% LTA) and green-winged teal (+64%, +217% LTA), which exceeded last year's estimates ($P \leq 0.036$) and long-term averages ($P<0.001$). American wigeon (+110%), and northern shoveler (+177%) remained well above their long-term averages ($P<0.001$) but did not differ from 2002 estimates.

Eastern Survey Area: Breeding waterfowl habitat conditions in the eastern survey area (strata 51-56 and 62-69) were highly variable, ranging from fair to excellent. In the southern and western part of this survey area, water and nesting cover were plentiful and temperatures were mild this spring. Habitat quality decreased to the north, especially in northern and western Quebec, where many shallow marshes and bogs were either completely dry or reduced to mudflats. Beaver pond habitat was also noticeably less common than normal. To the east in Maine and most of the Atlantic provinces, conditions were excellent, with adequate water, vegetation, and warm spring temperatures. However, in Newfoundland and Labrador, duck numbers were down, which biologists attributed to poor production the previous year, coupled with a late spring that discouraged ducks from settling. This had the effect of limiting production in that region, even though temperatures warmed rapidly once spring thaw commenced, and conditions were good thereafter. Total duck (-17%, $P=0.065$) and merganser (-30%, $P=0.035$) estimates decreased relative to last year (Table 6), but were similar to their long-term averages. Estimates for other species did not differ significantly from 2002 counts or from long-term averages.

Other areas: Breeding habitat conditions in British Columbia were below average this year and worse than in the previous 5 years, which reflects a 4-year drought in central BC. Approximately 8,200 ducks were observed in British Columbia's annual survey, statistically similar to 2002 counts and the long-term average. In Washington, even though ponds within the pothole survey areas increased by 31% last year, it will likely take at least 2 more wet years to recover from the 3-year drought there. The Washington 2003 total duck breeding pair index was 127,800, down 4% from 133,000 the previous year and 21% from the long-term average. Mallards went from 44,700 in 2002 to 39,800 in 2003, an 11% drop, and 20% below the long-term average. In California, spring weather was substantially wetter than normal after a winter of below-normal precipitation. Generally, northeastern portions of the state did not benefit as much as the remainder. Duck nesting effort was delayed in some areas, but good to excellent production was anticipated throughout much of the state. The total duck estimate was 533,700, 36% higher than last year's (P=0.030), but similar to the long-term average. Mallards (337,100) were not significantly different from their 2002 estimate, or the long-term average. In Nebraska, wetland conditions were generally fair and there were substantially fewer ducks in the Sandhills than in 2002. The estimated breeding duck population in the Nebraska Sandhills for 2003 was 96,700 ducks, 32% below the 2002 estimate and 52% below the 1999-2002 average. This was the lowest count since new operational procedures were implemented in 1999. Nevada suffered its third year of drought; all wetlands were below normal and many were less than 10% full; thus, poor duck production was expected. Total ducks numbered 10,600, compared to 5,800 in 2002. Mallards were also up from 2002 counts. Water levels and habitat conditions improved considerably in Wyoming, but the southwest portion of the state was still very dry and most moisture arrived too late to benefit early nesters. However, conditions for late nesters and broods in eastern and northern Wyoming were better than the past few years. In the Lake states conditions were generally average. In Minnesota, pond numbers were similar to the 2002 estimate, and were right at the 1968-2002 average. Mallard numbers were unchanged compared to 2002. At 193,300, blue-winged teal were 55% below 2002, and 15% below the long-term average. Total ducks numbered 748,900, down 39% from 2002. Wisconsin total duck numbers and mallard numbers were down from 2002 levels by 26% and 24%, respectively, but remained above long-term means. In Michigan, total ducks were down 41% from last year. Mallard numbers did not differ from last year's count, but remained 35% below the long-term average (P=0.031). In the Mid-Atlantic states, habitat conditions during the spring of 2003 were much improved over those of the past 2 years. Normal to above average precipitation through the winter and spring brought most wetland water levels across surveyed areas to normal. However, the very cool, wet spring delayed vegetation and nesting phenology by about 5-10 days, which may have affected waterfowl production. In some areas duck broods were fewer and younger than normal. Canada geese seemed less affected by the cool spring. Brood-rearing and renesting conditions were very good. Total duck and mallard numbers from the Atlantic Flyway's plot survey were similar to the 2002 estimates ($P \geq 0.166$) and to their long-term averages ($P \geq 0.241$).

Mallard Fall-flight Index

The mid-continent mallard population is comprised of mallards from the traditional survey area, Michigan, Minnesota, and Wisconsin and is 8.8 million (Fig. 4). This is similar to that of 2002 (8.6 million). The 2003 mid-continent mallard fall-flight index is 10.3 million, statistically similar to the 2002 estimate of 9.1 million birds. These indices were based on revised mid-continent mallard population models, and therefore, differ from those previously published (USFWS Adaptive Harvest Management Report 2003, Runge et al. 2002).

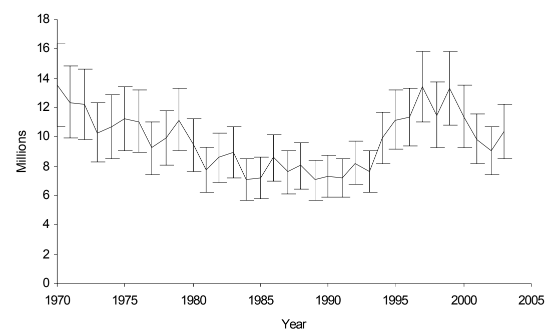

Fig. 4. Estimates and 95% confidence intervals for the size of the mallard population in the fall.

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STATUS OF GEESE AND SWANS

Abstract: We provide information on the population status and productivity of 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*). The timing of snowmelt and goose nesting activities in most areas of the Arctic and subarctic was near average in 2003. Only Alaska's North Slope, Banks and adjacent Arctic Islands, and Akimiski Island reported substantially delayed nesting phenology this year. Although Alaska's Yukon-Kuskokwim Delta experienced an early spring snowmelt, poor production of young by brant, cackling Canada geese, and emperor geese was observed, likely due to low wetland levels and high fox predation. Conditions in 2003 were especially favorable for greater snow geese. Of the 25 populations for which current primary population indices were available, 8 populations (Atlantic Population, Aleutian, Dusky, and 3 temperate-nesting populations of Canada geese; Pacific Population White-fronted Geese; and Eastern Population Tundra Swans) displayed significant positive trends, and only Short Grass Prairie Population Canada geese displayed a significant negative trend over the most recent 10-year period. Forecasts for production of geese and swans in North America in 2003 varied regionally, but generally will be similar to, or higher than in 2002.

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

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

METHODS

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

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

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

RESULTS AND DISCUSSION

Conditions in the Arctic and Subarctic

Biologists reported that spring phenology was average or earlier than average throughout most of North America. Alaska's North Slope, Banks and other nearby islands in the high Arctic, and Akimiski Island were among the few regions that reported a delayed snowmelt. Remaining areas of Alaska, Wrangel Island, northern Quebec, Bylot Island, and Newfoundland reported early snowmelt that allowed nesting to begin earlier than average. However, low water levels and predation in some areas depressed production despite early phenology. The snow and ice cover graphic (Fig. 2, provided by the National Oceanic and Atmospheric Administration) indicates a more-advanced spring breakup in most of the Arctic and subarctic than in 2002, with the exception of Alaska's North Slope.

Conditions in Southern Canada and the United States

Conditions that influence the productivity of Canada geese that nest in these regions vary less from year to year than in the Arctic and subarctic. Given adequate wetland numbers and the absence of flood events, temperate-nesting Canada geese are reliably productive. Wetland conditions in some western states and midwestern regions remain depressed from drought, and a few southern midwest areas experienced some flooding. Increased wetland abundance in the Canadian prairies in 2003 likely will benefit geese. Most temperate-nesting Canada goose populations, with the exception of the Pacific and Rocky Mountain Populations, likely experienced average or above average production in 2003.

Status of Canada Geese

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

During the 2003 BPHS, biologists estimated 60,800 (± 28,400) indicated pairs (singles plus pairs) in NAP range (strata 66 and 67), essentially unchanged from 2002 (62,000, Fig. 4). Indicated pair estimates have declined an average of 5% per year since surveys were initiated in 1996 (*P*=0.22). A total of 133,300 (± 63,700) Canada geese were

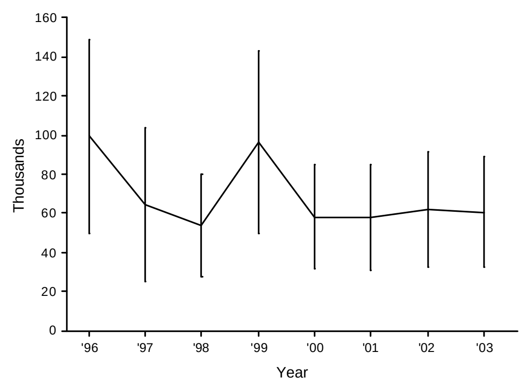

Fig. 4. Estimated number of North Atlantic Population Canada geese indicated pairs (and 95% confidence intervals) during spring.

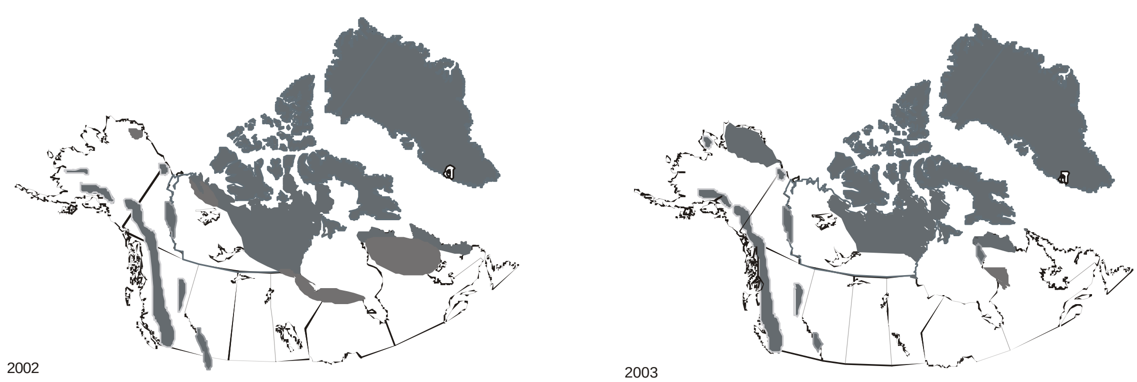

Fig. 2. The extent of snow and ice cover in North America for 2 June, 2002 and June 2, 2003. The figures were produced from reports prepared by the National Oceanic and Atmospheric Administration.

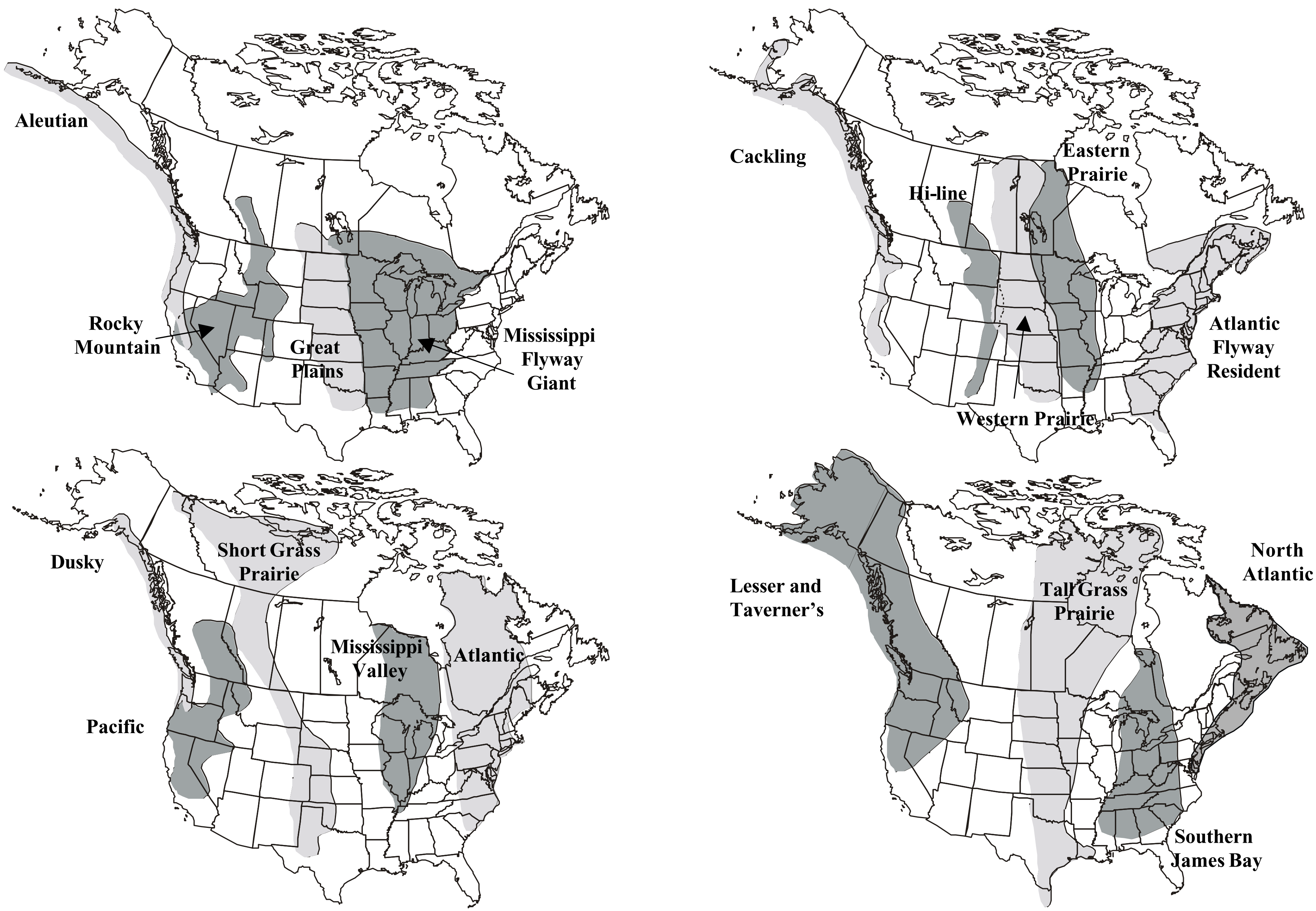

Fig. 3. Approximate ranges of Canada goose populations in North America.

estimated during the BPHS, 31% lower than last year (*P*=0.33). Total goose estimates also have declined an average of 5% per year during 1996-2003 (*P*=0.18). The lower number of geese observed in groups (i.e., nonbreeders) in 2003 likely reflects last year's poor gosling production. Record high temperatures in May contributed to an early spring breakup and early nesting phenology. The early breakup should result in increased production and a fall flight larger than produced during last year's harsh nesting conditions.

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 concentrations occur on the Delmarva Peninsula (Fig. 3).

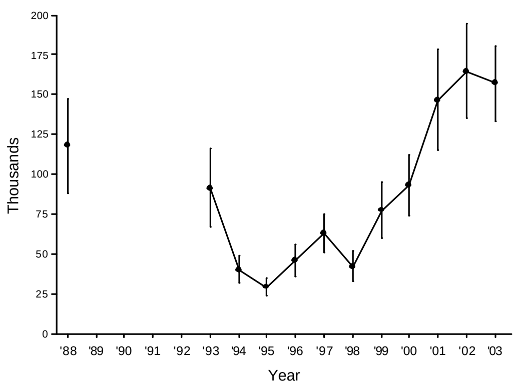

Fig. 5. Estimated number of breeding pairs (and 95% confidence intervals) of Atlantic Population Canada geese in northern Quebec.

Spring AP surveys estimated 156,900 (± 24,100) indicated breeding pairs in 2003, 5% lower than last year (*P*=0.68, Fig. 5). This population has increased from a low of 29,000 breeding pairs in 1995. The breeding pair estimates have increased an average of 19% per year during 1994-2003 (*P*<0.001). The estimated total spring population of 760,300 (± 174,500) geese in 2003 was 22% lower than last year (*P*=0.23). A warm period in late April contributed to early snowmelt and early nesting phenology, although subsequent cold temperatures delayed the thawing of larger lakes. During surveys, a high proportion of geese were observed as single geese (55% of indicated pairs), indicative of a strong nesting effort. Although temperatures during the incubation period were below normal, ground studies indicated high nest density, large clutch sizes, and moderate nest success. A fall flight somewhat larger than last year is expected.

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

Spring surveys in 2003 estimated there were 1,083,200 (± 180,100) Canada geese in this population (Fig. 6), about 12% higher than the previous year's count (*P*=0.35). These estimates have increased an average of 4% per year since 1994 (*P*<0.01). Nesting conditions in most states were reported as average. A large fall flight, similar to last year's is expected.

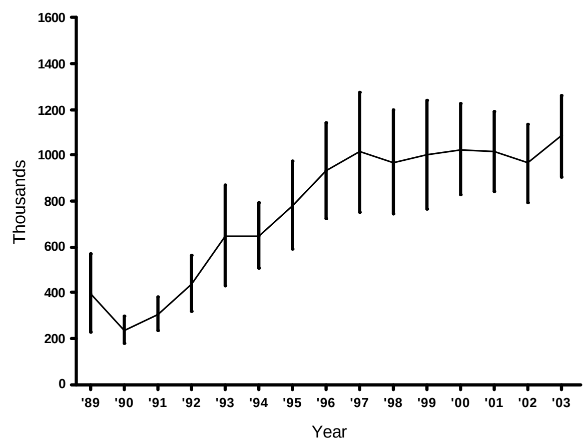

Fig. 6. Estimated number (and 95% confidence intervals) of Atlantic Flyway Resident Population Canada geese during spring.

Southern James Bay Population (SJBP): This population nests on Akimiski Island and in the Hudson Bay Lowlands to the west and south of James Bay. The SJBP winters from southern Ontario and Michigan to Mississippi, Alabama, Georgia, and South Carolina (Fig. 3).

Breeding ground surveys indicated a spring population of 106,500 (± 26,600) Canada geese in 2003, 40% higher than last year (*P*=0.03, Fig. 7). These estimates have decreased an average of <1% per year since 1994 (*P*=0.67). In 2003, there were 45,100 (± 10,100) breeding pairs, which is 55% higher than last year (*P*=0.03). Molt migrants likely were not a factor in this year's survey. Conditions in April and May suggested a late spring throughout SJBP range but rapid snowmelt improved conditions on the mainland. Nesting was delayed substantially on Akimiski Island but only slightly on the mainland. Akimiski Island production will be below average but better than in 2002. A fall flight larger than that of 2002 is expected.

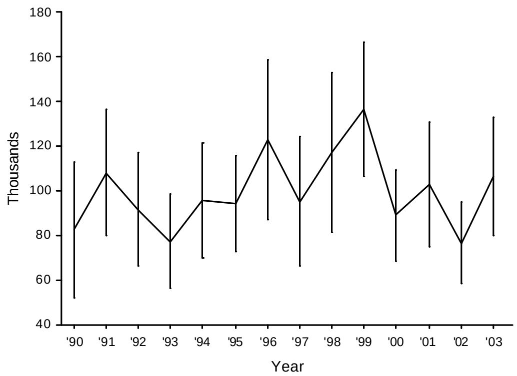

Fig. 7. Estimated total population (and 95% confidence intervals) of Southern James Bay Population Canada geese during spring.

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

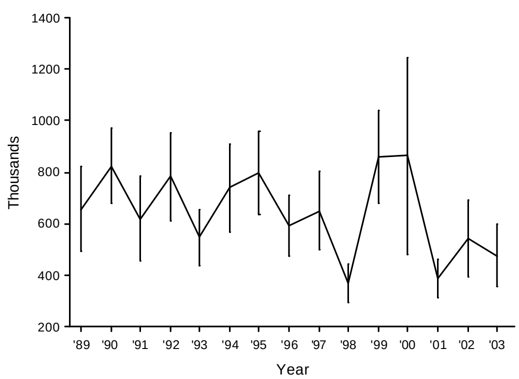

Fig. 8. Estimated number (and 95% confidence intervals) of Mississippi Valley Population Canada geese during spring.

Breeding ground surveys conducted in 2003 indicated a total population of 477,000 (± 119,500) Canada geese, a 12% decrease from last spring (*P*=0.49, Fig. 8). These estimates have declined an average of 4% per year since 1994 (*P*=0.23). Biologists estimated there were 180,000 (± 40,100) nests in 2003, 25% more than in 2002 (*P=0.13*). Estimates of MVP nests have declined an average of 2% per year during 1994-2003 (*P*=0.26). Molt migrants likely were not a factor in this year's survey. Conditions in April and May suggested a late spring throughout MVP range, but snowmelt progressed rapidly and nesting phenology was near average. Ground studies in the coastal area indicated average to slightly above average production, better than in 2002. A fall flight larger than last year's is predicted.

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

This population has been monitored with spring surveys since 1993. In 2003, the preliminary population estimate was 1,635,000, slightly larger than the final 2002 estimate of 1,612,300 (Fig. 9). These estimates have increased an average of 6% per year since 1993 (*P*<0.001). Drought reduced nesting potential in some states and flooding increased nest losses in portions of Illinois, Iowa, Missouri, and Ohio. However, even in affected states, biologists expected near-average production. Another large fall flight is expected.

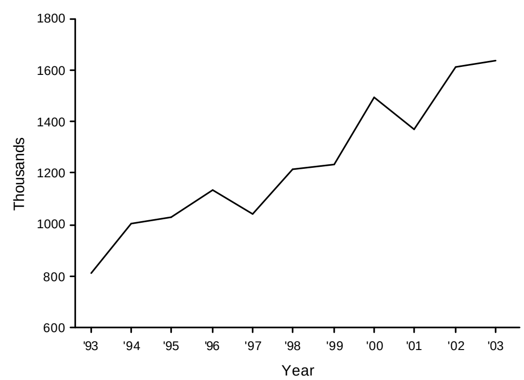

Fig. 9. Estimated number of Mississippi Flyway Giant Population Canada geese during spring.

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

The 2003 spring estimate of EPP geese was 229,200 (± 33,500), 6% larger than the 2002 estimate (*P*=0.55, Fig. 10, survey data for 2003 have been corrected for a visibility bias encountered this year). Spring estimates have increased an average of 2% per year over the last 10 years (P=0.39). The 2003 estimate of singles and pairs was 122,400 (± 18,100), 19% lower than last year (P=0.03). Warm temperatures in May contributed to early snowmelt and to slightly advanced nesting chronology in EPP range this year. Water levels in coastal and interior wetlands appeared below normal. Nesting studies near Cape Churchill reported nest densities among the highest since the late 1980s. More snow goose nests were observed than any year since 1976. Indices of lemming abundance were the highest observed in 15 years, which may have reduced predation on geese. Production on the Nestor One study area was above average, and well above the poor production experienced in 2002. A fall flight similar to, or larger than last year is expected.

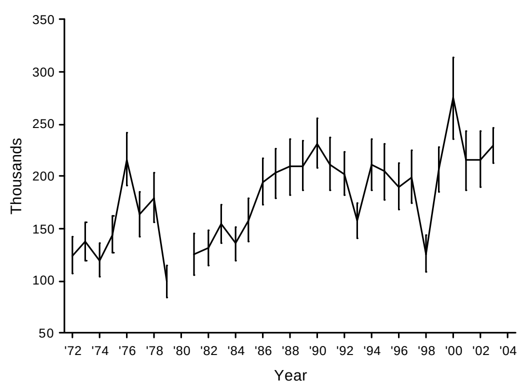

Fig. 10. Estimated number (and 95% confidence intervals) of Eastern Prairie Population Canada geese during spring.

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

During the 2003 MWS survey, 561,000 WPP/GPP geese were counted, 21% fewer than the 2002 estimate (Fig. 11). These indices have increased an average of 9% per year since 1994 (P<0.001). A 2003 index of the spring population in a portion of WPP/GPP range from the BPHS was 662,400, 16% larger than last year (P=0.22). The BPHS estimates have also increased an average of 9% per year since 1994 (P<0.001). Wetland abundance in the Canadian and U.S. prairies has improved markedly since last year and should contribute to increased production. A fall flight larger than last year's is expected.

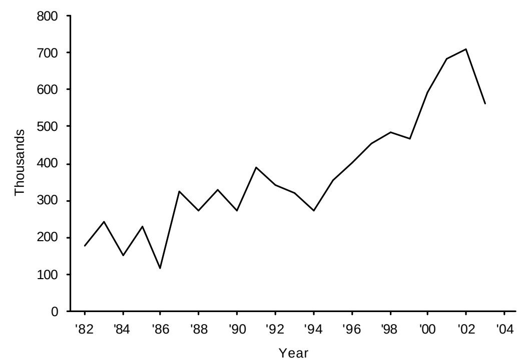

Fig. 11. Estimated number of Western Prairie Population/Great Plains Population Canada geese during winter.

Tall Grass Prairie Population (TGPP): These small Canada geese nest on Baffin (particularly on the Great Plain of the Koukdjuak), Southampton, and King William Islands; north of the Maguse and McConnell Rivers on the Hudson Bay coast; and in the eastern Queen Maud Gulf region. 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 2003 MWS in the Central Flyway, 611,800 TGPP geese were tallied, with survey methodologies similar to 2002 (Fig. 12). The 2003 MWS estimate is 21% higher than last year. Fall surveys of adult TGPP geese conducted on Baffin Island increased an average of 5% per year from 1994-2002 (P=0.06). Spring breakup near Southampton and Baffin Islands was earlier in 2003 than last year and limited information suggested the nesting phenology was average. Some late snow, sleet, and flooding were reported from Southampton Island. Average or slightly early phenology was reported on mainland areas within TGPP range. Limited information suggests production of TGPP geese will be average or higher in 2003.

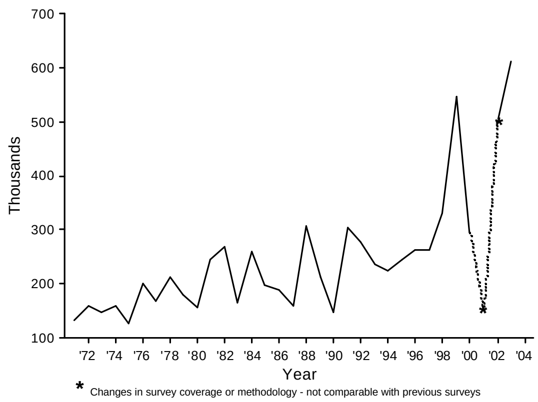

Fig. 12. Estimated number of Tall Grass Prairie Population Canada geese in the Central Flyway during winter.

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

During the 2003 MWS, biologists counted 156,700 SGPP Canada geese, 3% fewer than in 2002 (Fig. 13). These indices have declined 17% per year since 1994 (*P*<0.001). A portion of the SGPP breeding range in the Northwest Territories is covered by the BPHS (strata 13-18). The 2003 BPHS estimated 85,000 (± 37,900) SGPP geese, a 39% decrease from 2002 (*P*=0.18). These estimates have declined at an average of 1% per year since 1994 (*P*=0.80). General wetland

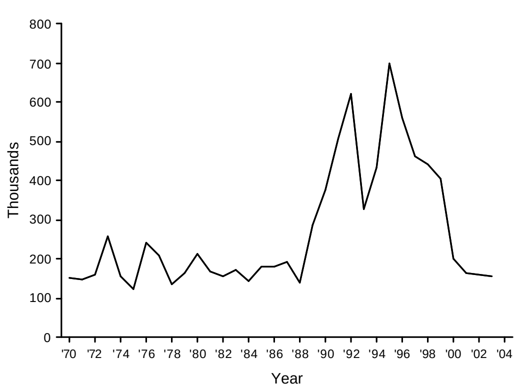

Fig. 13. Estimated number of Short Grass Prairie Population Canada geese during winter.

conditions in the surveyed boreal forest portion of SGPP range were reported as good. Spring phenology near Queen Maud Gulf was slightly earlier than average, and weather during incubation was mild. Nesting effort and the production outlook were reported as average to better than average. With only limited information, production from SGPP geese is expected to be better than average.

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 2003 MWS indicated a total of 205,900 HLP Canada geese, which is 5% below last year's estimate (Fig. 14). The MWS estimates have increased an average of 4% per year since 1994 (*P*=0.13). An estimate of the spring population was obtained from the 2003 BPHS in areas of Saskatchewan, Alberta, and Montana. The BPHS estimate was 231,500, virtually identical to the 2002 estimate (231,000). These population estimates have also increased 5% per year since 1994 (*P*=0.01). Wetland conditions in the Canadian and U.S. prairies were much improved compared to 2002, but generally remained poor in Wyoming and Colorado. The fall flight of HLP geese is expected to be larger than last year.

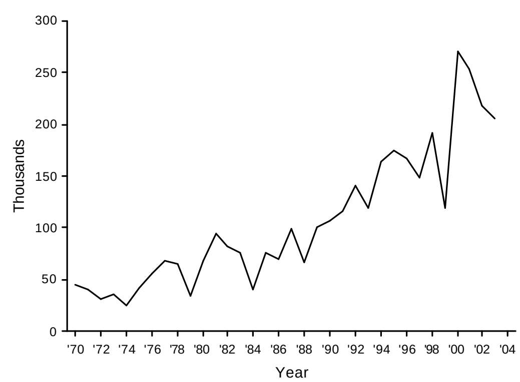

Fig. 14. Estimated number of Hi-Line Population Canada geese during winter.

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

The estimated spring population derived from the BPHS in 2003 was 134,300, unchanged from last year's estimate (134,700). The BPHS estimates have increased 4% per year during the last 10 years (*P*=0.08). During the 2003 MWS, 124,700 geese were counted, an 11% increase from the previous year (Fig. 15). MWS estimates have increased an average of 1% per year since 1994 (*P*=0.24). Wetland conditions improved in Alberta since 2002, but remain in poor condition in Wyoming, Colorado, Utah, and Nevada. The fall flight of RMP geese is expected to be somewhat larger than last year.

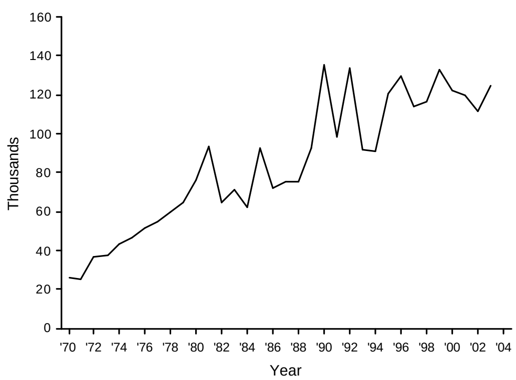

Fig. 15. Estimated number of Rocky Mountain Population Canada geese during winter.

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

BPHS indices of PP geese in Alberta (strata 76-77) were 77,100 in 2003, 8% lower than in 2002 (*P*=0.80). These estimates have increased an average of 12% per year since 1994 (*P*=0.01). Pooled indices of breeding geese in Washington, California, and Nevada in 2003 declined 4% from last year. Wetland abundance in the range of the PP continues to be reduced by drought. Estimates of production or fall flight can not be reliably predicted without more information.

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

The size of the population is estimated through observations of marked geese during December and January. The 2002-03 population estimate was 16,700 (+ 3,600), 3% lower than in 2001-02 (*P*=0.89, Fig. 16). These estimates have increased an average 7% per year during the last 10-year period (*P*=0.03). Preliminary results from the 2003 spring survey of the Copper River Delta indicated the index of total dusky Canada geese decreased 18%, and singles and pairs decreased 28% from last year's levels. A light overwinter snowpack contributed to a spring breakup about 7 days earlier than average on the Copper River Delta. Habitat conditions were favorable for geese, but high predation of dusky Canada geese by bald eagles and bears likely will result in lower than average nest success. A fall flight lower than last year is expected.

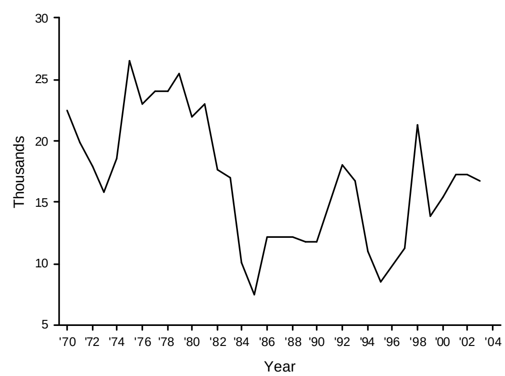

Fig. 16. Estimated number of dusky Canada geese during winter.

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

The index used for this population was a fall estimate from 1979-98. Since 1999, the index has been an estimate of the fall population derived from spring surveys on the YKD. The 2003 fall estimate is 176,000, 29% higher than that of 2002. These estimates have increased an average of 1% per year since 1994 (*P*=0.58, Fig. 17). Surveys in the coastal zone of the YKD during spring 2003 indicated total cackling geese increased 38%, and single and paired geese declined 3% from 2002. Little snowpack and mild spring temperatures contributed to a peak hatch for geese 7 days earlier than the long-term average (nest plot surveys).

However, reduced cackler nesting effort, nest success, and clutch size resulted in the lowest index of production in 13 years. Low water levels and high fox predation likely contributed to the poor reproductive performance. A fall flight similar to last year is expected.

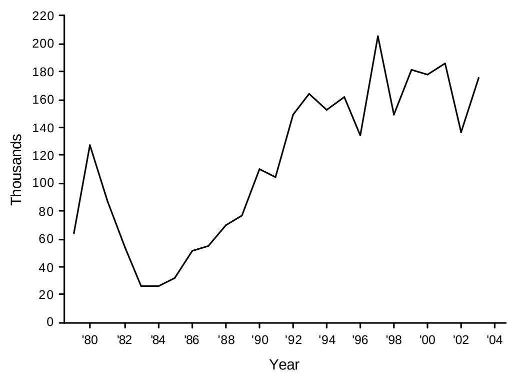

Fig. 17. Number of cackling Canada geese estimated from fall and spring surveys.

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

Spring breakup was delayed approximately 1 week on the North Slope which may reduce production of Taverner's geese. Throughout the remainder of Alaska, phenology was average or early and spring flooding was limited. Production from these areas is expected to be above average. The estimated number of Canada geese within BPHS strata predominantly occupied by these geese (strata 1-6, 8, 10-12) in 2003 increased 20% from 2002 levels. These estimates have declined an average of 2% per year since 1994 (P=0.18).

Aleutian Canada Geese (ACG): These geese currently nest primarily 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 (Fig. 3). The Aleutian Canada goose was listed as endangered in 1967 (the population numbered approximately 800 birds in 1974) and was delisted in 2001.

An indirect population estimate based on observations of neck-banded birds in California during 2002-03 was 62,400 ($\pm$ 11,600), 69% higher than last year's estimate (P<0.001, Fig. 18). These indirect estimates have increased an average of 11% per year over the last 10 years (P<0.001). Spring phenology was favorable for Aleutian geese and gosling production is expected to be high.

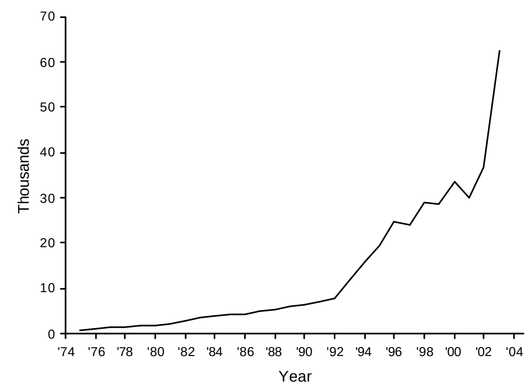

Fig. 18. Number of Aleutian Canada geese estimated from winter estimates and mark-resight methods.

Status of Light Geese

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

Ross's Geese: Most Ross's geese nest in the Queen Maud Gulf region, but increasing numbers nest along the western coast of Hudson Bay and Southampton, Baffin, and Banks Islands. Ross's geese are present in the range of 3 different populations of light geese and primarily winter in California, New Mexico, Texas, and Mexico, with increasing numbers in Louisiana and Arkansas (Fig. 19).

Periodic photo-inventories and annual surveys in the Queen Maud Gulf indicate the spring Ross's goose population has increased rapidly and has

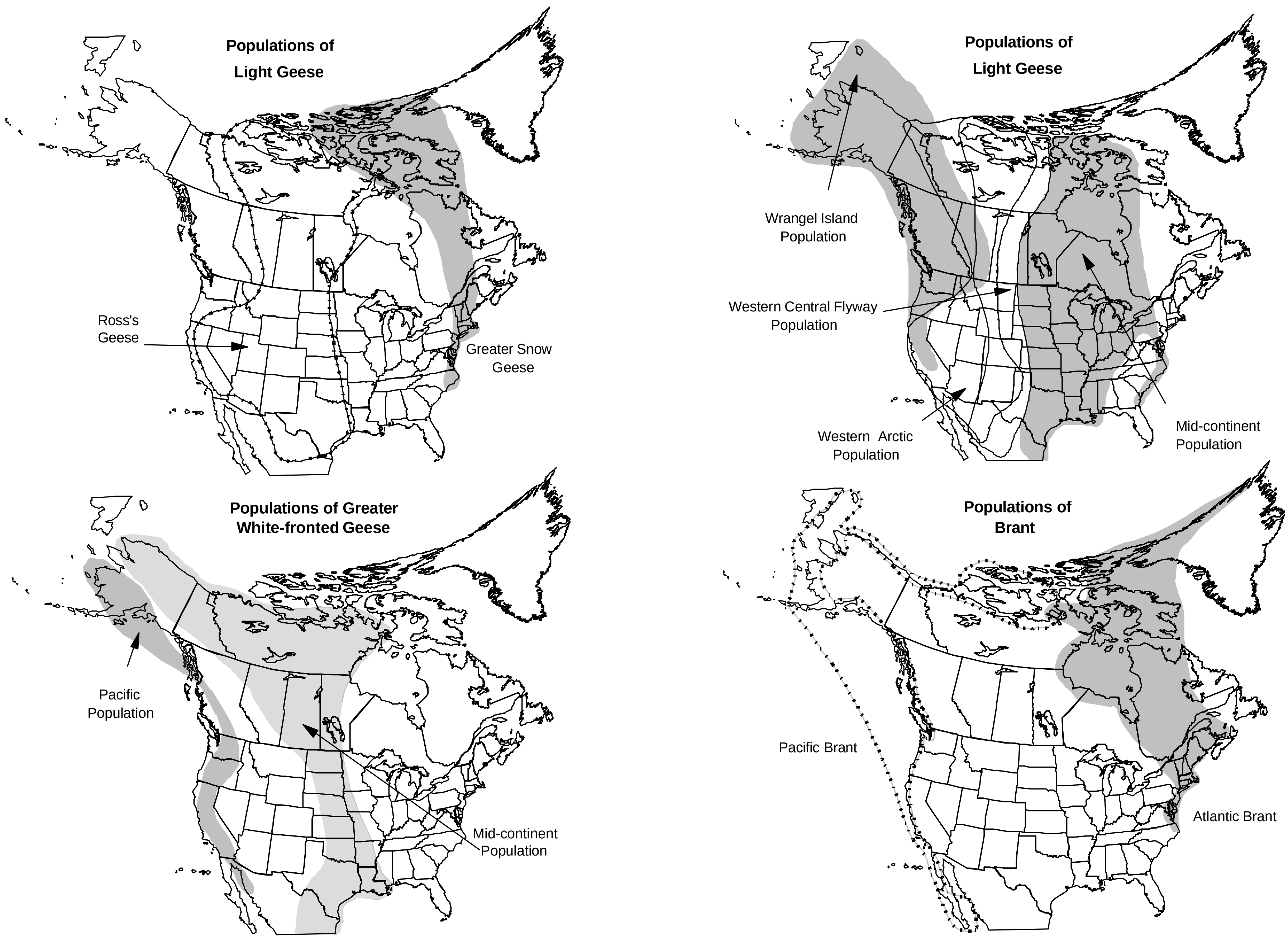

Fig. 19. Approximate ranges of brant and snow, Ross's, and white-fronted goose populations in North America.

exceeded 800,000 geese in recent years. Annual estimates of total wintering population size are not available, but surveys on wintering areas of light geese indicate increases in range, number, and proportions of Ross's geese. The largest Ross's goose colony is near Karrak Lake in the Queen Maud Gulf. Researchers estimated that 382,000 adult Ross's geese nested there in 2002 (Fig. 20). These preliminary estimates have increased an average of 9% per year from 1993-2002 (P<0.01). Despite heavy overwinter snowfall at Queen Maud Gulf in 2002-03, a rapid snowmelt allowed geese to initiate nesting earlier than average, in a patchwork of open ground and snow. Hundreds of light geese at several colonies there were suspected to have died from avian cholera. Weather conditions during the incubation period were mild and production from Queen Maud Gulf is expected to be average or better. Ross's geese nesting near the McConnell River exhibited high production, and spring phenology in other areas of recent range expansion was favorable for nesting. The size of the fall flight cannot be predicted without an annual index to the size of the total breeding population.

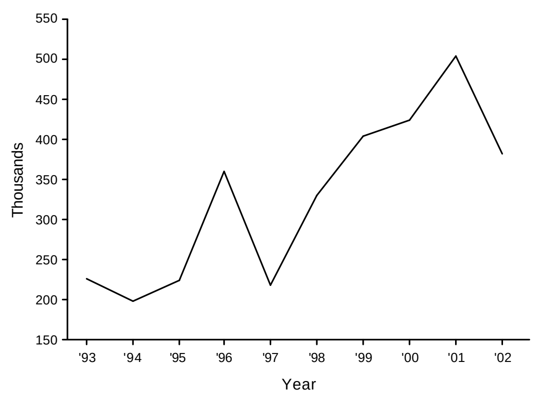

Fig. 20. Estimated number of nesting adult Ross's geese at Karrak Lake Colony, Nunavut.

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

During the 2003 MWS, biologists counted 2,435,000 light geese, 10% fewer than last year (Fig. 21). Due to declines in these indices since 1997, the indicated growth rate was less than 1% during 1994-2003 (P=0.98). Spring breakup and nesting phenology was near average or earlier than average in all MCP nesting areas reporting. MCP gosling production likely will be improved compared to last year, suggesting the fall flight will be similar or larger than in 2002.

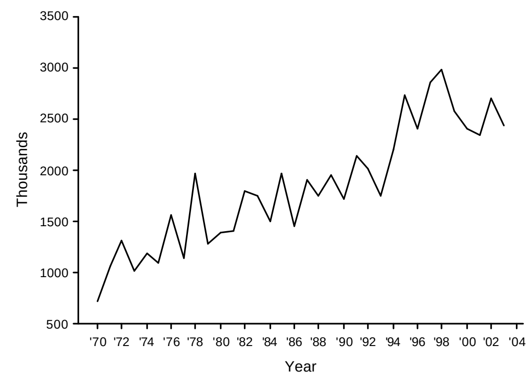

Fig. 21. Estimated number of Mid-continent Population light geese (lesser snow and Ross's geese) during winter.

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

WCFP geese wintering in the U.S. portion of their range are surveyed annually, but the entire range, including Mexico, is surveyed only once every 3 years. In the U.S. portion of the survey, 105,900 geese were counted in January 2003, 6% more than last year (Fig. 22). The indicated growth rate was less than 1% during 1994-2003 (P=0.86). During 2003 surveys in Mexico, 61,500 additional WCF light geese were counted, 48% lower than the last survey in 2000. Winter indices of all WCFP light geese in the U.S. and Mexico have declined 4% per year during 1994-2003 (P=0.29). Spring phenology was average or slightly early near Queen Maud Gulf in 2003 and weather during nesting was mild, which likely will result in average or better than average production. Spring phenology on Banks Island was reported as average to delayed and production could be below average. Although weather conditions at small mainland colonies in the western

Arctic were favorable, high predation was observed at Kendall Island and production will likely be low. Overall, production is expected to be near average for this population.

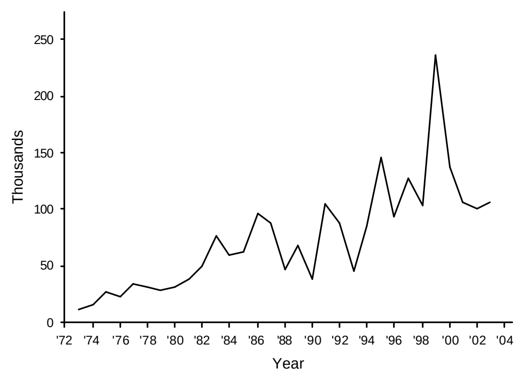

Fig. 22. Estimated number of Western Central Flyway Population light geese during winter in the United States.

Western Arctic/Wrangel Island Population (WAWI): Most of the snow geese in the Pacific Flyway originate from nesting colonies in the western and central Arctic (WA: Banks Island, the Anderson and Mackenzie River Deltas, Jenny Lind Island, the western Queen Maud Gulf region) or Wrangel Island (WI), located off the northern coast of Russia. The WA segment of the population winters in central and southern California, New Mexico, and Mexico; the WI segment winters in the Puget Sound area of Washington and in northern and central California (Fig. 19). In winter, WA and WI segments commingle with light geese from other populations in California, complicating winter surveys.

The fall 2002 estimate of WAWI snow geese was 596,900, 33% higher than estimated in 2001 (Fig. 23). Fall estimates have increased 2% per year during 1993-2002 (P=0.54). Spring phenology on Banks Island was reported as average to delayed and gosling production there could be below average. Although weather conditions at small mainland colonies in the western Arctic were favorable, high predation was observed at Kendall Island and production will likely be low. At Wrangel Island's Tundra River colony, nesting phenology was very early. Preliminary estimates from biologists on Wrangel Island indicate 25,000-30,000 nests were found and nest success was between 75 and 80%, similar to the favorable production year of 2002. They reported that the production outlook for 2003 was very good. A fall flight similar to last year's is expected.

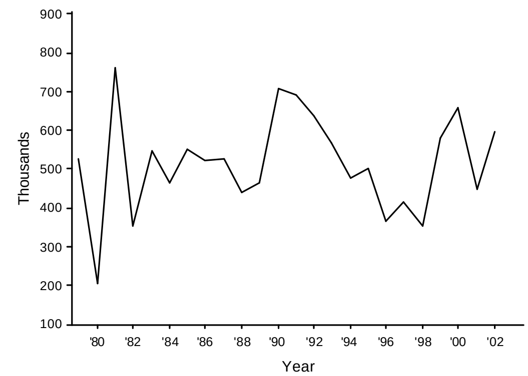

Fig. 23. Estimated number of Western Arctic/Wrangel Island Population light geese during fall.

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

The preliminary estimate from the spring 2003 photographic survey of greater snow geese in the St. Lawrence Valley was 631,500 (± 48,600), 1% lower than the last year's final estimate (Fig. 24). Spring estimates of greater snow geese have increased an average of 2% per year since 1994 (P=0.25). The number of snow geese counted during the 2003 MWS in the Atlantic Flyway was 402,300, a 7% increase from the previous survey. Midwinter counts have increased an average of 5% per year during 1994-2003 (P=0.06). The largest known greater snow goose colony is on Bylot Island. There, spring breakup occurred very early and peak nest initiation was the third earliest in 15 years. Nest densities in the colony were high, predation rates were low to moderate, and the resultant brood density was high.

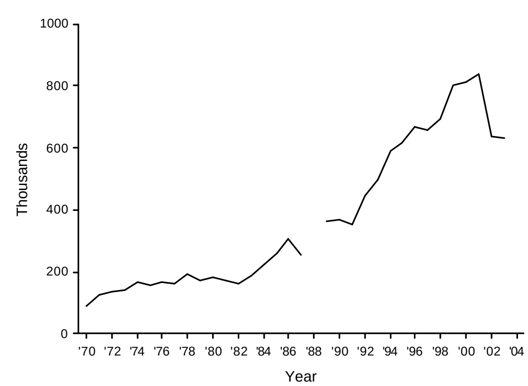

Fig. 24. Estimated number of greater snow geese during spring.

Biologists expected above average production, the highest of the last 4 years. A fall flight larger than last year is expected.

Status of Greater White-fronted Geese

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

The index for this population was a fall estimate from 1979-98. Since 1999, the index has been a fall population estimate derived from spring surveys on the Yukon-Kuskokwim Delta (YKD) and Bristol Bay. The 2003 fall estimate is 422,200, 18% higher than in 2002 (Fig. 25). These estimates have increased an average of 3% per year since 1994 (P=0.02). Light overwinter snowpack and mild spring temperatures on the YKD led to a spring breakup about 7 days earlier than average. Spring aerial surveys in the YKD coastal zone indicated increases in total white-fronts (+31%) and breeding pairs (+2%) from 2002 levels. Spring estimates of total white-fronted geese on the entire YKD and Bristol Bay have increased an average of 5% per year from 1994-2003 (P=0.02). Although clutch sizes and indices of nest success were slightly lower than in 2002, production will be near average and a fall flight larger than last year's is expected.

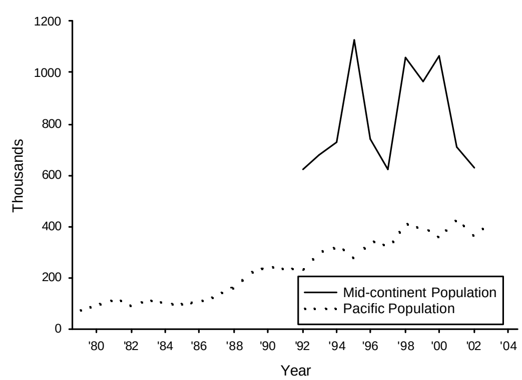

Fig. 25. Estimated number of Mid-continent and Pacific Population greater white-fronted geese during fall.

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

During the fall 2002 survey in Saskatchewan and Alberta, biologists counted 626,700 MCP geese, a decrease of 12% from the 2001 count (Fig. 25). During 1993-2002, the growth rate of MCP white-fronts was less than 1% (P=0.97). Spring phenology was near average in most of MCP white-front range, but late on Alaska's North Slope and slightly early in Alaska's interior region. A strong nesting effort and good productivity were reported near the Mackenzie and Anderson River Deltas. Near average phenology and mild temperatures during incubation in the Queen Maud Gulf, and limited flooding in interior Alaska should lead to above average production in 2003.

Status of Brant

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

The 2003 MWS estimate of brant in the Atlantic Flyway was 164,500, 9% fewer than last year's estimate (Fig. 26). These estimates have increased an average of 3% per year for the most recent 10-year period (P=0.14). Spring breakup in 2003 was near average in the eastern Arctic and production should be improved compared to 2002.

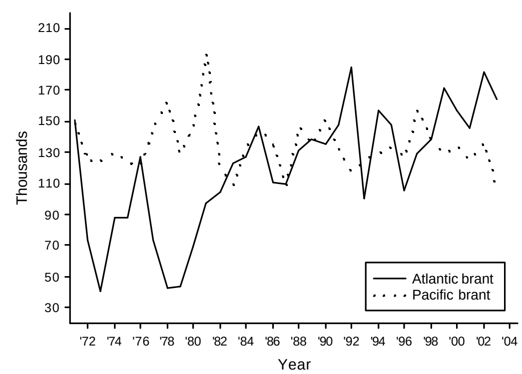

Fig. 26. Estimated number of Atlantic and Pacific Population brant during winter.

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

The 2003 MWS in the Pacific Flyway and Mexico resulted in a count of 106,500 brant, 22% fewer than the previous year's count (Fig. 26). These estimates have decreased an average of 1% per year during 1994-2003 (P=0.23). Spring breakup was about 1 week early on the YKD, later than average on the North Slope, and delayed on Banks and other nearby Islands. Brant nesting effort was very low throughout the YKD, and the rate of nest destruction by foxes was high. Production for much of this population is expected to be reduced and a fall flight smaller than last year's is expected.

Western High Arctic Brant (WHA): This recently recognized population of brant nests 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. The development of a management plan and monitoring program are underway for this newly designated population.

During 2003, the major nesting area for this population was subjected to a late spring breakup, which may reduce production.

Status of Emperor Geese

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

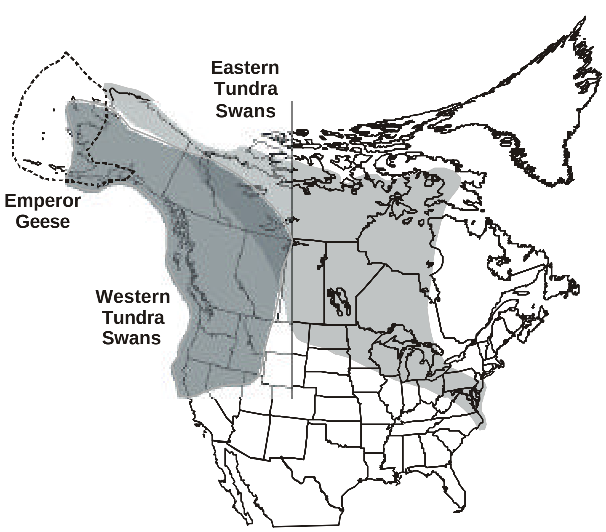

Fig. 27. Approximate range of emperor geese, and eastern and western tundra swan populations in North America.

The spring 2003 emperor survey estimate was 71,200 geese, 21% higher than last year (Fig. 28). These estimates have increased an average of 2% per year since 1994 (P=0.38). Spring indices of breeding pairs from the YKD coastal survey decreased 24%, and the total bird index increased 6% from 2002 levels. Light snowpack and mild spring temperatures contributed to a peak goose hatch 7 days earlier than the long-term average (nest plot studies). However, emperor goose nesting effort and nest success appeared low. Low water levels and high fox predation likely contributed to the poor reproductive performance. A fall flight smaller than last year's is expected.

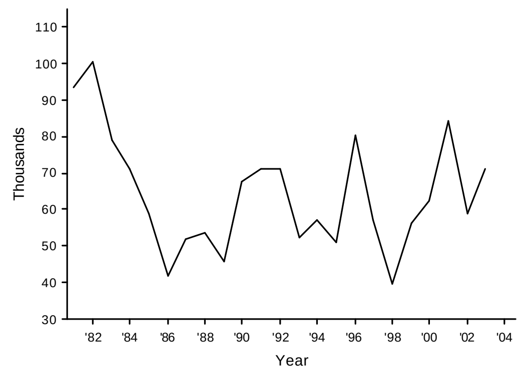

Fig. 28. Estimated numbers of emperor geese present during May surveys.

Status of Tundra Swans

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

The 2003 MWS estimate of 102,700 swans was 75% higher than the 2002 estimate (Fig. 29). These estimates have been increasing at an average rate of 1% per year since 1994 (P=0.71). Spring breakup in western Alaska was approximately 1 week earlier than average. The number of active swan nests observed during aerial surveys declined 18% from last year's record high, but was the third highest index since 1985. Despite the relatively poor nesting effort and success of other waterfowl on the Yukon Kuskokwim Delta in 2003, tundra swan nesting effort, clutch sizes, and nest success appeared very high. A fall flight similar to last year's is expected.

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

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

During the 2003 MWS, 108,200 eastern tundra swans were observed, 4% more than last year (Fig. 29). During the last 10 years, these estimates have increased an average of 3% per year (P<0.01). On Alaska's North Slope, spring phenology was delayed by about 1 week and numbers of tundra swans and their nests were fewer than in recent years. Near the Mackenzie River delta, a good swan nesting effort was reported and average to better than average production was expected. In most other parts of Eastern Population tundra swan range, spring phenology was near average. Overall, a fall flight similar to last year's is expected.

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

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

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

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

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

Air	E. Buelna, R. Bentley, and D. Roach
Ground	P. Pryor [a], K. Froggatt [b], S. Barry [a], E. Hofman [b], C. Procter [a], M. Barr [c], R. Engler [c], N. Fontaine [c], R. Hunka [c], T. Lang [a], K. Lumbis [c], D. Matheson [c], T. Mathews [c], M. Nieman [a], B. Peers [c], R. Russell [b], K. Zimmer [a]

Southern Saskatchewan (Strata 30-35):

Air	P. Thorpe, T. Lewis, R. King, K. Bollinger, and B. Fisher
Ground	D. Nieman [a], J. Smith [a], K. Warner [a], T. Barney [a], J. Clark [c], C. Downie [a], P. Nieman [a], C. Park [a], A. Williams [a], D. Caswell [a], J. Leafloor [a], P. Rakowski [a], M. Schuster [a], J. Galbraith [a], C. Lindgren [c], C. Meuckon [a], D. Pisiak [a]

Southern Manitoba (Strata 25 and 36-40):

Air	R. King K. Bollinger, and B. Fisher
Ground	D. Caswell [a], J. Leafloor [a], P. Rakowski [a], M. Schuster [a], F. Baldwin [a], G. Ball [b], J. Caswell [a], J. Galbraith [a], C. Lindgren [c], C. Meuckon [a], D. Pisiak [a]

Montana and Western Dakotas (Strata 41-44):

Air	J. Voelzer R. Bentley, and J. Wortham
Ground	P. Garrettson, K. Richkus, and L. Ridenour

Eastern Dakotas (Strata 45-49):

Air	J. Solberg and S. Thomas
Ground	G. Allen, K. Kruse, T. Menard, and T. Thorn

Central Quebec (Strata 68 and 69):

Air	J. Wortham and D. Fronczak
Helicopter	D. Holtby [b] and S. Boomer

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

Central and Western Ontario (Strata 50 and 51): W. Butler and K. Bollinger

Maine and Maritimes (Strata 62-67):

Air	J. Bidwell and M. Drut
Helicopter	H. MacRae [d] and B. Raftovich

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

California

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

Colorado: J. Gammonley [b]

Michigan: S. Chadwick [b], B. Dybas-Berger [b], E. Flegler [b], S. Hanna [b], L. Jablon [d], E. Kafcas [b], A. Karr [b], B. Lercel [b], R. Matthews [d], J. Niewoonder [b], T. Oliver [b], J. Robison [b], B. Scullon [b], G. Souillere [b], K. Sitar [b], V. Weigold [b]

Minnesota

Air	A. Buchert [b] and J. Lawrence [b]
Ground	S. Kelly, J. Artmann, L. Au, K. Bousquest, W. Brininger, J. Holler, D. Johnson, J. Kelley, R. Papasso, T. Rondeau, S. Swanson, G. Tischer, L. Wolff, S. Zodrow

Nebraska

Air	D. Benning [d], N. Lyman [b], and M. Vrtiska [b]
Ground	C. Juricek [b] and R. Walters [b]
Data Analysis	M. Vrtiska [b] and C. Juricek [b]

Appendix A. Continued.

Nevada	N. Saake[b], B. Tanner [b], and D. Johnson [b]
Northeastern U.S.	
Data Analysis	B. Raftovich
Connecticut	M. Huang [b] and K. Kubik [b]
Delaware	T. Whittendale [b]
Maryland	D. Brinker [b], T. Decker [b], T. DeWitt [b], B. Evans [b], C. Harris [b], B. Harvey [b], D. Heilmeier [b], W. Henry [b], R. Hill [b], L. Hindman [b], B. Joyce [b], B. Martin [b], B. Perry [b], D. Price [b], G. Timko [b], D. Webster [b]
Massachusetts	Massachusetts Division of Fisheries and Wildlife personnel
New Hampshire	E. Robinson [b], K. Bontaites [b], K. Bordeau [b], M. Fay [b], W. Ingham [b], J. Kelley [b], E. Orff [b], J. Robinson [b], W. Staats [b], K. Tuttle [b], A.Timmins [b], T. Walski [b], S. Wheeler [b],
New Jersey	T. Nichols [b], A. Burnett [b], P. Castelli [b], J. Garris [b], B. Kirkpatrick [b], J. Mangino [b], L. Widjeskog [b], D. Wilkinson [b], B. Willard, J. Ziemba [b], L. Ziemba, N. Zimpfer [b]
New York	Staff and volunteers of the NY State Department of Environmental Conservation
Pennsylvania	M. Casalena [b], J. Dunn [b], J. Gilbert [b], I. Gregg [b], T. Hardisty [b], K. Jacobs [b], A. Keister [b], M. Lovallo [b], B. Palmer [b], C. Rosenbery [b], M. Ternent [b], C. Thoma [b]
Rhode Island	C. Allin [b], C. Brown [b], L. Gibson [b], T. Silvia [d], B. Tefft [b]
Vermont	T. Appleton, J. Austin [b], D. Blodgett [b], J. Buck [b], P. Hamelin [b], F. Hammond [b], J. Mlcuch [b], K. Royar [b], D. Sausville [b]
Virginia	G. Costanzo [b], T. Bidrowski [b], and other staff of the Virginia Department of Game and Inland Fisheries
Washington	R. Friesz [b], D. Base [b], J. Bernatowicz [b], H. Ferguson [b], S. Fitkin [b], P. Fowler [b], T. Hames [b], J. Heinlen [b], T. Jafari [b], M. Livingston [b], T. McCall [b], B. Patterson [b], J. Tabor [b], D. Volsen [b]
Wisconsin	
Air	L. Waskow [b], B. Bacon [b], C. Cold [b], C. Milestone [b], P.Samerdyke [b]
Ground	T. Bahti [b], K. Belling [b], N. Christel [b], J. Cole [b], T. Connolly, T. Cook [d], P. David [b], G. Dunsmoor [b], J. Harbaugh [b], B. Hill [b], J. Huff [b], R. Krueger, S. Krueger [d], M. Lehner [b], R. McDonough [b], K. Morgan [b], A. Nelson [b], L. Nieman, D. North [b], J. Robaidek [b], A. Robidoux [b], J. Ruwaldt, J. Trick, D. Trudeau, G. VanVreede, M. Windsor [b]
Data Analysis	R. Gatti [b]

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The states of the Atlantic and Mississippi Flyway and Regions 3, 4, and 5 of the U.S. Fish and Wildlife Service for collecting mid-winter waterfowl survey data, from which we extract black duck counts, and J. Serie, K. Gamble, and B. Raftovich, for summarizing the counts; and the volunteers of the North American Breeding Bird Survey (a survey coordinated by the U.S. Geological Survey, Biological Resources Division [USGS/BRD]) for data used in estimation of wood duck population trends, and J. Sauer, USGS/BRD for conducting the wood duck trend analyses.

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

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

Flyway-wide and Regional Survey Reports: D. Caswell[a], K. Dickson[a], M. Drut, D. Fronczak, K. Gamble, K. Kruse, R. Oates, R. Raftovich, J. Serie, D. Sharp, and R. Trost

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

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

Atlantic Population of Canada Geese: P. Brosseau[a], R. Cotter[a], J. Dunn[b], W. Harvey[a], L. Hindman[b], and J. Rodrigue[a]

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

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

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

Mississippi Flyway Population Giant Canada Geese: K. Abraham[b], S. Barry[b], J. Bergquist[b], K. Chodachek[b], E. Flegler[b], D. Graber[b], J. Hughes[a], J. Lawrence[b], D. Luukkonen[b], R. Marshalla[b], R. Pritchert[b], E. Warr[b], and G. Zenner[b]

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

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

Tall Grass Prairie Population of Canada Geese: D. Caswell[a], J. Leafloor[a], and M. Mallory[a]

Short Grass Prairie Population of Canada Geese: R. Alisauskas[a], C. Ferguson, and J. Hines[a]

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

Rocky Mountain Population of Canada Geese: T. Aldrich[b], J. Dubovsky, J. Herbert[b], T. Hinz[b], C. Mortimore[b], L. Roberts[b], T. Sanders[b], and P. Thorpe

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

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

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

Cackling Canada Geese: M. Anthony[d], C. Dau, B. Eldridge, J. Fischer, D. Marks, B. Platte, and B. Stehn

Aleutian Canada Geese: V. Byrd

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

Mid-continent Population Light Geese: K. Abraham[b], D. Caswell[a], M. Gillespie[b], B. Lubinski, A. Raedeke[b], J. Leafloor[a], M. Mallory[a], R. Rockwell[d], K. Ross[a], P. Telander[b], and L. Walton[b]

Western Central Flyway Population Light Geese: R. Alisauskas[a], J. Hines[a], and P. Thorpe

Appendix B. Continued.

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

Ross's Geese: R. Alisauskas[a], J. Caswell[d], J. Leafloor[a], and P. Thorpe

Pacific Population White-Fronted Geese: C. Dau, B. Eldridge, J. Fischer, D. Groves, D. Marks, B. Platte, and B. Stehn

Mid-continent Population White-fronted Geese: R. Alisauskas[a], B. Conant, C. Ely[d], J. Hines[a], B. Larned, E. Malleck, D. Nieman[a], M. Spindler, and K. Warner[a]

Pacific Brant: M. Anthony[d], B. Eldridge, J. Fischer, and R. King

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

Western High Arctic Brant: D. Kraege[b]

Emperor Geese: C. Dau, B. Eldridge, J. Fischer, R. King, E. Malleck, D. Marks, B. Platte, and B. Stehn

Western Population of Tundra Swans: C. Dau, B. Eldridge, J. Fischer, and B. Stehn

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

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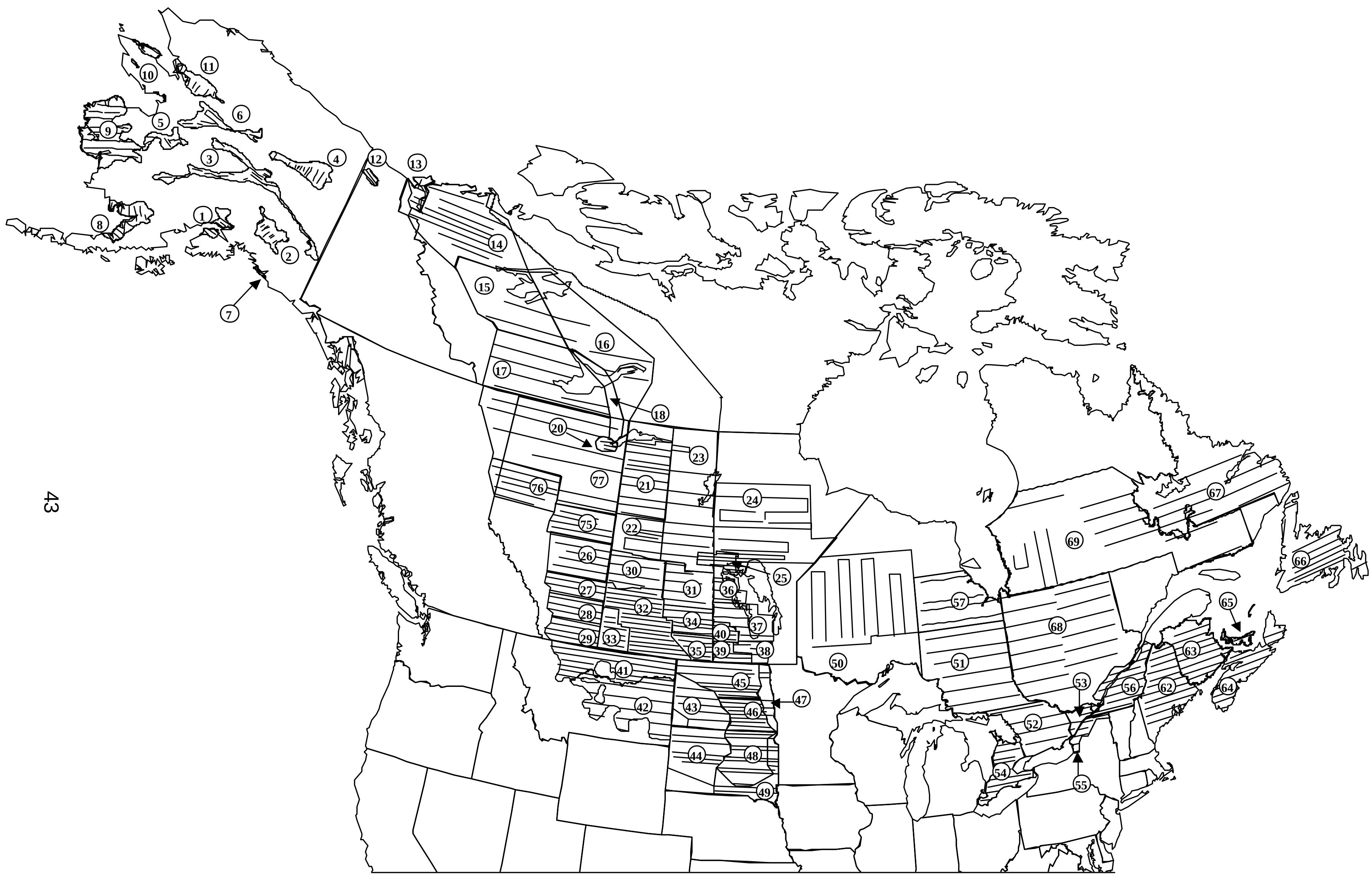
[a]Canadian Wildlife Service
[b]State, Provincial, or Tribal Conservation Agency
[c]Ducks Unlimited - Canada
[d]Other organization
All others - U.S. Fish and Wildlife Service



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

Appendix D. May pond estimates and standard errors (in thousands) in portions of Prairie Canada and the north-central U.S.

	Prairie Canada [a]		North-central U.S. [a]		Total	
Year	$\hat{N}$	$\hat{SE}$	$\hat{N}$	$\hat{SE}$	$\hat{N}$	$\hat{SE}$
1961	1977.2	165.4				
1962	2369.1	184.6				
1963	2482.0	129.3				
1964	3370.7	173.0				
1965	4378.8	212.2				
1966	4554.5	229.3				
1967	4691.2	272.1				
1968	1985.7	120.2				
1969	3547.6	221.9				
1970	4875.0	251.2				
1971	4053.4	200.4				
1972	4009.2	250.9				
1973	2949.5	197.6				
1974	6390.1	308.3	1840.8	197.2	8230.9	366.0
1975	5320.1	271.3	1910.8	116.1	7230.9	295.1
1976	4598.8	197.1	1391.5	99.2	5990.3	220.7
1977	2277.9	120.7	771.1	51.1	3049.1	131.1
1978	3622.1	158.0	1590.4	81.7	5212.4	177.9
1979	4858.9	252.0	1522.2	70.9	6381.1	261.8
1980	2140.9	107.7	761.4	35.8	2902.3	113.5
1981	1443.0	75.3	682.8	34.0	2125.8	82.6
1982	3184.9	178.6	1458.0	86.4	4642.8	198.4
1983	3905.7	208.2	1259.2	68.7	5164.9	219.2
1984	2473.1	196.6	1766.2	90.8	4239.3	216.5
1985	4283.1	244.1	1326.9	74.0	5610.0	255.1
1986	4024.7	174.4	1734.8	74.4	5759.5	189.6
1987	2523.7	131.0	1347.8	46.8	3871.5	139.1
1988	2110.1	132.4	790.7	39.4	2900.8	138.1
1989	1692.7	89.1	1289.9	61.7	2982.7	108.4
1990	2817.3	138.3	691.2	45.9	3508.5	145.7
1991	2493.9	110.2	706.1	33.6	3200.0	115.2
1992	2783.9	141.6	825.0	30.8	3608.9	144.9
1993	2261.1	94.0	1350.6	57.1	3611.7	110.0
1994	3769.1	173.9	2215.6	88.8	5984.8	195.3
1995	3892.5	223.8	2442.9	106.8	6335.4	248.0
1996	5002.6	184.9	2479.7	135.3	7482.2	229.1
1997	5061.0	180.3	2397.2	94.4	7458.2	203.5
1998	2521.7	133.8	2065.3	89.2	4586.9	160.8
1999	3862.0	157.2	2842.3	256.8	6704.3	301.1
2000	2422.2	96.1	1524.5	99.9	3946.9	138.6
2001	2747.2	115.6	1893.2	91.5	4640.4	147.4
2002	1439.0	105.0	1281.1	63.4	2720.0	122.7
2003	3522.3	151.8	1667.8	67.4	5707.1	168.7

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

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

	British Columbia[b]		California		Colorado		Michigan		Minnesota		Nebraska	
Year	Total Ducks	Mallards	Total Ducks	Mallards	Total Ducks	Mallards	Total Ducks	Mallards	Total Ducks	Mallards	Total Ducks	Mallards
1955	[c]										101.5	32.0
1956											94.9	25.8
1957											154.8	26.8
1958											176.4	28.1
1959											99.7	12.1
1960					51.1	32.4					143.6	21.6
1961					58.7	32.4					141.8	43.3
1962					72.7	59.4					68.9	35.8
1963					78.0	62.1					114.9	37.4
1964					110.8	64.0					124.8	66.8
1965					111.9	60.2					52.9	20.8
1966					100.8	57.8					118.8	36.0
1967					122.2	69.7					96.2	27.6
1968					145.4	73.3			368.5	83.7	96.5	24.1
1969					138.1	57.5			345.3	88.8	100.6	26.7
1970					114.8	46.5			343.8	113.9	112.4	24.5
1971					121.4	48.3			286.9	78.5	96.0	22.3
1972					94.6	45.0			237.6	62.2	91.7	15.2
1973					112.3	45.2			415.6	99.8	85.5	19.0
1974					129.0	56.9			332.8	72.8	67.4	19.5
1975					156.7	38.2			503.3	175.8	62.6	14.8
1976					142.0	34.6			759.4	117.8	87.2	20.1
1977									536.6	134.2	152.4	24.1
1978					145.1	42.6			511.3	146.8	126.0	29.0
1979					103.2	30.9			901.4	158.7	143.8	33.6
1980					110.7	32.0			740.7	172.0	133.4	37.3
1981					188.4	36.4			515.2	154.8	66.2	19.4
1982					70.2	30.1			558.4	120.5	73.2	22.3
1983					130.6	44.2			394.2	155.8	141.6	32.2
1984					109.9	39.3			563.8	188.1	154.1	36.1
1985									580.3	216.9	75.4	28.4
1986					105.0	42.0			537.5	233.6	69.5	15.1
1987					125.4	62.0			614.9	192.3	120.5	41.7
1988	6.0	0.6			123.1	63.4			752.8	271.7	126.5	27.8
1989	5.5	0.5			122.9	48.2			1021.6	273.0	136.7	18.7
1990	5.9	0.6			131.9	56.5			886.8	232.1	81.4	14.7
1991	7.4	0.7			124.1	49.8			868.2	225.0	126.3	26.0
1992	7.7	0.7	497.4	375.8	101.3	46.6	665.8[d]	384.0	1127.3	360.9	63.4	24.4
1993	7.1	0.6	666.7	359.0	145.6	68.7	813.5	454.3	875.9	305.8	92.8	23.8
1994	7.8	0.6	483.2	311.7	141.3	68.9	848.3	440.6	1320.1	426.5	118.9	17.5
1995	8.7	0.9	589.7	368.5	123.5	54.5	812.6	559.8	912.2	319.4	142.9	42.0
1996	8.3	0.6	843.7	536.7	142.8	60.1	790.2	395.8	1062.4	314.8	132.3	38.9
1997	8.1	0.6	824.3	511.3	107.5	51.9	886.3	489.3	953.0	407.4	128.3	26.1
1998	9.2	1.1	706.8	353.9	89.1	44.8	1305.2	567.1	739.6	368.5	155.7	43.4
1999	8.3	0.8	851.0	560.1	101.0	50.2	824.8	494.3	716.5	316.4	251.2[e]	81.1
2000	7.8	0.6	562.4	347.6			1121.7	462.8	815.3	318.1	178.8	54.3
2001	7.4	0.6	413.5	302.2	26.5[e]	11.8	673.5	358.2	761.3	320.6	225.3	69.2
2002	8.6	0.5	392.0	265.3			997.3	336.8	1224.1	366.6	141.8	50.6
2003	8.2	0.5	533.7	337.1			587.2	294.1	748.9	280.5	96.7	32.9

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

Appendix E. Continued.

	Nevada		Northeastern US[†]		Oregon		Washington		Wisconsin	
Year	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								
1968	10.5	1.2								
1969	18.2	1.4								
1970	19.6	1.5								
1971	18.3	1.1								
1972	19.0	0.9								
1973	20.7	0.7							364.4	114.5
1974	17.1	0.7							336.8	96.0
1975	14.5	0.6							437.4	109.0
1976	13.6	0.6							326.0	104.0
1977	16.5	1.0							277.5	91.5
1978	11.1	0.6							238.1	63.7
1979	12.8	0.6					98.6	32.1	328.7	82.6
1980	16.6	0.9					113.7	34.1	288.9	131.9
1981	26.9	1.6					148.3	41.8	516.6	139.9
1982	21.0	1.1					146.4	49.8	235.8	82.6
1983	24.3	1.5					149.5	47.6	275.0	143.7
1984	24.0	1.4					196.3	59.3	256.9	91.0
1985	24.9	1.5					216.2	63.1	257.8	76.6
1986	26.4	1.3					203.8	60.8	299.8	113.3
1987	33.4	1.5					183.6	58.3	364.5	114.3
1988	31.7	1.3					241.8	67.2	313.9	158.6
1989	18.8	1.3	1144.8	589.9			162.3	49.8	473.6	219.4
1990	22.2	1.3	1042.3	665.1			168.9	56.9	410.1	152.0
1991	14.6	1.4	1849.2	779.2			140.8	43.7	453.3	181.8
1992	12.4	0.9	1090.2	562.2			116.3	41.0	637.8	284.9
1993	14.1	1.2	1198.4	683.1			149.8	55.0	376.9	190.4
1994	19.2	1.4	1348.1	853.1	391.3	82.8	123.9	52.7	571.9	307.7
1995	17.9	1.0	1441.2	862.8	282.2	63.6	147.3	58.9	623.3	241.9
1996	26.4	1.7	1432.3	848.5	417.4	101.1	163.3	61.6	737.8	324.9
1997	25.3	2.5	1404.9	795.1	472.4	113.8	172.8	67.0	422.5	196.3
1998	27.9	2.1	1443.8	775.1	425.1	123.5	185.3	79.0	448.5	175.7
1999	29.9	2.3	1520.8	879.7	593.5	121.9	200.2	86.2	487.9	242.2
2000	26.1	2.1	1925.8	757.8			143.6	47.7	833.3	415.2
2001	22.2	2.0	1392.6	807.5			146.4	50.5	542.7	164.3
2002	11.7	0.7	1465.7	833.3			133.3	44.7	913.5	372.3
2003	21.1	1.7	1303.7	731.8			127.8	39.8	697.6	276.4

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

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

	Mallard		Gadwall		American wigeon		Green-winged teal		Blue-winged teal	
Year	$\hat{N}$	$\widehat{SE}$	$\hat{N}$	$\widehat{SE}$	$\hat{N}$	$\widehat{SE}$	$\hat{N}$	$\widehat{SE}$	$\hat{N}$	$\widehat{SE}$
1955	8777.3	457.1	651.5	149.5	3216.8	297.8	1807.2	291.5	5305.2	567.6
1956	10452.7	461.8	772.6	142.4	3145.0	227.8	1525.3	236.2	4997.6	527.6
1957	9296.9	443.5	666.8	148.2	2919.8	291.5	1102.9	161.2	4299.5	467.3
1958	11234.2	555.6	502.0	89.6	2551.7	177.9	1347.4	212.2	5456.6	483.7
1959	9024.3	466.6	590.0	72.7	3787.7	339.2	2653.4	459.3	5099.3	332.7
1960	7371.7	354.1	784.1	68.4	2987.6	407.0	1426.9	311.0	4293.0	294.3
1961	7330.0	510.5	654.8	77.5	3048.3	319.9	1729.3	251.5	3655.3	298.7
1962	5535.9	426.9	905.1	87.0	1958.7	145.4	722.9	117.6	3011.1	209.8
1963	6748.8	326.8	1055.3	89.5	1830.8	169.9	1242.3	226.9	3723.6	323.0
1964	6063.9	385.3	873.4	73.7	2589.6	259.7	1561.3	244.7	4020.6	320.4
1965	5131.7	274.8	1260.3	114.8	2301.1	189.4	1282.0	151.0	3594.5	270.4
1966	6731.9	311.4	1680.4	132.4	2318.4	139.2	1617.3	173.6	3733.2	233.6
1967	7509.5	338.2	1384.6	97.8	2325.5	136.2	1593.7	165.7	4491.5	305.7
1968	7089.2	340.8	1949.0	213.9	2298.6	156.1	1430.9	146.6	3462.5	389.1
1969	7531.6	280.2	1573.4	100.2	2941.4	168.6	1491.0	103.5	4138.6	239.5
1970	9985.9	617.2	1608.1	123.5	3469.9	318.5	2182.5	137.7	4861.8	372.3
1971	9416.4	459.5	1605.6	123.0	3272.9	186.2	1889.3	132.9	4610.2	322.8
1972	9265.5	363.9	1622.9	120.1	3200.1	194.1	1948.2	185.8	4278.5	230.5
1973	8079.2	377.5	1245.6	90.3	2877.9	197.4	1949.2	131.9	3332.5	220.3
1974	6880.2	351.8	1592.4	128.2	2672.0	159.3	1864.5	131.2	4976.2	394.6
1975	7726.9	344.1	1643.9	109.0	2778.3	192.0	1664.8	148.1	5885.4	337.4
1976	7933.6	337.4	1244.8	85.7	2505.2	152.7	1547.5	134.0	4744.7	294.5
1977	7397.1	381.8	1299.0	126.4	2575.1	185.9	1285.8	87.9	4462.8	328.4
1978	7425.0	307.0	1558.0	92.2	3282.4	208.0	2174.2	219.1	4498.6	293.3
1979	7883.4	327.0	1757.9	121.0	3106.5	198.2	2071.7	198.5	4875.9	297.6
1980	7706.5	307.2	1392.9	98.8	3595.5	213.2	2049.9	140.7	4895.1	295.6
1981	6409.7	308.4	1395.4	120.0	2946.0	173.0	1910.5	141.7	3720.6	242.1
1982	6408.5	302.2	1633.8	126.2	2458.7	167.3	1535.7	140.2	3657.6	203.7
1983	6456.0	286.9	1519.2	144.3	2636.2	181.4	1875.0	148.0	3366.5	197.2
1984	5415.3	258.4	1515.0	125.0	3002.2	174.2	1408.2	91.5	3979.3	267.6
1985	4960.9	234.7	1303.0	98.2	2050.7	143.7	1475.4	100.3	3502.4	246.3
1986	6124.2	241.6	1547.1	107.5	1736.5	109.9	1674.9	136.1	4478.8	237.1
1987	5789.8	217.9	1305.6	97.1	2012.5	134.3	2006.2	180.4	3528.7	220.2
1988	6369.3	310.3	1349.9	121.1	2211.1	139.1	2060.8	188.3	4011.1	290.4
1989	5645.4	244.1	1414.6	106.6	1972.9	106.0	1841.7	166.4	3125.3	229.8
1990	5452.4	238.6	1672.1	135.8	1860.1	108.3	1789.5	172.7	2776.4	178.7
1991	5444.6	205.6	1583.7	111.8	2254.0	139.5	1557.8	111.3	3763.7	270.8
1992	5976.1	241.0	2032.8	143.4	2208.4	131.9	1773.1	123.7	4333.1	263.2
1993	5708.3	208.9	1755.2	107.9	2053.0	109.3	1694.5	112.7	3192.9	205.6
1994	6980.1	282.8	2318.3	145.2	2382.2	130.3	2108.4	152.2	4616.2	259.2
1995	8269.4	287.5	2835.7	187.5	2614.5	136.3	2300.6	140.3	5140.0	253.3
1996	7941.3	262.9	2984.0	152.5	2271.7	125.4	2499.5	153.4	6407.4	353.9
1997	9939.7	308.5	3897.2	264.9	3117.6	161.6	2506.6	142.5	6124.3	330.7
1998	9640.4	301.6	3742.2	205.6	2857.7	145.3	2087.3	138.9	6398.8	332.3
1999	10805.7	344.5	3235.5	163.8	2920.1	185.5	2631.0	174.6	7149.5	364.5
2000	9470.2	290.2	3158.4	200.7	2733.1	138.8	3193.5	200.1	7431.4	425.0
2001	7904.0	226.9	2679.2	136.1	2493.5	149.6	2508.7	156.4	5757.0	288.8
2002	7503.7	246.5	2235.4	135.4	2334.4	137.9	2333.5	143.8	4206.5	227.9
2003	7949.7	267.3	2549.0	169.9	2551.4	156.9	2678.5	199.7	5518.2	312.7

Appendix F. Continued.

	Northern shoveler		Northern pintail		Redhead		Canvasback		Scaup	
Year	$\hat{N}$	$\hat{SE}$	$\hat{N}$	$\hat{SE}$	$\hat{N}$	$\hat{SE}$	$\hat{N}$	$\hat{SE}$	$\hat{N}$	$\hat{SE}$
1955	1642.8	218.7	9775.1	656.1	539.9	98.9	589.3	87.8	5620.1	582.1
1956	1781.4	196.4	10372.8	694.4	757.3	119.3	698.5	93.3	5994.1	434.0
1957	1476.1	181.8	6606.9	493.4	509.1	95.7	626.1	94.7	5766.9	411.7
1958	1383.8	185.1	6037.9	447.9	457.1	66.2	746.8	96.1	5350.4	355.1
1959	1577.6	301.1	5872.7	371.6	498.8	55.5	488.7	50.6	7037.6	492.3
1960	1824.5	130.1	5722.2	323.2	497.8	67.0	605.7	82.4	4868.6	362.5
1961	1383.0	166.5	4218.2	496.2	323.3	38.8	435.3	65.7	5380.0	442.2
1962	1269.0	113.9	3623.5	243.1	507.5	60.0	360.2	43.8	5286.1	426.4
1963	1398.4	143.8	3846.0	255.6	413.4	61.9	506.2	74.9	5438.4	357.9
1964	1718.3	240.3	3291.2	239.4	528.1	67.3	643.6	126.9	5131.8	386.1
1965	1423.7	114.1	3591.9	221.9	599.3	77.7	522.1	52.8	4640.0	411.2
1966	2147.0	163.9	4811.9	265.6	713.1	77.6	663.1	78.0	4439.2	356.2
1967	2314.7	154.6	5277.7	341.9	735.7	79.0	502.6	45.4	4927.7	456.1
1968	1684.5	176.8	3489.4	244.6	499.4	53.6	563.7	101.3	4412.7	351.8
1969	2156.8	117.2	5903.9	296.2	633.2	53.6	503.5	53.7	5139.8	378.5
1970	2230.4	117.4	6392.0	396.7	622.3	64.3	580.1	90.4	5662.5	391.4
1971	2011.4	122.7	5847.2	368.1	534.4	57.0	450.7	55.2	5143.3	333.8
1972	2466.5	182.8	6979.0	364.5	550.9	49.4	425.9	46.0	7997.0	718.0
1973	1619.0	112.2	4356.2	267.0	500.8	57.7	620.5	89.1	6257.4	523.1
1974	2011.3	129.9	6598.2	345.8	626.3	70.8	512.8	56.8	5780.5	409.8
1975	1980.8	106.7	5900.4	267.3	831.9	93.5	595.1	56.1	6460.0	486.0
1976	1748.1	106.9	5475.6	299.2	665.9	66.3	614.4	70.1	5818.7	348.7
1977	1451.8	82.1	3926.1	246.8	634.0	79.9	664.0	74.9	6260.2	362.8
1978	1975.3	115.6	5108.2	267.8	724.6	62.2	373.2	41.5	5984.4	403.0
1979	2406.5	135.6	5376.1	274.4	697.5	63.8	582.0	59.8	7657.9	548.6
1980	1908.2	119.9	4508.1	228.6	728.4	116.7	734.6	83.8	6381.7	421.2
1981	2333.6	177.4	3479.5	260.5	594.9	62.0	620.8	59.1	5990.9	414.2
1982	2147.6	121.7	3708.8	226.6	616.9	74.2	513.3	50.9	5532.0	380.9
1983	1875.7	105.3	3510.6	178.1	711.9	83.3	526.6	58.9	7173.8	494.9
1984	1618.2	91.9	2964.8	166.8	671.3	72.0	530.1	60.1	7024.3	484.7
1985	1702.1	125.7	2515.5	143.0	578.2	67.1	375.9	42.9	5098.0	333.1
1986	2128.2	112.0	2739.7	152.1	559.6	60.5	438.3	41.5	5235.3	355.5
1987	1950.2	118.4	2628.3	159.4	502.4	54.9	450.1	77.9	4862.7	303.8
1988	1680.9	210.4	2005.5	164.0	441.9	66.2	435.0	40.2	4671.4	309.5
1989	1538.3	95.9	2111.9	181.3	510.7	58.5	477.4	48.4	4342.1	291.3
1990	1759.3	118.6	2256.6	183.3	480.9	48.2	539.3	60.3	4293.1	264.9
1991	1716.2	104.6	1803.4	131.3	445.6	42.1	491.2	66.4	5254.9	364.9
1992	1954.4	132.1	2098.1	161.0	595.6	69.7	481.5	97.3	4639.2	291.9
1993	2046.5	114.3	2053.4	124.2	485.4	53.1	472.1	67.6	4080.1	249.4
1994	2912.0	141.4	2972.3	188.0	653.5	66.7	525.6	71.1	4529.0	253.6
1995	2854.9	150.3	2757.9	177.6	888.5	90.6	770.6	92.2	4446.4	277.6
1996	3449.0	165.7	2735.9	147.5	834.2	83.1	848.5	118.3	4217.4	234.5
1997	4120.4	194.0	3558.0	194.2	918.3	77.2	688.8	57.2	4112.3	224.2
1998	3183.2	156.5	2520.6	136.8	1005.1	122.9	685.9	63.8	3471.9	191.2
1999	3889.5	202.1	3057.9	230.5	973.4	69.5	716.0	79.1	4411.7	227.9
2000	3520.7	197.9	2907.6	170.5	926.3	78.1	706.8	81.0	4026.3	205.3
2001	3313.5	166.8	3296.0	266.6	712.0	70.2	579.8	52.7	3694.0	214.9
2002	2318.2	125.6	1789.7	125.2	564.8	69.0	486.6	43.8	3524.1	210.3
2003	3619.6	221.4	2558.2	174.8	636.8	56.6	557.6	48.0	3734.4	225.5

Appendix G. Total breeding duck estimates for the traditional and eastern survey areas in thousands.

	Traditional survey area [a]		Eastern survey area [b]	
Year	$\hat{N}$	$\hat{SE}$	$\hat{N}$	$\hat{SE}$
1955	39603.6	1264.0		
1956	42035.2	1177.3		
1957	34197.1	1016.6		
1958	36528.1	1013.6		
1959	40089.9	1103.6		
1960	32080.5	876.8		
1961	29829.0	1009.0		
1962	25038.9	740.6		
1963	27609.5	736.6		
1964	27768.8	827.5		
1965	25903.1	694.4		
1966	30574.2	689.5		
1967	32688.6	796.1		
1968	28971.2	789.4		
1969	33760.9	674.6		
1970	39676.3	1008.1		
1971	36905.1	821.8		
1972	40748.0	987.1		
1973	32573.9	805.3		
1974	35422.5	819.5		
1975	37792.8	836.2		
1976	34342.3	707.8		
1977	32049.0	743.8		
1978	35505.6	745.4		
1979	38622.0	843.4		
1980	36224.4	737.9		
1981	32267.3	734.9		
1982	30784.0	678.8		
1983	32635.2	725.8		
1984	31004.9	716.5		
1985	25638.3	574.9		
1986	29092.8	609.3		
1987	27412.1	562.1		
1988	27361.7	660.8		
1989	25112.8	555.4		
1990	25079.2	539.9	1057.8	108.6
1991	26605.6	588.7	1105.9	116.4
1992	29417.9	605.6	1346.9	112.2
1993	26312.4	493.9	1330.1	254.0
1994	32523.5	598.2	1272.3	126.6
1995	35869.6	629.4	1269.2	127.1
1996	37753.0	779.6	3665.2	372.3
1997	42556.3	718.9	2337.8	196.6
1998	39081.9	652.0	2953.5	194.5
1999	43435.8	733.9	3213.7	216.8
2000	41838.3	740.2	3204.1	345.7
2001	36177.5	633.1	3336.7	252.0
2002	31181.1	547.8	4398.6	303.5
2003	36225.1	664.7	3635.3	281.7

[a] Total ducks in the traditional survey area include species in Appendix F as well as black duck, ring-necked duck, goldeneyes, bufflehead, and ruddy duck.

[b] Species in the East includes those in Appendix H as well as gadwall, northern shoveler, northern pintail, and scaup

Appendix H. Breeding population estimates and standard errors (in thousands) for the 10 most abundant species of ducks in the eastern survey area, 1990-2003 [a].

Year	Mergansers		Mallard		American black duck		American wigeon		Am. green-winged teal		Lesser scaup		Ring-necked duck		Goldeneyes		Bufflehead		Scoters	
	$\hat{N}$	$\widehat{SE}$	$\hat{N}$	$\widehat{SE}$	$\hat{N}$	$\widehat{SE}$	$\hat{N}$	$\widehat{SE}$	$\hat{N}$	$\widehat{SE}$	$\hat{N}$	$\widehat{SE}$	$\hat{N}$	$\widehat{SE}$	$\hat{N}$	$\widehat{SE}$	$\hat{N}$	$\widehat{SE}$	$\hat{N}$	$\widehat{SE}$
1990	157.5	48.3	208.6	47.7	160.9	33.5	31.0	22.6	47.1	8.6	135.7	56.2	92.1	28.3	73.3	22.2	99.9	22.9	1.9	1.9
1991	263.9	78.6	169.8	34.5	126.0	35.3	45.4	21.8	42.2	14.4	43.5	16.4	158.1	30.2	138.4	44.3	94.1	32.1	6.4	5.3
1992	128.1	24.3	362.2	54.1	160.3	33.1	15.4	9.3	43.8	13.9	65.6	23.2	251.6	62.3	241.0	55.2	59.0	13.7	3.0	2.3
1993	164.9	23.7	333.8	49.7	124.6	25.6	9.4	7.4	47.4	9.9	288.6	235.3	248.1	65.1	90.2	32.6	13.1	3.6	0.0	0.0
1994	358.4	91.8	238.6	28.8	116.3	20.7	18.9	9.6	169.2	24.0	81.9	31.7	163.5	62.6	55.0	17.4	33.4	14.0	18.3	9.7
1995	376.3	89.7	212.6	41.1	234.5	46.6	13.8	7.9	96.2	14.1	62.0	20.5	195.6	51.0	9.2	3.7	26.5	8.8	5.0	4.8
1996	1083.1	279.6	387.6	63.6	562.2	97.1	34.7	17.0	436.2	86.9	38.5	15.1	611.9	98.7	410.3	169.7	50.6	12.5	23.6	10.5
1997	379.1	53.0	287.6	44.8	434.5	63.1	22.5	11.2	211.5	31.3	16.7	7.2	617.6	151.1	220.6	54.8	22.3	6.7	88.9	50.2
1998	327.4	38.8	363.2	71.3	542.1	55.4	83.6	24.6	299.5	81.1	20.1	10.6	361.8	53.8	715.7	124.7	44.6	10.3	159.4	47.1
1999	290.0	39.4	280.8	39.2	488.7	51.3	121.1	45.6	422.4	62.3	44.9	20.5	453.2	76.0	920.0	167.3	70.5	20.8	47.0	17.7
2000	400.0	54.0	212.3	31.3	396.9	53.9	41.7	20.4	201.6	28.7	19.8	9.1	618.8	71.3	946.5	318.7	49.3	11.3	182.1	59.0
2001	428.7	62.8	285.7	40.8	422.0	48.8	77.5	18.2	220.3	33.5	203.5	92.2	352.8	39.6	1032.2	202.4	95.0	20.9	178.6	49.4
2002	815.2	97.9	295.1	38.1	602.8	86.1	86.6	25.5	604.1	129.0	136.1	48.2	416.0	57.8	954.9	209.2	83.6	21.2	314.4	76.4
2003	569.1	63.9	383.1	57.8	532.6	60.2	79.0	32.8	452.3	120.1	101.2	21.2	399.3	50.3	767.9	212.1	66.3	16.7	237.1	66.9

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

Appendix I. July pond estimates and standard errors (in thousands) in portions of Prairie Canada and the north-central U.S.

	Prairie Canada		North-central U.S.[a]		Total	
Year	$\hat{N}$	$\hat{SE}$	$\hat{N}$	$\hat{SE}$	$\hat{N}$	$\hat{SE}$
1961	562.0	50.9				
1962	738.2	60.9				
1963	1813.2	98.7				
1964	1308.3	60.0				
1965	2231.0	113.9				
1966	1979.2	111.7				
1967	1498.4	94.5				
1968	802.9	50.7				
1969	1658.6	90.6				
1970	2613.3	143.9				
1971	2016.7	112.2				
1972	1312.5	77.8				
1973	1735.5	146.8				
1974	2753.2	136.1	609.6	45.1	3362.8	143.4
1975	2410.1	121.1	922.8	51.6	3332.9	131.7
1976	2137.6	101.6	786.8	46.8	2924.4	111.8
1977	1391.2	74.1	469.4	38.6	1860.6	83.6
1978	1520.3	63.5	697.1	41.4	2217.4	75.8
1979	1803.0	88.7	754.6	38.5	2557.6	96.7
1980	898.8	52.0	336.1	14.3	1234.9	53.9
1981	873.0	43.6	457.6	22.7	1330.6	49.2
1982	1662.0	85.9	882.2	50.3	2544.2	99.5
1983	2264.1	108.8	957.9	51.7	3222.0	120.4
1984	1270.3	90.1	1270.6	67.1	2540.9	112.4
1985	1563.1	91.2	753.5	39.3	2316.5	99.3
1986	1610.0	71.4	1056.9	46.1	2666.9	85.0
1987	1225.7	69.2	858.0	31.0	2083.7	75.8
1988	1009.2	63.8	518.7	26.4	1527.9	69.0
1989	932.4	47.9	731.3	32.8	1663.7	58.0
1990	1297.6	70.5	663.2	42.0	1960.7	82.1
1991	2562.8	127.2	865.0	40.9	3427.8	133.7
1992	1272.4	55.9	664.2	24.8	1936.8	61.2
1993	2292.5	102.6	1384.8	65.4	3677.4	121.7
1994	2329.9	105.7	1079.7	43.2	3409.6	114.2
1995	1773.4	95.3	1576.5	69.6	3350.0	118.0
1996	2648.2	94.2	1218.2	64.9	3866.4	114.3
1997	2489.7	96.5	1347.1	54.1	3836.8	110.6
1998	2850.7	149.0	1353.3	56.8	4203.9	159.5
1999	2047.1	124.3	1036.7	73.8	3083.8	144.6
2000	2450.8	95.9	1401.5	82.1	3852.4	126.3
2001	1837.9	73.0	1031.7	56.5	2869.7	92.3
2002	996.7	118.7	839.6	43.5	1836.3	126.5
2003	1465.5	63.8	1018.4	39.4	2483.8	75.0

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

Appendix J. Population indices (in thousands) for North American Canada goose populations, 1969-2003.

	Canada goose population														
Year	North Atlantic[a,b]	Atlantic[a,b]	Atlantic Flyway Resident[a]	Southern James Bay[a]	Miss. Valley[a]	Miss. Flyway Giant[a]	Eastern Prairie[a]	Western Prairie & Great Plains[c]	Tall Grass Prairie[c,g]	Short Grass Prairie[d]	Hi-line[d]	Rocky Mountain[d]	Dusky[d]	Cackling[e]	Aleutian[h]
1969/70										151.2	44.2	25.8	22.5		
1970/71									131.1	148.5	40.5	25.4	19.8		
1971/72							124.7		159.6	160.9	31.4	36.7	17.9		
1972/73							137.6		147.2	259.4	35.6	37.2	15.8		
1973/74							119.9		158.5	153.6	24.5	43.0	18.6		
1974/75							144.4		125.6	123.7	41.2	46.9	26.5		0.8
1975/76							216.5		201.5	242.5	55.6	51.7	23.0		0.9
1976/77							163.8		167.9	210.0	67.6	54.8	24.1		1.3
1977/78							179.7		211.3	134.0	65.1	59.4	24.0		1.5
1978/79							99.4		180.5	163.7	33.8	64.6	25.5	64.1	1.6
1979/80									155.2	213.0	67.3	75.9	22.0	127.4	1.7
1980/81							125.5		244.9	168.2	94.4	93.2	23.0	87.1	2.0
1981/82							131.8	175.0	268.6	156.0	81.9	64.7	17.7	54.1	2.7
1982/83							155.1	242.0	165.5	173.2	75.9	71.4	17.0	26.2	3.5
1983/84							135.6	150.0	260.7	143.5	39.5	62.6	10.1	25.8	3.8
1984/85							158.4	230.0	197.3	179.1	76.4	92.4	7.5	32.1	4.2
1985/86							194.8	115.0	189.4	181.0	69.8	71.7	12.2	51.4	4.3
1986/87							203.2	324.0	159.0	190.9	98.1	75.3		54.8	5.0
1987/88		118.0					209.2	272.1	306.1	139.1	66.8	75.7	12.2	69.9	5.4
1988/89			396.0		657.8		210.2	330.3	213.0	284.8	100.1	92.3	11.8	76.8	5.8
1989/90			236.6	82.4	825.0		231.8	271.0	146.5	378.1	105.9	135.1	11.7	110.2	6.3
1990/91			305.7	108.1	620.3		211.8	390.0	305.1	508.5	116.6	98.4		104.6	7.0
1991/92			439.2	91.6	782.3		202.5	341.9	276.3	620.2	140.5	134.1	18.0	149.3	7.7
1992/93		91.3	647.4	77.3	547.1	810.9	157.5	318.0	235.3	328.2	118.5	91.9	16.7	164.3	11.7
1993/94		40.1	648.3	95.7	741.2	1002.9	210.8	272.5	224.2	434.1	164.3	90.9	11.0	152.5	15.7
1994/95		29.3	780.0	94.0	796.2	1030.6	204.6	352.5	245.0	697.8	174.4	120.2	8.5	161.4	19.2
1995/96	99.6	46.1	932.6	123.0	593.9	1132.4	190.4	403.3	264.0	561.2	167.5	129.3		134.6	24.6
1996/97	64.4	63.2	1013.3	95.1	650.8	1038.7	199.3	453.4	262.9	460.7	148.5	113.8	11.2[h]	205.1	24.0
1997/98	53.9	42.2	970.1	117.1	370.5	1212.7	125.9	482.3	331.8	440.6	191.0	116.7	21.3[h]	148.6	29.0
1998/99	96.8	77.5	999.5	136.6	860.8	1234.1	206.7	467.2	548.2	403.2	119.5	132.7	13.8[h]	181.4	28.6
1999/00	58.0	93.2	1024.5	89.1	865.2	1497.4	275.1	594.7	295.7	200.0	270.7	122.3	15.5[h]	178.0	33.5
2000/01	57.8	146.7	1017.2	102.7	386.6	1371.3	215.4	682.7	149.1	164.1	252.9	119.7	17.3[h]	186.9	29.8
2001/02	62.0	164.8	966.0	76.3	544.0	1612.3	216.3	710.3	504.7	160.9	217.1	111.9	17.2[h]	136.1	36.8
2002/03	60.8	156.9	1083.2	106.5	477.0	1635.0	229.2	561.0	611.9	156.7	205.9	124.7	16.7[h]	176.0	62.4

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

Appendix K. Population indices (in thousands) for light goose, greater white-fronted goose, brant, emperor goose, and tundra swan populations during 1969-2003.

	Light geese				White-fronted geese		Brant		Emperor geese[a]	Tundra swans	
Year	Greater snow geese[a]	Mid-continent[b]	Western Central Flyway[c]	Western Arctic & Wrangel[d]	Mid-continent[d]	Pacific[e]	Atlantic[c]	Pacific[c, f]		Western[c]	Eastern[c]
1969/70	89.6	717.0						141.7		31.0	55.0
1970/71	123.3	1070.1					151.0	149.2		98.8	58.2
1971/72	134.8	1313.4					73.2	124.8		82.8	62.8
1972/73	143.0	1025.3	11.6				40.8	125.0		33.9	57.1
1973/74	165.0	1189.8	16.2				87.7	130.7		69.7	64.2
1974/75	153.8	1096.6	26.4				88.4	123.4		54.3	66.6
1975/76	165.6	1562.4	23.2				127.0	122.0		51.4	78.6
1976/77	160.0	1150.3	33.6				73.6	147.0		47.3	76.2
1977/78	192.6	1966.4	31.1				42.8	162.9		45.6	70.2
1978/79	170.1	1285.7	28.2			73.1	43.5	129.4		53.5	78.6
1979/80	180.0	1398.1	30.5	528.1		93.5	69.2	146.4		65.2	60.4
1980/81	170.8	1406.7	37.6	204.2		116.5	97.0	194.2	93.3	83.6	92.8
1981/82	163.0	1794.0	50.0	759.9		91.7	104.5	121.0	100.6	91.3	72.9
1982/83	185.0	1755.4	76.1	354.1		112.9	123.5	109.3	79.2	67.3	86.5
1983/84	225.4	1494.5	60.1	547.6		100.2	127.3	133.4	71.2	61.9	81.1
1984/85	260.0	1973.0	63.0	466.3		93.8	146.3	144.8	58.8	48.8	93.9
1985/86	303.5	1449.3	96.6	549.8		107.1	110.4	136.2	42.0	66.2	90.9
1986/87	255.0	1913.8	87.6	521.7		130.6	109.4	108.9	51.7	52.8	94.4
1987/88		1750.5	46.2	525.3		161.5	131.2	147.0	53.8	59.2	76.2
1988/89	363.2	1956.1	67.6	441.0		218.8	138.0	135.2	45.8	78.7	90.6
1989/90	368.3	1724.3	38.6	463.9		240.8	135.4	151.6	67.6	40.1	89.7
1990/91	352.6	2135.8	104.6	708.5		236.5	147.7	131.7	71.0	47.6	97.4
1991/92	448.1	2021.9	87.8	690.1		230.9	184.8	117.7	71.3	63.7	109.8
1992/93	498.4	1744.2	45.1	639.3	622.9	295.1	100.6	124.4	52.5	62.6[g]	76.6
1993/94	591.4	2200.8	84.9	569.2	676.3	324.8	157.2	130.0	57.3	79.4	84.5
1994/95	616.6	2725.1	146.4	478.2	727.3	277.5	148.2	133.7	51.2	52.9[g]	81.3
1995/96	669.1	2398.1	93.1	501.9	1129.4	344.1	105.9	126.9	80.3	98.1	79.0
1996/97	657.5	2850.9	127.2	366.3	742.5	319.0	129.1	157.9	57.1	122.5	86.1
1997/98	695.6	2977.2	103.5	416.4	622.2	413.1	138.0	138.4	39.7	70.5	96.6
1998/99	803.4	2575.7	236.4	354.3	1058.3	393.9	171.6	129.2	54.6	119.8	109.0
1999/00	813.9	2397.3	137.5	579.0	963.1	353.6	157.2	135.0	62.6	89.6	103.1
2000/01	837.4	2341.3	105.8	656.8	1067.6	433.7	145.3	124.7	84.4	87.3	98.2
2001/02	639.3[h]	2696.1	99.9	448.1	712.3	358.5	181.6	136.7	58.7	58.7	103.8
2002/03	631.5[h]	2435.0	105.9	596.9	626.7	422.2	164.5	106.5	71.2	102.7	108.2

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