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U.S. Fish & Wildlife Service

Trends in Duck Breeding Populations 1955–2012

June 29, 2012



TRENDS IN DUCK BREEDING POPULATIONS, 1955–2012

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Administrative Report—June 29, 2012

This report summarizes information about the status of duck populations and wetland habitats during spring 2012, focusing on areas encompassed by the U.S. Fish & Wildlife (USFWS) and Canadian Wildlife Services' (CWS) Waterfowl Breeding Population and Habitat Survey. We do 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 (Figure 1), the total duck population estimate (excluding scoters [*Melanitta* spp.], eiders [*Somateria* spp. and *Polysticta stelleri*], long-tailed ducks [*Clangula hyemalis*], mergansers [*Mergus* spp. and *Lophodytes cucullatus*], and wood ducks [*Aix sponsa*]) was 48.6 ± 0.8 [SE] million birds (Figure 3, Appendix A). This represents a 7% increase over last year's estimate of 45.6 ± 0.8 million, and is 43% higher than the long-term average^a (1955–2011; Table 1). Estimated mallard (*Anas platyrhynchos*) abundance was 10.6 ± 0.3 million, which was 15% above the 2011 estimate of 9.2 ± 0.3 million, and 40% above the long-term average of 7.6 ± 0.04 million (Table 2). Estimated abundance of gadwall (*A. strepera*; 3.6 ± 0.2 million) was similar to the 2011 estimate and 96% above the long-term average (1.8 ± 0.02 million; Table 3). The estimate for American wigeon (*A. americana*; 2.1 ± 0.1 million) was similar to the 2011 estimate and 17% below the long-term average of 2.6 ± 0.02 million (Table 4). The estimated abundance of green-winged teal (*A. crecca*) was 3.5 ± 0.2 million, which was 20% above the 2011 estimate and 74% above the long-term average (2.0 ± 0.02 million; Table 5). The estimates of blue-winged teal (*A. discors*; 9.2 ± 0.4 million) and northern shoveler (*A. clypeata*; 5.0 ± 0.3 million) were similar to their 2011 estimates and 94% and 111% above the long-term averages of 4.8 ± 0.04 million (Table 6) and 2.4 ± 0.02 million (Table 7), respectively. The estimate for northern pintails (*A. acuta*; 3.5 ± 0.2 million) was 22% below the 2011 estimate of 4.4 ± 0.3 million and 14% below the long-term average of 4.0 ± 0.04 million (Table 8). The estimated abundance for redheads (*Aythya americana*; 1.3 ± 0.1 million) and canvasbacks (*Aythya valisineria*; 0.8 ± 0.07 million) were similar to their 2011 estimates and were 89% and 33% above their long-term averages of 0.7 ± 0.01 million (Table 9) and 0.6 ± 0.01 million (Table 10), respectively. Estimated abundance of scaup (*A. affinis* and *A. marila* combined; 5.2 ± 0.3 million) was 21% above the 2011 estimate and similar to the long-term average of 5.0 ± 0.05 million (Table 11).

Habitat conditions during the 2012 Waterfowl Breeding Population and Habitat Survey were characterized by average to below-average moisture, a mild winter, and an early spring across the

^aPopulations are considered to have changed from the previous year or long-term average if the observed significance value associated with change is ≤ 0.10 . Actual *P*-values are presented in tables.

southern portion of the traditional and eastern survey areas. Northern habitats of the traditional and eastern surveys areas generally received average moisture and temperatures. The total pond estimate (Prairie Canada and U.S. combined) was 5.5 ± 0.2 million (Table 12, Figure 2). This was 32% below the 2011 estimate of 8.1 ± 0.2 million ponds, and 9% above the long-term average of 5.1 ± 0.03 million ponds.

Conditions across the Canadian prairies declined relative to 2011 (Figure 4). Residual moisture from prior years benefitted more permanent wetlands of the coteau in Saskatchewan and near the Saskatchewan and Manitoba border, but temporary wetlands retained little moisture owing to a shallow frost seal and below-average precipitation. The 2012 estimate of ponds in Prairie Canada was 3.9 ± 0.1 million. This was 21% below last year's estimate (4.9 ± 0.2 million) and 13% above the 1961–2011 average (3.4 ± 0.03 million). Much of the parkland was classified as good; however, habitat conditions declined westward toward Alberta. Following the completion of the survey, the Canadian prairies received above-average precipitation, which may improve habitat conditions for late-nesting waterfowl, re-nesting attempts and brood rearing.

Significant declines in wetland numbers and conditions occurred in the U.S. prairies during 2012. The 2012 pond estimate for the north-central U.S. was 1.7 ± 0.1 million, which was 49% below last year's estimate (3.2 ± 0.1 million) and similar to the 1974–2011 average. Nearly all of the north-central U.S. was rated as good to excellent in 2011; however, only the coteau of North and South Dakota was rated as good in 2012, and no areas were rated as excellent this year. Drastic wetland declines in western South Dakota and Montana resulted in mostly poor to fair habitat conditions.

In the bush regions of the traditional survey area (Alaska, Yukon, Northwest Territories, northern Alberta, northern Manitoba, northern Saskatchewan, and western Ontario), spring breakup was slightly early in 2012. Average to above-average annual precipitation over much of the bush and ice-free habitats benefitted arriving waterfowl. Drier conditions were observed in northern Alberta and Saskatchewan and habitat was classified as fair. A similar trend was noted in western Ontario where habitat conditions declined from excellent in 2011 to good in 2012.

Most of the eastern survey area had mild winter temperatures with below-average precipitation, although northern survey areas in Labrador, Newfoundland and eastern Quebec experienced more normal conditions, with some areas receiving heavy snowfall. While habitat quality declined overall relative to 2011, good conditions persisted over the majority of the eastern survey area. Exceptions were northwestern Quebec, northern Maine, and New Brunswick, where, despite an early spring, inadequate precipitation caused wetland conditions to deteriorate.

In 2005, the USFWS and CWS began to integrate data from two previously independent waterfowl surveys conducted in eastern North America into a single composite estimate using hierarchical models. Consequently, total indicated bird definitions for American black ducks (*Anas rubripes*) were modified to provide a common index across surveys, and adjustments were made to the geographic stratification of the eastern survey area. 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 (strata 51–72; Table 13) are not directly comparable with estimates presented in reports issued prior to 2006. Specifically, estimates are presented for only a portion of the eastern survey area and include data from strata 51, 52, 63, 64, 66–68, and 70–72. These 10 strata were chosen for presentation because at least one survey (i.e., either the CWS or USFWS survey) was conducted for each of these strata for the full period of record of the eastern survey (1990–2012). In cases where the USFWS has traditionally not recorded observations to the species level, composite estimates are provided only for multiple-species groupings (i.e., mergansers and goldeneyes [*Bucephala clangula* and *B. islandica*]). The CWS and USFWS agreed to use a hierarchical modeling approach for all species in the east. Currently, the models perform well for the six most common species. In previous years, we used design-based estimates

and an overall mean across the two surveys, weighted by their precision, to derive integrated annual population indices for the less common American wigeon, scaup, bufflehead, and scoters until the hierarchical models could adequately analyze the data for these species. These estimates have been discontinued because of concerns about (1) the appropriateness of weighting estimates from these surveys by precision, and (2) whether estimates for some species should be integrated given the data quality and coverage in the eastern survey. Nonetheless, the USFWS will continue to explore methods for deriving integrated estimates for some of the less common species in the eastern survey area. Analytical methods applied to eastern survey area data and results will be presented in greater detail in the 2012 Waterfowl Status Report.

Estimated abundance of American black ducks in the eastern survey area was 0.6 ± 0.04 million, which was 11% higher than the 2011 estimate and similar to the long-term average. The 2012 estimate for mallards was 0.4 ± 0.1 million, which was similar to the 2011 estimate and long-term average. Abundance estimates for goldeneyes, green-winged teal, ring-necked ducks, and mergansers were similar to last year's estimates and their 1990–2011 averages (Table 13, Figure 6, Appendix B).

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

Alaska, Yukon Territory, and Old Crow Flats (Strata 1–12)

Air E. Mallek and D. Groves

Northern Alberta, Northeastern British Columbia, and Northwest Territories (Strata 13–18, 20, and 77)

Air W. Rhodes and C. Spiegel

Northern Saskatchewan and Northern Manitoba (Strata 21–23, 24, 25)

Air K. Fox and M. Rabe^b

Air stratum 24 R. Spangler and J. Bredy

Air stratum 25 R. Spangler and D. Benning^e

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

Air J. Bredy and J. Hitchcock

Ground G. Raven^a, M. Watmough^a, R. Wiacek^a, J. Caswell^b, M. Gillespie^c, K. Jones^a, and L. Smith^a

Southern Saskatchewan (Strata 30–33)

Air P. Thorpe and S. Yates

Ground J.-M. DeVink^a, K. Dufour^a, K. Warner^a, P. Bergen^c, S. Leach^a, B. Tether^a, and S. Heap^a

Southern Manitoba (Strata 34–40)

Air R. Spangler and D. Benning^e

Ground M. Schuster^a, J. Asmundson^a, G. Ball^c, J. Leafloor^a, J. Ingram^a, K. Renwick^a, R. Buss^c, and D. Walker^c

Montana and Western Dakotas (Strata 41–44)

Air S. Bayless and J. Klimstra

Ground A. Mohler and G. Suleiman

Eastern Dakotas (Strata 45–49)

Air T. Liddick and D. Fronczak

Ground K. Kruse, S. Olson, V. Morgan, and J. Dowler

Western Ontario and Central Quebec (Strata 50, 55, 69–70)

Air J. Wortham and G. Boomer

Eastern Ontario and Southern Quebec (Strata 51–54, 56, 68)

Air S. Earsom and B. Berg

Maine and Maritimes (Strata 62–67)

Air M. Koneff and H. Obrecht^e

Canadian Wildlife Service helicopter plot survey

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

Ontario S. Meyer^a, C. Sharp^a, S. Badzinski^a, and A. Harasym^d

New Brunswick &

Nova Scotia R. Hicks^a and B. Pollard^a

Labrador &

Newfoundland S. Gilliland^a, P. Ryan^a, and R. Wells^a

^aCanadian Wildlife Service

^bState, Provincial or Tribal Conservation Agency

^cDucks Unlimited Canada

^dOther Organization

^eU.S. Fish & Wildlife Service Retired

All others—U.S. Fish & Wildlife Service

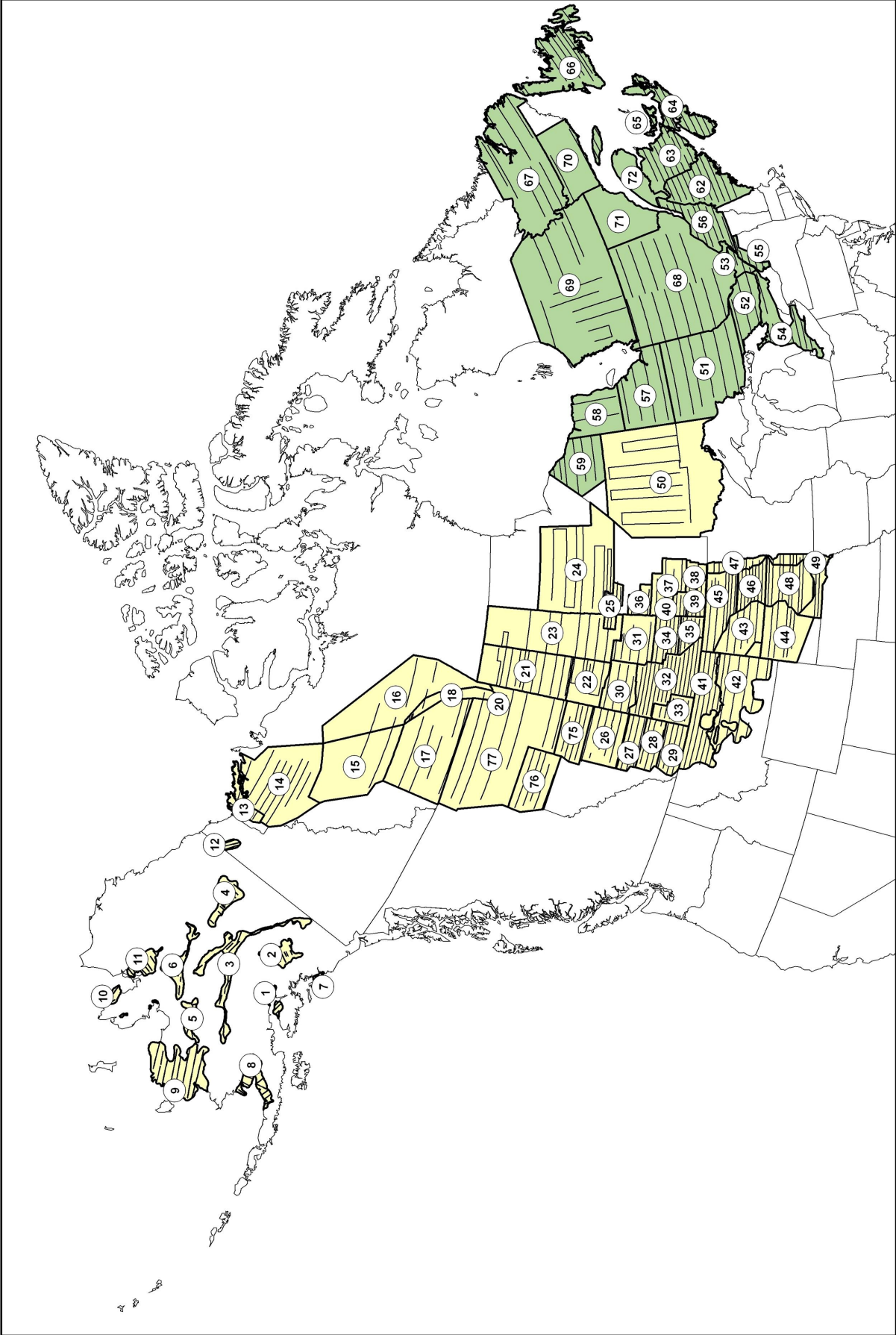


Figure 1: Strata and transects of the Waterfowl Breeding Population and Habitat Survey (yellow = traditional survey area, green = eastern survey area).

Table 1: Total duck^a breeding population estimates (in thousands) for regions in the traditional survey area.

Region	2012	2011	Change from 2011		LTA ^b	Change from LTA	
			%	<i>P</i>		%	<i>P</i>
Alaska–Yukon							
Territory–Old Crow Flats	4,455	3,756	+19	0.004	3,689	+21	<0.001
C. & N. Alberta–N.E. British							
Columbia–NWT	8,799	7,095	+24	0.001	7,119	+24	<0.001
N. Saskatchewan–							
N. Manitoba–W. Ontario	2,754	2,439	+13	0.181	3,490	-21	<0.001
S. Alberta	4,845	4,372	+11	0.081	4,242	+14	0.003
S. Saskatchewan	11,318	10,681	+6	0.202	7,551	+50	<0.001
S. Manitoba	1,538	1,554	-1	0.896	1,528	+1	0.925
Montana & Western Dakotas	2,467	3,135	-21	0.017	1,659	+49	<0.001
Eastern Dakotas	12,400	12,523	-1	0.852	4,737	+162	<0.001
Total	48,575	45,554	+7	0.006	34,015	+43	<0.001

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

^b Long-term average, 1955–2011.

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

Region	2012	2011	Change from 2011		LTA ^a	Change from LTA	
			%	<i>P</i>		%	<i>P</i>
Alaska–Yukon							
Territory–Old Crow Flats	506	416	+22	0.162	375	+35	0.011
C. & N. Alberta–N.E. British							
Columbia–NWT	1,547	975	+59	<0.001	1,077	+44	<0.001
N. Saskatchewan–							
N. Manitoba–W. Ontario	1,039	828	+25	0.277	1,127	-8	0.608
S. Alberta	1,261	939	+34	0.003	1,069	+18	0.029
S. Saskatchewan	2,502	2,093	+20	0.032	2,057	+22	0.001
S. Manitoba	401	521	-23	0.086	383	+5	0.700
Montana & Western Dakotas	793	837	-5	0.688	507	+56	0.002
Eastern Dakotas	2,554	2,574	-1	0.929	980	+161	<0.001
Total	10,602	9,183	+15	0.001	7,574	+40	<0.001

^a Long-term average, 1955–2011.

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

Region	2012	2011	Change from 2011		LTA ^a	Change from LTA	
			%	<i>P</i>		%	<i>P</i>
Alaska–Yukon							
Territory–Old Crow Flats	1	1	-53	0.633	2	-68	0.041
C. & N. Alberta–N.E. British							
Columbia–NWT	56	41	+37	0.313	51	+10	0.667
N. Saskatchewan–							
N. Manitoba–W. Ontario	31	33	-6	0.829	26	+17	0.489
S. Alberta	378	347	+9	0.649	316	+20	0.245
S. Saskatchewan	1,144	1,020	+12	0.385	612	+87	<0.001
S. Manitoba	113	92	+22	0.506	71	+58	0.115
Montana & Western Dakotas	254	470	-46	0.010	206	+23	0.275
Eastern Dakotas	1,609	1,253	+28	0.107	549	+193	<0.001
Total	3,586	3,257	+10	0.252	1,833	+96	<0.001

^a Long-term average, 1955–2011.

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

Region	2012	2011	Change from 2011		LTA ^a	Change from LTA	
			%	<i>P</i>		%	<i>P</i>
Alaska–Yukon							
Territory–Old Crow Flats	686	621	+10	0.407	551	+25	0.024
C. & N. Alberta–N.E. British							
Columbia–NWT	680	650	+5	0.831	891	-24	0.075
N. Saskatchewan–							
N. Manitoba–W. Ontario	130	126	+3	0.912	238	-45	<0.001
S. Alberta	234	200	+17	0.485	283	-17	0.212
S. Saskatchewan	243	281	-14	0.470	410	-41	<0.001
S. Manitoba	5	5	+1	0.977	56	-91	<0.001
Montana & Western Dakotas	85	92	-7	0.820	111	-23	0.177
Eastern Dakotas	81	109	-26	0.228	54	+49	0.099
Total	2,145	2,084	+3	0.738	2,594	-17	0.002

^a Long-term average, 1955–2011.

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

Region	2012	2011	Change from 2011		LTA ^a	Change from LTA	
			%	<i>P</i>		%	<i>P</i>
Alaska–Yukon							
Territory–Old Crow Flats	705	641	+10	0.484	399	+77	<0.001
C. & N. Alberta–N.E. British							
Columbia–NWT	1,567	1,251	+25	0.150	789	+99	<0.001
N. Saskatchewan–							
N. Manitoba–W. Ontario	136	126	+7	0.752	203	-33	0.003
S. Alberta	274	275	+0	0.986	197	+39	0.091
S. Saskatchewan	497	422	+18	0.401	257	+93	<0.001
S. Manitoba	157	55	+185	0.001	51	+206	<0.001
Montana & Western Dakotas	19	19	+0	0.995	42	-55	0.002
Eastern Dakotas	117	110	+6	0.861	53	+122	0.014
Total	3,471	2,900	+20	0.034	1,991	+74	<0.001

^a Long-term average, 1955–2011.

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

Region	2012	2011	Change from 2011		LTA ^a	Change from LTA	
			%	<i>P</i>		%	<i>P</i>
Alaska–Yukon							
Territory–Old Crow Flats	0	1	-100	0.332	1	-100	<0.001
C. & N. Alberta–N.E. British							
Columbia–NWT	147	144	+2	0.960	273	-46	<0.001
N. Saskatchewan–							
N. Manitoba–W. Ontario	51	31	+66	0.333	245	-79	<0.001
S. Alberta	596	470	+27	0.217	608	-2	0.891
S. Saskatchewan	2,608	2,489	+5	0.686	1,309	+99	<0.001
S. Manitoba	327	393	-17	0.360	375	-13	0.360
Montana & Western Dakotas	661	894	-26	0.220	278	+138	0.003
Eastern Dakotas	4,853	4,526	+7	0.480	1,673	+190	<0.001
Total	9,242	8,948	+3	0.622	4,762	+94	<0.001

^a Long-term average, 1955–2011.

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

Region	2012	2011	Change from 2011		LTA ^a	Change from LTA	
			%	<i>P</i>		%	<i>P</i>
Alaska–Yukon							
Territory–Old Crow Flats	377	322	+17	0.325	289	+30	0.049
C. & N. Alberta–N.E. British							
Columbia–NWT	275	133	+107	0.065	219	+26	0.433
N. Saskatchewan–							
N. Manitoba–W. Ontario	11	7	+61	0.457	40	-72	<0.001
S. Alberta	915	878	+4	0.786	395	+131	<0.001
S. Saskatchewan	1,858	1,496	+24	0.044	713	+160	<0.001
S. Manitoba	138	148	-7	0.720	109	+26	0.278
Montana & Western Dakotas	341	430	-21	0.496	160	+112	0.068
Eastern Dakotas	1,104	1,227	-10	0.541	457	+142	<0.001
Total	5,018	4,641	+8	0.275	2,383	+111	<0.001

^a Long-term average, 1955–2011.

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

Region	2012	2011	Change from 2011		LTA ^a	Change from LTA	
			%	<i>P</i>		%	<i>P</i>
Alaska–Yukon							
Territory–Old Crow Flats	1,176	746	+58	0.004	927	+27	0.046
C. & N. Alberta–N.E. British							
Columbia–NWT	79	121	-35	0.229	363	-78	<0.001
N. Saskatchewan–							
N. Manitoba–W. Ontario	16	10	+59	0.481	38	-58	0.006
S. Alberta	357	655	-45	0.003	685	-48	<0.001
S. Saskatchewan	605	1,106	-45	<0.001	1,165	-48	<0.001
S. Manitoba	22	38	-43	0.053	104	-79	<0.001
Montana & Western Dakotas	244	279	-12	0.616	263	-7	0.657
Eastern Dakotas	974	1,473	-34	0.033	494	+97	<0.001
Total	3,473	4,429	-22	0.004	4,038	-14	0.004

^a Long-term average, 1955–2011.

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

Region	2012	2011	Change from 2011		LTA	Change from LTA	
			%	<i>P</i>		%	<i>P</i>
Alaska–Yukon							
Territory–Old Crow Flats	0	1	-100	0.339	2	-100	<0.001
C. & N. Alberta–N.E. British							
Columbia–NWT	16	15	+10	0.830	40	-59	<0.001
N. Saskatchewan							
–N. Manitoba–W. Ontario	19	17	+17	0.710	26	-26	0.217
S. Alberta	183	167	+10	0.716	123	+50	0.079
S. Saskatchewan	383	438	-13	0.476	210	+82	<0.001
S. Manitoba	99	65	+52	0.199	73	+36	0.189
Montana & Western Dakotas	20	40	-49	0.152	11	+85	0.283
Eastern Dakotas	549	614	-11	0.617	188	+192	<0.001
Total	1,270	1,356	-6	0.595	672	+89	<0.001

^a Long-term average, 1955–2011.

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

Region	2012	2011	Change from 2011		LTA ^a	Change from LTA	
			%	<i>P</i>		%	<i>P</i>
Alaska–Yukon							
Territory–Old Crow Flats	35	22	+56	0.314	88	-60	<0.001
C. & N. Alberta–N.E. British							
Columbia–NWT	93	51	+81	0.174	75	+24	0.532
N. Saskatchewan–							
N. Manitoba–W. Ontario	27	31	-12	0.734	53	-49	0.005
S. Alberta	146	33	+339	<0.001	64	+127	0.003
S. Saskatchewan	313	335	-7	0.719	191	+64	0.016
S. Manitoba	52	68	-22	0.227	56	-6	0.694
Montana & Western Dakotas	10	17	-39	0.479	9	+15	0.788
Eastern Dakotas	84	135	-38	0.076	37	+125	0.010
Total	760	692	+10	0.407	573	+33	0.007

^a Long-term average, 1955–2011.

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

Region	2012	2011	Change from 2011		LTA ^a	Change from LTA	
			%	<i>P</i>		%	<i>P</i>
Alaska–Yukon							
Territory–Old Crow Flats	849	847	+0	0.987	920	-8	0.423
C. & N. Alberta–N.E. British							
Columbia–NWT	2,839	2,165	+31	0.049	2,531	+12	0.236
N. Saskatchewan–							
N. Manitoba–W. Ontario	338	367	-8	0.666	565	-40	<0.001
S. Alberta	294	228	+29	0.343	337	-13	0.327
S. Saskatchewan	521	347	+50	0.065	405	+29	0.156
S. Manitoba	102	85	+20	0.648	128	-20	0.448
Montana & Western Dakotas	18	38	-53	0.011	50	-65	<0.001
Eastern Dakotas	277	242	+14	0.595	108	+155	0.001
Total	5,239	4,319	+21	0.020	5,045	+4	0.520

^a Long-term average, 1955–2011.

Table 12: Estimated number (in thousands) of May ponds in portions of Prairie and Parkland Canada and the north-central U.S.

Region	2012	2011	Change from 2011		LTA ^a	Change from LTA		
			%	<i>P</i>		%	<i>P</i>	
Prairie & Parkland Canada								
S. Alberta	807	1,086	-26	0.007	745	+8	0.215	
S. Saskatchewan	2,678	3,151	-15	0.029	2,033	+32	<0.001	
S. Manitoba	401	656	-39	<0.001	669	-40	<0.001	
Subtotal	3,885	4,893	-21	<0.001	3,448	+13	0.003	
North-central U.S.								
Montana & western Dakotas	428	969	-56	<0.001	563	-24	<0.001	
Eastern Dakotas	1,231	2,271	-46	<0.001	1,088	+13	0.003	
Subtotal	1,659	3,239	-49	<0.001	1,651	+1	0.879	
Total	5,544	8,132	-32	<0.001	5,088	+9	0.004	

^a Long-term average. Prairie and Parkland Canada, 1961–2011; north-central U.S. and Total, 1974–2011.

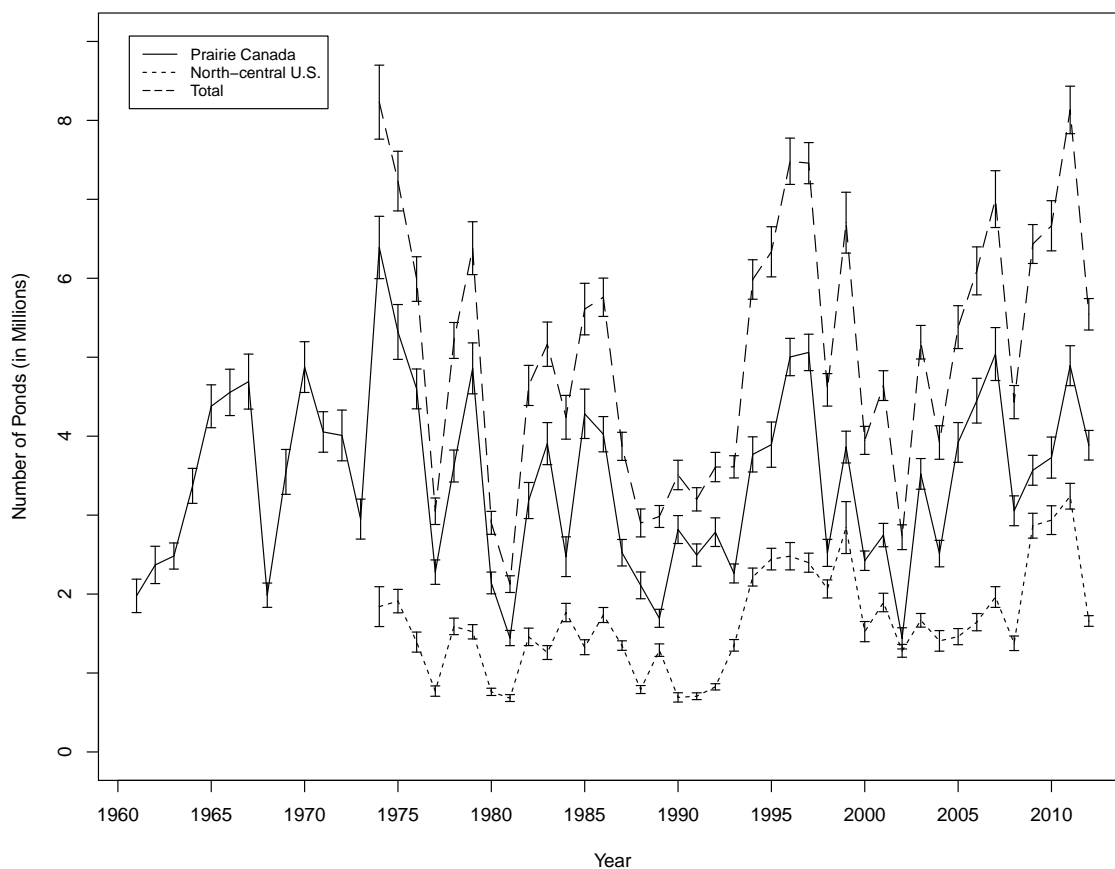


Figure 2: Number of ponds in May and 90% confidence intervals in Prairie Canada and the north-central U.S.

Table 13: Duck breeding population estimates^a (in thousands) for 6 most abundant species in the eastern survey area.

Species	2012	2011	% Change from 2011	Average ^b	% Change from average
Mallard	395	410	-4	385	+3
American black duck	603	544	+11 ^c	622	-3
Green-winged teal	259	256	+1	257	+1
Ring-necked duck	488	492	-1	496	-2
Goldeneyes (common and Barrow's)	394	401	-2	418	-6
Mergansers (common, red-breasted, and hooded)	421	400	+5	437	-4

^a Estimates from Bayesian hierarchical analysis using USFWS and CWS data from strata 51, 52, 63, 64, 66–68, 70–72.

^b Average for 1990–2011.

^c Indicates significant change. Significance determined by non-overlap of Bayesian credibility intervals with zero.

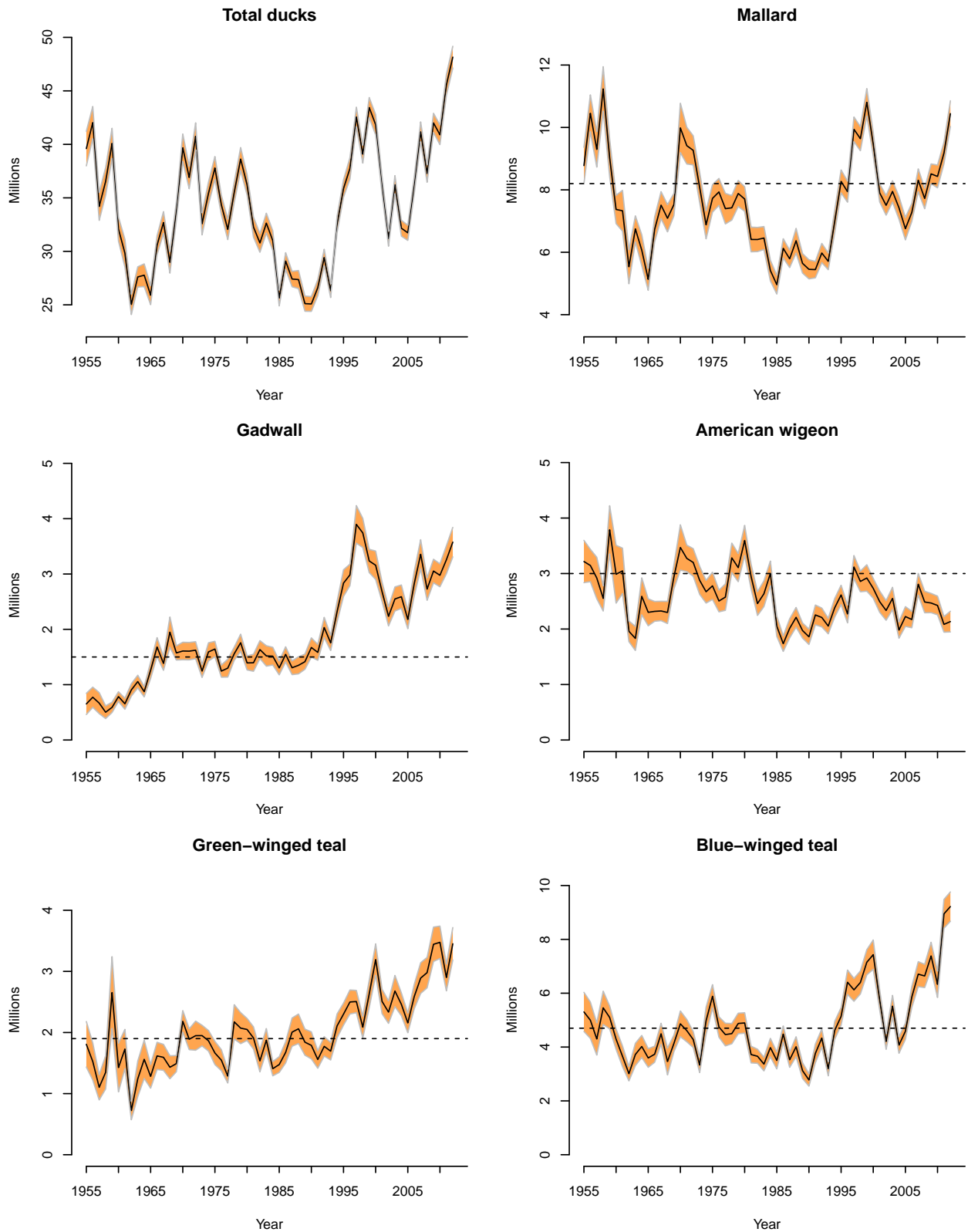


Figure 3: Breeding population estimates, 95% confidence intervals, and North American Waterfowl Management Plan population goal (dashed line) for selected species in the traditional survey area (strata 1–18, 20–50, 75–77).

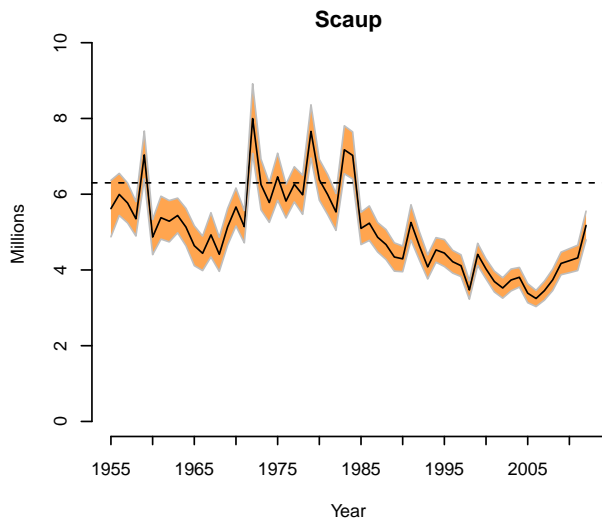
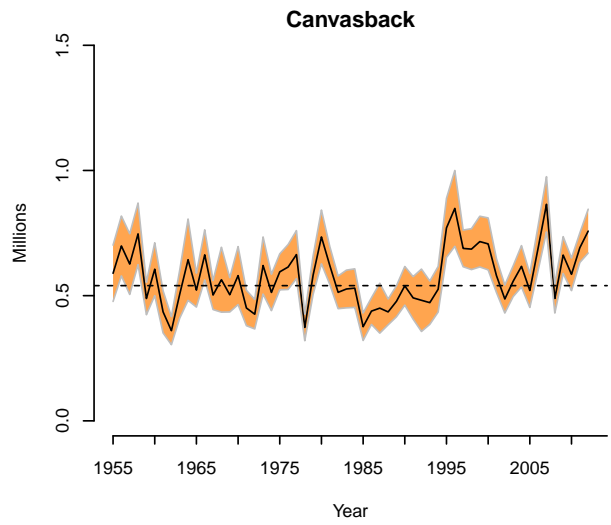
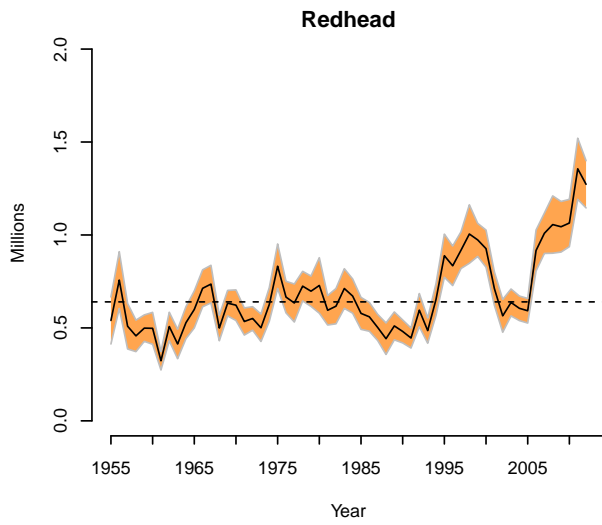
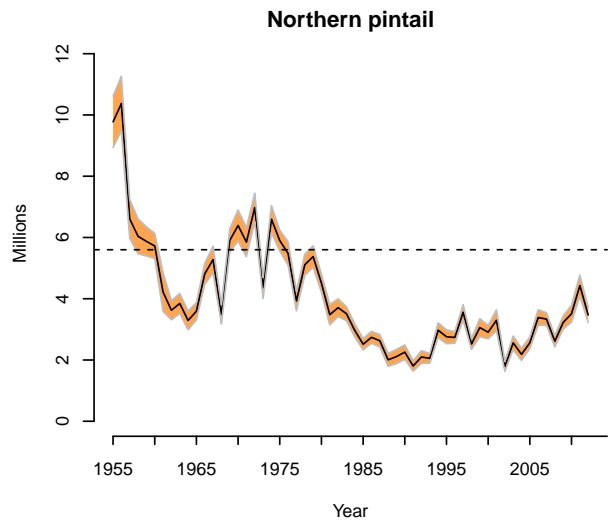
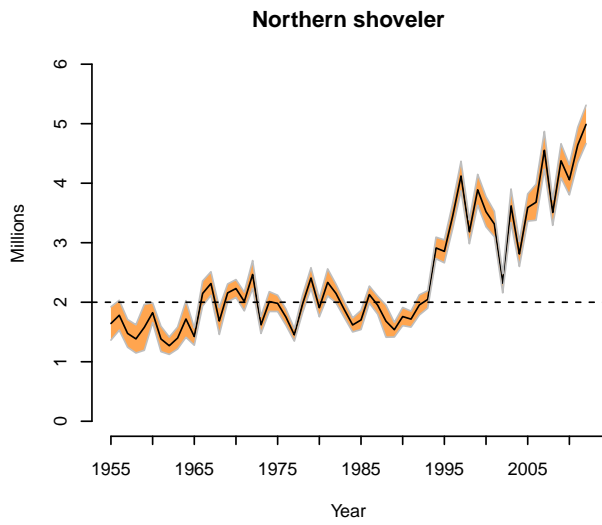


Figure 3: Continued.

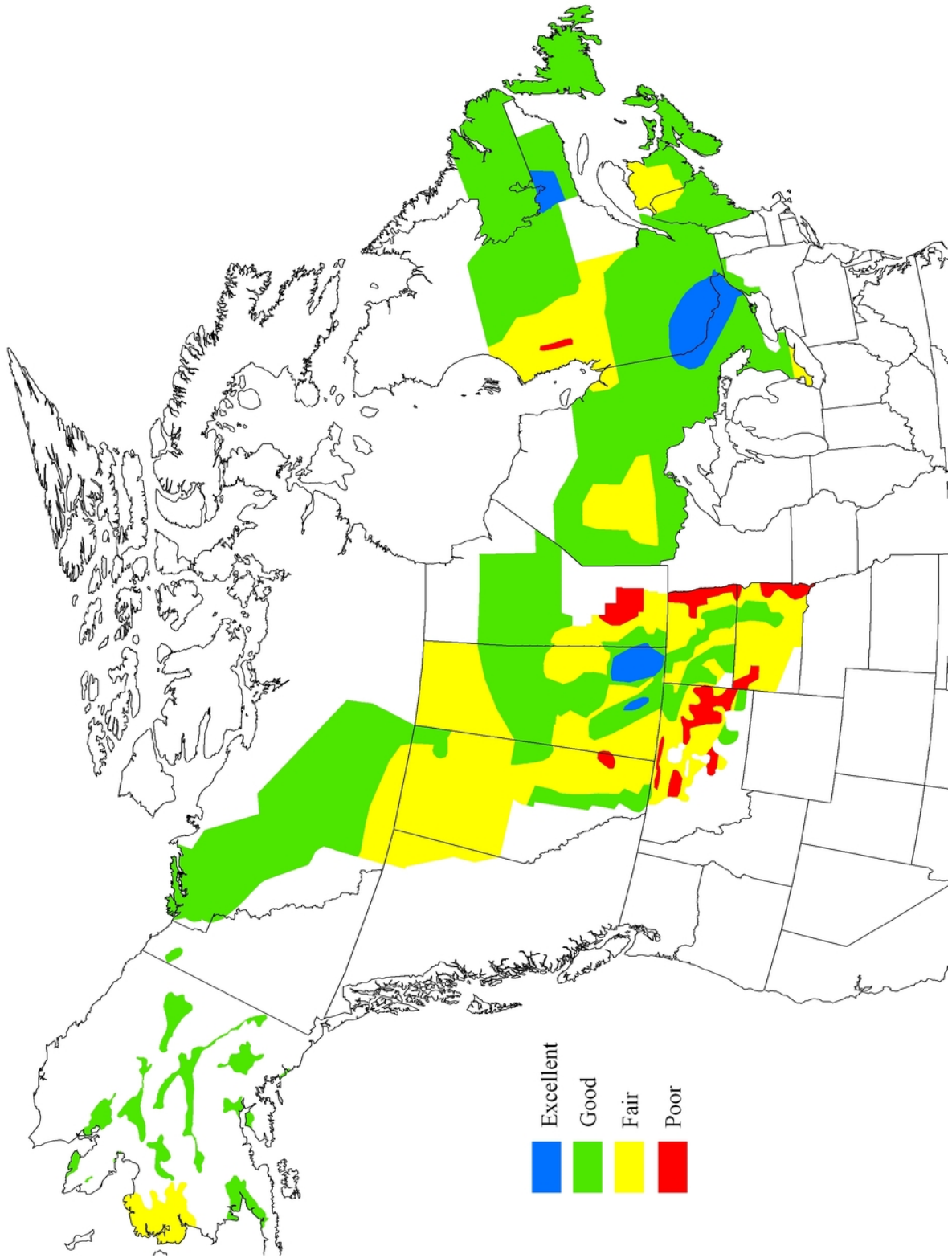


Figure 4: Breeding waterfowl habitat conditions during the 2012 Waterfowl Breeding Population and Habitat Survey, as judged by U.S. Fish and Wildlife Service Flyway Biologists.

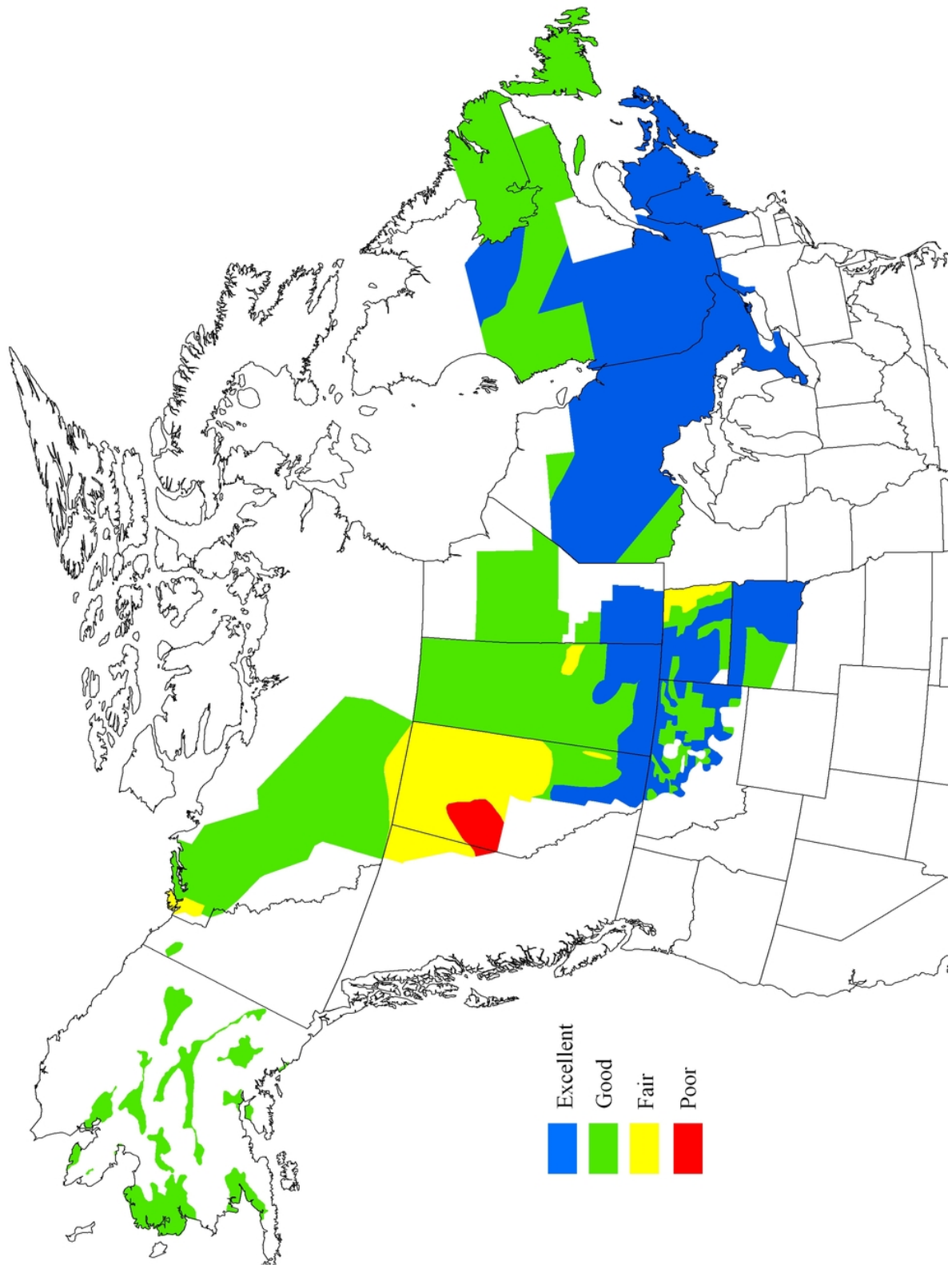


Figure 5: Breeding waterfowl habitat conditions during the 2011 Waterfowl Breeding Population and Habitat Survey, as judged by U.S. Fish and Wildlife Service Flyway Biologists.

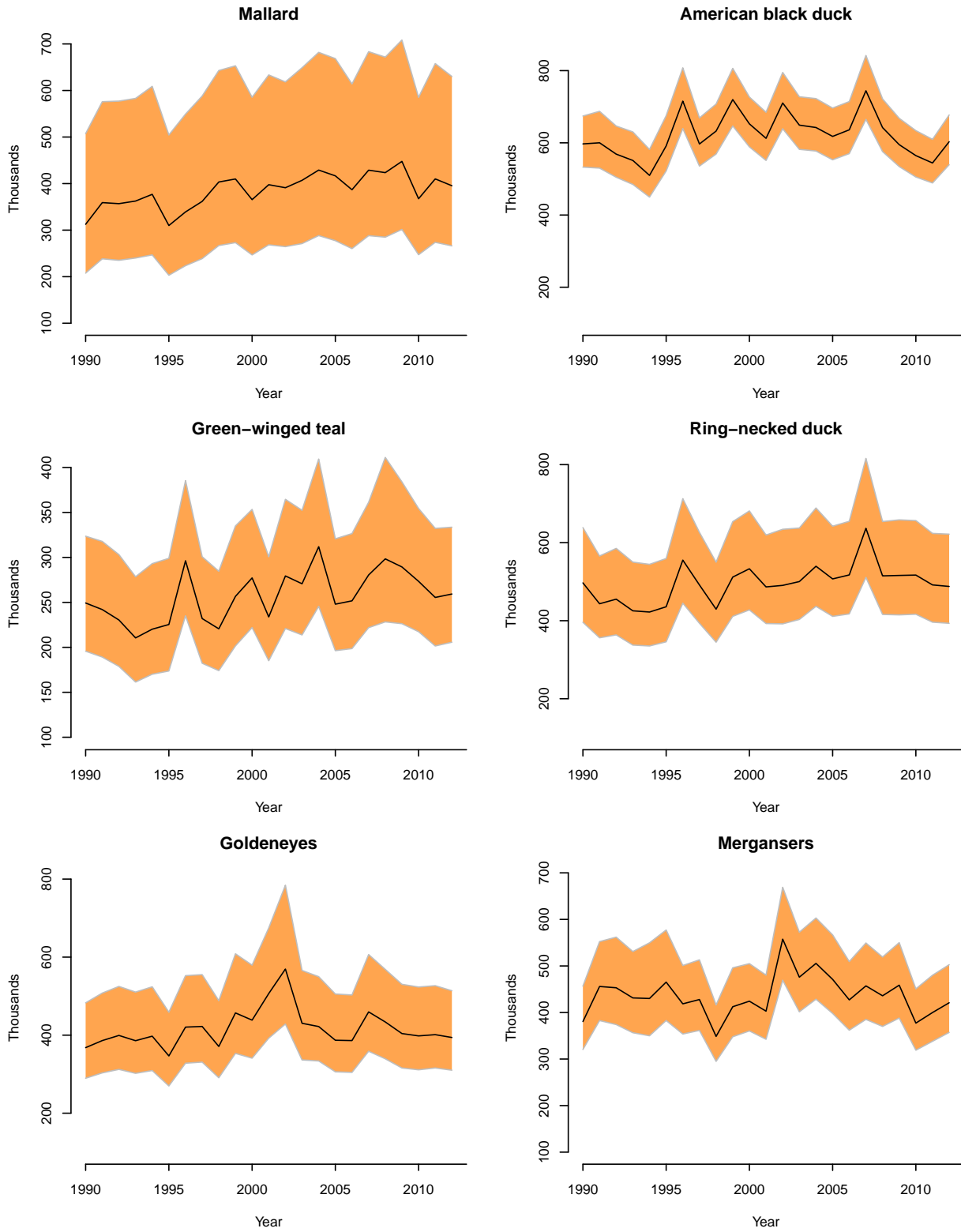


Figure 6: Breeding population estimates and 90% credibility intervals for selected species in the eastern survey area (strata 51, 52, 63, 64, 66–68, 70–72).

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}	\widehat{SE}	\hat{N}	\widehat{SE}	\hat{N}	\widehat{SE}	\hat{N}	\widehat{SE}	\hat{N}	\widehat{SE}
1955	8,777.3	457.1	651.5	149.5	3,216.8	297.8	1,807.2	291.5	5,305.2	567.6
1956	10,452.7	461.8	772.6	142.4	3,145.0	227.8	1,525.3	236.2	4,997.6	527.6
1957	9,296.9	443.5	666.8	148.2	2,919.8	291.5	1,102.9	161.2	4,299.5	467.3
1958	11,234.2	555.6	502.0	89.6	2,551.7	177.9	1,347.4	212.2	5,456.6	483.7
1959	9,024.3	466.6	590.0	72.7	3,787.7	339.2	2,653.4	459.3	5,099.3	332.7
1960	7,371.7	354.1	784.1	68.4	2,987.6	407.0	1,426.9	311.0	4,293.0	294.3
1961	7,330.0	510.5	654.8	77.5	3,048.3	319.9	1,729.3	251.5	3,655.3	298.7
1962	5,535.9	426.9	905.1	87.0	1,958.7	145.4	722.9	117.6	3,011.1	209.8
1963	6,748.8	326.8	1,055.3	89.5	1,830.8	169.9	1,242.3	226.9	3,723.6	323.0
1964	6,063.9	385.3	873.4	73.7	2,589.6	259.7	1,561.3	244.7	4,020.6	320.4
1965	5,131.7	274.8	1,260.3	114.8	2,301.1	189.4	1,282.0	151.0	3,594.5	270.4
1966	6,731.9	311.4	1,680.4	132.4	2,318.4	139.2	1,617.3	173.6	3,733.2	233.6
1967	7,509.5	338.2	1,384.6	97.8	2,325.5	136.2	1,593.7	165.7	4,491.5	305.7
1968	7,089.2	340.8	1,949.0	213.9	2,298.6	156.1	1,430.9	146.6	3,462.5	389.1
1969	7,531.6	280.2	1,573.4	100.2	2,941.4	168.6	1,491.0	103.5	4,138.6	239.5
1970	9,985.9	617.2	1,608.1	123.5	3,469.9	318.5	2,182.5	137.7	4,861.8	372.3
1971	9,416.4	459.5	1,605.6	123.0	3,272.9	186.2	1,889.3	132.9	4,610.2	322.8
1972	9,265.5	363.9	1,622.9	120.1	3,200.1	194.1	1,948.2	185.8	4,278.5	230.5
1973	8,079.2	377.5	1,245.6	90.3	2,877.9	197.4	1,949.2	131.9	3,332.5	220.3
1974	6,880.2	351.8	1,592.4	128.2	2,672.0	159.3	1,864.5	131.2	4,976.2	394.6
1975	7,726.9	344.1	1,643.9	109.0	2,778.3	192.0	1,664.8	148.1	5,885.4	337.4
1976	7,933.6	337.4	1,244.8	85.7	2,505.2	152.7	1,547.5	134.0	4,744.7	294.5
1977	7,397.1	381.8	1,299.0	126.4	2,575.1	185.9	1,285.8	87.9	4,462.8	328.4
1978	7,425.0	307.0	1,558.0	92.2	3,282.4	208.0	2,174.2	219.1	4,498.6	293.3
1979	7,883.4	327.0	1,757.9	121.0	3,106.5	198.2	2,071.7	198.5	4,875.9	297.6
1980	7,706.5	307.2	1,392.9	98.8	3,595.5	213.2	2,049.9	140.7	4,895.1	295.6
1981	6,409.7	308.4	1,395.4	120.0	2,946.0	173.0	1,910.5	141.7	3,720.6	242.1
1982	6,408.5	302.2	1,633.8	126.2	2,458.7	167.3	1,535.7	140.2	3,657.6	203.7
1983	6,456.0	286.9	1,519.2	144.3	2,636.2	181.4	1,875.0	148.0	3,366.5	197.2
1984	5,415.3	258.4	1,515.0	125.0	3,002.2	174.2	1,408.2	91.5	3,979.3	267.6
1985	4,960.9	234.7	1,303.0	98.2	2,050.7	143.7	1,475.4	100.3	3,502.4	246.3
1986	6,124.2	241.6	1,547.1	107.5	1,736.5	109.9	1,674.9	136.1	4,478.8	237.1
1987	5,789.8	217.9	1,305.6	97.1	2,012.5	134.3	2,006.2	180.4	3,528.7	220.2
1988	6,369.3	310.3	1,349.9	121.1	2,211.1	139.1	2,060.8	188.3	4,011.1	290.4
1989	5,645.4	244.1	1,414.6	106.6	1,972.9	106.0	1,841.7	166.4	3,125.3	229.8

Appendix A: Continued.

Year	Mallard		Gadwall		American wigeon		Green-winged teal		Blue-winged teal	
	\hat{N}	\widehat{SE}	\hat{N}	\widehat{SE}	\hat{N}	\widehat{SE}	\hat{N}	\widehat{SE}	\hat{N}	\widehat{SE}
1990	5,452.4	238.6	1,672.1	135.8	1,860.1	108.3	1,789.5	172.7	2,776.4	178.7
1991	5,444.6	205.6	1,583.7	111.8	2,254.0	139.5	1,557.8	111.3	3,763.7	270.8
1992	5,976.1	241.0	2,032.8	143.4	2,208.4	131.9	1,773.1	123.7	4,333.1	263.2
1993	5,708.3	208.9	1,755.2	107.9	2,053.0	109.3	1,694.5	112.7	3,192.9	205.6
1994	6,980.1	282.8	2,318.3	145.2	2,382.2	130.3	2,108.4	152.2	4,616.2	259.2
1995	8,269.4	287.5	2,835.7	187.5	2,614.5	136.3	2,300.6	140.3	5,140.0	253.3
1996	7,941.3	262.9	2,984.0	152.5	2,271.7	125.4	2,499.5	153.4	6,407.4	353.9
1997	9,939.7	308.5	3,897.2	264.9	3,117.6	161.6	2,506.6	142.5	6,124.3	330.7
1998	9,640.4	301.6	3,742.2	205.6	2,857.7	145.3	2,087.3	138.9	6,398.8	332.3
1999	10,805.7	344.5	3,235.5	163.8	2,920.1	185.5	2,631.0	174.6	7,149.5	364.5
2000	9,470.2	290.2	3,158.4	200.7	2,733.1	138.8	3,193.5	200.1	7,431.4	425.0
2001	7,904.0	226.9	2,679.2	136.1	2,493.5	149.6	2,508.7	156.4	5,757.0	288.8
2002	7,503.7	246.5	2,235.4	135.4	2,334.4	137.9	2,333.5	143.8	4,206.5	227.9
2003	7,949.7	267.3	2,549.0	169.9	2,551.4	156.9	2,678.5	199.7	5,518.2	312.7
2004	7,425.3	282.0	2,589.6	165.6	1,981.3	114.9	2,460.8	145.2	4,073.0	238.0
2005	6,755.3	280.8	2,179.1	131.0	2,225.1	139.2	2,156.9	125.8	4,585.5	236.3
2006	7,276.5	223.7	2,824.7	174.2	2,171.2	115.7	2,587.2	155.3	5,859.6	303.5
2007	8,307.3	285.8	3,355.9	206.2	2,806.8	152.0	2,890.3	196.1	6,707.6	362.2
2008	7,723.8	256.8	2,727.7	158.9	2,486.6	151.3	2,979.7	194.4	6,640.1	337.3
2009	8,512.4	248.3	3,053.5	166.3	2,468.6	135.4	3,443.6	219.9	7,383.8	396.8
2010	8,430.1	284.9	2,976.7	161.6	2,424.6	131.5	3,475.9	207.2	6,328.5	382.6
2011	9,182.6	267.8	3,256.9	196.9	2,084.0	110.1	2,900.1	170.7	8,948.5	418.2
2012	10,601.5	324.0	3,585.6	208.7	2,145.0	145.6	3,471.2	207.9	9,242.3	425.1

Appendix A: Continued.

Year	Northern shoveler		Northern pintail		Redhead		Canvasback		Scaup	
	\hat{N}	\widehat{SE}	\hat{N}	\widehat{SE}	\hat{N}	\widehat{SE}	\hat{N}	\widehat{SE}	\hat{N}	\widehat{SE}
1955	1,642.8	218.7	9,775.1	656.1	539.9	98.9	589.3	87.8	5,620.1	582.1
1956	1,781.4	196.4	10,372.8	694.4	757.3	119.3	698.5	93.3	5,994.1	434.0
1957	1,476.1	181.8	6,606.9	493.4	509.1	95.7	626.1	94.7	5,766.9	411.7
1958	1,383.8	185.1	6,037.9	447.9	457.1	66.2	746.8	96.1	5,350.4	355.1
1959	1,577.6	301.1	5,872.7	371.6	498.8	55.5	488.7	50.6	7,037.6	492.3
1960	1,824.5	130.1	5,722.2	323.2	497.8	67.0	605.7	82.4	4,868.6	362.5
1961	1,383.0	166.5	4,218.2	496.2	323.3	38.8	435.3	65.7	5,380.0	442.2
1962	1,269.0	113.9	3,623.5	243.1	507.5	60.0	360.2	43.8	5,286.1	426.4
1963	1,398.4	143.8	3,846.0	255.6	413.4	61.9	506.2	74.9	5,438.4	357.9
1964	1,718.3	240.3	3,291.2	239.4	528.1	67.3	643.6	126.9	5,131.8	386.1
1965	1,423.7	114.1	3,591.9	221.9	599.3	77.7	522.1	52.8	4,640.0	411.2
1966	2,147.0	163.9	4,811.9	265.6	713.1	77.6	663.1	78.0	4,439.2	356.2
1967	2,314.7	154.6	5,277.7	341.9	735.7	79.0	502.6	45.4	4,927.7	456.1
1968	1,684.5	176.8	3,489.4	244.6	499.4	53.6	563.7	101.3	4,412.7	351.8
1969	2,156.8	117.2	5,903.9	296.2	633.2	53.6	503.5	53.7	5,139.8	378.5
1970	2,230.4	117.4	6,392.0	396.7	622.3	64.3	580.1	90.4	5,662.5	391.4
1971	2,011.4	122.7	5,847.2	368.1	534.4	57.0	450.7	55.2	5,143.3	333.8
1972	2,466.5	182.8	6,979.0	364.5	550.9	49.4	425.9	46.0	7,997.0	718.0
1973	1,619.0	112.2	4,356.2	267.0	500.8	57.7	620.5	89.1	6,257.4	523.1
1974	2,011.3	129.9	6,598.2	345.8	626.3	70.8	512.8	56.8	5,780.5	409.8
1975	1,980.8	106.7	5,900.4	267.3	831.9	93.5	595.1	56.1	6,460.0	486.0
1976	1,748.1	106.9	5,475.6	299.2	665.9	66.3	614.4	70.1	5,818.7	348.7
1977	1,451.8	82.1	3,926.1	246.8	634.0	79.9	664.0	74.9	6,260.2	362.8
1978	1,975.3	115.6	5,108.2	267.8	724.6	62.2	373.2	41.5	5,984.4	403.0
1979	2,406.5	135.6	5,376.1	274.4	697.5	63.8	582.0	59.8	7,657.9	548.6
1980	1,908.2	119.9	4,508.1	228.6	728.4	116.7	734.6	83.8	6,381.7	421.2
1981	2,333.6	177.4	3,479.5	260.5	594.9	62.0	620.8	59.1	5,990.9	414.2
1982	2,147.6	121.7	3,708.8	226.6	616.9	74.2	513.3	50.9	5,532.0	380.9
1983	1,875.7	105.3	3,510.6	178.1	711.9	83.3	526.6	58.9	7,173.8	494.9
1984	1,618.2	91.9	2,964.8	166.8	671.3	72.0	530.1	60.1	7,024.3	484.7
1985	1,702.1	125.7	2,515.5	143.0	578.2	67.1	375.9	42.9	5,098.0	333.1
1986	2,128.2	112.0	2,739.7	152.1	559.6	60.5	438.3	41.5	5,235.3	355.5
1987	1,950.2	118.4	2,628.3	159.4	502.4	54.9	450.1	77.9	4,862.7	303.8
1988	1,680.9	210.4	2,005.5	164.0	441.9	66.2	435.0	40.2	4,671.4	309.5
1989	1,538.3	95.9	2,111.9	181.3	510.7	58.5	477.4	48.4	4,342.1	291.3
1990	1,759.3	118.6	2,256.6	183.3	480.9	48.2	539.3	60.3	4,293.1	264.9

Appendix A: Continued.

Year	Northern shoveler		Northern pintail		Redhead		Canvasback		Scaup	
	\hat{N}	\widehat{SE}	\hat{N}	\widehat{SE}	\hat{N}	\widehat{SE}	\hat{N}	\widehat{SE}	\hat{N}	\widehat{SE}
1991	1,716.2	104.6	1,803.4	131.3	445.6	42.1	491.2	66.4	5,254.9	364.9
1992	1,954.4	132.1	2,098.1	161.0	595.6	69.7	481.5	97.3	4,639.2	291.9
1993	2,046.5	114.3	2,053.4	124.2	485.4	53.1	472.1	67.6	4,080.1	249.4
1994	2,912.0	141.4	2,972.3	188.0	653.5	66.7	525.6	71.1	4,529.0	253.6
1995	2,854.9	150.3	2,757.9	177.6	888.5	90.6	770.6	92.2	4,446.4	277.6
1996	3,449.0	165.7	2,735.9	147.5	834.2	83.1	848.5	118.3	4,217.4	234.5
1997	4,120.4	194.0	3,558.0	194.2	918.3	77.2	688.8	57.2	4,112.3	224.2
1998	3,183.2	156.5	2,520.6	136.8	1,005.1	122.9	685.9	63.8	3,471.9	191.2
1999	3,889.5	202.1	3,057.9	230.5	973.4	69.5	716.0	79.1	4,411.7	227.9
2000	3,520.7	197.9	2,907.6	170.5	926.3	78.1	706.8	81.0	4,026.3	205.3
2001	3,313.5	166.8	3,296.0	266.6	712.0	70.2	579.8	52.7	3,694.0	214.9
2002	2,318.2	125.6	1,789.7	125.2	564.8	69.0	486.6	43.8	3,524.1	210.3
2003	3,619.6	221.4	2,558.2	174.8	636.8	56.6	557.6	48.0	3,734.4	225.5
2004	2,810.4	163.9	2,184.6	155.2	605.3	51.5	617.2	64.6	3,807.2	202.3
2005	3,591.5	178.6	2,560.5	146.8	592.3	51.7	520.6	52.9	3,386.9	196.4
2006	3,680.2	236.5	3,386.4	198.7	916.3	86.1	691.0	69.6	3,246.7	166.9
2007	4,552.8	247.5	3,335.3	160.4	1,009.0	84.7	864.9	86.2	3,452.2	195.3
2008	3,507.8	168.4	2,612.8	143.0	1,056.0	120.4	488.7	45.4	3,738.3	220.1
2009	4,376.3	224.1	3,225.0	166.9	1,044.1	106.3	662.1	57.4	4,172.1	232.3
2010	4,057.4	198.4	3,508.6	216.4	1,064.2	99.5	585.2	50.8	4,244.4	247.9
2011	4,641.0	232.8	4,428.6	267.9	1,356.1	128.3	691.6	46.0	4,319.3	261.1
2012	5,017.6	254.2	3,473.1	192.4	1,269.9	99.2	759.9	68.5	5,238.6	296.8

Appendix B: Breeding population estimates and 90% confidence intervals or credibility intervals (in thousands) for the 6 most abundant species of ducks in the eastern survey area, 1990–2012^a.

Year	Mallard			American black duck			Green-winged teal			Ring-necked duck			Goldeneyes ^b			Mergansers ^c		
	\hat{N}	90% CI	\hat{N}	90% CI	\hat{N}	90% CI	\hat{N}	90% CI	\hat{N}	90% CI	\hat{N}	90% CI	\hat{N}	90% CI	\hat{N}	90% CI	\hat{N}	90% CI
1990	312.5	(207.6, 507.3)	597.0	(532.7, 674.2)	249.3	(195.7, 323.6)	496.9	(395.9, 638.6)	368.0	(289.6, 482.8)	380.5	(320.6, 456.6)						
1991	359.1	(238.4, 575.9)	600.1	(530.0, 687.3)	242.0	(189.2, 317.8)	443.4	(356.2, 565.8)	386.1	(303.3, 507.8)	455.9	(382.7, 552.3)						
1992	356.9	(235.2, 577.2)	568.7	(504.7, 646.5)	230.4	(178.8, 303.1)	455.2	(363.6, 585.3)	399.3	(312.3, 524.9)	453.1	(374.1, 561.9)						
1993	362.5	(240.1, 583.0)	551.2	(484.8, 630.2)	210.5	(161.4, 278.5)	425.3	(337.5, 550.1)	385.8	(302.2, 510.4)	431.3	(356.5, 530.9)						
1994	376.9	(246.8, 608.9)	509.8	(449.7, 581.6)	220.2	(170.1, 293.1)	422.2	(335.2, 544.4)	397.4	(309.3, 523.9)	430.1	(350.0, 549.7)						
1995	309.9	(203.1, 504.4)	591.4	(522.0, 675.1)	225.4	(173.7, 299.0)	435.7	(345.9, 559.3)	346.8	(269.8, 458.8)	465.3	(382.8, 577.2)						
1996	339.1	(223.6, 549.2)	715.5	(639.6, 807.8)	296.3	(235.1, 385.4)	555.3	(444.9, 712.7)	420.6	(328.1, 552.5)	418.6	(353.8, 500.9)						
1997	361.7	(238.8, 588.1)	596.8	(535.6, 669.0)	232.0	(182.3, 300.8)	491.5	(393.4, 626.3)	422.3	(331.0, 555.1)	427.9	(361.5, 513.1)						
1998	403.4	(266.9, 642.9)	632.5	(568.9, 707.4)	220.6	(174.1, 284.6)	429.5	(344.9, 550.0)	371.0	(290.8, 488.3)	348.6	(295.0, 416.3)						
1999	409.9	(273.1, 653.0)	719.8	(646.7, 806.3)	256.7	(201.6, 335.0)	511.8	(411.2, 653.9)	457.0	(353.2, 608.5)	412.4	(347.9, 496.0)						
2000	365.5	(246.7, 585.4)	652.5	(588.8, 726.8)	277.2	(222.0, 353.4)	533.1	(427.7, 681.3)	438.5	(341.0, 579.4)	424.3	(360.4, 504.9)						
2001	397.6	(268.4, 633.4)	612.5	(551.2, 684.7)	233.8	(185.1, 300.7)	486.6	(392.7, 619.5)	506.7	(392.3, 674.8)	402.9	(342.5, 480.3)						
2002	391.1	(264.6, 618.4)	710.3	(639.0, 794.9)	279.4	(220.9, 364.6)	490.5	(391.9, 634.3)	569.4	(428.5, 784.3)	557.6	(469.4, 669.0)						
2003	407.0	(271.1, 648.9)	649.0	(581.9, 727.6)	270.7	(213.8, 352.4)	500.3	(403.2, 637.5)	430.4	(336.5, 565.8)	475.9	(401.5, 572.5)						
2004	429.0	(288.3, 681.9)	642.4	(577.3, 722.5)	311.9	(245.6, 409.4)	539.6	(436.8, 688.8)	422.1	(333.9, 549.9)	505.5	(428.6, 603.0)						
2005	416.6	(277.4, 668.5)	617.8	(553.0, 696.3)	248.0	(196.3, 320.7)	507.1	(411.1, 642.2)	387.0	(306.1, 505.4)	471.2	(398.0, 566.7)						
2006	386.8	(260.3, 614.0)	636.0	(570.1, 714.2)	251.7	(198.6, 326.5)	517.3	(417.4, 654.7)	386.1	(304.6, 503.0)	427.1	(362.0, 509.4)						
2007	428.8	(288.1, 683.4)	744.3	(665.0, 842.0)	280.5	(221.9, 361.3)	636.8	(511.0, 815.9)	459.6	(358.8, 606.6)	457.2	(385.1, 549.3)						
2008	423.5	(284.9, 671.7)	642.2	(575.8, 721.6)	298.4	(228.3, 411.2)	514.9	(416.0, 654.1)	433.8	(339.4, 568.5)	435.9	(370.1, 519.2)						
2009	447.7	(301.5, 708.4)	594.9	(534.2, 667.9)	289.4	(226.3, 384.0)	516.0	(414.9, 658.4)	404.1	(315.9, 530.3)	458.7	(388.1, 550.1)						
2010	367.4	(247.2, 585.2)	564.6	(505.3, 633.8)	273.4	(217.4, 354.4)	516.9	(416.6, 656.6)	398.1	(311.2, 523.4)	377.2	(319.0, 450.8)						
2011	410.1	(273.8, 657.8)	544.2	(488.8, 609.6)	255.5	(201.5, 332.3)	491.7	(396.2, 623.7)	401.3	(315.9, 526.8)	399.9	(338.1, 480.0)						
2012	395.4	(266.2, 630.1)	603.1	(539.4, 677.2)	259.3	(205.7, 333.6)	487.8	(393.3, 621.8)	394.0	(310.2, 513.8)	420.9	(357.2, 502.7)						

^a Estimates from Bayesian hierarchical analysis using FWS and CWS data from strata 51, 52, 63, 64, 66–68, 70–72.

^b Common and Barrow's, combined.

^c Common, red-breasted, and hooded, combined.

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