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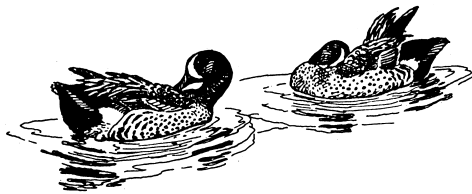
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TRENDS IN DUCK BREEDING POPULATIONS, 1955-2007

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Division of Migratory Bird Management
11510 American Holly Drive
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Administrative Report – July 11, 2007



This report summarizes information about the status of duck populations and wetland habitats during spring 2007, focusing on areas encompassed by the U.S. Fish and Wildlife (USFWS) and Canadian Wildlife Services' (CWS) Waterfowl Breeding Population and Habitat Survey. This report does not include information from surveys conducted by State or Provincial agencies. In the traditional survey area, which includes strata 1-18, 20-50, and 75-77 (Fig. 1), the total duck population estimate (excluding scoters [*Melanitta* spp.], eiders [*Somateria* and *Polysticta* spp.], long-tailed ducks [*Clangula hyemalis*], mergansers [*Mergus* and *Lophodytes* spp.], and wood ducks [*Aix sponsa*]) was 41.2 ± 0.8 [SE] million birds. This was 14% greater than last year's estimate of 36.2 ± 0.6 million birds and 24% above the 1955-2006 long-term average^a (Tables 1-12). Mallard (*Anas platyrhynchos*) abundance was 8.0 ± 0.3 million birds, which was 10% above last year's estimate of 7.3 ± 0.2 million birds and 7% above the long-term average (Appendix A). Blue-winged teal (*A. discors*) abundance was 6.7 ± 0.4 million birds. This value was the third highest estimate since 1955, 14% greater than last year's estimate of 5.9 ± 0.3 million birds, and 48% above the long-term average. Estimated abundances of gadwall (*A. strepera*; 3.4 ± 0.2 million) and Northern shovelers (*A. clypeata*; 4.6 ± 0.2 million) were also above those of last year (+19% and +24%, respectively) and well above their long-term averages (+96% and +106%, respectively). Estimated abundance of American wigeon (*A. americana*; 2.8 ± 0.2 million) was 29% greater than last year but similar to the long-term average. Estimated abundances of green-winged teal (*A. crecca*; 2.9 ± 0.2 million), redheads (*Aythya americana*; 1.0 ± 0.08 million), and canvasbacks (*A. valisineria*; 0.9 ± 0.09 million) were similar to last year's, but were each >50% above their long-term averages. Abundances of Northern shovelers, redheads, and canvasbacks were the highest ever estimated in this survey area, and the

^a Populations are considered to have changed from the previous year or long-term average if observed significance value associated with change is ≤ 0.10 . Actual p-values are given in tables.

abundance of green-winged teal was the second highest estimated for this region. Estimates for Northern pintails (*Anas acuta*; 3.3 ± 0.2 million) and scaup (*Aythya affinis* and *A. marila* combined; 3.5 ± 0.2 million) were unchanged from those of 2006, and remained below long-term averages (-19% and -33%, respectively).

Overall, habitat conditions for breeding waterfowl in 2007 were similar or slightly improved compared to conditions in 2006. The total pond estimate (Prairie Canada and U.S. combined) was 7.0 ± 0.3 million ponds. This was 15% greater than last year's estimate of 6.1 ± 0.2 million ponds and 44% higher than the long-term average of 4.9 ± 0.03 million ponds. For the third year in a row, habitat conditions were good or excellent in the northern grasslands and parklands of southern Saskatchewan and southern Manitoba. Three years of plentiful precipitation has generally maintained or improved the quality of the wetland and upland vegetation in this region. The 2007 estimate of ponds in Prairie Canada was 5.0 ± 0.3 million. This was a 13% increase from last year's estimate (4.4 ± 0.2 million), 49% above the 1955-2006 average (3.4 ± 0.03 million), and the fourth highest number of Canadian ponds on record (Table 12; Figure 2). However, some areas of the parklands of southern Saskatchewan experienced severe flooding resulting from record amounts of spring runoff and some nests may have flooded. The southern grasslands of Saskatchewan and Manitoba remained dry, and were in fair to poor condition. Conditions in southern Alberta, which have generally been either fair or poor for much of the last decade, improved for the second consecutive year, largely due to melting of large snowpacks and wet soil conditions.

Habitat conditions in U.S. prairies were highly variable, ranging from good to poor. The 2007 pond estimate for the north-central U.S. of 2.0 ± 0.1 million was 19% greater than last year's estimate (1.6 ± 0.09 million) and 29% above the long-term average (1.5 ± 0.02 million). The drought conditions seen last year in the Eastern Dakotas were improved by abundant fall and winter precipitation, especially in eastern South Dakota. Exceptionally heavy rain events during May helped to improve conditions in eastern Montana and parts of the Dakotas. Unfortunately, the area affected by this rain did not include the high quality duck habitat of the Missouri Coteau region in the Eastern Dakotas. Although this precipitation occurred after many ducks had moved through the survey area, it probably benefited renesting birds and improved vegetation quality in wetlands and uplands, thereby aiding brood survival.

Habitat in the bush regions of the traditional survey area (Alaska, Northern Manitoba, Northern Saskatchewan, Western Ontario) was mostly classified as good due to a normal spring ice break-up and generally good water conditions in the beaver ponds, river deltas, and small lakes and ponds that are characteristic of this region. Spring phenology and water levels varied slightly in local areas. For example, spring was slightly late in the Old Crow Flats, slightly early in the Yukon Delta, and slightly drier in the Yukon Flats compared to other regions in Alaska, but habitat conditions were still generally good across the bush region. The exceptions were the somewhat drier conditions in northwest Saskatchewan and central Alberta and the potential for some flooding in northern Saskatchewan and Manitoba.

The boreal forests of the eastern survey area were generally in good or excellent condition this spring, except for a few drier patches in Northern Quebec that were in fair condition. Spring arrived early in the James and Hudson Bay Lowlands for the 3rd consecutive year, and habitat conditions were classified as excellent. In eastern and southern Ontario, the winter snowpack was below normal; however, a good frost seal, spring runoff, and spring storms left this region in good condition at the time of the survey. Storms following the survey period produced local flooding of some nesting habitat. Wetland basins in Quebec were adequately charged and spring temperatures were near normal. There was some potential for flooding of nests in Maine and the Maritimes due to heavy rain during mid-May, but this was not as problematic as it had been during the past few years. Newfoundland and Labrador experienced a late spring compared to the last 5 years, with the northernmost part of the survey region in Labrador still frozen in late May. However, this region was still considered in good condition.

In 2005, the USFWS and CWS began to integrate several previously-independent waterfowl surveys of eastern North America. Specifically, new analytical methods were used to generate composite estimates from USFWS and CWS survey data, total indicated bird definitions for American black ducks were modified to provide a common index across the surveys, and adjustments were made to the geographic stratification of eastern North America. Additional refinements to analytical methods are incorporated in the estimates presented in this report. For these reasons, population estimates presented in this report for the eastern survey area (that encompasses strata 51-72) are not directly comparable with estimates presented in reports presented prior to 2006. Specifically, composite estimates are presented for only a portion of the eastern survey area and include data only from strata 51, 52, 63, 64, 66, 67, 68, 70, 71, and 72. These strata were chosen for composite estimation because at least one survey (i.e., that is either the CWS or USFWS survey) was conducted for each of these strata for the full period of record of the eastern survey (1990-2007). In cases where the USFWS has traditionally not recorded observations to the species level, estimates are provided only for multiple-species groupings (i.e., scoters, mergansers, goldeneyes, scaup). As soon as possible, we intend to produce species-specific estimates based solely on CWS plot survey data for: surf scoter (*Melanitta perspicillata*) black scoter (*M. nigra*), hooded merganser (*Lophodytes cucullatus*), common merganser (*Mergus merganser*), red-breasted merganser (*M. serrator*), common goldeneye (*Bucephala clangula*), Barrow's goldeneye (*B. islandica*), and greater and lesser scaup. Analytical methods applied to eastern survey area data and results will be presented in greater detail in the 2007 Waterfowl Status Report. We anticipate additional refinements to composite estimates for the eastern survey area in the coming years as the USFWS and CWS work toward a final integrated survey design and analytical approach. Population estimates for all species were similar to last year and to the 1990-2006 averages (Table 13; Figures 6-7). The exceptions were American black ducks (*Anas rubripes*; 539,000 ducks, +16%) and ring-necked ducks (*Aythya collaris*; 617,000 ducks, +20%), which increased over the 1990-2006 averages.

The data in this report were contributed by the following individuals:

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

Northern Alberta, Northeastern British Columbia, and Northwest Territories (Strata 13-18, 20, and 77): C. Ferguson and D. Benning^d

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

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

Air E. Huggins and J. Mitchell
Ground J. Leafloor^a, F. Baldwin^a, K. Froggatt^b, E. Hofman^b, M. Barr^c, D. Chambers^c,
N. Clements^a, C. Downie^a, T. Gunderson^a, S. Leach^a, T. Matthews^c,
I. McFarlane^c, B. Peers^c, J. Pierce^c, C. Twerdoelib^a, and N. Wiebe^a

Southern Saskatchewan (Strata 30-35):

Air P. Thorpe, T. Lewis, B. Larned, and G. Zimmerman
Ground D. Nieman^a, K. Dufour^a, K. Warner^a, A. Williams^a, D. Caswell^a, M. Schuster^a,
G. Ball^b, J. Caswell^c, P. Rakowski^a, B. Bartzen^a, L. Brennan^c, A. Crosby^a,
P. Nieman^a, D. Paslowski^a, L. Sitter^a, K. Wilkins, N. Astleford^a, M. Gillespie^b,
C. Meuckon^a, D. Routhier^a, and D. Walker^a

Southern Manitoba (Strata 25 and 36-40):

Air B. Larned and G. Zimmerman
Ground D. Caswell^a, M. Schuster^a, G. Ball^b, J. Caswell^c, P. Rakowski^a, N. Astleford^a,
M. Gillespie^b, C. Meuckon^a, D. Routhier^a, and D. Walker^a

Montana and Western Dakotas (Strata 41-44):

Air R. Bentley and P. Fashbender
Ground P. Garrettson, K. Fleming, and E. Silverman

Eastern Dakotas (Strata 45-49):

Air J. Solberg and R. Cox^d
Ground K. Kruse, S. Beauchaine, J. Gleason, M. Grovijahn^b, and J. Hoskins

Western Ontario and Central Quebec (Strata 50, 68-69):

Air J. Wortham, G. Boomer, and D. Fronczak
Helicopter D. Holtby^b, G. Boomer, and P. Padding

Central and Eastern Ontario, Hudson and James Bay Lowlands of Ontario, and Southern Quebec (Strata 51-54, 56-59): M. Koneff, D. Forsell, and R. Raftovich

Maine and Maritimes (Strata 62-67, 70): J. Bidwell and J. Goldsberry^d

Canadian Wildlife Service helicopter plot survey

Quebec: D. Bordage^a, C. Lepage^a, and S. Orichefsky^a

Ontario: R. Ross^a, D. Fillman^a, D. McNicol^a, and J. Bionda^d

New Brunswick and Nova Scotia: B. Pollard^a

Labrador and Newfoundland: S. Gilliland^a

Habitat information was provided by U.S. Fish and Wildlife Service and Canadian Wildlife Service biologists.

^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

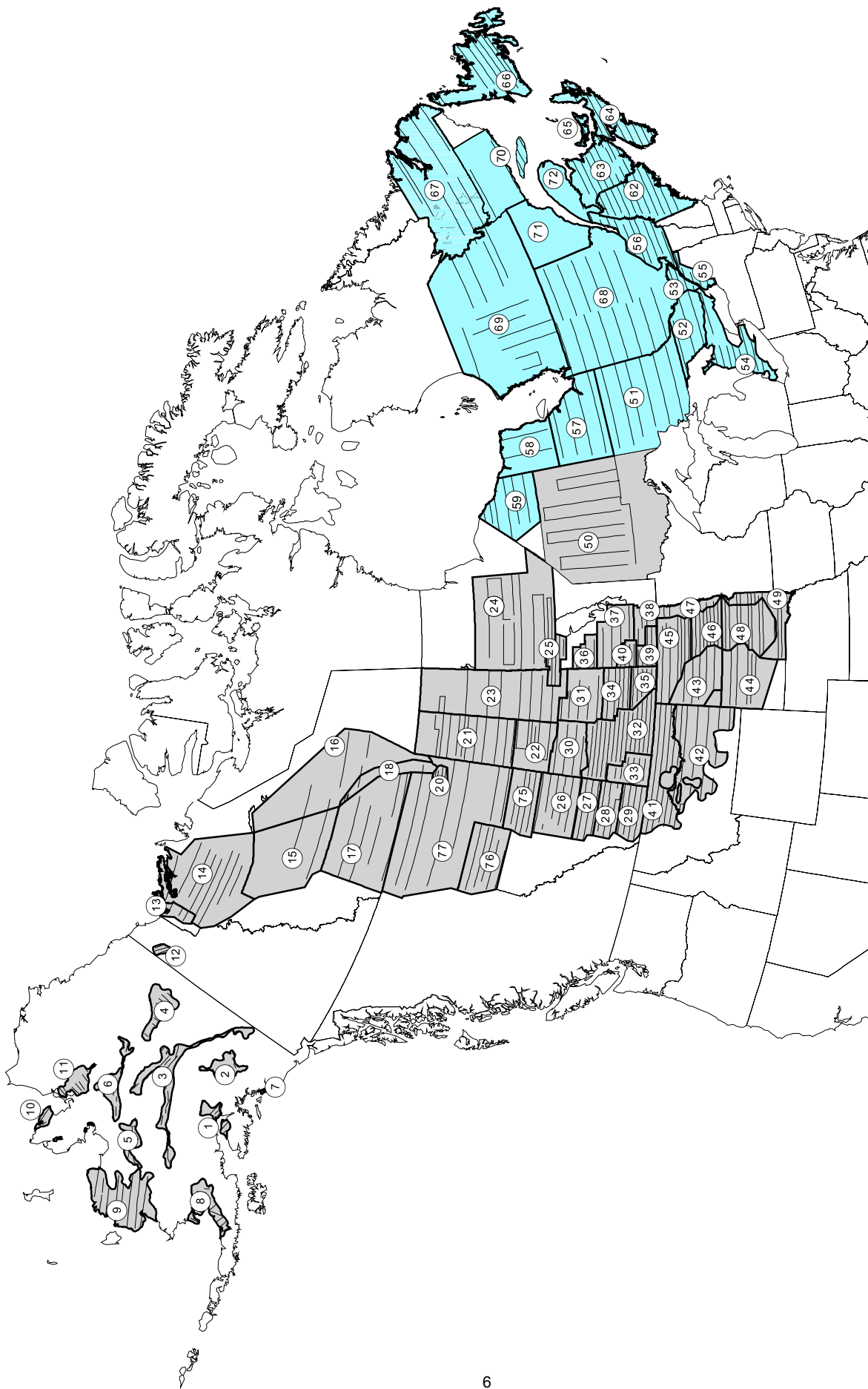


Table 1. Duck breeding population estimates (in thousands) for regions in the traditional survey area.

Region	2007	Change from 2006			Change from LTA		
		2006	%	<i>P</i>	LTA ^a	%	<i>P</i>
Alaska-Yukon Territory – Old Crow Flats	5,690	4,755	+20	<0.001	3,574	+59	<0.001
C. & N. Alberta – N.E. British Columbia - Northwest Territories	6,137	5,132	+20	0.006	7,114	-14	0.001
N. Saskatchewan- N. Manitoba - W. Ontario	3,197	2,711	+18	0.280	3,541	-10	0.415
S. Alberta	4,293	4,581	-6	0.290	4,289	0	0.983
S. Saskatchewan	11,036	10,096	+9	0.128	7,401	+49	<0.001
S. Manitoba	1,322	1,796	-26	<0.001	1,549	-15	0.001
Montana and Western Dakotas	1,625	1,910	-15	0.036	1,619	0	0.951
Eastern Dakotas	7,857	5,181	+52	<0.001	4,220	+86	<0.001
Total ^b	41,157	36,160	+14	<0.001	33,307	+24	<0.001

^a Long-term average, 1955-2006.

^b Includes 10 species in Appendix A plus American black duck, ring-necked duck, goldeneyes, bufflehead, and ruddy duck; excludes eiders, long-tailed duck, scoters, mergansers, and wood duck.

Table 2. Mallard breeding population estimates (in thousands) for regions in the traditional survey area.

Region	2007	Change from 2006			Change from LTA		
		2006	%	<i>P</i>	LTA	%	<i>P</i>
Alaska-Yukon Territory – Old Crow Flats	581	516	+13	0.364	360	+61	<0.001
C. & N. Alberta – N.E. British Columbia - Northwest Territories	887	558	+59	0.002	1,075	-17	0.025
N. Saskatchewan- N. Manitoba - W. Ontario	588	656	-10	0.538	1,149	-49	<0.001
S. Alberta	830	901	-8	0.364	1,095	-24	<0.001
S. Saskatchewan	2,155	1,832	+18	0.076	2,067	+4	0.567
S. Manitoba	387	511	-24	0.038	381	+2	0.870
Montana and Western Dakotas	553	679	-19	0.124	503	+10	0.413
Eastern Dakotas	2,049	1,624	+26	0.050	861	+138	<0.001
Total	8,032	7,277	+10	0.033	7,491	+7	0.053

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

Region	2007	Change from 2006			Change from LTA		
		2006	%	<i>P</i>	LTA	%	<i>P</i>
Alaska-Yukon Territory – Old Crow Flats	3	2	+71	0.556	2	+71	0.508
C. & N. Alberta – N.E. British Columbia - Northwest Territories	100	135	-26	0.336	49	+106	0.003
N. Saskatchewan- N. Manitoba - W. Ontario	14	16	-16	0.674	27	-50	<0.001
S. Alberta	343	455	-25	0.081	311	+10	0.307
S. Saskatchewan	1,317	1,202	+10	0.580	568	+132	<0.001
S. Manitoba	110	125	-12	0.562	68	+63	0.034
Montana and Western Dakotas	266	216	+23	0.365	194	+37	0.129
Eastern Dakotas	1,201	673	+78	<0.001	494	+143	<0.001
Total	3,355	2,825	+19	0.050	1,714	+96	<0.001

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

Region	2007	Change from 2006			Change from LTA		
		2006	%	<i>P</i>	LTA	%	<i>P</i>
Alaska-Yukon Territory – Old Crow Flats	1,113	822	+35	0.004	517	+115	<0.001
C. & N. Alberta – N.E. British Columbia - Northwest Territories	843	570	+48	0.050	906	-7	0.579
N. Saskatchewan- N. Manitoba - W. Ontario	139	105	+32	0.314	250	-44	<0.001
S. Alberta	170	189	-10	0.574	294	-42	<0.001
S. Saskatchewan	325	282	+15	0.455	422	-23	0.023
S. Manitoba	9	16	-47	0.063	61	-86	<0.001
Montana and Western Dakotas	121	120	+1	0.965	109	+11	0.598
Eastern Dakotas	83	67	+23	0.462	49	+70	0.047
Total	2,803	2,171	+29	0.001	2,608	+7	0.205

Table 5. Green-winged teal breeding population estimates (in thousands) for regions in the traditional survey area.

Region	2007	Change from 2006			Change from LTA		
		2006	%	<i>P</i>	LTA	%	<i>P</i>
Alaska-Yukon Territory – Old Crow Flats	823	780	+5	0.670	366	+125	<0.001
C. & N. Alberta – N.E. British Columbia - Northwest Territories	862	751	+15	0.541	752	+15	0.448
N. Saskatchewan- N. Manitoba - W. Ontario	328	303	+8	0.659	199	+65	0.006
S. Alberta	283	178	+59	0.179	193	+46	0.176
S. Saskatchewan	495	401	+24	0.347	233	+113	0.001
S. Manitoba	33	65	-49	0.007	52	-36	<0.001
Montana and Western Dakotas	44	34	+30	0.356	40	+10	0.650
Eastern Dakotas	43	75	-43	0.192	46	-7	0.810
Total	2,911	2,587	+13	0.199	1,881	+55	<0.001

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

Region	2007	Change from 2006			Change from LTA		
		2006	%	<i>P</i>	LTA	%	<i>P</i>
Alaska-Yukon Territory – Old Crow Flats	9	0	+–	-	1	+588	0.264
C. & N. Alberta – N.E. British Columbia - Northwest Territories	369	316	+17	0.597	271	+36	0.191
N. Saskatchewan- N. Manitoba - W. Ontario	108	82	+32	0.396	262	-59	<0.001
S. Alberta	669	864	-23	0.263	613	+9	0.697
S. Saskatchewan	2,380	2,228	+7	0.652	1,237	+92	<0.001
S. Manitoba	274	426	-36	0.005	383	-28	0.001
Montana and Western Dakotas	277	346	-20	0.235	265	+4	0.790
Eastern Dakotas	2,610	1,598	+63	<0.001	1,494	+75	<0.001
Total	6,694	5,860	+14	0.077	4,527	+48	<0.001

Table 7. Northern shoveler breeding population estimates (in thousands) for regions in the traditional survey area.

Region	2007	Change from 2006			Change from LTA		
		2006	%	<i>P</i>	LTA	%	<i>P</i>
Alaska-Yukon Territory – Old Crow Flats	580	409	+42	0.027	269	+115	<0.001
C. & N. Alberta – N.E. British Columbia - Northwest Territories	346	193	+80	0.044	213	+62	0.062
N. Saskatchewan- N. Manitoba - W. Ontario	28	12	+137	0.161	42	-34	0.200
S. Alberta	977	701	+39	0.009	367	+167	<0.001
S. Saskatchewan	1,656	1,612	+3	0.880	666	+149	<0.001
S. Manitoba	116	178	-35	0.007	109	+6	0.569
Montana and Western Dakotas	169	163	+3	0.887	150	+13	0.547
Eastern Dakotas	682	414	+65	0.001	390	+75	<0.001
Total	4,553	3,680	+24	0.011	2,206	+106	<0.001

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

Region	2007	Change from 2006			Change from LTA		
		2006	%	<i>P</i>	LTA	%	<i>P</i>
Alaska-Yukon Territory – Old Crow Flats	1,135	1,041	+9	0.473	915	+24	0.018
C. & N. Alberta – N.E. British Columbia - Northwest Territories	234	126	+86	0.056	374	-37	0.006
N. Saskatchewan- N. Manitoba - W. Ontario	5	6	-7	0.899	40	-87	<0.001
S. Alberta	324	611	-47	<0.001	719	-55	<0.001
S. Saskatchewan	960	1,024	-6	0.724	1,214	-21	0.011
S. Manitoba	15	57	-74	<0.001	111	-87	<0.001
Montana and Western Dakotas	118	264	-55	<0.001	269	-56	<0.001
Eastern Dakotas	544	257	+111	<0.001	455	+19	0.187
Total	3,335	3,386	-2	0.841	4,098	-19	<0.001

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

Region	2007	Change from 2006			Change from LTA		
		2006	%	<i>P</i>	LTA	%	<i>P</i>
Alaska-Yukon Territory – Old Crow Flats	2	10	-83	0.176	2	+10	0.886
C. & N. Alberta – N.E. British Columbia - Northwest Territories	80	59	+35	0.345	39	+106	0.016
N. Saskatchewan- N. Manitoba - W. Ontario	10	5	+93	0.326	28	-64	<0.001
S. Alberta	179	154	+16	0.571	117	+53	0.051
S. Saskatchewan	414	435	-5	0.831	195	+113	0.001
S. Manitoba	72	102	-30	0.273	72	-1	0.962
Montana and Western Dakotas	6	12	-51	0.249	9	-39	0.260
Eastern Dakotas	247	139	+78	0.013	168	+47	0.021
Total	1,009	916	+10	0.443	630	+60	<0.001

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

Region	2007	Change from 2006			Change from LTA		
		2006	%	<i>P</i>	LTA	%	<i>P</i>
Alaska-Yukon Territory – Old Crow Flats	92	73	+25	0.615	91	+1	0.980
C. & N. Alberta – N.E. British Columbia - Northwest Territories	139	109	+27	0.487	73	+89	0.048
N. Saskatchewan- N. Manitoba - W. Ontario	34	13	+167	0.109	55	-37	0.123
S. Alberta	127	76	+67	0.141	64	+99	0.039
S. Saskatchewan	324	287	+13	0.642	184	+76	0.029
S. Manitoba	77	87	-12	0.739	57	+37	0.220
Montana and Western Dakotas	17	12	+36	0.503	8	+113	0.069
Eastern Dakotas	54	33	+66	0.141	33	+66	0.090
Total	865	691	+25	0.117	565	+53	0.001

Table 11. Scaup (greater and lesser combined) breeding population estimates (in thousands) for regions in the traditional survey area.

Region	2007	2006	Change from 2006		LTA	Change from LTA	
			%	<i>P</i>		%	<i>P</i>
Alaska-Yukon Territory – Old Crow Flats	1,191	884	+35	0.022	914	+30	0.014
C. & N. Alberta – N.E. British Columbia - Northwest Territories	1,261	1,169	+8	0.603	2,599	-51	<0.001
N. Saskatchewan- N. Manitoba - W. Ontario	271	335	-19	0.288	582	-53	<0.001
S. Alberta	182	214	-15	0.538	351	-48	<0.001
S. Saskatchewan	302	391	-23	0.339	416	-27	0.079
S. Manitoba	50	97	-48	0.064	134	-63	<0.001
Montana and Western Dakotas	15	19	-20	0.535	53	-72	<0.001
Eastern Dakotas	179	138	+30	0.256	98	+83	0.003
Total	3,452	3,247	+6	0.424	5,147	-33	<0.001

Table 12. Estimated number (in thousands) of May ponds in portions of prairie and parkland Canada and the northcentral U.S.

Survey area	2007	2006	Change from 2006		LTA ^a	Change from LTA		
			%	<i>P</i>		%	<i>P</i>	
Prairie Canada								
S. Alberta	1,225	996	+23	0.175	728	+68	0.001	
S. Saskatchewan	3,000	2,719	+10	0.318	1,980	+52	<0.001	
S. Manitoba	815	735	+11	0.413	674	+21	0.054	
Subtotal	5,040	4,450	+13	0.085	3,382	+49	<0.001	
Northcentral U.S.								
Montana and Western Dakotas	740	615	+20	0.147	531	+39	0.004	
Eastern Dakotas	1,223	1,030	+19	0.058	995	+23	0.002	
Subtotal	1,963	1,644	+19	0.017	1,525	+29	<0.001	
Grand total	7,003	6,094	+15	0.014	4,869	+44	<0.001	

^aLong-term average. Prairie and parkland Canada, 1961-2006; northcentral U.S. and Grand total, 1974-2006.

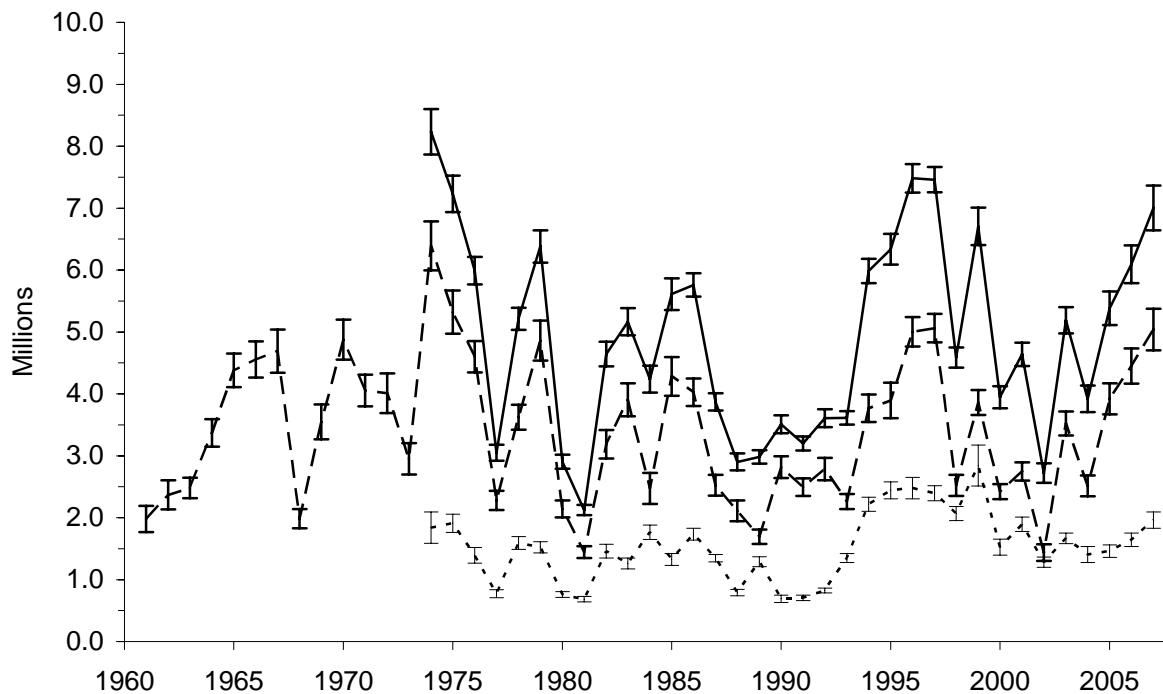


Figure 2. Number of ponds in May and 90% confidence intervals in prairie Canada and the northcentral U.S.

Table 13. Duck breeding population estimates ^a (in thousands) for the 10 most abundant species in the eastern survey area.

Species	2007	2006	% Change from 2006	Average ^b	% Change from average
Mergansers (common, red-breasted, and hooded)	394	315	+25	328	+20
Mallard	446	415	+7	408	+9
American black duck	539	493	+9	463	+16 ^c
American wigeon	12	12	+7 ^d	20	-38
Green-winged teal	251	229	+10	227	+10
Scaup (greater and lesser)	25	30	-17	36	-31
Ring-necked duck	617	551	+14	509	+20 ^c
Goldeneyes (common and Barrow's)	318	215	+48	259	+23
Bufflehead	15	13	+19	25	+38
Scoters (black, white-winged , and surf)	126	79	+61	81	+56

^a Estimates for mallard, American black duck, green-winged teal, and ring-necked duck from Bayesian hierarchical analysis using FWS and CWS data from strata 51, 52, 63, 64, 66-68, 70-72. All others were computed as the variance-weighted means of FWS and CWS estimates for strata 51, 52, 63, 64, 66-68, 70-72.

^b Average for 1990-2006.

^c Significance ($P < 0.10$) determined by non-overlap of Bayesian credibility intervals or confidence intervals.

^d Rounded values mask change in estimates.

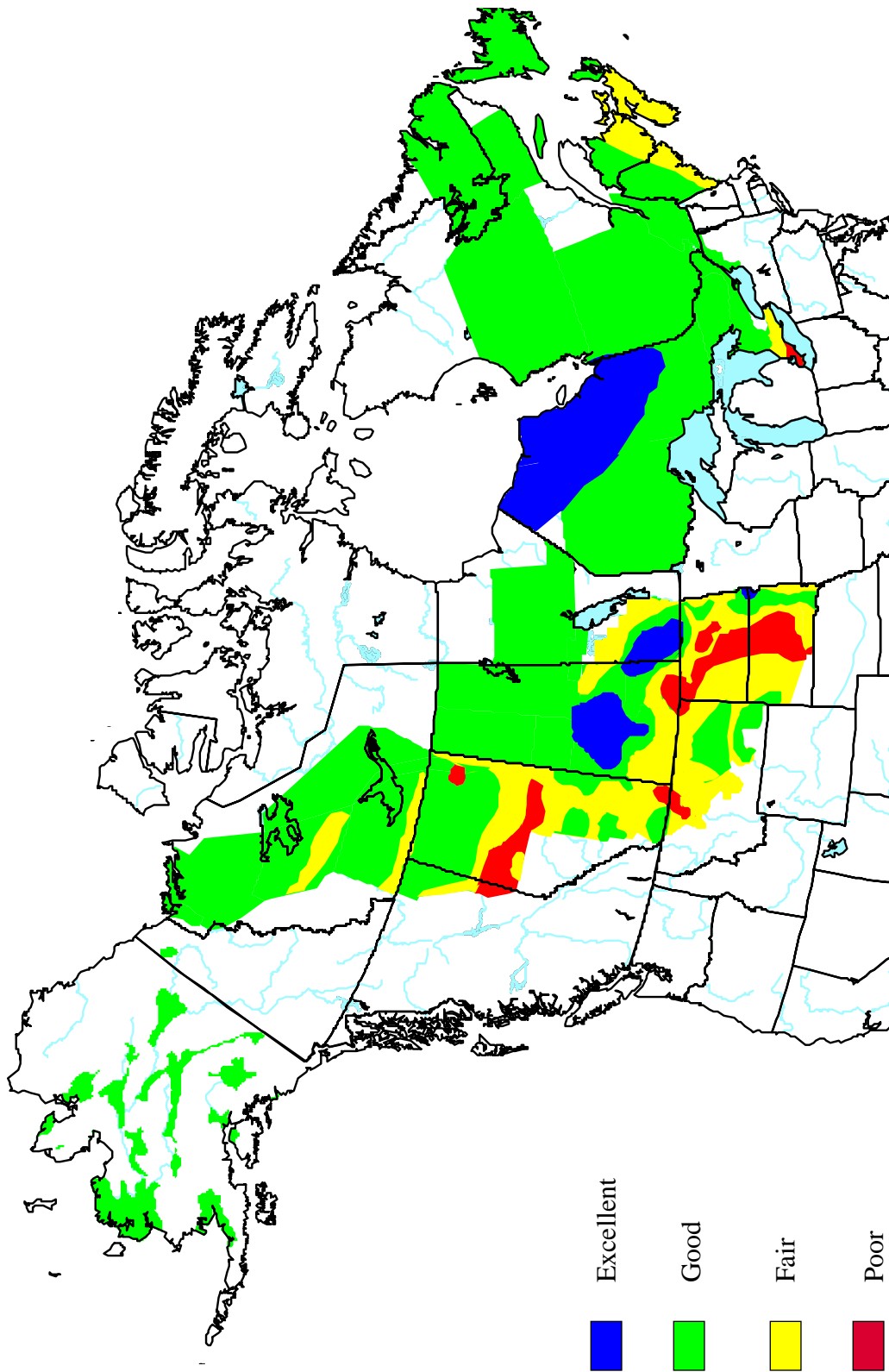


Figure 4. Breeding waterfowl habitat conditions during the 2006 Waterfowl Breeding Population and Habitat Survey, as judged by U.S. Fish and Wildlife Service Flyway Biologists.

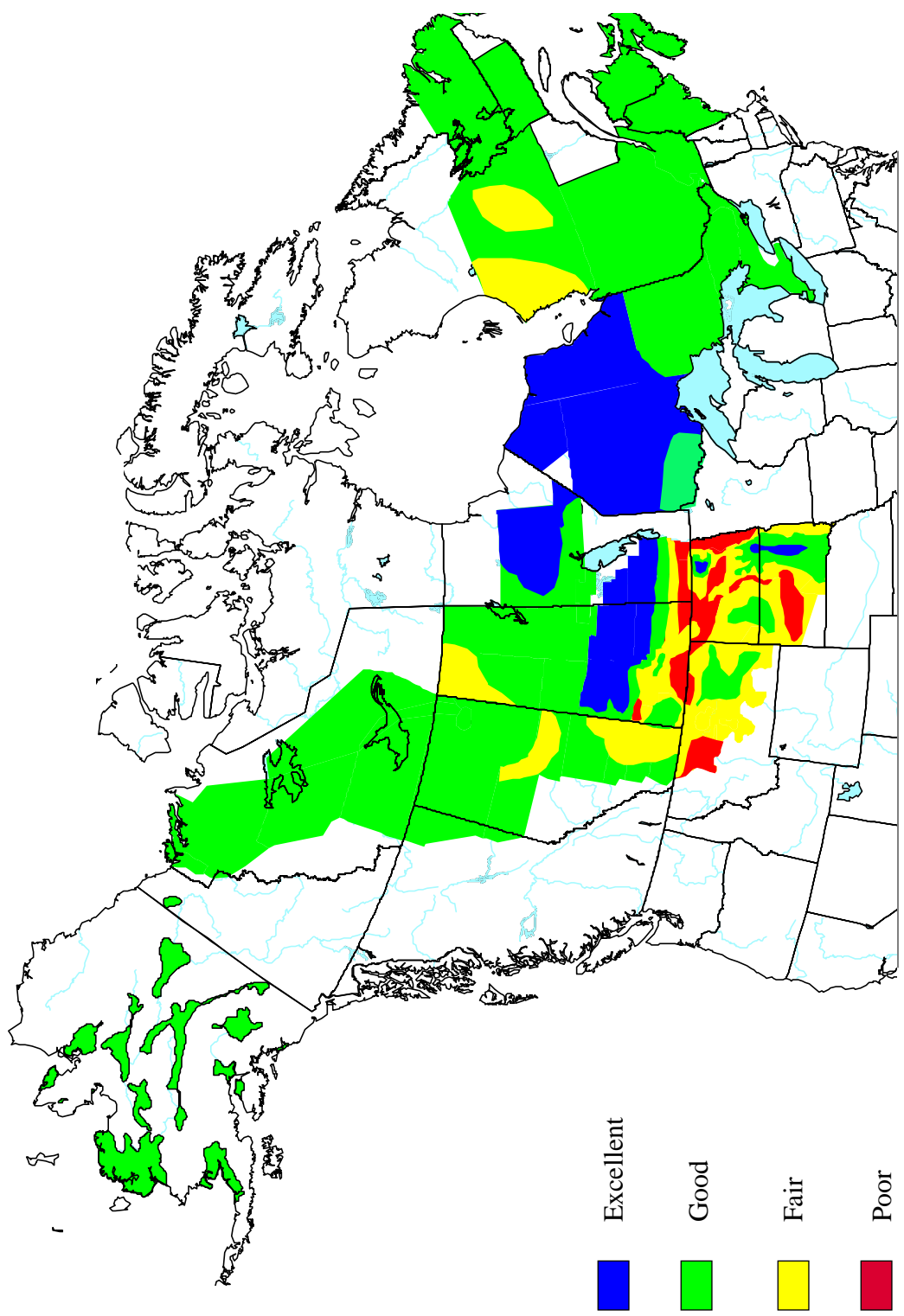


Figure 3. Breeding waterfowl habitat conditions during the 2007 Waterfowl Breeding Population and Habitat Survey, as judged by U.S. Fish and Wildlife Service Flyway Biologists.

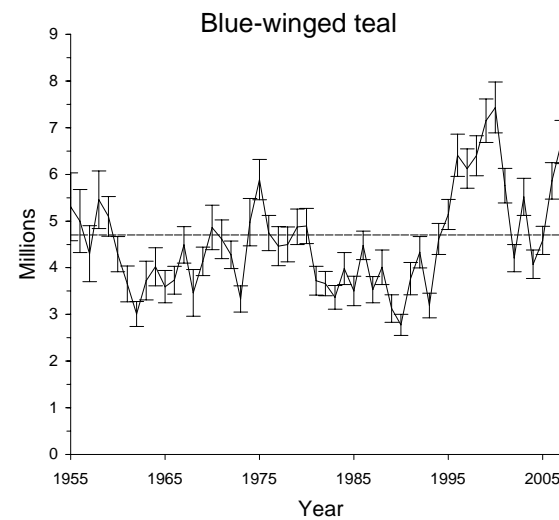
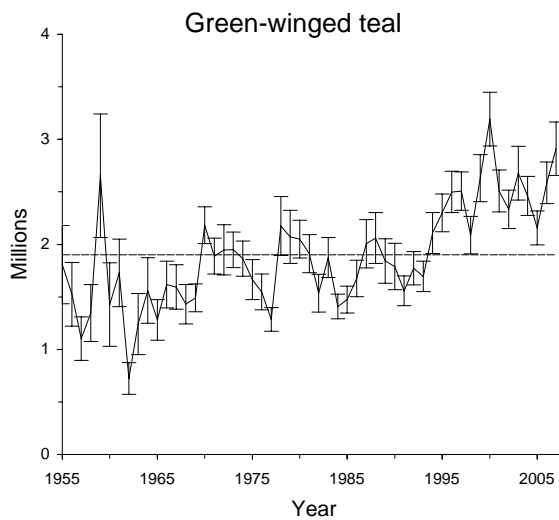
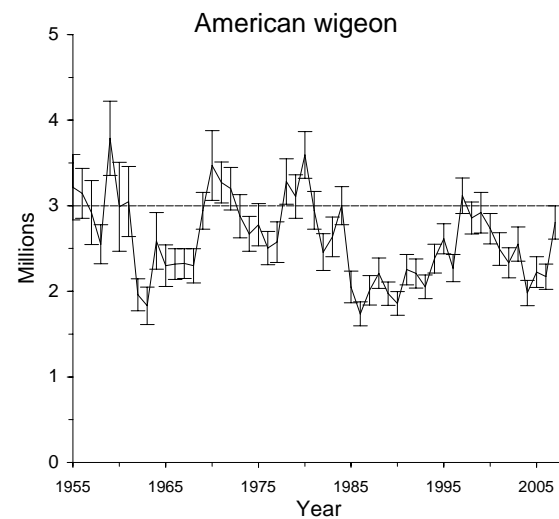
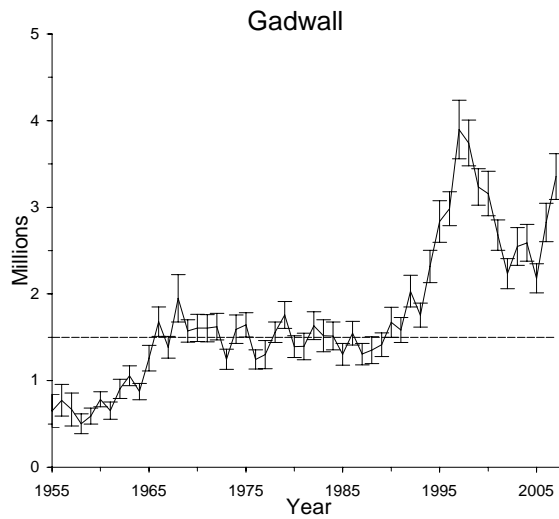
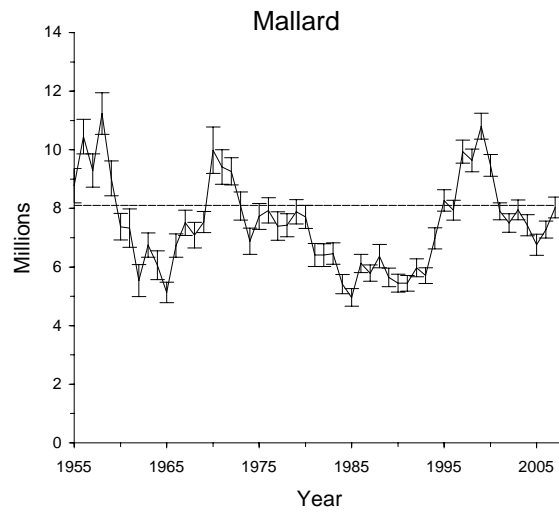
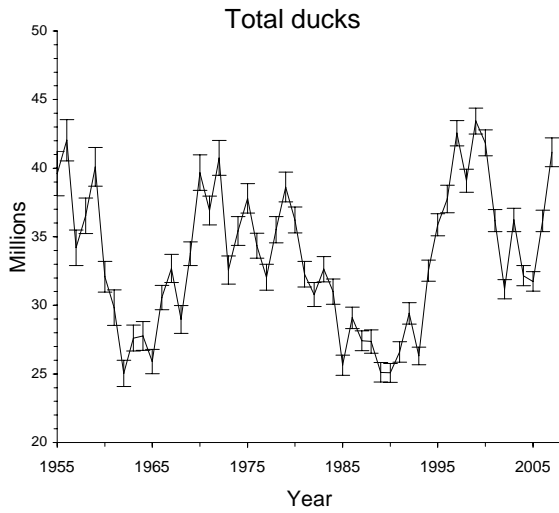


Figure 5. Breeding population estimates, 90% confidence intervals, and North American Waterfowl Management Plan population goal (dashed line) for selected species in the traditional survey area (strata 1-18, 20-50, 75-77).

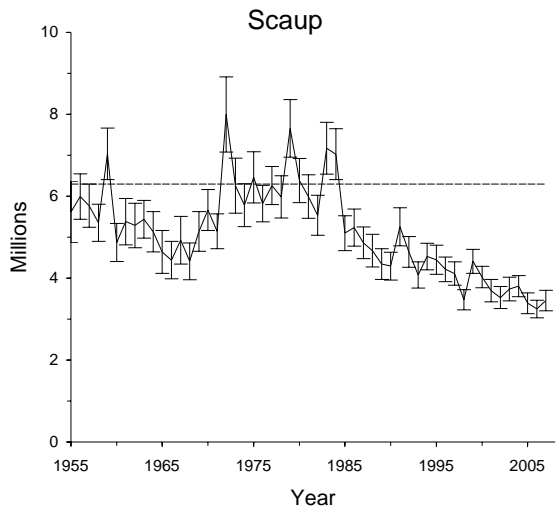
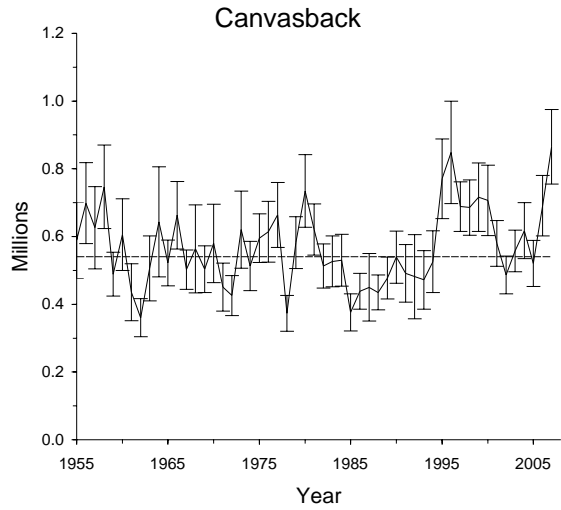
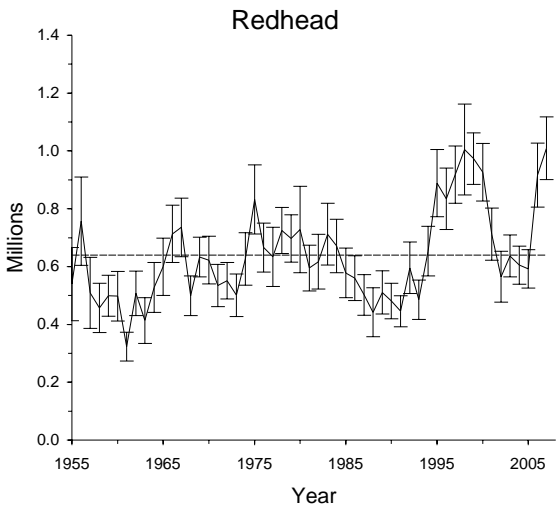
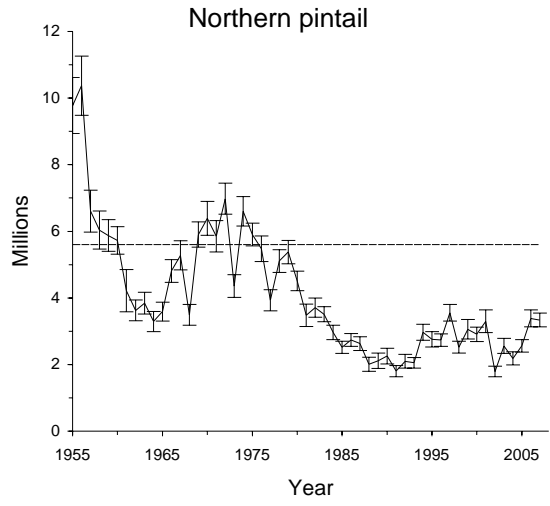
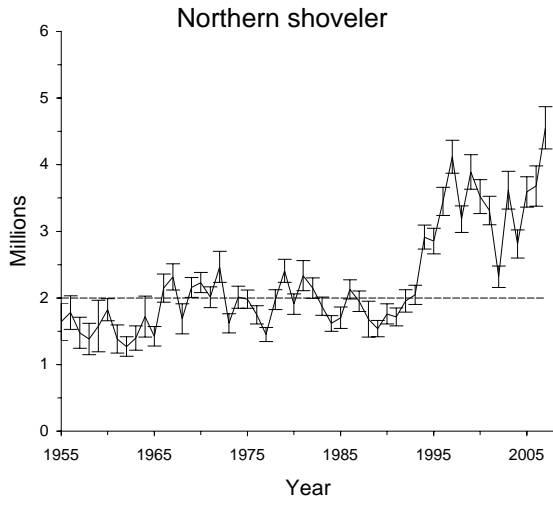


Figure 5 (continued).

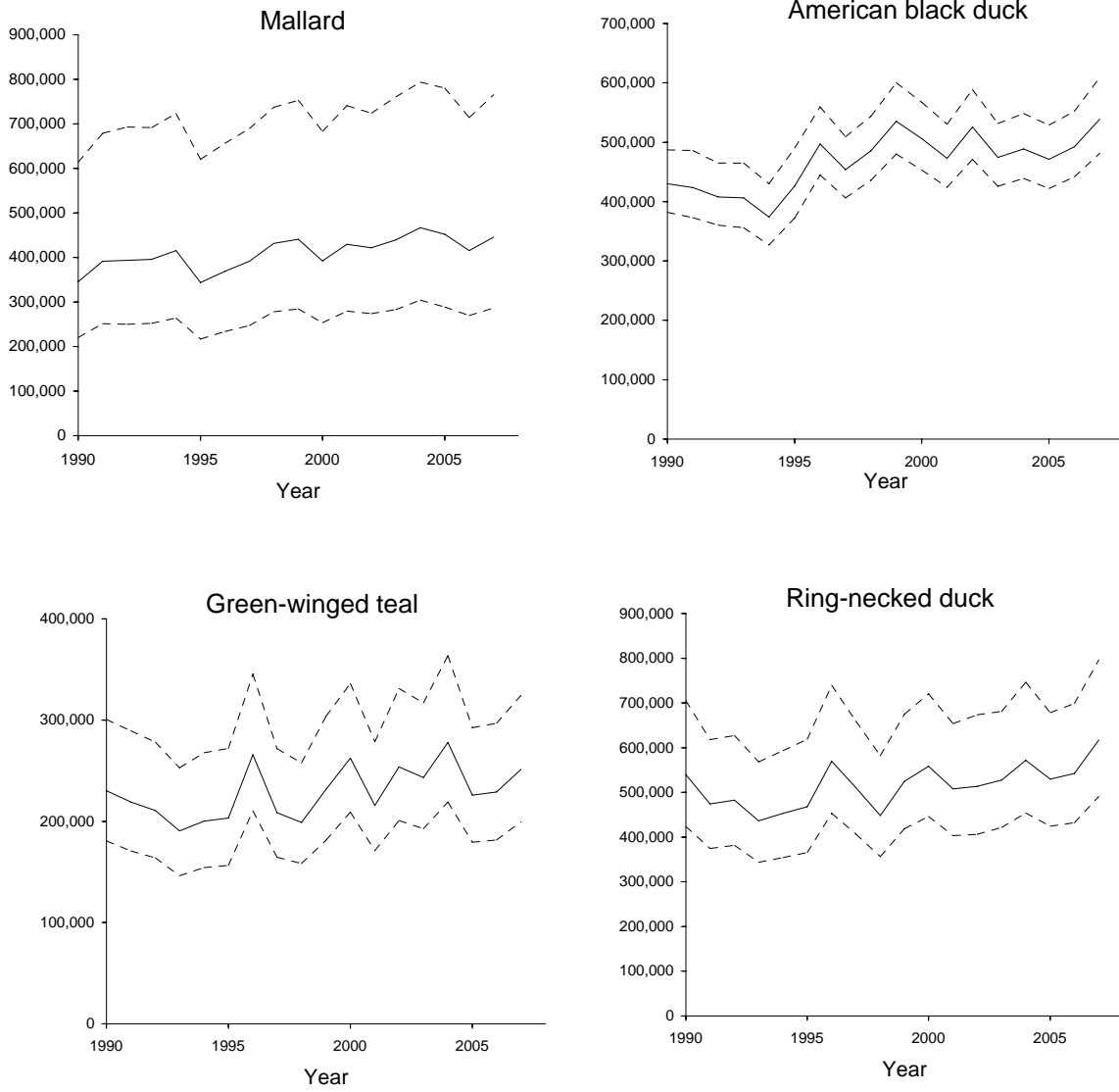


Figure 6. Breeding population estimates (from Bayesian hierarchical models) and 90% credibility intervals for selected species in the eastern survey area (strata 51, 52, 63, 64, 66-68, 70-72).

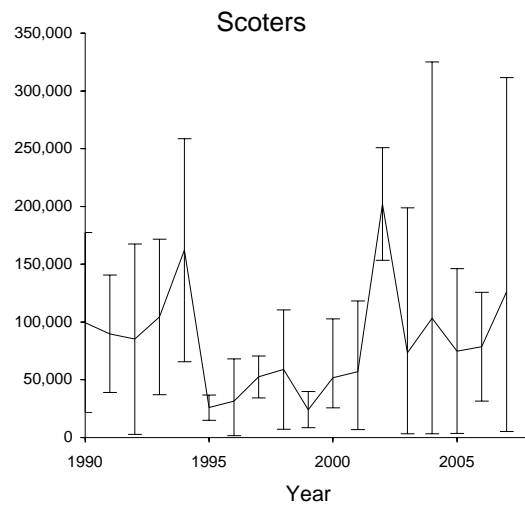
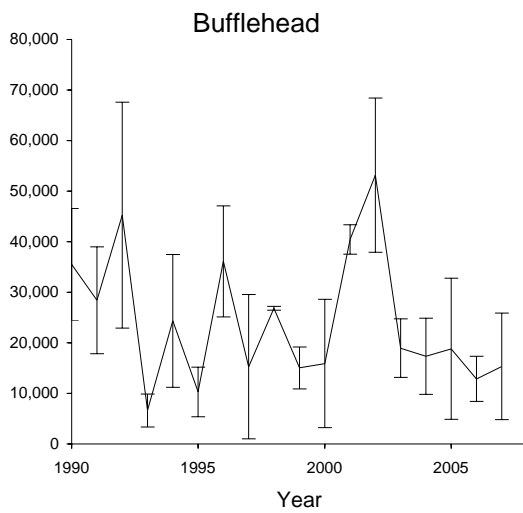
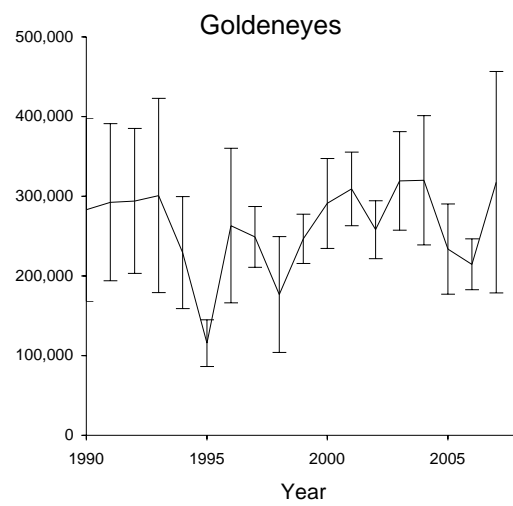
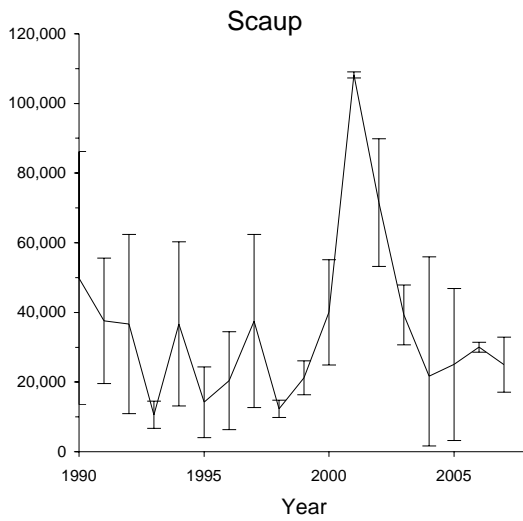
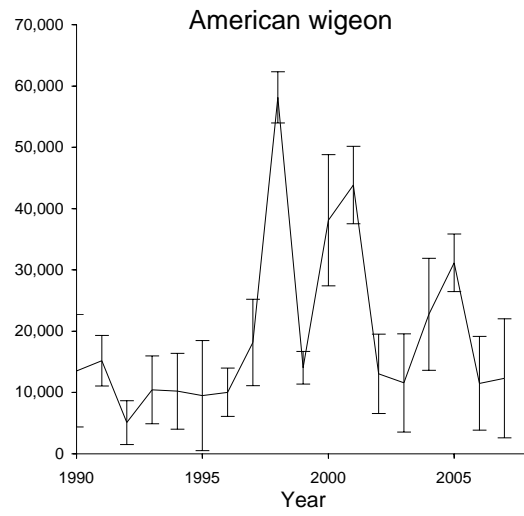
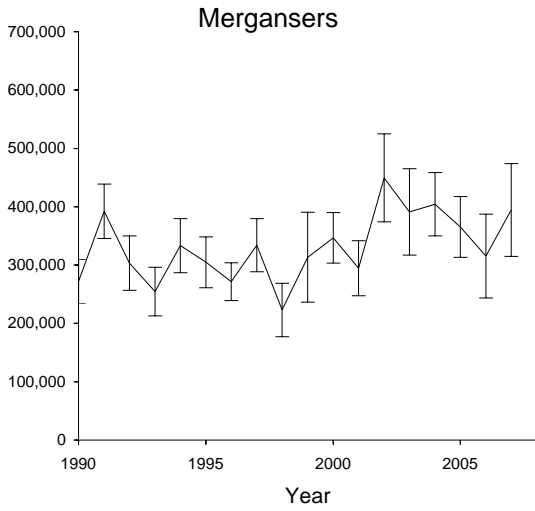


Figure 7. Breeding population estimates (variance-weighted means) and 90% confidence intervals for selected species in the eastern survey area (strata 51, 52, 63, 64, 66-68, 70-72).

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

Year	Mallard		Gadwall		American wigeon		Green-winged teal		Blue-winged teal	
	\hat{N}	\hat{SE}	\hat{N}	\hat{SE}	\hat{N}	\hat{SE}	\hat{N}	\hat{SE}	\hat{N}	\hat{SE}
1955	8777.3	457.1	651.5	149.5	3216.8	297.8	1807.2	291.5	5305.2	567.6
1956	10452.7	461.8	772.6	142.4	3145.0	227.8	1525.3	236.2	4997.6	527.6
1957	9296.9	443.5	666.8	148.2	2919.8	291.5	1102.9	161.2	4299.5	467.3
1958	11234.2	555.6	502.0	89.6	2551.7	177.9	1347.4	212.2	5456.6	483.7
1959	9024.3	466.6	590.0	72.7	3787.7	339.2	2653.4	459.3	5099.3	332.7
1960	7371.7	354.1	784.1	68.4	2987.6	407.0	1426.9	311.0	4293.0	294.3
1961	7330.0	510.5	654.8	77.5	3048.3	319.9	1729.3	251.5	3655.3	298.7
1962	5535.9	426.9	905.1	87.0	1958.7	145.4	722.9	117.6	3011.1	209.8
1963	6748.8	326.8	1055.3	89.5	1830.8	169.9	1242.3	226.9	3723.6	323.0
1964	6063.9	385.3	873.4	73.7	2589.6	259.7	1561.3	244.7	4020.6	320.4
1965	5131.7	274.8	1260.3	114.8	2301.1	189.4	1282.0	151.0	3594.5	270.4
1966	6731.9	311.4	1680.4	132.4	2318.4	139.2	1617.3	173.6	3733.2	233.6
1967	7509.5	338.2	1384.6	97.8	2325.5	136.2	1593.7	165.7	4491.5	305.7
1968	7089.2	340.8	1949.0	213.9	2298.6	156.1	1430.9	146.6	3462.5	389.1
1969	7531.6	280.2	1573.4	100.2	2941.4	168.6	1491.0	103.5	4138.6	239.5
1970	9985.9	617.2	1608.1	123.5	3469.9	318.5	2182.5	137.7	4861.8	372.3
1971	9416.4	459.5	1605.6	123.0	3272.9	186.2	1889.3	132.9	4610.2	322.8
1972	9265.5	363.9	1622.9	120.1	3200.1	194.1	1948.2	185.8	4278.5	230.5
1973	8079.2	377.5	1245.6	90.3	2877.9	197.4	1949.2	131.9	3332.5	220.3
1974	6880.2	351.8	1592.4	128.2	2672.0	159.3	1864.5	131.2	4976.2	394.6
1975	7726.9	344.1	1643.9	109.0	2778.3	192.0	1664.8	148.1	5885.4	337.4
1976	7933.6	337.4	1244.8	85.7	2505.2	152.7	1547.5	134.0	4744.7	294.5
1977	7397.1	381.8	1299.0	126.4	2575.1	185.9	1285.8	87.9	4462.8	328.4
1978	7425.0	307.0	1558.0	92.2	3282.4	208.0	2174.2	219.1	4498.6	293.3
1979	7883.4	327.0	1757.9	121.0	3106.5	198.2	2071.7	198.5	4875.9	297.6
1980	7706.5	307.2	1392.9	98.8	3595.5	213.2	2049.9	140.7	4895.1	295.6
1981	6409.7	308.4	1395.4	120.0	2946.0	173.0	1910.5	141.7	3720.6	242.1
1982	6408.5	302.2	1633.8	126.2	2458.7	167.3	1535.7	140.2	3657.6	203.7
1983	6456.0	286.9	1519.2	144.3	2636.2	181.4	1875.0	148.0	3366.5	197.2
1984	5415.3	258.4	1515.0	125.0	3002.2	174.2	1408.2	91.5	3979.3	267.6
1985	4960.9	234.7	1303.0	98.2	2050.7	143.7	1475.4	100.3	3502.4	246.3
1986	6124.2	241.6	1547.1	107.5	1736.5	109.9	1674.9	136.1	4478.8	237.1
1987	5789.8	217.9	1305.6	97.1	2012.5	134.3	2006.2	180.4	3528.7	220.2
1988	6369.3	310.3	1349.9	121.1	2211.1	139.1	2060.8	188.3	4011.1	290.4
1989	5645.4	244.1	1414.6	106.6	1972.9	106.0	1841.7	166.4	3125.3	229.8
1990	5452.4	238.6	1672.1	135.8	1860.1	108.3	1789.5	172.7	2776.4	178.7
1991	5444.6	205.6	1583.7	111.8	2254.0	139.5	1557.8	111.3	3763.7	270.8
1992	5976.1	241.0	2032.8	143.4	2208.4	131.9	1773.1	123.7	4333.1	263.2
1993	5708.3	208.9	1755.2	107.9	2053.0	109.3	1694.5	112.7	3192.9	205.6
1994	6980.1	282.8	2318.3	145.2	2382.2	130.3	2108.4	152.2	4616.2	259.2
1995	8269.4	287.5	2835.7	187.5	2614.5	136.3	2300.6	140.3	5140.0	253.3
1996	7941.3	262.9	2984.0	152.5	2271.7	125.4	2499.5	153.4	6407.4	353.9
1997	9939.7	308.5	3897.2	264.9	3117.6	161.6	2506.6	142.5	6124.3	330.7
1998	9640.4	301.6	3742.2	205.6	2857.7	145.3	2087.3	138.9	6398.8	332.3
1999	10805.7	344.5	3235.5	163.8	2920.1	185.5	2631.0	174.6	7149.5	364.5
2000	9470.2	290.2	3158.4	200.7	2733.1	138.8	3193.5	200.1	7431.4	425.0
2001	7904.0	226.9	2679.2	136.1	2493.5	149.6	2508.7	156.4	5757.0	288.8
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
2004	7425.3	282.0	2589.6	165.6	1981.3	114.9	2460.8	145.2	4073.0	238.0
2005	6755.3	280.8	2179.1	131.0	2225.1	139.2	2156.9	125.8	4585.5	236.3
2006	7276.5	223.7	2824.7	174.2	2171.2	115.7	2587.2	155.3	5859.6	303.5
2007	8031.6	275.2	3354.9	206.2	2803.2	151.8	2910.9	198.5	6694.2	361.7

Appendix A (continued).

Year	Northern shoveler		Northern pintail		Redhead		Canvasback		Scaup	
	\hat{N}	\hat{SE}	\hat{N}	\hat{SE}	\hat{N}	\hat{SE}	\hat{N}	\hat{SE}	\hat{N}	\hat{SE}
1955	1642.8	218.7	9775.1	656.1	539.9	98.9	589.3	87.8	5620.1	582.1
1956	1781.4	196.4	10372.8	694.4	757.3	119.3	698.5	93.3	5994.1	434.0
1957	1476.1	181.8	6606.9	493.4	509.1	95.7	626.1	94.7	5766.9	411.7
1958	1383.8	185.1	6037.9	447.9	457.1	66.2	746.8	96.1	5350.4	355.1
1959	1577.6	301.1	5872.7	371.6	498.8	55.5	488.7	50.6	7037.6	492.3
1960	1824.5	130.1	5722.2	323.2	497.8	67.0	605.7	82.4	4868.6	362.5
1961	1383.0	166.5	4218.2	496.2	323.3	38.8	435.3	65.7	5380.0	442.2
1962	1269.0	113.9	3623.5	243.1	507.5	60.0	360.2	43.8	5286.1	426.4
1963	1398.4	143.8	3846.0	255.6	413.4	61.9	506.2	74.9	5438.4	357.9
1964	1718.3	240.3	3291.2	239.4	528.1	67.3	643.6	126.9	5131.8	386.1
1965	1423.7	114.1	3591.9	221.9	599.3	77.7	522.1	52.8	4640.0	411.2
1966	2147.0	163.9	4811.9	265.6	713.1	77.6	663.1	78.0	4439.2	356.2
1967	2314.7	154.6	5277.7	341.9	735.7	79.0	502.6	45.4	4927.7	456.1
1968	1684.5	176.8	3489.4	244.6	499.4	53.6	563.7	101.3	4412.7	351.8
1969	2156.8	117.2	5903.9	296.2	633.2	53.6	503.5	53.7	5139.8	378.5
1970	2230.4	117.4	6392.0	396.7	622.3	64.3	580.1	90.4	5662.5	391.4
1971	2011.4	122.7	5847.2	368.1	534.4	57.0	450.7	55.2	5143.3	333.8
1972	2466.5	182.8	6979.0	364.5	550.9	49.4	425.9	46.0	7997.0	718.0
1973	1619.0	112.2	4356.2	267.0	500.8	57.7	620.5	89.1	6257.4	523.1
1974	2011.3	129.9	6598.2	345.8	626.3	70.8	512.8	56.8	5780.5	409.8
1975	1980.8	106.7	5900.4	267.3	831.9	93.5	595.1	56.1	6460.0	486.0
1976	1748.1	106.9	5475.6	299.2	665.9	66.3	614.4	70.1	5818.7	348.7
1977	1451.8	82.1	3926.1	246.8	634.0	79.9	664.0	74.9	6260.2	362.8
1978	1975.3	115.6	5108.2	267.8	724.6	62.2	373.2	41.5	5984.4	403.0
1979	2406.5	135.6	5376.1	274.4	697.5	63.8	582.0	59.8	7657.9	548.6
1980	1908.2	119.9	4508.1	228.6	728.4	116.7	734.6	83.8	6381.7	421.2
1981	2333.6	177.4	3479.5	260.5	594.9	62.0	620.8	59.1	5990.9	414.2
1982	2147.6	121.7	3708.8	226.6	616.9	74.2	513.3	50.9	5532.0	380.9
1983	1875.7	105.3	3510.6	178.1	711.9	83.3	526.6	58.9	7173.8	494.9
1984	1618.2	91.9	2964.8	166.8	671.3	72.0	530.1	60.1	7024.3	484.7
1985	1702.1	125.7	2515.5	143.0	578.2	67.1	375.9	42.9	5098.0	333.1
1986	2128.2	112.0	2739.7	152.1	559.6	60.5	438.3	41.5	5235.3	355.5
1987	1950.2	118.4	2628.3	159.4	502.4	54.9	450.1	77.9	4862.7	303.8
1988	1680.9	210.4	2005.5	164.0	441.9	66.2	435.0	40.2	4671.4	309.5
1989	1538.3	95.9	2111.9	181.3	510.7	58.5	477.4	48.4	4342.1	291.3
1990	1759.3	118.6	2256.6	183.3	480.9	48.2	539.3	60.3	4293.1	264.9
1991	1716.2	104.6	1803.4	131.3	445.6	42.1	491.2	66.4	5254.9	364.9
1992	1954.4	132.1	2098.1	161.0	595.6	69.7	481.5	97.3	4639.2	291.9
1993	2046.5	114.3	2053.4	124.2	485.4	53.1	472.1	67.6	4080.1	249.4
1994	2912.0	141.4	2972.3	188.0	653.5	66.7	525.6	71.1	4529.0	253.6
1995	2854.9	150.3	2757.9	177.6	888.5	90.6	770.6	92.2	4446.4	277.6
1996	3449.0	165.7	2735.9	147.5	834.2	83.1	848.5	118.3	4217.4	234.5
1997	4120.4	194.0	3558.0	194.2	918.3	77.2	688.8	57.2	4112.3	224.2
1998	3183.2	156.5	2520.6	136.8	1005.1	122.9	685.9	63.8	3471.9	191.2
1999	3889.5	202.1	3057.9	230.5	973.4	69.5	716.0	79.1	4411.7	227.9
2000	3520.7	197.9	2907.6	170.5	926.3	78.1	706.8	81.0	4026.3	205.3
2001	3313.5	166.8	3296.0	266.6	712.0	70.2	579.8	52.7	3694.0	214.9
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
2004	2810.4	163.9	2184.6	155.2	605.3	51.5	617.2	64.6	3807.2	202.3
2005	3591.5	178.6	2560.5	146.8	592.3	51.7	520.6	52.9	3386.9	196.4
2006	3680.2	236.5	3386.4	198.7	916.3	86.1	691.0	69.6	3246.7	166.9
2007	4552.8	247.5	3335.3	160.4	1009.0	84.7	864.9	86.2	3452.2	195.3

Appendix B. Breeding population estimates and 90% confidence intervals or credibility intervals (CIs; in thousands) for the 10 most abundant species of ducks in the eastern survey area, 1990-2007^a.

Year	<u>Mergansers^b</u>		<u>Mallard</u>		<u>American black duck</u>		<u>American wigeon</u>		<u>Green-winged teal</u>	
	\hat{N}	90% CI	\hat{N}	90% CI	\hat{N}	90% CI	\hat{N}	90% CI	\hat{N}	90% CI
1990	272.3	(234.7, 309.9)	345.6	(220.1, 614.4)	430.1	(381.8, 487.3)	13.5	(4.3, 22.7)	230.1	(180.6, 300.5)
1991	392.2	(345.6, 438.8)	391.4	(251.3, 678.9)	423.5	(372.9, 485.9)	15.2	(11.1, 19.3)	219.1	(170.8, 289.4)
1992	303.2	(256.6, 349.8)	393.7	(249.9, 692.8)	407.8	(360.4, 465.0)	5.1	(1.5, 8.7)	210.7	(163.8, 278.1)
1993	254.7	(212.8, 296.6)	396.1	(252.1, 691.5)	406.1	(356.3, 465.0)	10.4	(4.9, 15.9)	190.4	(146.2, 252.7)
1994	333.4	(286.9, 379.9)	415.5	(263.9, 723.2)	374.3	(327.2, 429.9)	10.2	(4.1, 16.3)	200.3	(154.4, 267.6)
1995	304.8	(261.4, 348.2)	343.8	(216.8, 620.5)	426.4	(372.4, 490.1)	9.5	(0.5, 18.5)	203.1	(156.6, 272.0)
1996	271.6	(239.1, 304.1)	369.3	(233.6, 656.4)	497.0	(444.7, 559.4)	10.0	(6.0, 14.0)	265.9	(210.5, 345.5)
1997	334.0	(288.6, 379.4)	391.2	(247.2, 689.3)	453.8	(406.3, 509.4)	18.2	(11.2, 25.2)	208.4	(164.6, 271.6)
1998	223.1	(177.4, 268.8)	431.9	(277.9, 737.5)	485.4	(436.0, 543.5)	58.2	(54.0, 62.4)	199.0	(158.4, 257.8)
1999	313.4	(236.3, 390.5)	441.1	(284.4, 752.6)	535.4	(480.3, 600.2)	14.0	(11.3, 16.7)	231.5	(181.1, 303.7)
2000	346.7	(303.4, 390.0)	392.1	(253.3, 683.4)	506.3	(453.2, 567.3)	38.1	(27.3, 48.9)	262.3	(209.2, 336.1)
2001	294.7	(247.6, 341.8)	429.6	(279.6, 741.0)	472.6	(424.0, 530.5)	43.9	(37.6, 50.2)	215.8	(171.1, 278.6)
2002	449.4	(374.0, 524.8)	421.9	(274.1, 723.9)	525.4	(471.2, 588.6)	13.1	(6.6, 19.6)	253.9	(200.7, 331.1)
2003	391.1	(317.0, 465.2)	439.7	(283.0, 760.3)	474.5	(425.6, 531.7)	11.6	(3.5, 19.7)	243.2	(192.6, 316.9)
2004	404.3	(350.2, 458.4)	466.8	(304.1, 793.9)	488.8	(438.9, 548.2)	22.8	(13.7, 31.9)	277.9	(219.1, 363.8)
2005	365.5	(313.3, 417.7)	451.8	(288.7, 780.1)	471.2	(422.0, 529.0)	31.2	(26.5, 35.9)	226.0	(179.3, 292.5)
2006	315.5	(243.7, 387.3)	415.2	(269.8, 713.8)	492.6	(441.4, 551.9)	11.5	(3.8, 19.2)	229.0	(181.5, 296.9)
2007	394.4	(314.8, 474.0)	445.9	(286.8, 765.3)	539.1	(481.5, 609.0)	12.3	(2.6, 22.0)	251.3	(199.4, 324.4)

Year	<u>Scaup^c</u>		<u>Ring-necked duck</u>		<u>Goldeneyes^d</u>		<u>Bufflehead</u>		<u>Scoters^e</u>	
	\hat{N}	90% CI	\hat{N}	90% CI	\hat{N}	90% CI	\hat{N}	90% CI	\hat{N}	90% CI
1990	49.8	(13.4, 86.2)	539.2	(423.8, 705.2)	283.1	(168.3, 397.9)	35.5	(24.5, 46.5)	99.5	(21.5, 177.5)
1991	37.6	(19.6, 55.6)	474.1	(374.6, 618.1)	292.6	(194.0, 391.2)	28.4	(17.8, 39.0)	89.8	(39.0, 140.6)
1992	36.7	(11.0, 62.4)	482.3	(381.5, 627.1)	294.1	(203.1, 385.1)	45.3	(23.0, 67.6)	85.2	(2.9, 167.5)
1993	10.6	(6.8, 14.4)	436.4	(343.5, 568.5)	300.9	(179.0, 422.8)	6.6	(3.3, 9.9)	104.4	(37.2, 171.6)
1994	36.7	(13.1, 60.3)	453.4	(354.4, 593.2)	229.5	(159.2, 299.8)	24.3	(11.1, 37.5)	162.2	(65.7, 258.7)
1995	14.2	(4.1, 24.3)	467.9	(365.8, 618.5)	115.6	(86.3, 144.9)	10.3	(5.4, 15.2)	25.9	(14.9, 36.9)
1996	20.4	(6.3, 34.5)	569.8	(453.3, 739.4)	263.2	(166.3, 360.1)	36.1	(25.1, 47.1)	31.6	(0.0, 68.0)
1997	37.5	(12.7, 62.3)	510.4	(406.8, 659.2)	248.9	(210.9, 286.9)	15.3	(1.0, 29.6)	52.5	(34.5, 70.5)
1998	12.3	(9.9, 14.7)	448.5	(356.2, 582.0)	176.7	(104.0, 249.4)	26.8	(26.4, 27.2)	58.9	(7.3, 110.5)
1999	21.2	(16.3, 26.1)	524.4	(419.1, 675.1)	246.7	(215.7, 277.7)	15.0	(10.8, 19.2)	24.2	(8.7, 39.7)
2000	40.1	(25.0, 55.2)	558.6	(445.8, 720.3)	291.0	(234.4, 347.6)	15.9	(3.2, 28.6)	51.7	(0.6, 102.8)
2001	108.2	(107.3, 109.1)	507.6	(403.6, 654.1)	309.2	(263.1, 355.3)	40.5	(37.6, 43.4)	57.0	(0.0, 118.1)
2002	71.5	(53.2, 89.8)	513.8	(406.4, 673.1)	258.1	(221.7, 294.5)	53.2	(38.0, 68.4)	202.1	(153.3, 250.9)
2003	39.3	(30.7, 47.9)	527.8	(421.5, 681.0)	319.3	(257.5, 381.1)	18.9	(13.1, 24.7)	73.3	(0.0, 198.7)
2004	21.7	(0.0, 56.0)	571.7	(454.1, 746.2)	320.0	(238.8, 401.2)	17.3	(9.7, 24.9)	103.3	(0.0, 325.3)
2005	25.0	(3.2, 46.8)	529.9	(424.3, 678.3)	233.7	(176.9, 290.5)	18.8	(4.8, 32.8)	74.8	(3.5, 146.1)
2006	30.0	(28.6, 31.4)	542.5	(432.3, 698.4)	214.6	(182.6, 246.6)	12.9	(8.4, 17.4)	78.7	(31.6, 125.8)
2007	25.0	(17.1, 32.9)	617.1	(491.2, 796.3)	317.6	(178.6, 456.6)	15.3	(4.8, 25.8)	126.3	(0.0, 311.6)

^a Estimates for mallards, American black ducks, green-winged teal, and ring-necked duck from Bayesian hierarchical analysis using FWS and CWS data from strata 51, 52, 63, 64, 66-68, 70-72. All others were computed as variance-weighted means of FWS and CWS estimates for strata 51, 52, 63, 64, 66-68, 70-72.

^b Common, red-breasted, and hooded.

^c Greater and lesser.

^d Common and Barrow's.

^e Black, white-winged, and surf.