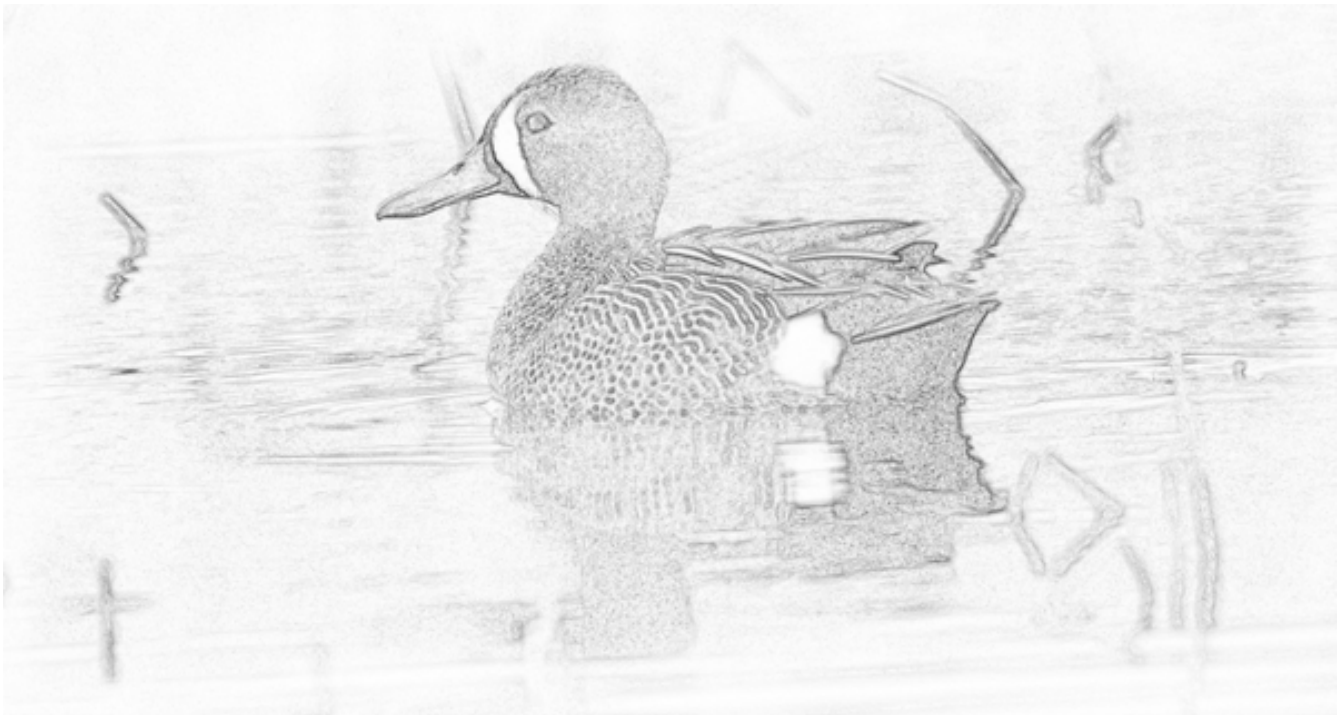




U.S. Fish & Wildlife Service

Trends in Duck Breeding Populations 1955–2014

July 2, 2014



TRENDS IN DUCK BREEDING POPULATIONS, 1955–2014

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Administrative Report—July 2, 2014

This report summarizes information about the status of duck populations and wetland habitats during spring 2014, 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 49.2 ± 0.8 [SE] million birds (Figure 3, Appendix A). This represents an 8% increase over last year's estimate of 45.6 ± 0.7 million, and is 43% higher than the long-term average^a (1955–2013; Table 1). Estimated mallard (*Anas platyrhynchos*) abundance was 10.9 ± 0.3 million, which was similar to the 2013 estimate, and 42% above the long-term average of 7.7 ± 0.04 million (Table 2). Estimated abundance of gadwall (*A. strepera*; 3.8 ± 0.2 million) was similar to the 2013 estimate and 102% above the long-term average (1.9 ± 0.02 million; Table 3). The estimate for American wigeon (*A. americana*; 3.1 ± 0.2 million) was 18% above the 2013 estimate of 2.6 ± 0.2 million and 20% above the long-term average of 2.6 ± 0.02 million (Table 4). The estimated abundance of green-winged teal (*A. crecca*) was 3.4 ± 0.2 million, which was similar to the 2013 estimate and 69% above the long-term average (2.0 ± 0.02 million; Table 5). The estimate for blue-winged teal (*A. discors*; 8.5 ± 0.5 million) was similar to the 2013 estimate and 75% above the long-term average of 4.9 ± 0.04 million (Table 6). Estimates of northern shovelers (*A. clypeata*; 5.3 ± 0.3 million) and northern pintails (*A. acuta*; 3.2 ± 0.2 million) were similar to the 2013 estimates and were 114% above and 20% below their long-term averages of 2.5 ± 0.02 million (Table 7) and 4.0 ± 0.04 million (Table 8), respectively. Abundance estimates for redheads (*Aythya americana*; 1.3 ± 0.1 million) and canvasbacks (*Aythya valisineria*; 0.7 ± 0.05 million) were similar to their 2013 estimates and were 85% and 18% 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; 4.6 ± 0.3 million) was similar to the 2013 estimate and similar to the long-term average of 5.0 ± 0.05 million (Table 11).

Spring was delayed even later than last year across most of the survey area. Habitat conditions during the survey were mostly improved or similar to last year, due to average to above-average annual precipitation. The exceptions were west-central Alberta and east of James Bay in Quebec (Figure 4). Alaska was the only region that experienced an early spring. The total pond estimate (Prairie Canada and U.S. combined) was 7.2 ± 0.2 million which was similar to the 2013 estimate of 6.9 ± 0.2 million and 40% above the long-term average of 5.1 ± 0.03 million (Table 12, Figure 2).

In the traditional survey area, the majority of the Canadian prairies had below to well-below-average winter temperatures and average precipitation. Southern Manitoba benefitted from last year's summer and

Cover art derived from a photo by Mark Hoffman.

^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.

fall precipitation, whereas southern Saskatchewan and most of Alberta were aided by spring 2014 precipitation. The 2014 estimate of ponds in Prairie Canada was 4.6 ± 0.2 million. This estimate was similar to the 2013 estimate (4.6 ± 0.2 million) and 33% above the 1961–2013 average (3.5 ± 0.03 million). The Parklands remained in good condition from previous years' carry-over water and the boreal region has benefitted from above-average annual precipitation. Most of the Canadian portion of the traditional survey area was rated as good or excellent this year and the region continued to receive additional precipitation after the survey.

Much of the U.S. prairies had average winter precipitation and well-below-average winter temperatures that continued into spring. Habitat conditions improved in the western Dakotas and Montana from 2013 but remained similar in the eastern Dakotas. The 2014 pond estimate for the northcentral U.S. was 2.6 ± 0.1 million which was similar to the 2013 estimate (2.3 ± 0.1 million) and 53% above the 1974–2013 average (1.7 ± 0.02 million). Waterfowl habitat in North Dakota remains under pressure from wetland drainage, loss of CRP grasses, and energy development.

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 (Figure 1; 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 (1990–2014). 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 the 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 (*B. albeola*), and scoters until the hierarchical models could adequately accommodate 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 2014 Waterfowl Status Report.

Estimated abundance of American black ducks in the eastern survey area was 0.6 ± 0.04 million which was similar to last year and the 1990–2013 average. The estimated abundance of mallards was 0.4 ± 0.1 million, which was similar to the 2013 estimate and the 1990–2013 average. Abundance estimates of green-winged teal (0.2 ± 0.04 million) and ring-necked ducks (0.5 ± 0.1 million) were 19% and 22% below their 2013 estimates, and similar to their 1990–2013 averages, respectively. Abundance estimates for goldeneyes and mergansers were similar to last year's estimates and their 1990–2013 averages (Table 13, Figure 6, Appendix B).

Winter and spring temperatures in the eastern survey area were also well below normal with most areas receiving average to above-average precipitation. Habitat conditions were similar to 2013 or improved, particularly in the northeastern United States. An exception was the area east of James Bay in Quebec which has experienced dry conditions and extensive wildfires. Less flooding was noted across the eastern survey area, in contrast to some years, and continued cool, damp spring conditions in the Maritimes could limit waterfowl production.

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

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

Air H. Wilson and W. Larned^e (Stratum 1)

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

Air B. Shults and D. Groves (Strata 2–6, 8–11)

Air F. Roetker and S. Olson (Stratum 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 M. Simmons

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, T. Coffin^d, and M. Chupik^d

Southern Saskatchewan (Strata 30–33)

Air P. Thorpe and S. Chandler

Ground B. Bartzen^a, K. Dufour^a, K. Warner^a, P. Bergen^c, S. Leach^a, S. Heap^a, and J. Porter^a

Southern Manitoba (Strata 34–39)

Air S. Yates and J. Bidwell^e

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

Montana and Western Dakotas (Strata 41–44)

Air R. Spangler and B. Kelly^b

Ground P. Garrettson and B. West

Eastern Dakotas (Strata 45–49)

Air T. Liddick and D. Fronczak

Ground K. Kruse, S. LeJeune, M. Nelson, and F. Healy

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

Air J. Wortham and B. Pendley

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

Air S. Earsom and N. Wirwa

Maine and Maritimes (Stratum 62–67)

Air M. Koneff and R. Mickley^d (Strata 62–65)

Air M. Koneff and J. Bidwell^e (Strata 66 and 67)

Canadian Wildlife Service helicopter plot survey

Quebec D. Bordage^a, C. Lepage^a, C. Marcotte^a, and S. Orichesky^a
Ontario S. Meyer^a, C. Sharp^a, S. Badzinski^a, and D. Sadler^a
New Brunswick &
Nova Scotia R. Hicks^a and A. Hicks^a
Newfoundland &
Labrador S. Gilliland^a, P. Ryan^a, R. Wells^a, and B. Pollard^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

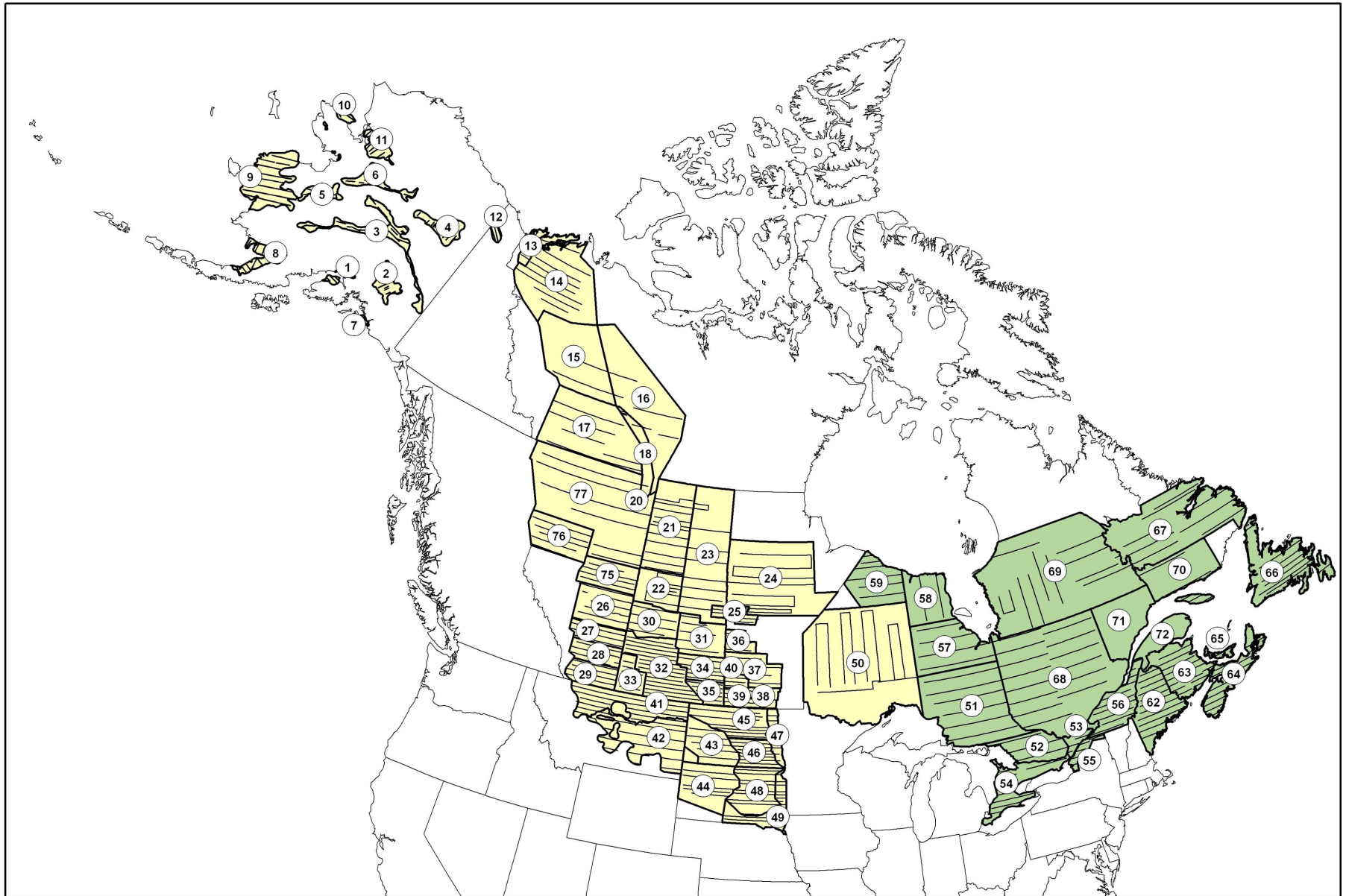


Figure 1. Strata and transects of the Waterfowl Breeding Population and Habitat Survey (yellow = traditional survey area, green = eastern survey area).

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

Region	2014	2013	Change from 2013		LTA ^b	Change from LTA	
			%	<i>P</i>		%	<i>P</i>
Alaska–Yukon Territory– Old Crow Flats	3,510	3,296	+6	0.373	3,696	−5	0.261
C. & N. Alberta–N.E. British Columbia–NWT	9,946	8,323	+19	0.002	7,168	+39	<0.001
N. Saskatchewan– N. Manitoba–W. Ontario	2,566	3,441	−25	0.014	3,477	−26	<0.001
S. Alberta	5,644	4,471	+26	<0.001	4,256	+33	<0.001
S. Saskatchewan	12,893	12,258	+5	0.251	7,695	+68	<0.001
S. Manitoba	2,193	1,575	+39	<0.001	1,529	+43	<0.001
Montana & Western Dakotas	3,660	1,599	+129	<0.001	1,671	+119	<0.001
Eastern Dakotas	8,740	10,643	−18	0.001	4,967	+76	<0.001
Total	49,152	45,607	+8	0.002	34,458	+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, 1955–2013.

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

Region	2014	2013	Change from 2013		LTA ^a	Change from LTA	
			%	<i>P</i>		%	<i>P</i>
Alaska–Yukon Territory– Old Crow Flats	501	338	+48	0.018	377	+33	0.031
C. & N. Alberta–N.E. British Columbia–NWT	1,757	1,020	+72	<0.001	1,084	+62	<0.001
N. Saskatchewan– N. Manitoba–W. Ontario	1,126	1,427	−21	0.329	1,130	0	0.984
S. Alberta	1,444	1,141	+27	0.011	1,073	+34	<0.001
S. Saskatchewan	2,553	2,576	−1	0.907	2,073	+23	<0.001
S. Manitoba	602	448	+34	0.007	385	+56	<0.001
Montana & Western Dakotas	1,014	794	+28	0.106	516	+96	<0.001
Eastern Dakotas	1,903	2,627	−28	0.001	1,035	+84	<0.001
Total	10,900	10,372	+5	0.292	7,673	+42	<0.001

^a Long-term average, 1955–2013.

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

Region	2014	2013	Change from 2013		LTA ^a	Change from LTA	
			%	<i>P</i>		%	<i>P</i>
Alaska–Yukon Territory–							
Old Crow Flats	0	2	–100	0.087	2	–100	<0.001
C. & N. Alberta–N.E. British							
Columbia–NWT	43	33	+29	0.363	51	–15	0.361
N. Saskatchewan–							
N. Manitoba–W. Ontario	36	13	+180	0.048	26	+37	0.342
S. Alberta	565	340	+66	0.020	318	+78	0.004
S. Saskatchewan	1,455	1,300	+12	0.334	632	+130	<0.001
S. Manitoba	236	133	+78	0.001	73	+224	<0.001
Montana & Western Dakotas	426	217	+96	0.014	207	+105	0.005
Eastern Dakotas	1,051	1,314	–20	0.193	580	+81	<0.001
Total	3,811	3,351	+14	0.113	1,889	+102	<0.001

^a Long-term average, 1955–2013.

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

Region	2014	2013	Change from 2013		LTA ^a	Change from LTA	
			%	<i>P</i>		%	<i>P</i>
Alaska–Yukon Territory–							
Old Crow Flats	734	577	+27	0.101	554	+33	0.027
C. & N. Alberta–N.E. British							
Columbia–NWT	1,562	1,100	+42	0.031	891	+75	<0.001
N. Saskatchewan–							
N. Manitoba–W. Ontario	74	230	–68	0.002	236	–69	<0.001
S. Alberta	224	197	+14	0.554	280	–20	0.120
S. Saskatchewan	273	369	–26	0.057	407	–33	<0.001
S. Manitoba	14	10	+38	0.169	55	–75	<0.001
Montana & Western Dakotas	129	43	+198	0.001	110	+18	0.418
Eastern Dakotas	106	117	–9	0.812	56	+90	0.131
Total	3,117	2,644	+18	0.064	2,588	+20	0.006

^a Long-term average, 1955–2013.

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

Region	2014	2013	Change from 2013		LTA ^a	Change from LTA	
			%	<i>P</i>		%	<i>P</i>
Alaska–Yukon Territory–							
Old Crow Flats	475	452	+5	0.744	405	+17	0.182
C. & N. Alberta–N.E. British							
Columbia–NWT	1,716	1,229	+40	0.058	810	+112	<0.001
N. Saskatchewan–							
N. Manitoba–W. Ontario	118	358	–67	<0.001	205	–43	<0.001
S. Alberta	368	195	+88	0.016	198	+86	0.008
S. Saskatchewan	466	575	–19	0.161	266	+75	<0.001
S. Manitoba	76	60	+27	0.285	53	+43	0.013
Montana & Western Dakotas	12	23	–48	0.265	41	–72	<0.001
Eastern Dakotas	209	161	+30	0.534	56	+276	0.001
Total	3,440	3,053	+13	0.201	2,034	+69	<0.001

^a Long-term average, 1955–2013.

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

Region	2014	2013	Change from 2013		LTA ^a	Change from LTA	
			%	<i>P</i>		%	<i>P</i>
Alaska–Yukon Territory–							
Old Crow Flats	0	0	0	1.000	1	–100	<0.001
C. & N. Alberta–N.E. British							
Columbia–NWT	377	386	–2	0.938	272	+39	0.215
N. Saskatchewan–							
N. Manitoba–W. Ontario	46	40	+16	0.825	238	–81	<0.001
S. Alberta	834	752	+11	0.547	610	+37	0.034
S. Saskatchewan	3,109	2,759	+13	0.315	1,356	+129	<0.001
S. Manitoba	474	345	+37	0.060	373	+27	0.016
Montana & Western Dakotas	1,178	226	+421	<0.001	283	+316	<0.001
Eastern Dakotas	2,523	3,225	–22	0.074	1,754	+44	0.014
Total	8,542	7,732	+10	0.168	4,888	+75	<0.001

^a Long-term average, 1955–2013.

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

Region	2014	2013	Change from 2013		LTA ^a	Change from LTA	
			%	<i>P</i>		%	<i>P</i>
Alaska–Yukon Territory–							
Old Crow Flats	372	226	+65	0.021	289	+29	0.141
C. & N. Alberta–N.E. British							
Columbia–NWT	372	348	+7	0.778	222	+67	0.006
N. Saskatchewan–							
N. Manitoba–W. Ontario	24	35	–32	0.438	40	–40	0.042
S. Alberta	914	853	+7	0.584	412	+122	<0.001
S. Saskatchewan	1,711	1,706	0	0.978	750	+128	<0.001
S. Manitoba	255	149	+71	0.004	110	+131	<0.001
Montana & Western Dakotas	521	170	+206	0.001	164	+219	<0.001
Eastern Dakotas	1,110	1,263	–12	0.432	481	+131	<0.001
Total	5,279	4,751	+11	0.114	2,468	+114	<0.001

^a Long-term average, 1955–2013.

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

Region	2014	2013	Change from 2013		LTA ^a	Change from LTA	
			%	<i>P</i>		%	<i>P</i>
Alaska–Yukon Territory–							
Old Crow Flats	701	995	–30	0.075	932	–25	0.006
C. & N. Alberta–N.E. British							
Columbia–NWT	318	235	+35	0.260	356	–11	0.551
N. Saskatchewan–							
N. Manitoba–W. Ontario	5	10	–46	0.288	37	–86	<0.001
S. Alberta	461	368	+25	0.301	674	–32	0.007
S. Saskatchewan	739	825	–10	0.367	1,150	–36	<0.001
S. Manitoba	49	36	+38	0.255	101	–52	<0.001
Montana & Western Dakotas	252	88	+185	<0.001	260	–3	0.828
Eastern Dakotas	695	779	–11	0.510	507	+37	0.059
Total	3,220	3,335	–3	0.660	4,017	–20	<0.001

^a Long-term average, 1955–2013.

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

Region	2014	2013	Change from 2013		LTA ^a	Change from LTA	
			%	<i>P</i>		%	<i>P</i>
Alaska–Yukon Territory–							
Old Crow Flats	0	1	–100	0.037	2	–100	<0.001
C. & N. Alberta–N.E. British							
Columbia–NWT	59	22	+167	0.009	39	+51	0.123
N. Saskatchewan–							
N. Manitoba–W. Ontario	2	5	–64	0.349	26	–94	<0.001
S. Alberta	263	204	+29	0.311	125	+110	0.002
S. Saskatchewan	542	437	+24	0.271	217	+150	<0.001
S. Manitoba	95	71	+35	0.260	73	+31	0.163
Montana & Western Dakotas	17	7	+125	0.236	11	+50	0.420
Eastern Dakotas	301	455	–34	0.040	198	+52	0.027
Total	1,279	1,202	+6	0.576	691	+85	<0.001

^a Long-term average, 1955–2013.

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

Region	2014	2013	Change from 2013		LTA ^a	Change from LTA	
			%	<i>P</i>		%	<i>P</i>
Alaska–Yukon Territory–							
Old Crow Flats	21	35	–40	0.432	86	–76	<0.001
C. & N. Alberta–N.E. British							
Columbia–NWT	62	92	–33	0.329	75	–18	0.432
N. Saskatchewan–							
N. Manitoba–W. Ontario	23	30	–23	0.656	52	–56	0.014
S. Alberta	71	54	+32	0.362	65	+9	0.713
S. Saskatchewan	325	381	–15	0.279	196	+65	<0.001
S. Manitoba	59	62	–4	0.832	56	+6	0.663
Montana & Western Dakotas	15	13	+15	0.791	9	+68	0.325
Eastern Dakotas	108	119	–9	0.748	40	+174	0.004
Total	685	787	–13	0.185	580	+18	0.040

^a Long-term average, 1955–2013.

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

Region	2014	2013	Change from 2013		LTA ^a	Change from LTA	
			%	<i>P</i>		%	<i>P</i>
Alaska–Yukon Territory–							
Old Crow Flats	578	548	+6	0.706	912	–37	<0.001
C. & N. Alberta–N.E. British							
Columbia–NWT	2,127	2,343	–9	0.430	2,533	–16	0.015
N. Saskatchewan–							
N. Manitoba–W. Ontario	201	315	–36	0.072	557	–64	<0.001
S. Alberta	247	150	+65	0.012	333	–26	0.011
S. Saskatchewan	850	475	+79	0.028	408	+108	0.005
S. Manitoba	164	38	+329	0.006	126	+30	0.400
Montana & Western Dakotas	22	14	+62	0.350	49	–55	0.002
Eastern Dakotas	422	282	+49	0.137	114	+269	<0.001
Total	4,611	4,166	+11	0.211	5,033	–8	0.101

^a Long-term average, 1955–2013.

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

Region	2014	2013	Change from 2013		LTA ^a	Change from LTA	
			%	<i>P</i>		%	<i>P</i>
Prairie & Parkland Canada							
S. Alberta	1,218	1,127	+8	0.414	754	+62	<0.001
S. Saskatchewan	2,744	2,846	-4	0.635	2,061	+33	<0.001
S. Manitoba	668	578	+16	0.133	663	+1	0.917
Subtotal	4,630	4,551	+2	0.751	3,477	+33	<0.001
Northcentral U.S.							
Montana & western Dakotas	966	383	+152	<0.001	555	+74	<0.001
Eastern Dakotas	1,586	1,958	-19	0.004	1,113	+42	<0.001
Subtotal	2,551	2,341	+9	0.148	1,668	+53	<0.001
Total	7,181	6,892	+4	0.317	5,144	+40	<0.001

^a Long-term average. Prairie and Parkland Canada, 1961–2013; northcentral U.S. and Total, 1974–2013.

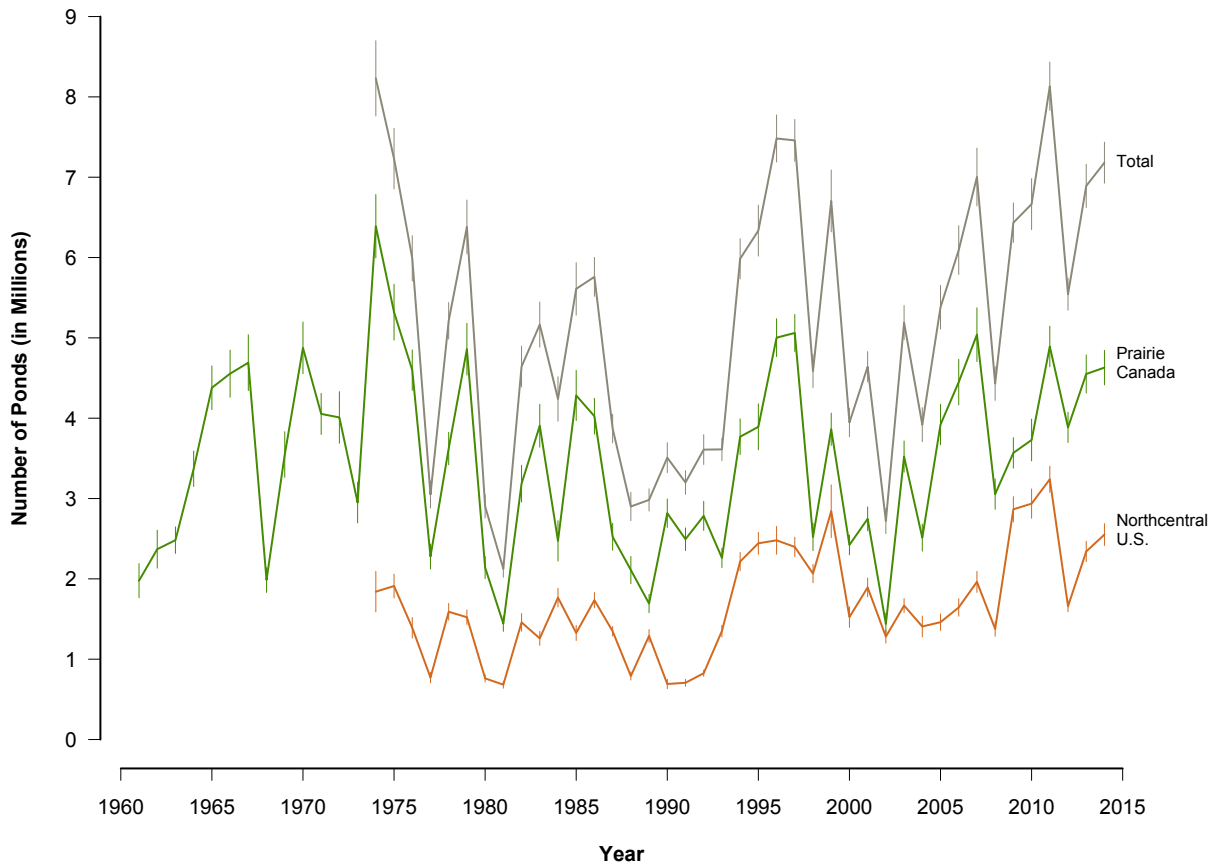


Figure 2. Number of ponds in May and 90% confidence intervals in Prairie Canada, the northcentral U.S., and total ponds.

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

Species	2014	2013	% Change from 2013	Average ^b	% Change from average
Mallard	445	501	-12	404	+9
American black duck	619	626	-1	623	-1
Green-winged teal	236	291	-19 ^c	260	-10
Ring-necked duck	494	635	-22 ^c	519	-5
Goldeneyes (common and Barrow's)	392	457	-15	418	-7
Mergansers (common, red-breasted, and hooded)	416	471	-12	441	-6

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

^b Average for 1990–2013.

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

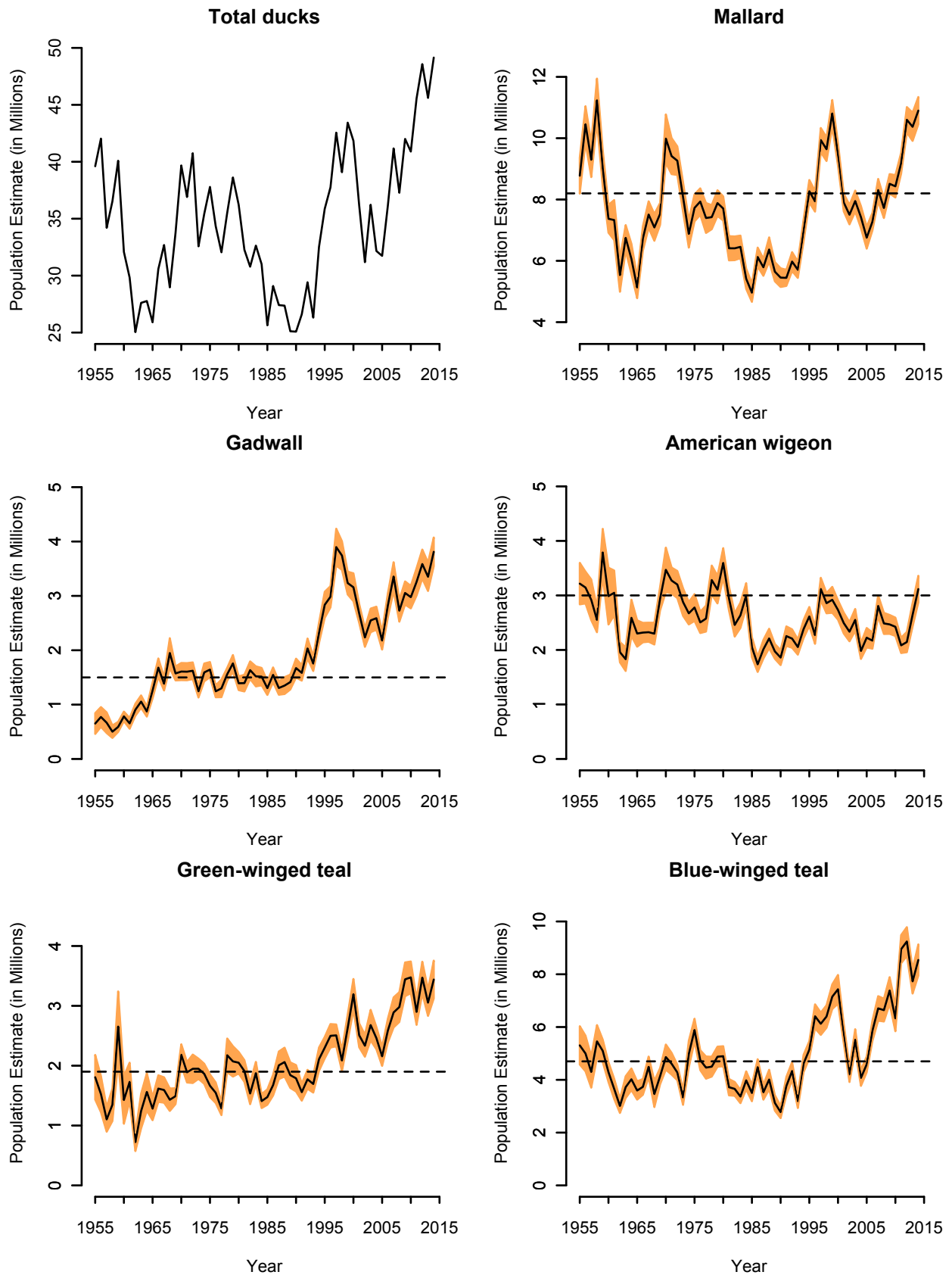


Figure 3. Breeding population estimates, 90% confidence intervals, and North American Waterfowl Management Plan population goal (dashed line) for selected species in the traditional survey area (strata 1–18, 20–50, 75–77).

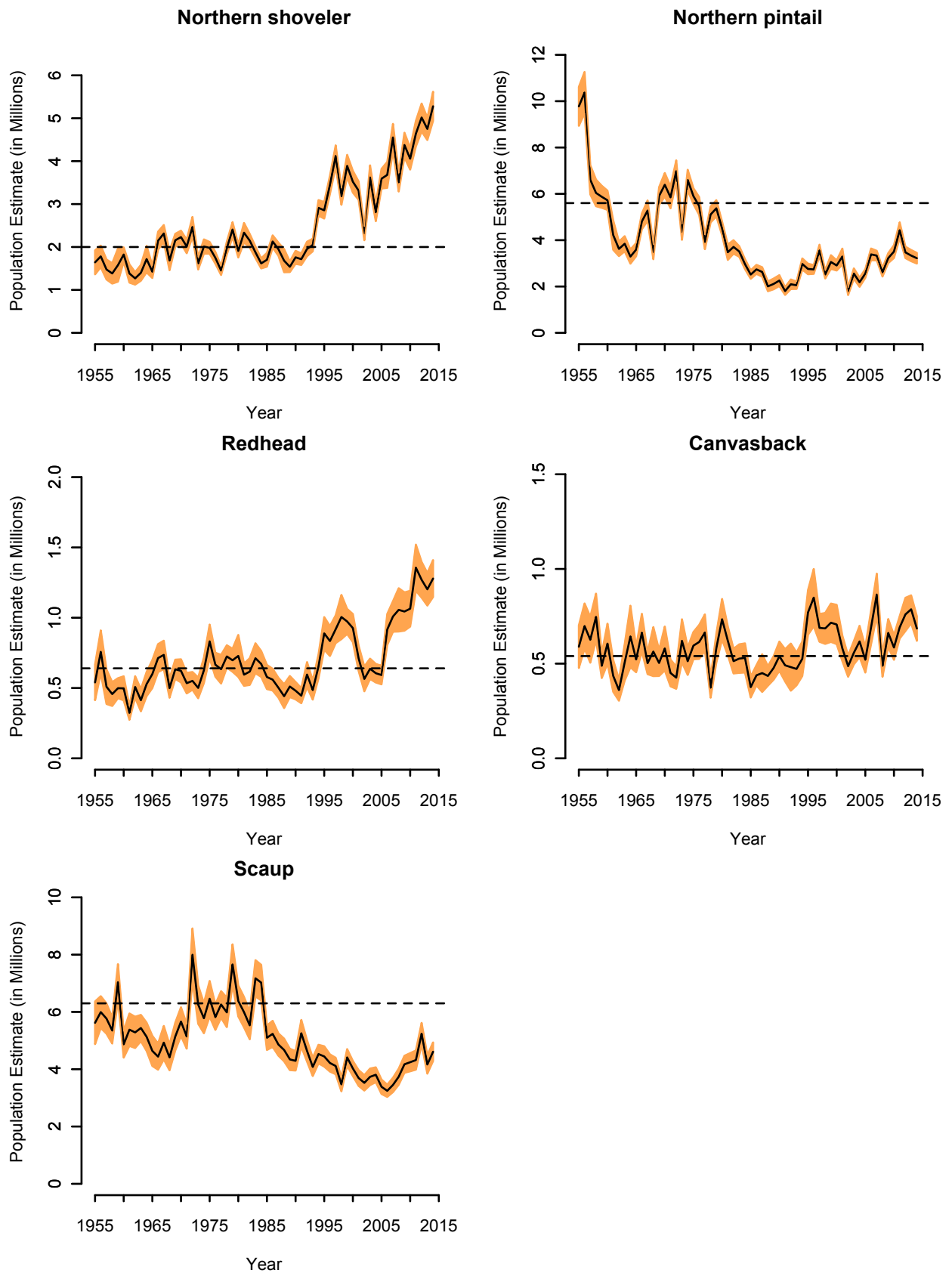


Figure 3. Continued.

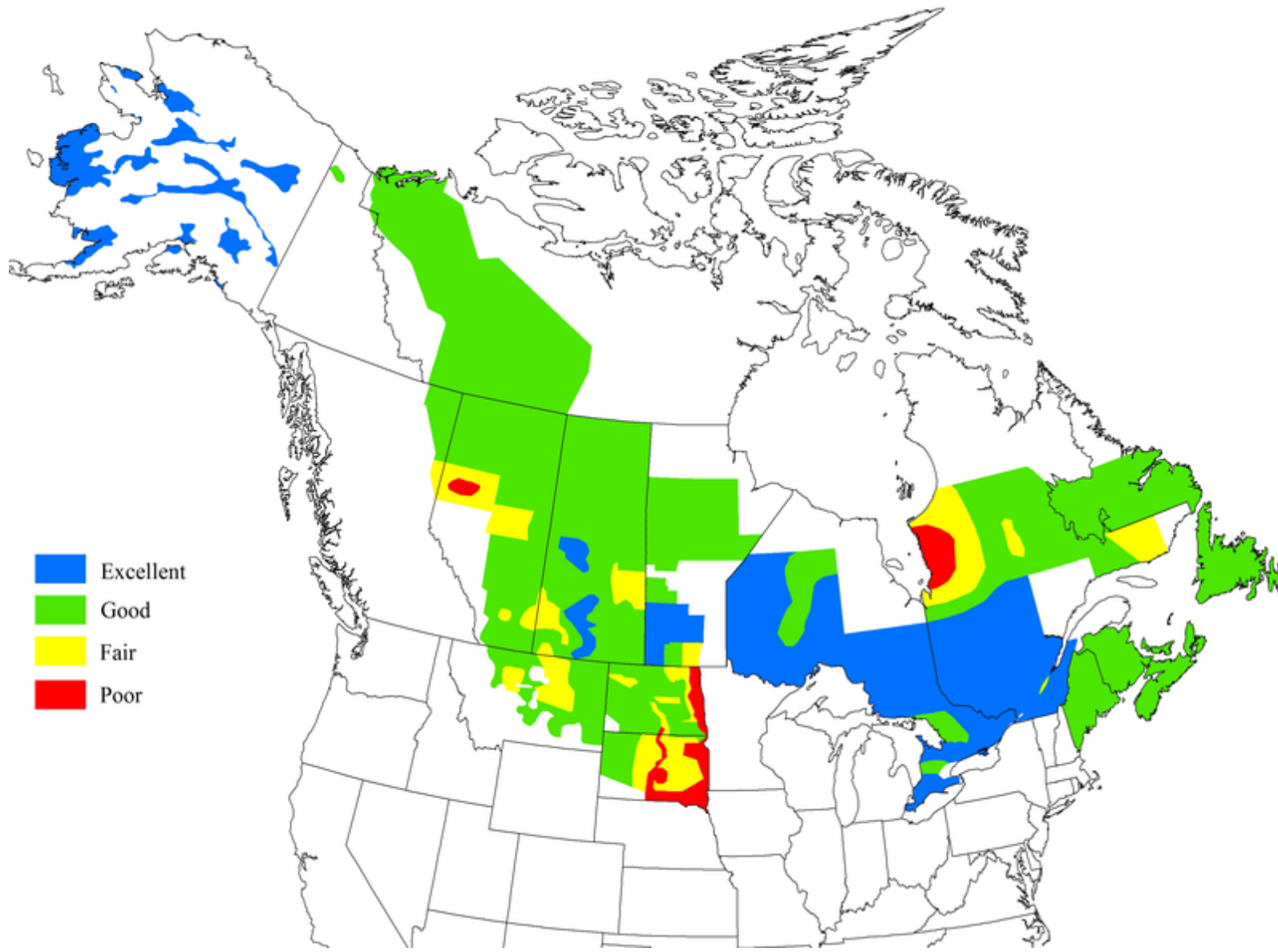


Figure 4. Breeding waterfowl habitat conditions during the 2014 Waterfowl Breeding Population and Habitat Survey, as judged by U.S. Fish and Wildlife Service and Canadian Wildlife Service biologists.

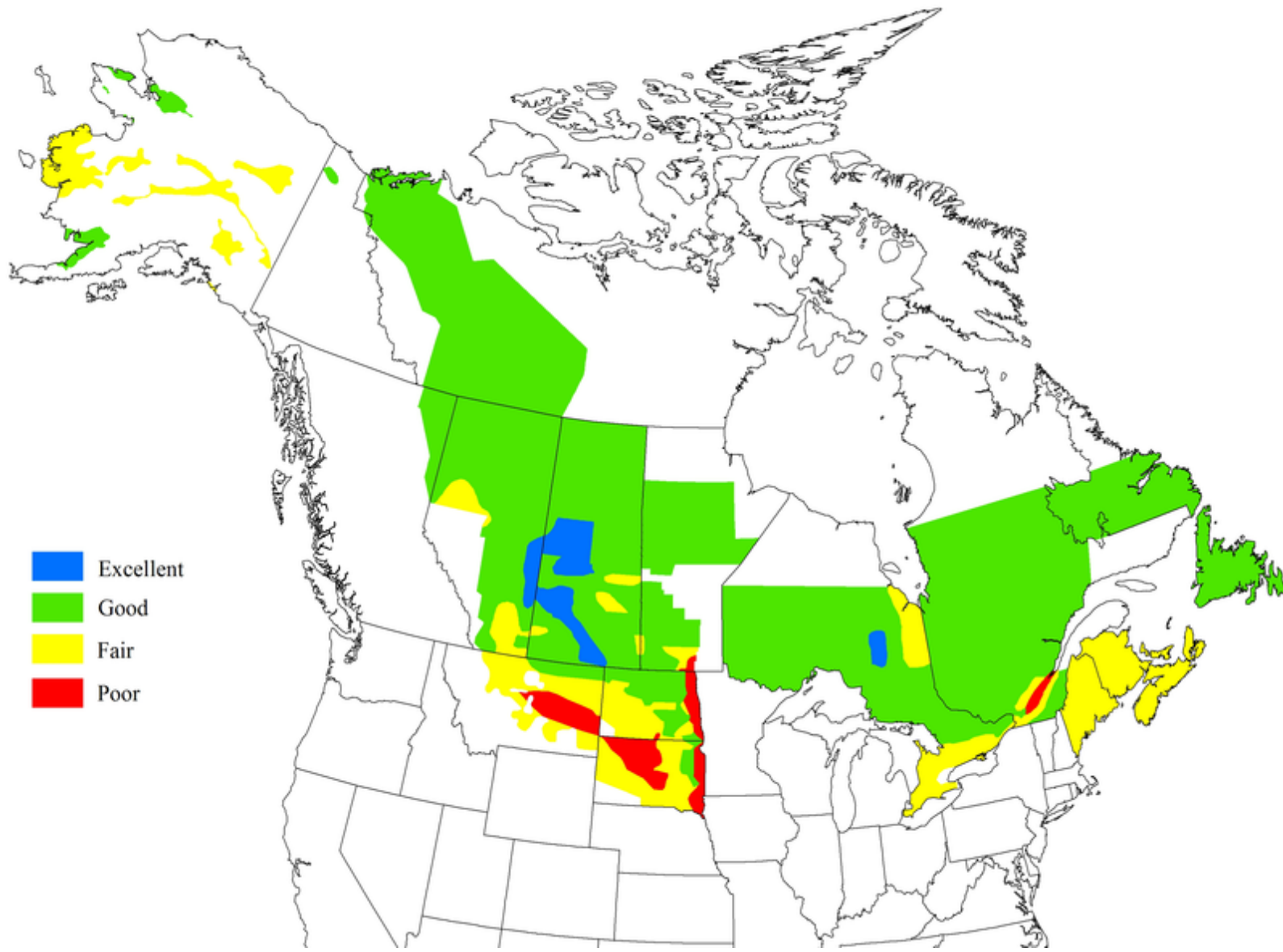


Figure 5. Breeding waterfowl habitat conditions during the 2013 Waterfowl Breeding Population and Habitat Survey, as judged by U.S. Fish and Wildlife Service and Canadian Wildlife Service biologists.

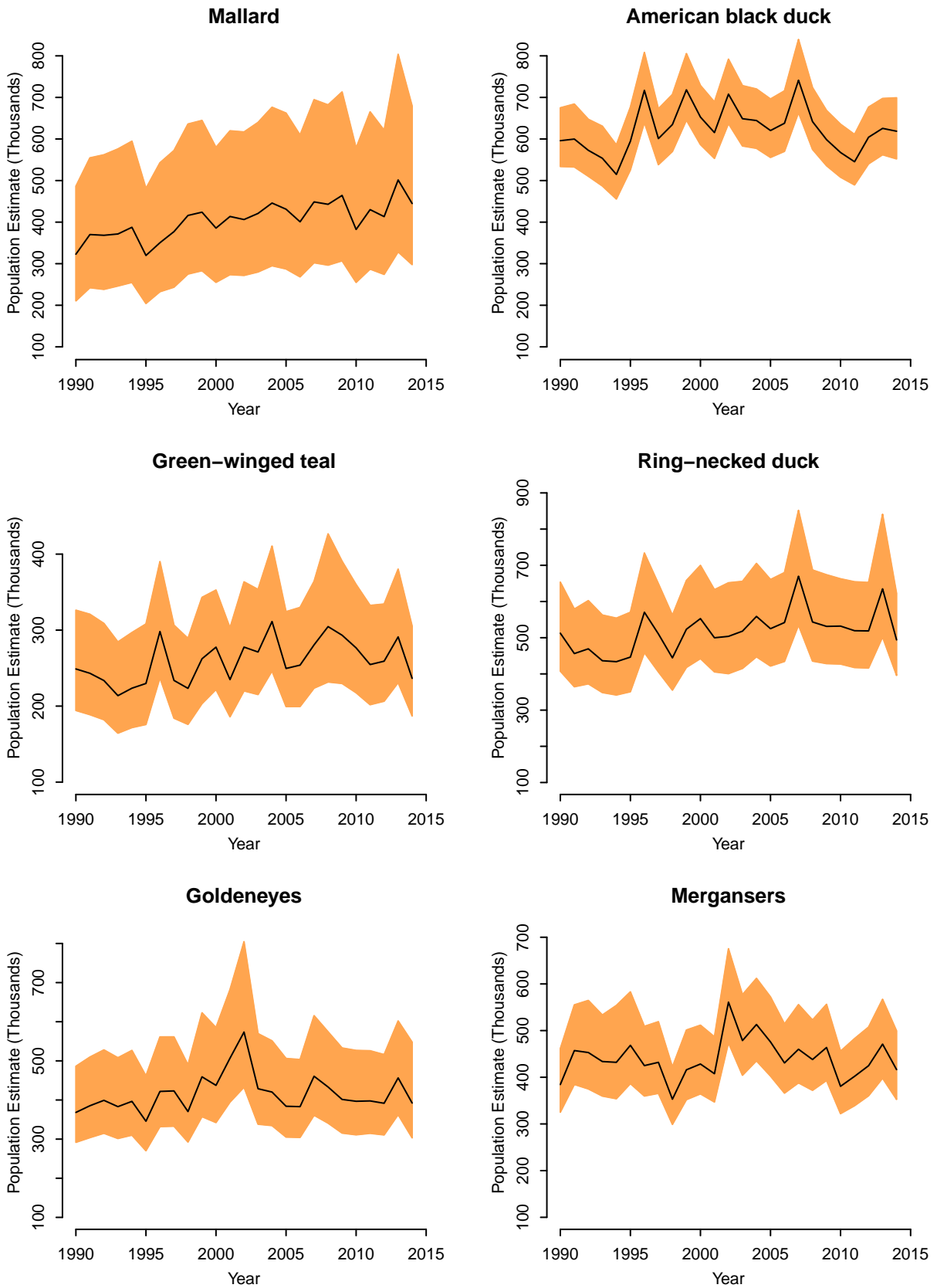


Figure 6. Breeding population estimates and 90% credibility intervals for selected species in the eastern survey area (strata 51, 52, 63, 64, 66–68, 70–72).

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
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.

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}
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

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
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.

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}
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

Appendix B. Breeding population estimates and 90% credibility intervals (in thousands) for the 6 most abundant species of ducks in the eastern survey area, 1990–2014^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
1990	322.8	(210.6, 486.3)	595.9	(533.8, 675.0)	248.9	(194.3, 326.2)	512.4	(407.6, 653.5)	368.2	(291.8, 486.2)	384.4	(325.1, 461.4)
1991	370.2	(242.2, 554.6)	599.8	(532.7, 684.1)	243.2	(188.7, 320.9)	456.2	(364.5, 579.1)	385.3	(303.8, 509.7)	457.2	(384.6, 555.1)
1992	368.3	(238.2, 561.9)	572.7	(510.3, 647.4)	233.6	(182.1, 308.8)	469.3	(372.5, 602.5)	399.1	(314.9, 528.0)	453.0	(375.0, 564.6)
1993	371.5	(246.3, 576.1)	553.6	(487.0, 630.8)	213.7	(164.4, 284.4)	436.4	(348.5, 562.6)	383.0	(301.6, 508.0)	433.7	(359.7, 533.4)
1994	387.6	(255.0, 594.7)	514.8	(455.6, 585.6)	223.6	(171.7, 296.8)	433.8	(341.8, 554.1)	396.5	(310.1, 526.7)	432.0	(354.0, 553.9)
1995	319.8	(204.3, 481.1)	594.6	(525.5, 676.7)	229.8	(175.8, 308.1)	446.4	(350.7, 570.3)	345.6	(270.3, 461.6)	468.5	(386.4, 583.0)
1996	350.4	(232.6, 542.8)	717.1	(639.7, 808.2)	298.2	(237.2, 390.2)	570.4	(458.9, 734.0)	421.9	(331.9, 561.2)	425.0	(359.8, 509.1)
1997	377.1	(243.5, 572.2)	600.9	(538.2, 672.6)	233.8	(184.1, 306.5)	510.4	(405.6, 649.2)	423.2	(333.0, 561.3)	432.0	(365.5, 519.1)
1998	416.1	(275.0, 636.0)	634.7	(569.9, 707.1)	223.4	(176.0, 289.2)	444.3	(355.1, 561.9)	370.4	(292.5, 489.8)	353.0	(299.0, 422.1)
1999	423.9	(283.1, 644.6)	718.2	(645.4, 805.5)	262.3	(203.2, 343.1)	523.4	(417.9, 658.0)	459.2	(357.4, 622.9)	416.0	(352.0, 501.2)
2000	385.6	(255.1, 579.7)	652.7	(586.6, 728.8)	277.6	(221.8, 352.7)	552.8	(442.3, 699.8)	437.4	(342.3, 585.1)	428.4	(364.4, 511.6)
2001	413.6	(273.6, 619.7)	615.4	(553.3, 689.0)	234.9	(185.9, 303.0)	499.8	(405.6, 632.7)	506.9	(394.6, 682.2)	407.6	(347.0, 486.7)
2002	406.2	(271.8, 616.9)	707.9	(637.1, 792.0)	277.6	(220.0, 363.5)	503.8	(400.7, 651.7)	573.6	(432.6, 804.6)	561.0	(473.9, 675.4)
2003	420.9	(280.1, 639.9)	648.7	(583.2, 728.4)	271.2	(215.2, 353.5)	518.0	(415.1, 655.7)	428.7	(338.1, 569.6)	478.6	(404.2, 577.0)
2004	445.9	(295.0, 676.4)	644.4	(577.5, 720.3)	311.3	(246.2, 410.6)	558.9	(447.2, 705.3)	420.3	(334.5, 551.2)	513.1	(435.2, 611.9)
2005	431.1	(287.4, 662.3)	620.4	(555.6, 696.3)	249.5	(199.4, 324.3)	524.9	(421.7, 660.7)	384.0	(305.2, 506.1)	475.7	(402.6, 572.1)
2006	400.8	(268.3, 609.5)	637.8	(570.2, 715.8)	253.9	(199.5, 329.9)	541.9	(434.4, 680.0)	383.0	(304.3, 503.4)	430.7	(366.0, 514.3)
2007	448.7	(302.3, 694.6)	741.4	(663.4, 839.4)	280.6	(223.6, 364.2)	669.8	(534.7, 851.9)	460.7	(361.0, 615.6)	460.0	(388.0, 555.7)
2008	442.9	(296.5, 682.0)	641.8	(575.0, 723.6)	304.6	(231.7, 426.7)	543.4	(435.3, 687.0)	433.2	(340.8, 574.2)	438.0	(372.0, 522.6)
2009	464.2	(306.9, 713.2)	598.4	(535.7, 668.5)	293.3	(229.8, 390.6)	531.2	(428.4, 673.9)	401.4	(315.4, 532.9)	463.8	(393.1, 556.4)
2010	382.4	(255.0, 578.3)	567.5	(508.1, 635.6)	276.6	(217.6, 360.0)	532.0	(427.2, 662.7)	396.7	(311.0, 526.7)	380.6	(322.0, 455.8)
2011	430.1	(287.1, 665.3)	545.2	(489.5, 611.0)	254.6	(201.8, 332.5)	519.3	(417.6, 654.5)	397.6	(314.8, 525.8)	402.0	(339.0, 482.8)
2012	413.3	(274.3, 621.1)	604.2	(540.1, 676.7)	259.1	(206.4, 334.3)	518.8	(416.2, 652.5)	391.6	(310.7, 516.1)	424.7	(360.3, 507.5)
2013	501.5	(328.4, 803.8)	625.5	(562.0, 697.5)	291.1	(230.9, 380.3)	634.9	(502.0, 841.1)	456.5	(362.5, 602.0)	471.0	(398.0, 567.1)
2014	444.7	(297.8, 679.2)	618.7	(552.1, 699.1)	236.5	(187.0, 305.2)	494.0	(395.9, 622.0)	392.2	(303.2, 547.8)	416.4	(352.6, 499.3)

^a Estimates derived using 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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