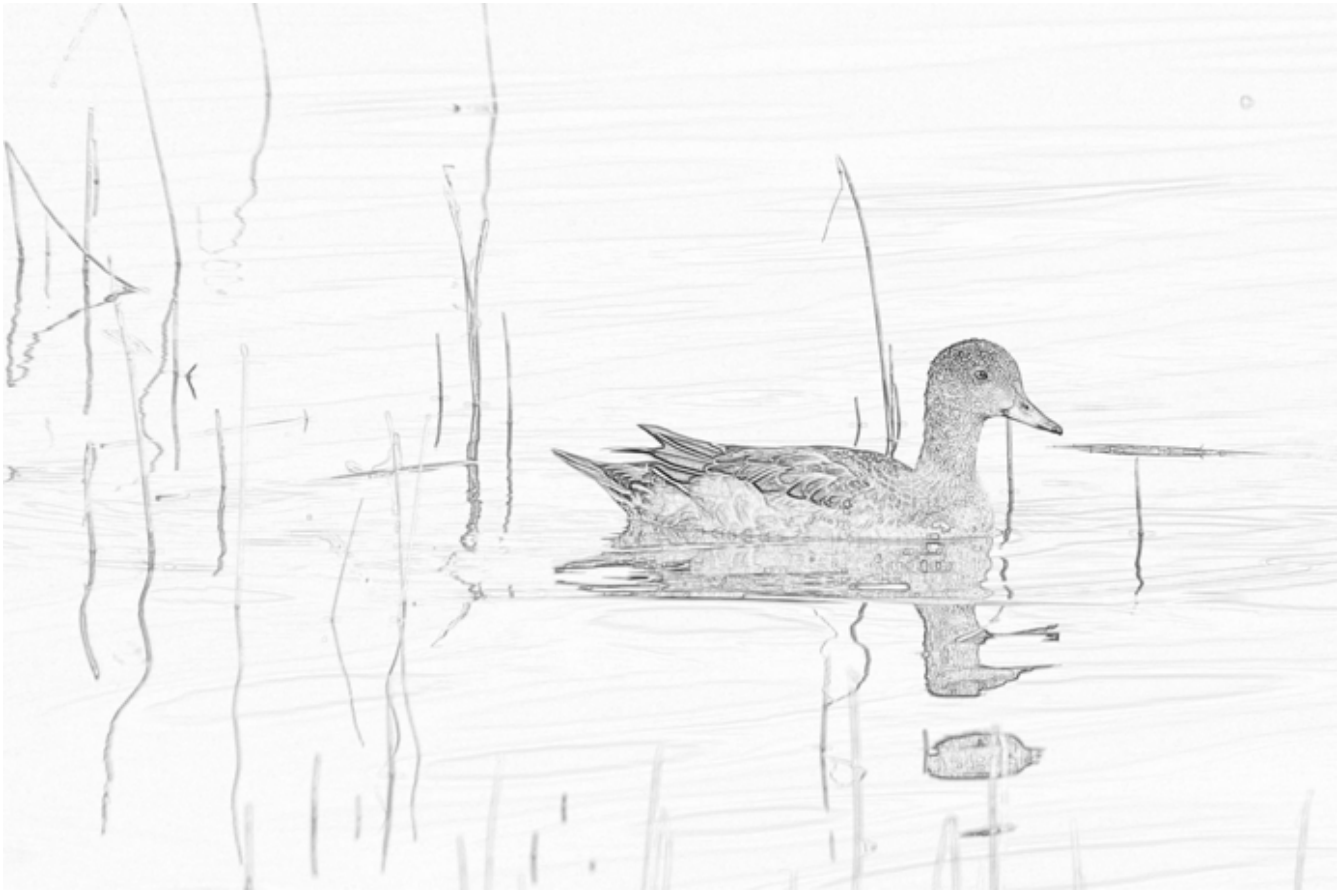
U.S. Fish & Wildlife Service

Trends in Duck Breeding Populations 1955–2015

July 2, 2015



Trends in Duck Breeding Populations, 1955–2015

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Administrative Report—July 2, 2015

This report summarizes information about the status of duck populations and wetland habitats during spring 2015, focusing on areas encompassed by the U.S. Fish & Wildlife (USFWS) and Canadian Wildlife Services' (CWS) Waterfowl Breeding Population and Habitat Survey (WBPHS). 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 (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 49.5 ± 0.8 [SE] million birds (Figure 3, Appendix A). This estimate is similar to the 2014 estimate of 49.2 ± 0.8 million, and is 43% higher than the long-term average[a] (1955–2014; Table 1). This year also marks the highest estimates in the time series for mallards (*Anas platyrhynchos*) and green-winged teal (*A. crecca*). Estimated mallard abundance was 11.6 ± 0.4 million, which was similar to the 2014 estimate of 10.9 ± 0.3 million, and 51% above the long-term average of 7.7 ± 0.04 million (Table 2). Estimated abundance of gadwall (*A. strepera*; 3.8 ± 0.2 million) and American wigeon (*A. americana*; 3.0 ± 0.2 million) were similar to last year's estimates, and were 100% and 17% above their long-term averages of 1.9 ± 0.02 million (Table 3) and 2.6 ± 0.02 million (Table 4), respectively. The estimated abundance of green-winged teal was 4.1 ± 0.3 million, which was 19% above the 2014 estimate of 3.4 ± 0.2 million and 98% above the long-term average (2.1 ± 0.02 million; Table 5). Estimated blue-winged teal (*A. discors*; 8.5 ± 0.4 million) abundance was similar to the 2014 estimate, and was 73% above the long-term average of 4.9 ± 0.04 million (Table 6). Estimated abundance of northern shovelers (*A. clypeata*; 4.4 ± 0.2 million) was 17% below the 2014 estimate but 75% above the long-term average of 2.5 ± 0.02 million (Table 7). Northern pintail abundance (*A. acuta*; 3.0 ± 0.2 million) was similar to the 2014 estimate and 24% below the long-term average of 4.0 ± 0.04 million (Table 8). Abundance estimates for redheads (*Aythya americana*; 1.2 ± 0.1 million) and canvasbacks (*Aythya valisineria*; 0.8 ± 0.06 million) were similar to their 2014 estimates and were 71% and 30% 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; 4.4 ± 0.3 million) was similar to the 2014 estimate and was 13% below the long-term average of 5.0 ± 0.05 million (Table 11).

Despite an early spring over most of the survey area, habitat conditions during the 2015 WBPHS were similar to or poorer than last year. In many areas, the decline in habitat conditions was due to average to below-average annual precipitation, with the exception of portions of southern Saskatchewan and central latitudes of eastern Canada. The total pond estimate (Prairie Canada and U.S. combined) was 6.3 ± 0.2 million, which was 12% below the 2014 estimate of 7.2 ± 0.2 million but 21% above the long-term average of5.2 ± 0.03 million (Table 12, Figure 2).

Spring phenology was early across the traditional survey area, particularly in relation to 2013 and 2014. Much of the Canadian prairies had average to below-average winter precipitation and above-average

[a]Populations 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.

temperatures. The best moisture conditions were centered in southern Saskatchewan, but nearly all of Prairie Canada experienced below-normal spring precipitation. The 2015 estimate of ponds in Prairie Canada was 4.2 ± 0.1 million. This estimate was 10% below the 2014 estimate of 4.6 ± 0.2 million but 19% above the long-term average (3.5 ± 0.02 million). Annual winter precipitation was lower in the northern part of the survey area; the Parklands, however, continue to benefit from precipitation received in 2013 and 2014. The boreal region and Alaska exhibited drier conditions, but an early spring and the absence of flooding in important nesting areas should aid waterfowl production. Habitats in most of the Canadian portion of the traditional survey area were rated as fair or good this year; however, some areas received greater annual precipitation resulting in excellent conditions.

Following a relatively mild winter, the U.S. prairies also recorded an early spring, although precipitation since last summer was average to mostly below average. Habitat conditions declined relative to 2014 in Montana and the Dakotas despite significant rainfall in May, which came too late to benefit most early nesting waterfowl. The 2015 pond estimate for the northcentral U.S. was 2.2 ± 0.09 million, which was 16% below the 2014 estimate of 2.6 ± 0.1 million and 28% above the long-term average (1.7 ± 0.02 million).

In 2005, the USFWS and CWS integrated 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 (Figure 1). Hierarchical model estimates for the time series 1990 to present are updated each year, resulting in estimates that may differ slightly from those previously published. 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 (Table 13). 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 (1990–2015). In cases where the USFWS has traditionally not recorded observations to the species level, composite estimates are provided for multiple-species groupings (i.e., mergansers and goldeneyes [*Bucephala clangula* and *B. islandica*]).

Estimated abundance of American black ducks in the eastern survey area was 0.5 ± 0.04 million, which was 11% below last year's estimate of 0.6 ± 0.04 million, and 13% below the 1990–2014 average of 0.6 ± 0.04 million. The estimated abundance of mallards (0.4 ± 0.1 million) and mergansers (0.4 ± 0.04 million) were similar to the 2014 estimates and their 1990–2014 averages. Abundance estimates of green-winged teal (0.2 ± 0.04 million) and goldeneyes were similar to their 2014 estimates, and were 14% and 15% below their 1990–2014 averages of 0.3 ± 0.04 million and 0.4 ± 0.07 million, respectively. The abundance estimate of ring-necked ducks (0.5 ± 0.07 million) was similar to the 2014 estimate and the 1990–2014 average (Table 13).

Winter and spring temperatures in the eastern survey area were again well below normal. February was the coldest on record in Maine and the state had near-record snowfall. Despite this, minimal additional precipitation was received during spring which left conditions dry across most of Maine at the time of the survey. Southern Ontario and southern Quebec entered winter dry and had below normal winter and early spring precipitation which resulted in the fair conditions observed during the survey. Western and central Ontario and northern Quebec received average to above-average winter and spring precipitation and conditions were good to excellent. A protracted thaw combined with above-average precipitation in the Maritimes, Newfoundland and Labrador resulted in good conditions, except at higher elevations where early nesting waterfowl may have been impacted by persistent snowpack and ice coverage.

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

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

Air B. Shults and D. Groves (Strata 1, 4, and 6)

Air B. Shults, J. Bredy, and D. Groves (Strata 3 and 5)

Air H. Wilson and D. Groves (Stratum 7)

Air J. Bredy and D. Groves (Strata 2, 8–12)

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

Air F. Roetker and S. Olson

Northern Saskatchewan and Northern Manitoba (Strata 21–25)

Air W. Rhodes and D. Head II

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

Air J. Bredy and J. Sands

Ground G. Raven[a], M. Gillespie[c], J. Caswell[b], K. Zimmer[a], M. Watmough[a], M. Tanguay[a], D. Knop[a], and N. Clements[d]

Southern Saskatchewan (Strata 30–33)

Air P. Thorpe and S. Chandler

Ground B. Bartzen[a], K. Dufour[a], K. Warner[a], A. Raquel[d], P. Bergen[c], H. Fehr[a], and J. Brewster[a]

Southern Manitoba (Strata 34–39, 40)

Air K. Fox and J. Bidwell[e]

Ground M. Schuster[a], J. Leafloor[a], D. Walker[c], G. Ball[c], M. Ross[a], R. Bazin[a], and R. Buss[c]

Montana and Western Dakotas (Strata 41–44)

Air R. Spangler and B. Kelly[b]

Ground P. Garrettson and A. Roberts

Eastern Dakotas (Strata 45–49)

Air T. Liddick and D. Fronczak

Ground K. Kruse, H. Alvarez, S. LeJeune, and C. Reighn

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

Air J. Wortham and B. Pendley

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

Air S. Earsom and N. Wirwa

Maine and Atlantic Canada (Stratum 62–67)

Air M. Koneff and B. Rodgers

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 D. Sadler[a]
New Brunswick & Nova Scotia	B. Pollard[a] and A. Hicks[a]
Newfoundland & Labrador	S. Gilliland[a], P. Ryan[a], R. Wells[a], B. Pollard[a], P. Devers, D. Whittaker[d], and L. Pike[d]

[a]Canadian Wildlife Service
[b]State, Provincial or Tribal Conservation Agency
[c]Ducks Unlimited Canada
[d]Other Organization
[e]U.S. Fish & Wildlife Service Retired
All others—U.S. Fish & Wildlife Service

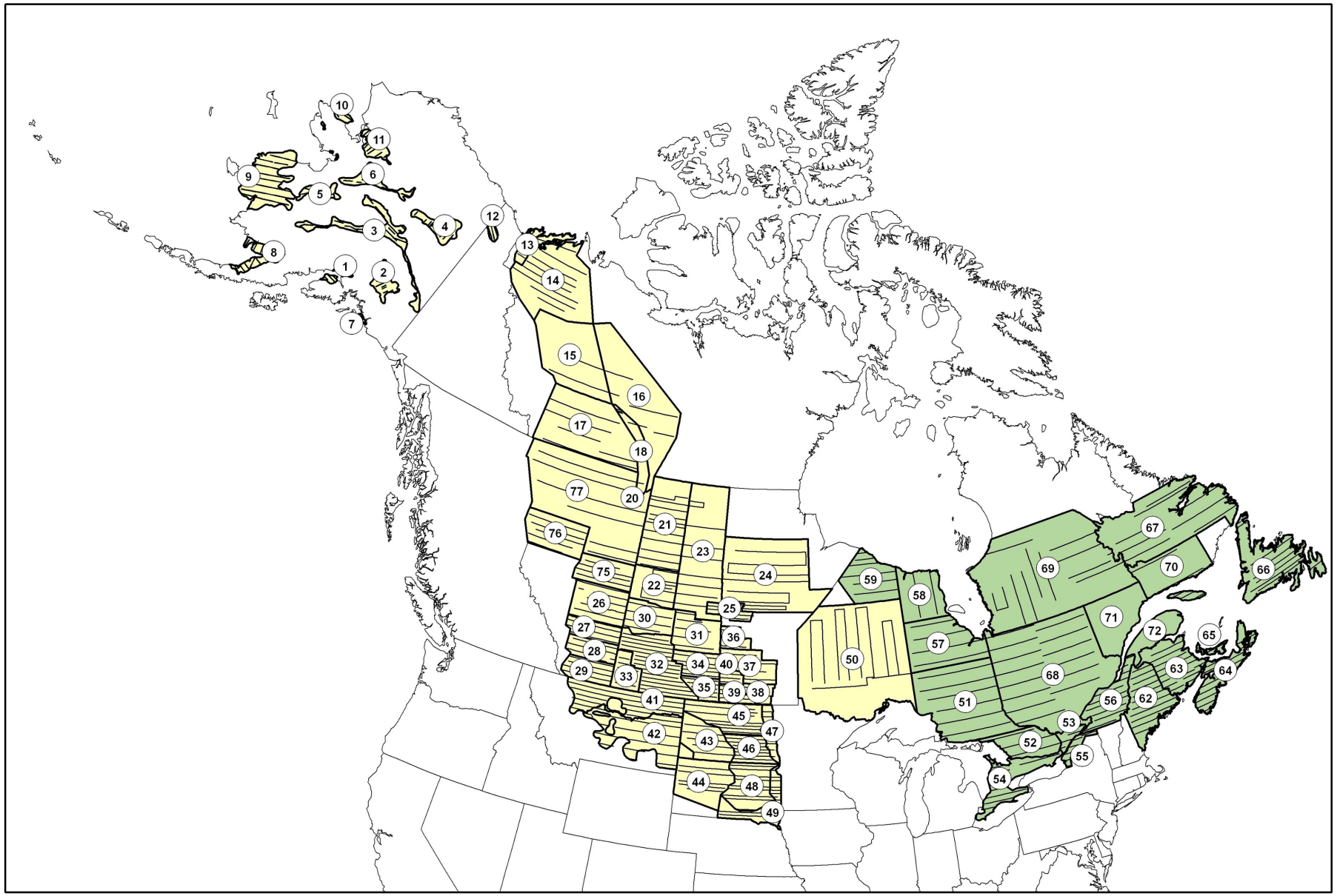

Figure 1. Strata and transects of the Waterfowl Breeding Population and Habitat Survey (yellow = traditional survey area, green = eastern survey area).

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

			Change from 2014			Change from LTA	
Region	2015	2014	%	*P*	LTA[b]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	3,389	3,510	−3	0.592	3,693	−8	0.053
C. & N. Alberta–N.E. British Columbia–NWT	11,546	9,946	+16	0.007	7,214	+60	<0.001
N. Saskatchewan–N. Manitoba–W. Ontario	3,527	2,566	+37	0.002	3,461	+2	0.772
S. Alberta	5,678	5,644	+1	0.918	4,279	+33	<0.001
S. Saskatchewan	13,542	12,893	+5	0.258	7,781	+74	<0.001
S. Manitoba	1,988	2,193	−9	0.182	1,540	+29	<0.001
Montana & Western Dakotas	2,730	3,660	−25	0.002	1,704	+60	<0.001
Eastern Dakotas	7,121	8,740	−19	0.003	5,030	+42	<0.001
Total	49,522	49,152	+1	0.751	34,703	+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, 1955–2014.

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

			Change from 2014			Change from LTA	
Region	2015	2014	%	*P*	LTA[a]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	471	501	−6	0.696	379	+24	0.071
C. & N. Alberta–N.E. British Columbia–NWT	1,981	1,757	+13	0.328	1,095	+81	<0.001
N. Saskatchewan–N. Manitoba–W. Ontario	1,728	1,126	+53	0.028	1,130	+53	0.003
S. Alberta	1,392	1,444	−4	0.715	1,080	+29	0.005
S. Saskatchewan	3,068	2,553	+20	0.012	2,081	+47	<0.001
S. Manitoba	538	602	−11	0.488	388	+39	0.057
Montana & Western Dakotas	767	1,014	−24	0.044	525	+46	0.001
Eastern Dakotas	1,698	1,903	−11	0.256	1,049	+62	<0.001
Total	11,643	10,900	+7	0.138	7,726	+51	<0.001

[a] Long-term average, 1955–2014.

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

			Change from 2014			Change from LTA	
Region	2015	2014	%	*P*	LTA[a]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	2	0	+200	0.321	2	+6	0.956
C. & N. Alberta–N.E. British Columbia–NWT	34	43	−20	0.364	51	−32	0.008
N. Saskatchewan–N. Manitoba–W. Ontario	7	36	−81	0.005	26	−75	<0.001
S. Alberta	564	565	0	0.996	322	+75	0.003
S. Saskatchewan	1,463	1,455	+1	0.958	646	+126	<0.001
S. Manitoba	205	236	−13	0.455	76	+171	<0.001
Montana & Western Dakotas	528	426	+24	0.415	211	+150	0.001
Eastern Dakotas	1,031	1,051	−2	0.915	588	+75	0.001
Total	3,834	3,811	+1	0.939	1,921	+100	<0.001

[a] Long-term average, 1955–2014.

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

			Change from 2014			Change from LTA	
Region	2015	2014	%	*P*	LTA[a]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	541	734	−26	0.043	557	−3	0.756
C. & N. Alberta–N.E. British Columbia–NWT	1,506	1,562	−4	0.814	902	+67	0.001
N. Saskatchewan–N. Manitoba–W. Ontario	99	74	+34	0.256	233	−57	<0.001
S. Alberta	305	224	+36	0.143	279	+9	0.544
S. Saskatchewan	251	273	−8	0.645	404	−38	<0.001
S. Manitoba	8	14	−39	0.076	54	−85	<0.001
Montana & Western Dakotas	195	129	+51	0.115	110	+77	0.014
Eastern Dakotas	131	106	+23	0.639	57	+131	0.073
Total	3,037	3,117	−3	0.773	2,596	+17	0.028

[a] Long-term average, 1955–2014.

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

			Change from 2014			Change from LTA	
Region	2015	2014	%	*P*	LTA[a]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	566	475	+19	0.227	406	+39	0.003
C. & N. Alberta–N.E. British Columbia–NWT	2,333	1,716	+36	0.066	825	+183	<0.001
N. Saskatchewan–N. Manitoba–W. Ontario	140	118	+20	0.381	203	−31	0.001
S. Alberta	327	368	−11	0.637	201	+63	0.027
S. Saskatchewan	452	466	−3	0.829	269	+68	<0.001
S. Manitoba	99	76	+30	0.219	54	+84	0.005
Montana & Western Dakotas	56	12	+382	<0.001	41	+39	0.189
Eastern Dakotas	107	209	−49	0.052	58	+84	0.062
Total	4,081	3,440	+19	0.080	2,058	+98	<0.001

[a] Long-term average, 1955–2014.

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

			Change from 2014			Change from LTA	
Region	2015	2014	%	*P*	LTA[a]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	0	0	0	1.000	1	−100	<0.001
C. & N. Alberta–N.E. British Columbia–NWT	360	377	−5	0.874	274	+31	0.234
N. Saskatchewan–N. Manitoba–W. Ontario	94	46	+105	0.146	235	−60	<0.001
S. Alberta	1,169	834	+40	0.071	614	+91	<0.001
S. Saskatchewan	3,567	3,109	+15	0.199	1,385	+158	<0.001
S. Manitoba	522	474	+10	0.578	375	+39	0.056
Montana & Western Dakotas	618	1,178	−48	0.004	298	+107	<0.001
Eastern Dakotas	2,217	2,523	−12	0.437	1,766	+25	0.063
Total	8,547	8,542	0	0.992	4,949	+73	<0.001

[a] Long-term average, 1955–2014.

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

			Change from 2014			Change from LTA	
Region	2015	2014	%	*P*	LTA[a]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	397	372	+7	0.752	291	+36	0.043
C. & N. Alberta–N.E. British Columbia–NWT	454	372	+22	0.291	224	+103	<0.001
N. Saskatchewan–N. Manitoba–W. Ontario	20	24	−17	0.668	39	−50	0.001
S. Alberta	887	914	−3	0.818	420	+111	<0.001
S. Saskatchewan	1,692	1,711	−1	0.931	766	+121	<0.001
S. Manitoba	131	255	−49	0.001	113	+16	0.421
Montana & Western Dakotas	297	521	−43	0.056	170	+75	0.033
Eastern Dakotas	513	1,110	−54	0.001	492	+4	0.756
Total	4,391	5,279	−17	0.010	2,515	+75	<0.001

[a] Long-term average, 1955–2014.

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

			Change from 2014			Change from LTA	
Region	2015	2014	%	*P*	LTA[a]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	668	701	−5	0.778	928	−28	0.002
C. & N. Alberta–N.E. British Columbia–NWT	639	318	+101	0.008	355	+80	0.006
N. Saskatchewan–N. Manitoba–W. Ontario	52	5	+910	<0.001	36	+45	0.195
S. Alberta	260	461	−44	0.015	670	−61	<0.001
S. Saskatchewan	720	739	−3	0.861	1,143	−37	<0.001
S. Manitoba	41	49	−17	0.465	101	−60	<0.001
Montana & Western Dakotas	197	252	−22	0.269	260	−24	0.068
Eastern Dakotas	466	695	−33	0.069	510	−9	0.577
Total	3,043	3,220	−6	0.489	4,003	−24	<0.001

[a] Long-term average, 1955–2014.

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

Region	2015	2014	Change from 2014		LTA[a]	Change from LTA	
			%	*P*		%	*P*
Alaska–Yukon Territory–Old Crow Flats	0	0	0	1.000	1	−100	<0.001
C. & N. Alberta–N.E. British Columbia–NWT	47	59	−20	0.530	40	+19	0.599
N. Saskatchewan–N. Manitoba–W. Ontario	20	2	+1,114	0.015	25	−21	0.493
S. Alberta	167	263	−36	0.111	127	+31	0.314
S. Saskatchewan	603	542	+11	0.565	222	+171	<0.001
S. Manitoba	102	95	+7	0.766	73	+40	0.102
Montana & Western Dakotas	8	17	−52	0.252	11	−29	0.343
Eastern Dakotas	248	301	−18	0.354	200	+24	0.164
Total	1,196	1,279	−6	0.549	701	+71	<0.001

[a] Long-term average, 1955–2014.

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

Region	2015	2014	Change from 2014		LTA[a]	Change from LTA	
			%	*P*		%	*P*
Alaska–Yukon Territory–Old Crow Flats	41	21	+96	0.443	85	−52	0.063
C. & N. Alberta–N.E. British Columbia–NWT	109	62	+77	0.182	75	+46	0.279
N. Saskatchewan–N. Manitoba–W. Ontario	35	23	+54	0.352	51	−31	0.064
S. Alberta	114	71	+60	0.121	65	+75	0.028
S. Saskatchewan	270	325	−17	0.197	198	+36	0.007
S. Manitoba	38	59	−37	0.029	56	−33	0.008
Montana & Western Dakotas	18	15	+17	0.769	9	+95	0.183
Eastern Dakotas	132	108	+21	0.575	41	+224	0.007
Total	757	685	+11	0.374	581	+30	0.006

[a] Long-term average, 1955–2014.

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

			Change from 2014			Change from LTA	
Region	2015	2014	%	*P*	LTA[a]	%	*P*
Alaska–Yukon Territory–Old Crow Flats	587	578	+2	0.924	907	−35	<0.001
C. & N. Alberta–N.E. British Columbia–NWT	2,215	2,127	+4	0.734	2,526	−12	0.130
N. Saskatchewan–N. Manitoba–W. Ontario	345	201	+72	0.004	551	−37	<0.001
S. Alberta	262	247	+6	0.782	332	−21	0.096
S. Saskatchewan	471	850	−45	0.024	416	+13	0.372
S. Manitoba	112	164	−31	0.295	127	−12	0.503
Montana & Western Dakotas	10	22	−54	0.190	49	−79	<0.001
Eastern Dakotas	393	422	−7	0.813	119	+229	0.005
Total	4,395	4,611	−5	0.546	5,026	−13	0.014

[a] Long-term average, 1955–2014.

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

			Change from 2014			Change from LTA	
Region	2015	2014	%	*P*	LTA[a]	%	*P*
Prairie & Parkland Canada							
S. Alberta	1,023	1,218	−16	0.051	762	+34	<0.001
S. Saskatchewan	2,571	2,744	−6	0.362	2,074	+24	<0.001
S. Manitoba	557	668	−17	0.080	663	−16	0.009
Subtotal	4,151	4,630	−10	0.032	3,499	+19	<0.001
Northcentral U.S.							
Montana & western Dakotas	910	966	−6	0.466	565	+61	<0.001
Eastern Dakotas	1,247	1,586	−21	0.003	1,125	+11	0.092
Subtotal	2,157	2,551	−15	0.004	1,690	+28	<0.001
Total	6,308	7,181	−12	0.001	5,194	+21	<0.001

[a] Long-term average. Prairie and Parkland Canada, 1961–2014; northcentral U.S. and Total, 1974–2014.

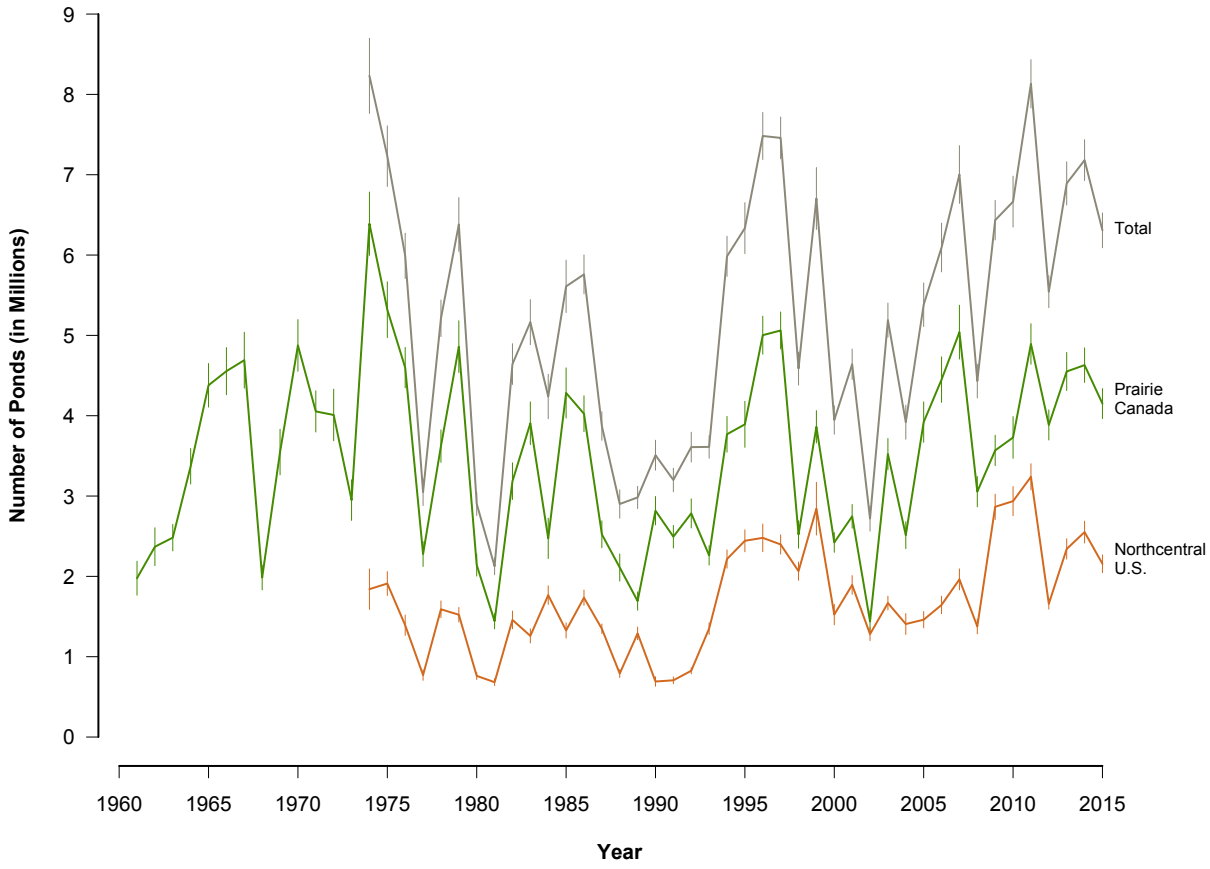

Figure 2. Number of ponds in May and 90% confidence intervals in Prairie Canada, the northcentral U.S., and total ponds.

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

Species	2015	2014	% Change from 2014	Average[b]	% Change from average
Mallard	406	432	−6	392	+2
American black duck	541	610	−11[c]	618	−13[c]
Green-winged teal	221	229	−3	256	−14[c]
Ring-necked duck	505	490	+3	513	−2
Goldeneyes (common and Barrow's)	358	390	−8	422	−15[c]
Mergansers (common, red-breasted, and hooded)	409	416	−2	441	−7

[a] Estimates derived using FWS and CWS data from strata 51, 52, 63, 64, 66–68, 70–72.

[b] Average for 1990–2014.

[c] Indicates significant change. Significance ($P \leq 0.10$) determined by non-overlap of Bayesian credibility intervals.

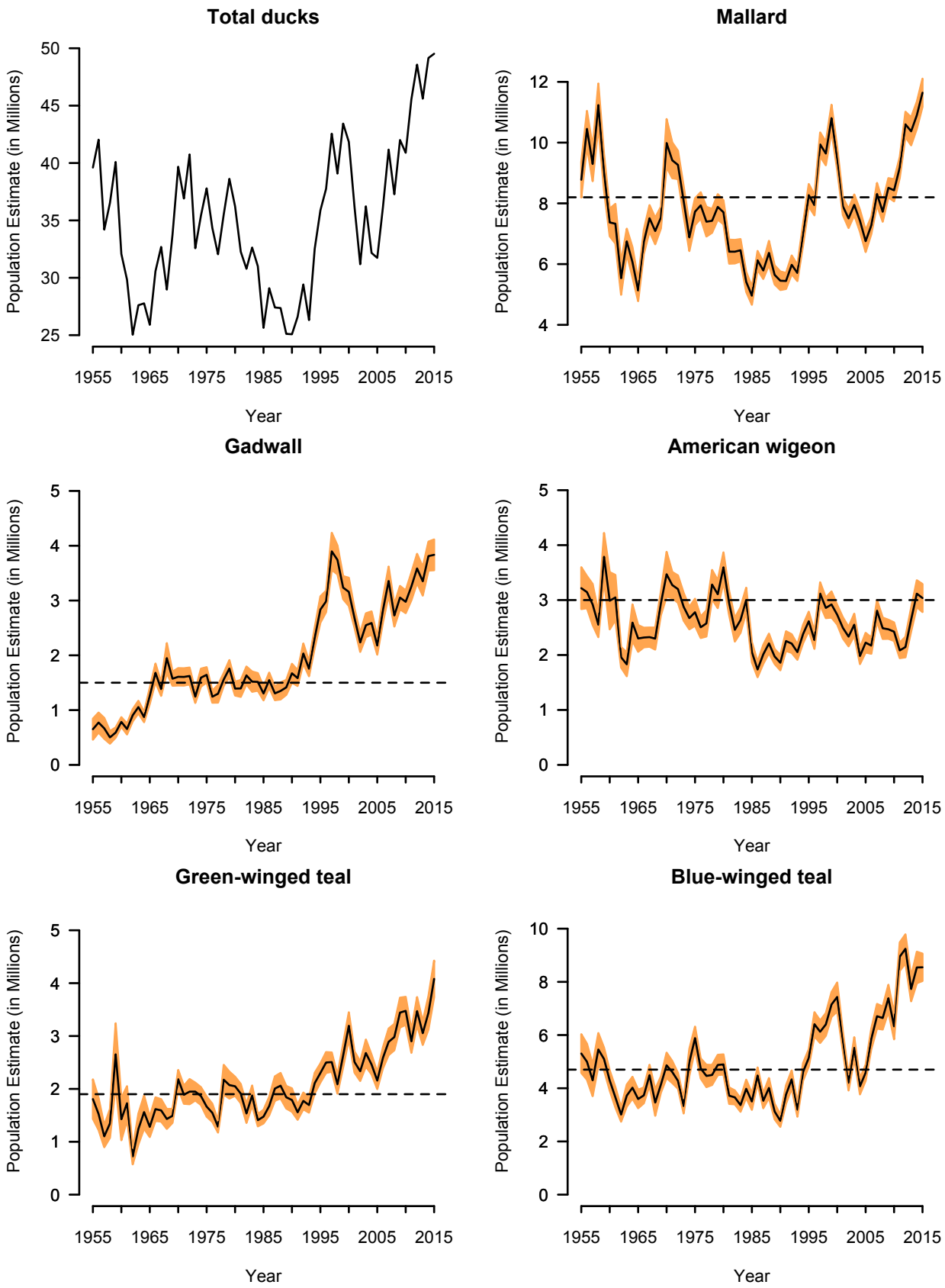

Figure 3. Breeding population estimates, 90% confidence intervals, and North American Waterfowl Management Plan population goal (dashed line) for selected species in the traditional survey area (strata 1–18, 20–50, 75–77).

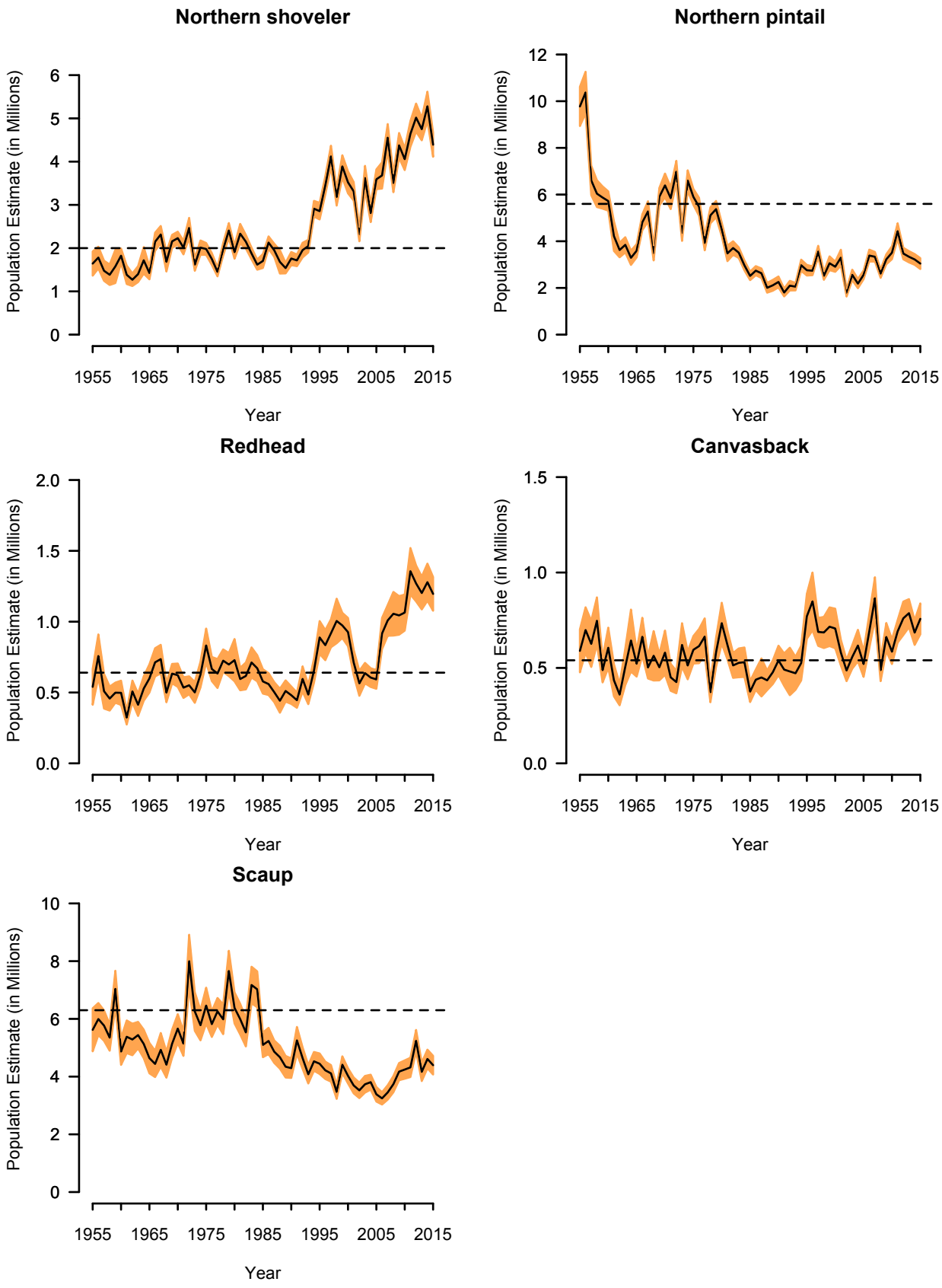

Figure 3. Continued.

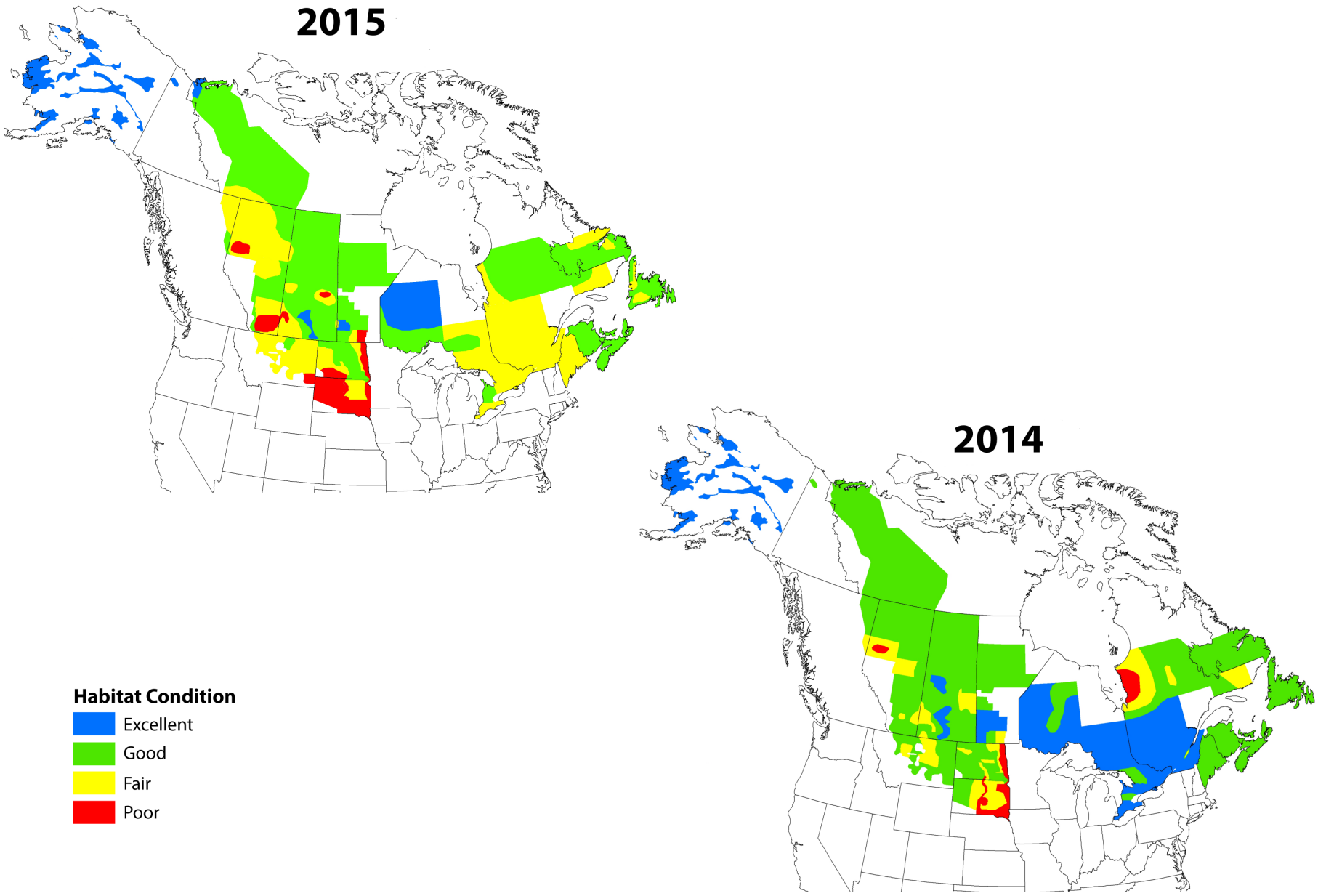

Figure 4. Breeding waterfowl habitat conditions during the 2014 and 2015 Waterfowl Breeding Population and Habitat Survey, as judged by U.S. Fish and Wildlife Service and Canadian Wildlife Service biologists.

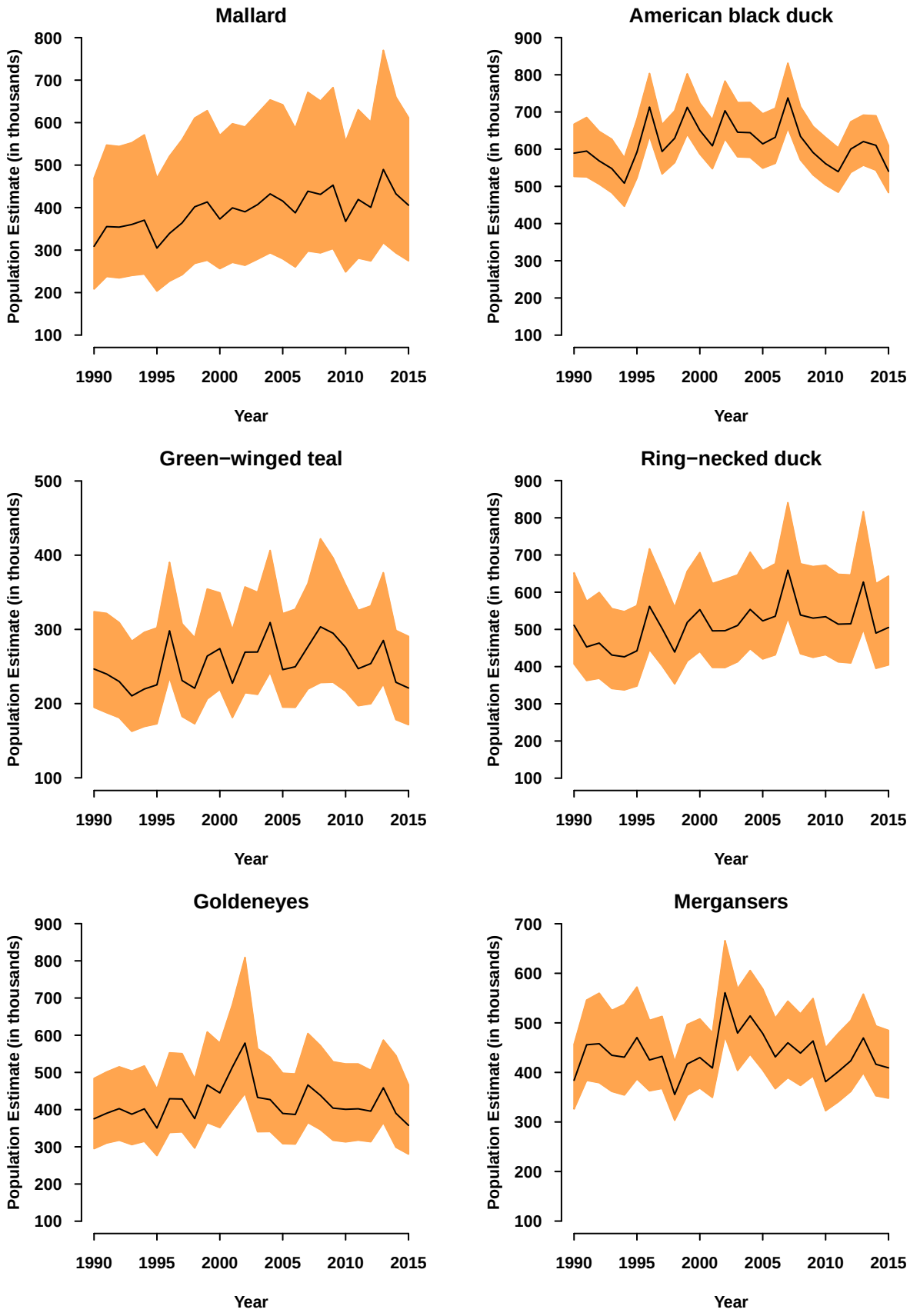

Figure 5. Breeding population estimates and 90% credibility intervals for selected species in the eastern survey area (strata 51, 52, 63, 64, 66–68, 70–72).

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).

	Mallard		Gadwall		American wigeon		Green-winged teal		Blue-winged teal	
Year	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$
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
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

Appendix A. Continued.

	Mallard		Gadwall		American wigeon		Green-winged teal		Blue-winged teal	
Year	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$
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
2013	10,371.9	360.6	3,351.4	204.5	2,644.3	169.2	3,053.4	173.7	7,731.7	363.2
2014	10,899.8	347.6	3,811.0	206.0	3,116.7	190.4	3,439.9	247.4	8,541.5	461.9
2015	11,643.3	361.8	3,834.1	219.4	3,037.0	199.2	4,080.9	269.8	8,547.3	401.1

Appendix A. Continued.

	Northern shoveler		Northern pintail		Redhead		Canvasback		Scaup	
Year	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$
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
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

Appendix A. Continued.

	Northern shoveler		Northern pintail		Redhead		Canvasback		Scaup	
Year	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$	$\widehat{N}$	$\widehat{SE}$
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
2013	4,751.0	202.3	3,335.0	188.4	1,202.2	90.5	787.0	57.6	4,165.7	250.8
2014	5,278.9	265.3	3,220.3	179.7	1,278.7	102.5	685.3	50.7	4,611.1	253.3
2015	4,391.4	219.0	3,043.0	182.5	1,195.9	92.9	757.3	63.3	4,395.3	252.5

Appendix B. Breeding population estimates and 90% credibility intervals (in thousands) for the 6 most abundant species of ducks in the eastern survey area, 1990–2015[a].

	Mallard		American black duck		Green-winged teal		Ring-necked duck		Goldeneyes[b]		Mergansers[c]	
Year	$\hat{N}$	90% CI	$\hat{N}$	90% CI	$\hat{N}$	90% CI	$\hat{N}$	90% CI	$\hat{N}$	90% CI	$\hat{N}$	90% CI
1990	308.9	(208.4, 469.2)	589.4	(526.7, 667.1)	246.6	(195.0, 323.8)	511.0	(407.3, 652.2)	375.3	(295.0, 483.8)	384.1	(326.3, 456.5)
1991	355.4	(238.0, 547.2)	594.8	(525.6, 685.2)	239.8	(187.8, 321.5)	452.9	(362.6, 575.4)	390.1	(310.2, 501.0)	455.8	(384.1, 545.9)
1992	354.1	(234.7, 543.8)	568.5	(506.0, 647.7)	229.8	(181.1, 309.1)	463.2	(368.5, 599.3)	402.6	(317.7, 515.0)	457.9	(379.3, 559.9)
1993	360.3	(240.4, 552.6)	547.8	(483.0, 626.7)	210.4	(162.6, 284.1)	431.1	(341.1, 555.8)	387.7	(305.9, 503.6)	434.6	(361.7, 525.1)
1994	370.5	(243.8, 571.2)	508.5	(446.4, 576.9)	219.6	(169.2, 296.0)	426.2	(337.3, 547.7)	402.0	(314.7, 517.4)	430.8	(354.4, 537.1)
1995	304.6	(203.6, 469.1)	592.2	(522.7, 680.1)	225.3	(172.8, 302.0)	442.3	(347.8, 563.7)	350.4	(276.3, 455.4)	470.5	(387.0, 572.2)
1996	339.3	(227.0, 520.7)	713.1	(635.2, 803.6)	298.1	(235.2, 390.4)	561.9	(445.8, 716.6)	429.3	(338.4, 552.6)	425.2	(362.9, 505.0)
1997	364.0	(242.0, 559.8)	593.7	(533.3, 666.1)	231.1	(182.7, 307.5)	502.5	(402.4, 640.0)	428.5	(340.3, 550.5)	432.4	(367.8, 513.0)
1998	401.9	(268.8, 610.7)	629.3	(563.9, 702.8)	220.7	(172.8, 288.8)	439.0	(353.4, 558.9)	375.8	(296.5, 482.8)	355.4	(303.4, 421.5)
1999	413.3	(276.3, 628.2)	712.6	(640.4, 802.6)	264.1	(206.3, 354.4)	518.8	(414.9, 656.1)	466.3	(365.2, 608.8)	417.0	(354.0, 496.6)
2000	373.1	(256.4, 569.8)	650.5	(587.2, 723.6)	274.1	(219.2, 349.2)	553.2	(440.9, 706.6)	444.9	(351.8, 578.7)	430.0	(368.5, 507.9)
2001	399.4	(271.3, 597.4)	608.9	(547.4, 679.0)	227.4	(181.2, 299.2)	496.1	(397.8, 623.1)	514.3	(398.9, 682.0)	408.8	(349.5, 479.9)
2002	390.2	(264.3, 589.7)	703.4	(628.1, 783.2)	269.3	(214.7, 357.2)	496.4	(397.5, 634.2)	579.0	(443.6, 809.2)	560.9	(472.8, 666.0)
2003	407.1	(278.7, 621.6)	645.6	(579.5, 725.1)	269.5	(212.5, 350.0)	510.5	(413.0, 646.3)	432.7	(340.6, 563.6)	479.3	(403.9, 568.7)
2004	432.4	(293.7, 653.5)	644.4	(578.0, 725.5)	309.3	(242.3, 406.4)	553.7	(448.1, 707.5)	426.9	(341.1, 540.8)	514.1	(436.7, 605.8)
2005	415.5	(279.7, 641.9)	614.3	(548.9, 695.0)	245.8	(195.2, 321.1)	522.8	(420.5, 658.0)	389.8	(308.5, 497.9)	478.5	(404.9, 568.5)
2006	387.7	(260.3, 586.4)	632.0	(562.1, 709.8)	249.7	(195.0, 327.2)	535.3	(431.7, 676.4)	386.9	(307.5, 495.8)	431.2	(367.1, 509.4)
2007	438.6	(297.9, 671.3)	737.8	(656.9, 831.3)	276.7	(219.7, 361.5)	659.2	(530.6, 840.7)	466.3	(365.4, 604.7)	459.8	(389.5, 543.8)
2008	431.1	(293.5, 650.8)	634.5	(571.3, 714.2)	303.5	(228.3, 422.1)	538.6	(434.6, 676.3)	438.2	(346.2, 571.7)	438.9	(373.6, 518.1)
2009	452.9	(303.8, 682.5)	591.1	(531.1, 661.2)	294.9	(228.9, 396.3)	530.3	(424.9, 668.9)	404.0	(317.7, 528.5)	463.5	(393.1, 549.2)
2010	367.5	(248.6, 555.5)	561.0	(503.8, 631.4)	275.7	(216.8, 359.9)	534.1	(432.0, 672.5)	400.8	(313.3, 522.8)	381.3	(322.7, 449.7)
2011	419.2	(281.2, 630.5)	539.5	(484.3, 603.3)	247.0	(197.2, 325.5)	514.1	(412.7, 648.1)	402.2	(318.0, 522.7)	401.6	(340.6, 478.7)
2012	400.6	(274.6, 601.1)	600.3	(537.7, 673.6)	253.9	(199.9, 331.5)	515.0	(409.9, 646.2)	395.7	(313.7, 505.6)	423.4	(361.7, 504.5)
2013	489.7	(317.5, 770.2)	620.5	(556.9, 691.6)	285.1	(226.4, 376.4)	627.4	(500.3, 816.6)	458.6	(365.1, 587.0)	469.6	(399.1, 558.0)
2014	432.4	(293.5, 659.9)	610.3	(543.5, 689.8)	228.7	(178.4, 298.5)	490.0	(395.3, 622.6)	390.0	(298.9, 545.2)	416.4	(352.9, 493.7)
2015	405.7	(274.9, 611.7)	540.6	(483.1, 609.5)	221.0	(171.6, 290.5)	505.2	(404.6, 643.3)	357.6	(280.4, 466.6)	409.3	(348.1, 484.7)

[a] Entire time series, for mallards, American black ducks, green-winged teal, ring-necked duck, goldeneyes, and mergansers are updated each year using hierarchical models integrating FWS and CWS data from strata 51, 52, 63, 64, 66–68, 70–72.

[b] Common and Barrow's.

[c] Common, red-breasted, and hooded.

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