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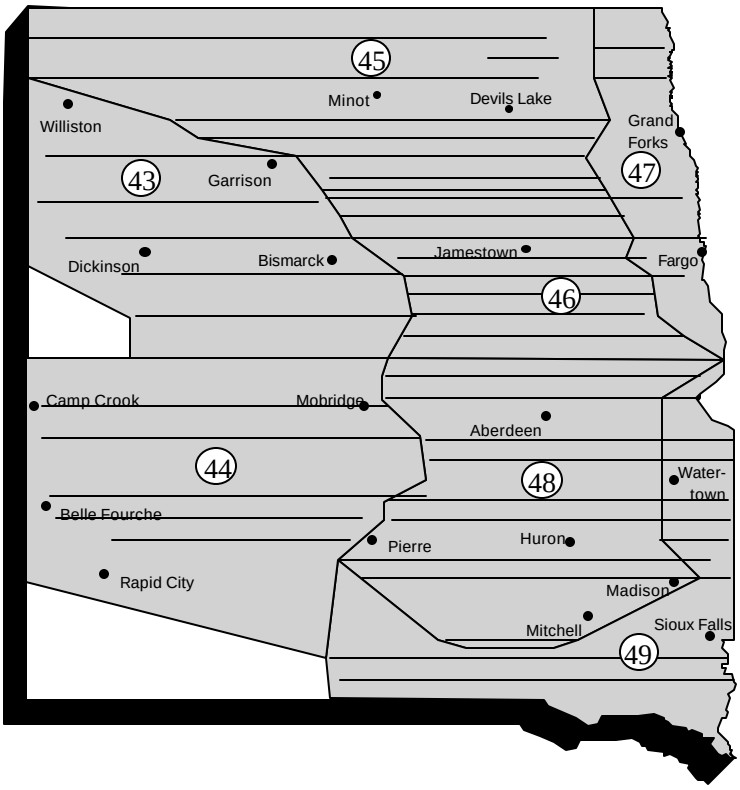
2001

WATERFOWL BREEDING POPULATION SURVEY

FOR

SOUTH DAKOTA AND NORTH DAKOTA



TITLE: Waterfowl Breeding Population and Habitat Survey for South and North Dakota

STRATA SURVEYED: 44, 48, 49 (South Dakota)
43, 45, 46, 47 (North Dakota)

DATES: 2 - 4 May 2001 (43 and 44)
7 - 28 May 2001 (45, 46, 47, 48, and 49)

DATA SUPPLIED BY: United States Fish and Wildlife Service

Strata 45, 46, 47, 48, 49

Aerial Crew

Observer/Pilot - John W. Solberg, Flyway Biologist, WPS/DMBM, Bismarck, ND

Observer - Sue Thomas, Secretary, MBHP, R-1, Portland, OR

Ground Crew

Leader - George Allen, Wildlife Biologist, BSA/DMBM, Arlington, VA

Assistants -

Monte Ellingson, Private Lands Biological Technician, Crosby WMD, Crosby, ND
Pam Garrettson, Wildlife Biologist, PHAS/DMBM, Laurel, MD
Fritz Prellwitz, Wildlife Biologist, Bowdoin NWR, Malta, MT

Strata 43 and 44

Aerial Crew

Observer/Pilot - James F. Voelzer, Chief - WPS/DMBM, Portland, OR

Observer - Ray Bentley, Flyway Biologist, WPS/DMBM, Corvallis, OR

Ground Crew

Leader - Allison Arnold, Wildlife Biologist, EPIC, LLC, Dripping Springs, TX

Assistants - Vincent Griego, Wildlife Biologist, Salton Sea NWR, Calipatria, CA

ABSTRACT: The 2001 Waterfowl Breeding Ground and Habitat Survey for South and North Dakota was conducted 7 - 28 May with standard aerial coverage accomplished. Personnel changes occurred this year in both the air and ground crew. Habitat conditions were good to excellent through out most of the crew area. Compared to 2000 levels, wetland counts increased 58% in South Dakota and were similar (2%) in North Dakota. Waterfowl breeding populations were second and third highest of record for South Dakota (4.301 million) and North Dakota (5.767 million), respectively. The outlook for waterfowl production in 2001 is above average.

Selected information for 2001 is presented below:

South Dakota

	2001 Indices (thousands)	Percent Change From 2000	1991-2000 mean	1959-2000 mean
Mallard	1040.5	-6%	28%	128%
Gadwall	508.9	-20%	7%	133%
Blue-winged Teal	1608.7	2%	25%	96%
Northern Pintail	385.4	92%	89%	75%
Redhead	51.0	54%	-9%	8%
Canvasback	5.1	-24%	-27%	-20%
Total Ducks	4301.1	6%	29%	104%
May Ponds	989.1	58%	38%	88%

North Dakota

	2001 Indices (thousands)	Percent Change From 2000	1991-2000 mean	1959-2000 mean
Mallard	1484.3	NC	53%	163%
Gadwall	780.3	-37%	14%	122%
Blue-winged Teal	1688.7	-41%	26%	101%
Northern Pintail	377.0	44%	32%	9%
Redhead	226.4	-26%	17%	68%
Canvasback	66.5	219%	73%	130%
Total Ducks	5767.4	-22%	35%	108%
May Ponds	750.2	2%	-13%	3%

METHODS: The procedures followed in conducting the survey are described in the Standard Operating Procedures for Aerial Breeding Ground and Habitat Surveys in North America, Section III, revised 1987. There were no changes in survey coverage (Tables 3 and 6) and all transects were flown. Survey end time (12:00 noon), as outlined in the operating procedures, was violated on two days. In these instances, a late departure (due to foggy conditions), resulted in the completion of sampling no longer than 1.5 hours past the cut-off time. The decision to

violate the operating procedures sampling time was made in attempt to minimize the late date of survey completion in the crew area.

Personnel changes involved both the air and ground crew in 2001. Pam Garrettson, a wildlife biologist with the DMBM in Laurel, Maryland, joined the east river ground crew this year. Pam worked last year assisting with ground crew activities in the western Dakota/Montana survey area. Fritz Prellwitz, a wildlife biologist from Bowdoin NWR, also provided his able assistance completing ground survey activities. Sue Thomas, from the Migratory Birds and Habitat Programs office in Portland, Oregon, participated as a first year aerial observer. Remaining air and ground personnel were unchanged since 2000. All new members received pre-survey training/review sessions relating to air and ground procedures. Participants were critiqued regarding species identification, judgement of transect width, and adherence to standard operating procedures.

Visibility Correction Factors (VCF's) in the crew area are typically calculated using observations collected from 17 air/ground comparison segments. All comparison segments in the crew area are co-located with operational survey segments and this year, all were completed. The VCF for wetlands, established by comparison of air and ground observations, was 1.06. Wetland counts and all other data are considered comparable to all years when VCF's were determined.

Transect flying was accomplished in a wheeled Cessna 185. The survey required 70 hours of flight time including aerial observer training, reconnaissance, and the collection of footage for the "Status of Waterfowl" video. For the second time in the crew area, on-board computers, interfaced with the aircraft GPS, were used to record waterfowl and wetland observations. With each observation, time and location information were also captured. Transect flying commenced 7 May in the eastern Dakotas and was completed 28 May. Once the survey was initiated, 7 days were forfeited to adverse weather. The common culprit this year was wind, which exceeded 50 mph on numerous occasions. Information from Stratum 43 and 44 was collected 2 - 4 May by the Montana survey crew led by James Voelzer. Our appreciation is extended to that crew for their efforts and contributions of data and habitat information from the Western Dakotas.

WEATHER AND HABITAT CONDITIONS:

The crew area entered the fall of 2000 with the extreme northwestern portion of North Dakota considered abnormally dry. Similar conditions existed in much of the southern 2/3rds of South Dakota. In fact, southern fringes of the southeastern and south central regions of South Dakota were considered in first stages of drought.

Temperatures during September and October were generally above normal. Benefits from precipitation received early during this period were negated by warm winds and evaporation. Late in October and particularly in northern areas, heavier rains arrived. Portions of North Dakota received up to four times normal precipitation for the month. Rains continued into the first week of November.

Atypical for this late in the season, clashing air masses in early November spawned tornadoes in the Bismarck area. The second week of November ushered in a cold snap, freezing most wetlands and causing a major exodus of waterfowl from Canada and the Dakotas. By the end of November, the majority of the crew area was snow covered, with larger amounts occurring in South Dakota.

Although December was windy and bitter cold (wind chill temperatures commonly -40° to -50° F), little snow was received. Temperatures in January moderated to normal or slightly above for the season. North Dakota received little snow during the month but South Dakota (and points south to Oklahoma and Arkansas) continued to experience major snow/winter events. A major storm front passed through South Dakota during the last week in January, strongly increasing precipitation levels in the south to 200 - 400% of normal, reversing the trend in moisture levels between the two states as North Dakota received 25 - 50% less precipitation than normal for the month.

In February, temperatures returned to average. Snow continued to fall, again with larger amounts in South Dakota, and by months end, snow cover from 5" - 40" covered the entire crew area. Huron, SD reported a record season-to-date snowfall of over 80". By mid-March, temperatures climbed above normal and an 8 to 9 day snow melt occurred. Scattered rains began by the end of the month. Showers continued in April and though temperatures were cool, thawing continued and some flooding of roads and rivers occurred.

During May, weather conditions were generally windy and warm. Scattered showers occurred in South Dakota, but North Dakota received little rain. Temperatures turned colder than normal in both states for the closing of May.

SOUTH DAKOTA (St. 44: 2 - 3 May, St. 48, 49: 7 -13 May)

Stratum 44 - Although the 2001 wetland index decreased -35%, -48%, and -32% from last year, and the ten-year and long-term means, it was reported that residual nesting cover was above average and pond levels were nearly full. Additionally, CRP was conspicuous in all portions of the stratum. New growth of grasses was slightly behind normal, but the aforementioned cover was adequate for nest initiation. Overall , habitat conditions in the stratum are considered good and production should be average to slightly above average.

Stratum 48 - Recall that portions of Stratum 48 from Redfield/Huron south were quite dry in 2000. A dramatic recovery in wetland conditions occurred in Stratum 48 where the wetland index increased 73% since last year. Not only were the more persistent wetland types improved in quantity and quality, but the reappearance of temporary and seasonal wetlands was reminiscent of the mid to latter 1990's. Many areas in the southern half of the stratum were too wet for spring agricultural activities and by the completion of the South Dakota portion of the survey, had not yet been affected by farming. Because of the wet conditions, plowing of large quantities of field stubble or wetland basin margins and no ditch/field burning was observed. In the northern 1/3 of the stratum, comparatively less temporary water was evident and farming activities were farther advanced than in the south. In this region, eruption of current year crop had occurred by mid-

month and despite farming activities, residual cover was present in good supply. Overall conditions in the stratum are considered good to excellent. Compared to the ten-year and long-term averages, the 2001 wetland index was 59% and 131% respectively. Particularly considering the improvements in the southern portion of the stratum, above average production is expected this year.

Stratum 49 - The entire stratum possesses good to excellent habitat conditions where wetland counts increased 126% since last year. Particularly in the south central region, much temporary/sheet water exists, which has curtailed agricultural activities. Nesting cover in the stratum has been slow to develop, but residual supplies are in good standing. Cover/water combinations in the Prairie Coteau, as well as "west river" areas of the southwest, are also providing attractive habitat. The 2001 wetland index is 97% above the ten-year average and 150% above the long-term average. Waterfowl production from Stratum 49 is expected to be above average.

NORTH DAKOTA (St. 43: 3 - 4 May, St. 45, 46, 47: 15 - 28 May)

Stratum 43 - The west river survey crew rated the north, central and eastern portions of the stratum as good for nesting and production while the extreme western and south central portions only fair. Because the former is the most productive portion of the stratum, average production is expected in Stratum 43. Residual nesting cover was adequate over most of the stratum; the extreme western portion and the extreme south central parts being the exception. For the first time in over a decade, CRP was noticeable by it's presence and will contribute to production this year. In the past, the west river crew has observed that haying and grazing reduced the effectiveness of CRP to annual waterfowl production. Water counts decreased -18% from the 2000 level and remain -41% and -26% below the ten-year and long-term figures.

Stratum 45 - Wetland numbers in Stratum 45 improved slightly (14%) compared to 2000. Generally, the eastern third of the stratum, and particularly the Devils Lake region, offer excellent conditions. Many acres in the Devils Lake area have been too wet for spring tillage and may not be planted this year. Moving west, the central third offers good conditions with the best combinations of cover and water occurring in southern portions of the Missouri Coteau. Although the coteau is somewhat drier than it was in the mid to late 1990's, water/cover combinations are still good as is the potential for waterfowl production. Northwestern Stratum 45, in the coteau slope, is relatively drier and exhibits less available cover. We considered habitat conditions in this region only fair. The 2001 wetland index for Stratum 45 is similar to the ten-year average (-1%) and the long-term average (7%). We anticipate waterfowl production in the stratum to be average or above.

Stratum 46 -The southeast portion of Stratum 46 provided noticeable improvements in wetland conditions compared to last year. Wetland numbers in the remainder of the stratum were similar to last year. As in Stratum 45, the Missouri Coteau in Stratum 46 is slightly drier than in recent past years, but still looks good. As usual, the highest potential for waterfowl production occurs in this region, based on wetland/nesting cover combinations. Overall habitat conditions in the stratum are considered good, with small areas in the southeast and north central considered

excellent. The wetland index for 2001 was similar (-8%) to the 2000 figure, decreased (-15%) compared to the ten-year average, and was above (13%) the long-term mean. The potential for waterfowl production in the stratum is above average.

Stratum 47 - Admittedly, Stratum 47 offers relatively little in terms of potential waterfowl production. Precipitation during the past annual cycle benefitted the region, resulting in a 14% increase in the wetland index since 2000. The 2001 wetland index is below the ten-year average (-18%) and similar to the long-term average (3%). Agricultural intensity and cropping patterns are generally detrimental to nesting cover and increases predator efficiency. Habitat conditions in the stratum range from fair (in the north) to excellent (in southern reaches. Realizing the low relative contribution potential offered by 47, waterfowl production is expected to be average this year.

DISCUSSION/BREEDING POPULATION ESTIMATES: Precipitation received since last year's breeding season erased wetland deficits in South Dakota, east of the Missouri River (Table 2). The return of temporary and seasonal water in the southern half of Stratum 48 and in south central Stratum 49, was dramatic. In these areas, conditions were so wet, essentially no farming activity (other than aerial) had commenced by mid-May. As a result, field stubble from the 2000 growing season was untouched. Additionally, no burning of ditches or wetland margins was observed here. North of Huron, habitat conditions were more similar to last year. Vegetation development, farming activities, and crop development were farther advanced than in the south. All types of nesting cover were in good supply for breeding waterfowl in South Dakota.

In North Dakota, we believe that improvements in wetland conditions in some areas were off-set by losses in other areas. Improvements resulting from precipitation affected primarily the eastern areas (most of Stratum 47, southeastern 46, and northeastern 45). Conditions on the west side of the "east river" crew area were drier than last year. This was evident in the Missouri Coteau (excellent cover but less water than in the mid to late 1990's) and in the coteau slope region between Williston and Parshall. Even though the west river survey crew reported an -18% decline in Stratum 43 and our counts in Stratum 46 (-8%) followed a similar trend, the statewide wetland index remained similar to last year (2%) and the long-term average (3%, Table 5).

Mirroring the trend of plant phenology, waterfowl breeding activities appeared to be slightly later in southern South Dakota compared to the northern part of the state and in North Dakota. In the northern areas, breeding activities were more "normal" or at least farther advanced. Based on our observations in the south, along with reports of Canada geese nesting 7 to 10 days later than last year, we elected to postpone our survey initiation until the 7th of May. At the onset, drake to pair ratios of early nesting mallards and pintails were acceptable (something close to 50:50). As our sampling progressed into the northern quarter or third of South Dakota and into North Dakota, the numerator of the ratios increased at a faster than expected rate. Arriving in Jamestown, we were "pinned down" by a strong, slow moving low pressure system that provided 4 to 5 days of 35 - 50 mph winds. Missing these days of survey, further aggravated the problem of survey timing for the early nesting species. By the time we completed the survey in extreme northwestern North Dakota, we observed some large flocks (10 - 20) of male mallards and pintails. Based on our observations, we feel that our overall survey timing for early nesting

waterfowl in east river South and North Dakota, was slightly late. For the crew area, drake to pair ratios for mallards were 63:37 for both states. The pintail ratio in South Dakota was 59:41 and in North Dakota, 67:33.

To illustrate the intensity of nesting activities in the Dakotas, we will again examine preliminary information from nest searching on two areas. In Brown County, near Sand Lake NWR in South Dakota, an 80 acre predator exclosure was monitored again this year. Service biologists reported that on 23 April, a storm blanketed the area with 10" of snow. This event caused some nest abandonment/loss. By mid-June, three rounds of nest searching had been completed. A total of 180 nests (-15% from 2000) were located for their efforts. Near Medina, North Dakota (in the Missouri Coteau in Stratum 46), Service biologists had located 60 nests by late June in a 70 acre exclosure. These nests represent a -25% decrease compared to the 80 nests found in 2000. The biologists commented that late nesting activity appeared low at the North Dakota site. Despite the decline in nest numbers since last year (granted, only 2 areas), the 1 to 2 nests per acre, in these two exclosures, are impressive.

In South Dakota, the second highest waterfowl breeding population index of record (4.301 million) was observed. The 2001 total duck index is essentially unchanged (6%) from the 2000 figure and is 29% and 104% above the respective ten-year and long-term averages (Appendix 1). For the fifth year running, the mallard index exceeded one million birds, falling just short (-6%) of the 2000 index. Blue-winged Teal posted a new record high, exceeding 1.6 million birds. Pintails too, responded to the excellent habitat conditions and increased 92% from last year's index. All species of dabbling ducks in South Dakota were at or above ten-year and long-term means. In the diver group, only Redhead (54%) and Bufflehead (58%) increased since last year. All divers except Canvasback (-20%) and Bufflehead (-60%) were above long-term averages in 2001 (Table 1).

The total index for breeding waterfowl in North Dakota in 2001 was 5.767 million birds (Appendix 2). This represents a -22% decrease from last year's figure. The 2001 index for mallards was unchanged from last year and is similar to the 1999 record index. As in South Dakota, pintails responded positively to the good/excellent habitat conditions in North Dakota by increasing nearly 44% since 2000. Significant decreases, since last year, were recorded for Gadwall (-37%) and Blue-winged teal (-41%), which were major contributors to the overall decline (-22%) in the dabbler group. Although Canvasback (-26%), Scaup (-27%), and Ruddy Ducks (-13%) all declined since last year, all members of the diver category with significant sample sizes, remained at or above the ten-year and long-term levels (Table 4).

CONCLUSIONS:

1. Following a winter of generous precipitation, wetland conditions in South Dakota rebounded since the spring of 2000. Compared to last year, the statewide wetland index increased 58%. Most noticeable was the return of water in the southern half of Stratum

48 and the south central region of Stratum 49. The water index is 38% above the ten-year average and 88% above the long-term mean. Although current year vegetation development was slightly later than normal, residual nesting cover in and around wetland basins, that associated with agricultural fields, and CRP, offer abundant supplies of nesting areas. Total breeding waterfowl recorded showed little change (6%) from last year but is the second highest index of record. Mallards (-6%) were similar to the 2000 index and remained above one million birds. Attracted to the improved conditions, northern pintails exceeded last year's index by 92% and were significantly higher that historic time comparisons. Although scaup declined -25% since last year and compared to the ten-year mean -41%, the 2000 index is similar to the long-term average (2%). With good to excellent habitat conditions in place, waterfowl production should be above average in South Dakota in 2001.

2. Wetland counts in North Dakota this year were similar (2%) to those in 2000. The 2001 index is 13% below the ten-year mean and similar (3%) to the long-term average. Gains in wetland numbers realized in eastern regions were probably off-set by drier conditions in the west. At the start of the survey, current year vegetation development was farther advanced than in southern South Dakota, and with CRP and residual wetland associated cover, supplies were above average. The waterfowl breeding population for total ducks exceeded 5.7 million birds. The 2001 index represents a -22% decrease compared to last year, but again is above the ten-year (35%) and long-term (108%) averages. This year's mallard index (1.484 million) is second highest of record and is similar to the 1999 and 2000 indices. As in South Dakota, pintails (43%) responded in a positive way to the good/excellent habitat conditions offered in North Dakota. The pintail index is 32% and 9% above the ten-year and long-term means. Echoing the trend in South Dakota, North Dakota scaup decreased -27% since last year but are 28% and 94% above the respective ten-year and long-term comparisons. With mostly good to excellent habitat conditions in North Dakota, waterfowl production is expected to again be above average in 2001.

John W. Solberg and Sue Thomas
July 2001

Table 1. Status of waterfowl breeding population estimates (thousands, adjusted for visibility bias) by species and stratum with comparisons against the previous year, the previous 10-year mean, and the long-term mean (from 1959) for South Dakota.

	Stratum							% Change From		
Species/Ponds	44	48	49	2001 Total	2000 Total	10-Year Mean	Long-Term Mean	2000	10-Year Mean	Long-Term Mean
Ducks										
Dabblers										
Mallard	135.8	654.3	250.3	1040.5	1108.4	815.4	456.4	-6.1%	27.6%	128.0%
Am. black duck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	--	-100.0%
Gadwall	132.1	322.0	54.8	508.9	636.2	474.9	218.5	-20.0%	7.2%	132.9%
Am. wigeon	38.4	11.7	3.5	53.5	69.9	53.8	39.4	-23.4%	-0.4%	35.9%
Am. green-winged teal	26.2	29.5	14.0	69.8	51.6	40.7	28.8	35.3%	71.4%	142.1%
Blue-winged teal	36.7	1192.8	379.1	1608.7	1576.9	1282.7	819.3	2.0%	25.4%	96.3%
N. shoveler	32.5	359.0	70.4	461.9	226.8	259.0	185.1	103.7%	78.4%	149.6%
N. pintail	44.7	300.4	40.3	385.4	200.5	204.1	220.0	92.2%	88.8%	75.2%
Subtotal	446.5	2869.8	812.4	4128.7	3870.3	3130.5	1967.5	6.7%	31.9%	109.8%
Divers										
Redhead	0.0	42.8	8.2	51.0	33.0	55.9	47.3	54.4%	-8.9%	7.8%
Canvasback	0.5	3.5	1.1	5.1	6.7	6.9	6.4	-24.1%	-26.9%	-20.4%
Scaups	4.3	31.7	8.5	44.5	59.1	75.5	43.4	-24.6%	-41.0%	2.5%
Ring-necked duck	1.9	5.9	0.9	8.7	10.8	17.3	8.2	-19.7%	-49.7%	6.4%
Goldeneyes	0.0	0.0	0.0	0.0	0.0	0.6	0.3	--	-100.0%	-100.0%
Bufflehead	0.6	0.0	0.0	0.6	0.4	3.2	1.5	57.6%	-81.1%	-60.2%
Ruddy Duck	0.0	42.7	16.1	58.8	65.9	32.2	30.9	-10.7%	82.9%	90.6%
Subtotal	7.3	126.7	34.7	168.7	175.9	191.7	138.0	-4.1%	-12.0%	22.2%
Miscellaneous										
Oldsquaw	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	--	--
Eiders	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	--	--
Scoters	0.0	0.0	0.0	0.0	0.0	0.2	0.0	--	-100.0%	-100.0%
Mergansers	3.2	0.5	0.0	3.7	2.9	3.2	1.5	27.8%	14.3%	140.1%
Subtotal	3.2	0.5	0.0	3.7	2.9	3.4	1.6	27.8%	8.9%	134.3%
Total Ducks	457.0	2997.0	847.1	4301.1	4049.1	3325.6	2107.1	6.2%	29.3%	104.1%
Canada Goose	24.0	110.6	35.3	169.9	165.3	77.0	26.2	2.8%	120.6%	548.9%
Am. coot	0.7	95.7	45.2	141.7	300.9	346.9	202.7	-52.9%	-59.2%	-30.1%
Ponds	105.3	562.9	320.9	989.1	627.6	719.5	526.9	57.6%	37.5%	87.7%

Table 2. Long-term trend in adjusted May pond estimates (thousands) by stratum with comparisons against the previous year, the previous 10-year mean, and the long-term mean (from 1974) for South Dakota. Estimates prior to 1974 were not adjusted for visibility bias.

	Stratum			
Year	44	48	49	Total
1961	33.1	48.1	34.2	115.4
1962	69.5	152.3	95.7	317.4
1963	80.2	142.2	106.9	329.3
1964	62.0	79.3	56.8	198.0
1965	84.5	100.3	53.0	237.8
1966	94.5	143.6	79.7	317.8
1967	90.2	132.4	66.5	289.0
1968	71.8	146.0	61.1	278.9
1969	156.5	263.5	111.6	531.6
1970	161.3	183.3	58.9	403.4
1971	146.4	132.7	85.4	364.4
1972	205.5	263.8	108.1	577.4
1973	153.4	126.1	82.4	362.0
1974	68.0	186.0	125.4	379.4
1975	151.0	236.4	108.3	495.7
1976	92.9	121.8	93.1	307.8
1977	84.7	114.5	73.0	272.3
1978	212.3	307.4	131.5	651.2
1979	82.0	214.6	148.6	445.3
1980	66.8	108.4	88.3	263.5
1981	64.3	58.8	40.0	163.0
1982	148.1	176.7	73.7	398.4
1983	104.3	189.4	142.6	436.4
1984	142.8	262.4	189.4	594.6
1985	116.7	183.8	124.4	425.0
1986	216.7	260.5	132.2	609.4
1987	194.9	216.4	105.9	517.3
1988	92.5	99.9	114.4	306.8
1989	195.4	222.0	86.7	504.1
1990	124.0	79.4	56.7	260.0
1991	106.5	113.1	69.5	289.1
1992	107.5	96.8	61.6	265.8
1993	141.1	334.7	225.0	700.7
1994	281.1	356.5	180.9	818.4
1995	279.4	458.2	195.9	933.4
1996	324.4	418.2	172.2	914.8
1997	278.8	478.8	167.5	925.1
1998	195.3	337.8	162.0	695.1
1999	157.4	618.1	249.4	1025.0
2000	161.3	324.7	141.6	627.6
2001	105.3	562.9	320.9	989.1
10-year Mean	203.3	353.7	162.6	719.5
Long-term Mean	155.2	243.5	128.1	526.9
Percent Change:				
From 2000	-34.7%	73.3%	126.7%	57.6%
From 10-year Mean	-48.2%	59.2%	97.4%	37.5%
From Long-term Mean	-32.1%	131.1%	150.4%	87.7%

Table 3. Survey design for South Dakota, May 2001.

	Stratum			
	44	48	49	Total
Survey design				
Square miles in stratum	27,299	24,587	15,830	67,716
Square miles in sample	216	315	171	702
Linear miles in sample	864	1,260	684	2,808
Number of transects in sample	5	9	11	25
Number of segments in sample	48	70	38	156
Expansion factor	126.3842	78.05396	92.57309	---
Current year coverage				
Square miles in sample	216	315	171	702
Linear miles in sample	864	1,260	684	2,808
Number of transects in sample	5	9	11	25
Number of segments in sample	48	70	38	156
Expansion factor	126.3842	78.05396	92.57309	---

Appendix 1. Long –term trend in adjusted waterfowl breeding population estimates (thousands) in South Dakota.

Species/Ponds	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968
Ducks										
Dabblers										
Mallard	108.2	176.6	212.1	367.3	535.8	261.1	314.5	216.3	248.2	450.7
Am. black duck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gadwall	0.0	9.9	18.9	73.9	164.0	53.6	115.4	112.9	75.1	197.8
Am. wigeon	7.1	9.6	6.1	8.1	3.1	4.4	0.0	9.6	29.7	22.6
Am. green-winged teal	0.0	0.0	2.7	10.0	2.7	0.0	0.0	7.7	9.6	23.5
Blue-winged teal	413.1	524.5	673.8	602.5	1201.5	686.3	703.6	623.9	313.7	466.1
N. shoveler	38.4	156.3	96.4	335.5	225.4	95.7	90.2	108.3	82.2	150.6
N. pintail	25.5	305.7	175.4	557.8	221.6	108.8	128.9	228.9	186.6	129.1
Subtotal	592.3	1182.5	1185.3	1955.1	2354.1	1209.9	1352.6	1307.7	945.1	1440.2
Divers										
Redhead	0.0	30.1	14.3	56.4	50.5	50.4	56.4	56.7	20.1	33.4
Canvasback	2.8	1.4	2.8	2.2	2.6	5.0	2.0	6.1	3.5	2.6
Scaups	13.6	18.3	8.1	32.9	11.0	1.4	29.2	29.7	11.2	22.3
Ring-necked duck	0.0	0.0	0.0	0.0	1.0	0.0	0.0	1.4	1.1	0.0
Goldeneyes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bufflehead	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.9	0.0
Ruddy Duck	0.0	10.7	3.6	11.8	5.6	1.4	1.9	5.6	0.0	8.9
Subtotal	16.4	60.5	28.8	103.4	70.7	58.1	89.5	100.0	36.8	67.2
Miscellaneous										
Oldsquaw	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eiders	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Scoters	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mergansers	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0
Subtotal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0
Total Ducks	608.7	1243.0	1214.2	2058.5	2424.9	1268.1	1442.0	1409.0	982.0	1507.4
Canada Goose	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3	0.9	0.0
Am. coot	31.1	40.4	29.3	61.0	21.0	53.4	19.3	33.8	28.0	75.7
Ponds										

Species/Ponds	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
Ducks										
Dabblers										
Mallard	443.3	415.2	392.0	493.0	432.6	276.5	354.3	256.2	186.8	537.3
Am. black duck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gadwall	243.8	214.5	162.2	192.1	149.9	85.5	126.4	44.6	31.4	233.6
Am. wigeon	30.7	21.4	19.0	99.1	43.7	16.3	42.7	56.6	29.2	92.7
Am. green-winged teal	29.0	115.1	25.4	42.6	29.6	19.1	37.4	31.1	9.8	38.5
Blue-winged teal	742.2	706.8	654.3	1209.0	777.1	348.8	437.2	351.7	318.9	1287.3
N. shoveler	195.7	260.3	103.2	330.9	110.6	51.1	92.9	56.5	58.6	419.1
N. pintail	396.6	333.3	247.8	395.4	275.1	99.1	218.2	111.7	130.8	678.4
Subtotal	2081.2	2066.8	1603.9	2762.1	1818.6	896.5	1309.0	908.4	765.5	3287.0
Divers										
Redhead	87.8	53.6	60.7	48.6	34.6	20.2	27.3	4.1	10.8	144.4
Canvasback	17.9	6.1	2.8	14.2	13.1	6.4	5.6	3.1	3.0	12.3
Scaups	12.1	74.4	7.3	41.1	19.2	13.0	12.7	45.3	16.4	73.7
Ring-necked duck	0.0	1.1	0.5	0.0	0.0	0.0	0.0	0.3	0.4	1.4
Goldeneyes	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	1.0
Bufflehead	0.0	0.0	0.0	1.5	0.0	0.5	0.0	0.0	0.0	0.5
Ruddy Duck	7.0	39.3	27.7	30.1	18.6	23.2	209.7	6.2	5.8	28.7
Subtotal	124.8	174.5	99.0	136.6	85.5	63.2	255.4	59.0	36.4	261.9
Miscellaneous										
Oldsquaw	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eiders	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Scoters	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mergansers	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0
Subtotal	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0
Total Ducks	2206.0	2241.2	1702.9	2898.7	1904.9	959.7	1564.4	967.4	801.9	3548.9
Canada Goose	8.2	0.9	2.1	3.4	6.4	3.7	1.9	3.0	1.8	7.2
Am. coot	91.1	91.8	35.0	110.9	126.1	27.8	75.7	66.6	91.4	232.5
Ponds						379.4	495.7	307.8	272.3	651.2

Appendix 1 (continued). Long –term trend in adjusted waterfowl breeding population estimates (thousands) in South Dakota.

Species/Ponds	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Ducks										
Dabblers										
Mallard	441.7	338.9	186.8	291.7	314.9	334.9	310.1	532.0	556.8	374.1
Am. black duck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gadwall	136.7	69.8	113.6	189.1	219.0	263.7	145.5	254.3	205.7	222.5
Am. wigeon	33.6	41.5	60.0	40.7	73.8	87.0	45.2	39.7	45.6	48.8
Am. green-winged teal	19.3	70.2	21.1	34.9	36.6	22.0	31.6	52.1	23.4	25.5
Blue-winged teal	906.0	483.3	254.1	519.9	801.8	938.8	604.5	1433.5	777.1	617.1
N. shoveler	341.8	59.3	66.7	152.4	200.0	236.9	113.2	379.8	226.9	84.4
N. pintail	280.0	119.7	53.0	204.2	223.8	263.5	165.3	389.5	212.8	118.4
Subtotal	2159.0	1182.6	755.3	1432.9	1869.9	2146.9	1415.3	3080.8	2048.2	1490.9
Divers										
Redhead	50.9	28.2	22.0	45.2	82.9	111.9	35.9	64.2	34.1	19.3
Canvasback	5.6	8.0	5.9	2.2	2.3	15.8	4.6	11.5	5.7	7.6
Scaups	36.7	5.4	19.1	43.7	54.3	58.6	30.6	104.7	35.4	63.2
Ring-necked duck	0.6	1.2	2.8	7.1	59.0	17.3	1.4	18.3	14.4	5.7
Goldeneyes	0.0	0.0	0.0	1.2	2.4	0.8	0.8	0.8	0.0	0.0
Bufflehead	1.5	1.1	0.9	3.1	6.1	2.8	0.0	4.8	0.0	2.9
Ruddy Duck	16.0	21.6	67.0	84.4	88.9	48.7	23.1	69.4	28.5	3.2
Subtotal	111.3	65.5	117.8	187.0	295.9	255.8	96.5	273.6	118.1	101.8
Miscellaneous										
Oldsquaw	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eiders	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Scoters	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mergansers	2.5	0.8	0.0	7.0	5.7	6.1	0.0	0.0	0.0	2.1
Subtotal	2.5	0.8	0.0	7.0	5.7	6.1	0.0	0.0	0.0	2.1
Total Ducks	2272.9	1248.9	873.1	1626.9	2171.4	2408.9	1511.8	3354.5	2166.3	1594.7
Canada Goose	4.8	3.4	9.8	23.9	13.0	19.0	15.2	12.5	17.6	57.2
Am. coot	356.1	77.1	176.8	202.7	263.5	603.7	196.5	487.5	427.3	436.4
Ponds	445.3	263.5	163.0	398.4	436.4	594.6	425.0	609.4	517.3	306.8

Species/Ponds	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Ducks										
Dabblers										
Mallard	472.0	183.5	342.6	360.6	491.5	715.9	919.7	839.8	1323.2	1035.6
Am. black duck	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gadwall	177.7	125.7	282.9	281.5	246.6	383.0	541.5	451.8	819.5	624.2
Am. wigeon	21.6	27.4	44.4	32.9	17.3	83.6	46.8	47.6	71.3	74.6
Am. green-winged teal	24.4	8.5	17.0	12.6	6.6	55.2	58.4	63.0	69.4	34.3
Blue-winged teal	860.2	346.3	1075.4	626.4	679.9	1383.6	1468.4	1390.9	1535.0	1573.4
N. shoveler	185.4	79.2	117.2	102.0	213.4	283.5	350.0	287.6	414.3	230.3
N. pintail	148.3	63.4	69.8	65.7	166.7	230.1	364.2	187.3	349.9	205.4
Subtotal	1889.5	834.3	1949.3	1481.8	1821.9	3134.8	3749.0	3268.0	4582.7	3777.8
Divers										
Redhead	55.1	16.7	11.7	41.0	62.4	98.2	68.4	54.3	55.6	78.9
Canvasback	5.3	8.1	5.3	1.4	8.0	14.6	7.6	9.1	9.2	4.5
Scaups	80.4	43.5	66.8	47.9	7.3	155.2	120.9	94.6	75.6	87.4
Ring-necked duck	17.7	17.6	5.5	27.6	5.8	11.1	41.6	17.4	19.1	8.4
Goldeneyes	0.0	0.0	3.6	0.0	0.0	0.8	0.8	0.9	0.0	0.0
Bufflehead	5.0	0.5	1.2	7.5	0.0	12.0	5.9	1.2	1.3	0.6
Ruddy Duck	44.0	34.1	10.2	3.9	21.5	36.7	43.2	14.7	18.7	24.9
Subtotal	207.6	120.5	104.2	129.3	105.0	328.7	288.4	192.1	179.5	204.8
Miscellaneous										
Oldsquaw	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eiders	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Scoters	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0
Mergansers	3.5	2.4	4.0	0.0	2.1	3.7	4.9	0.5	7.7	2.5
Subtotal	3.5	2.4	4.0	1.6	2.1	3.7	4.9	0.5	7.7	2.5
Total Ducks	2100.5	957.3	2057.5	1612.7	1929.1	3467.2	4042.3	3460.6	4769.9	3985.1
Canada Goose	65.4	46.2	44.2	48.6	37.7	46.5	55.9	73.5	86.8	99.8
Am. coot	284.7	191.5	77.4	132.8	167.2	311.0	616.9	409.9	525.7	469.0
Ponds	504.1	260.0	289.1	265.8	700.7	818.4	933.4	914.8	925.1	695.1

Appendix 1 (continued). Long –term trend in adjusted waterfowl breeding population estimates (thousands) in South Dakota.

Species/Ponds	1999	2000	2001
Ducks			
Dabblers			
Mallard	1016.4	1108.4	1040.5
Am. black duck	0.0	0.0	0.0
Gadwall	481.6	636.2	508.9
Am. wigeon	49.1	69.9	53.5
Am. green-winged teal	39.1	51.6	69.8
Blue-winged teal	1516.6	1576.9	1608.7
N. shoveler	364.3	226.8	461.9
N. pintail	201.9	200.5	385.4
Subtotal	3669.0	3870.3	4128.7
Divers			
Redhead	56.0	33.0	51.0
Canvasback	2.9	6.7	5.1
Scaups	40.3	59.1	44.5
Ring-necked duck	25.7	10.8	8.7
Goldeneyes	0.0	0.0	0.0
Bufflehead	2.3	0.4	0.6
Ruddy Duck	82.1	65.9	58.8
Subtotal	209.4	175.9	168.7
Miscellaneous			
Oldsquaw	0.0	0.0	0.0
Eiders	0.0	0.0	0.0
Scoters	0.0	0.0	0.0
Mergansers	4.0	2.9	3.7
Subtotal	4.0	2.9	3.7
Total Ducks	3882.5	4049.1	4301.1
Canada Goose	111.8	165.3	169.9
Am. coot	458.6	300.9	141.7
Ponds	1025.0	627.6	989.1

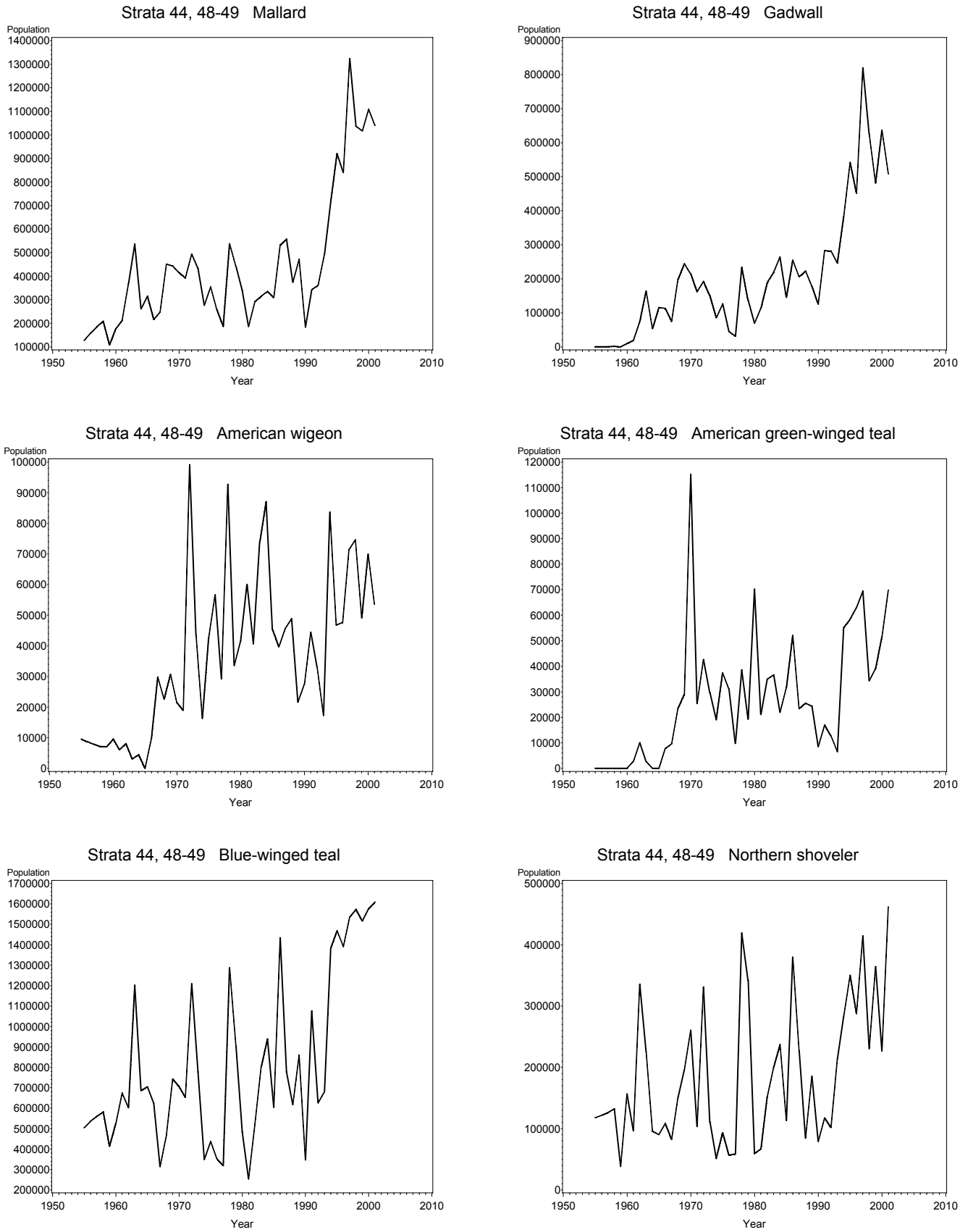
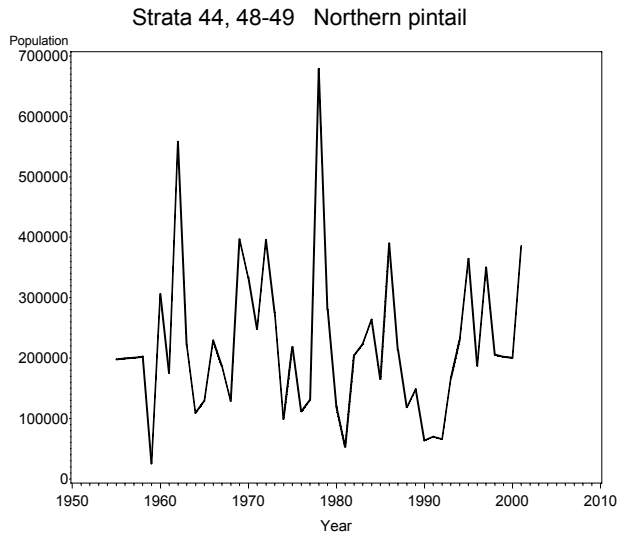
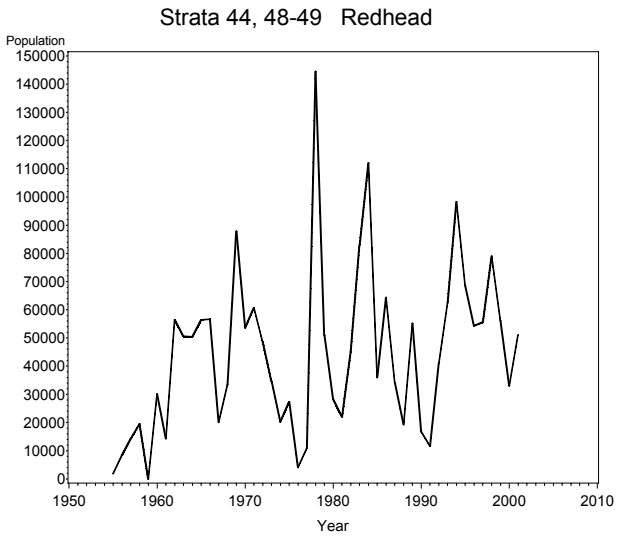
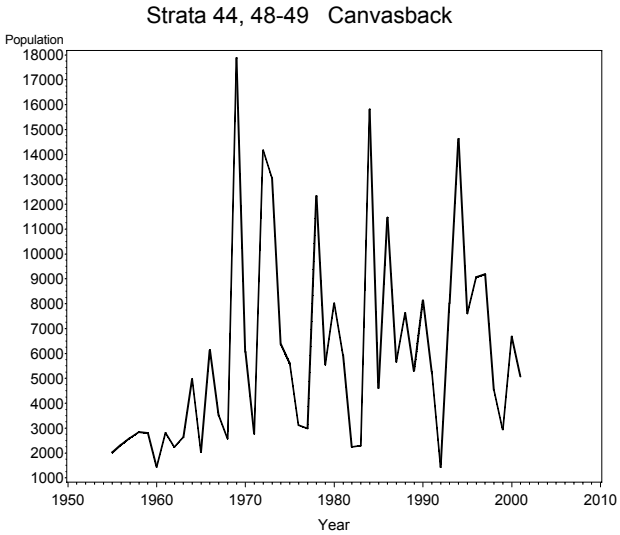
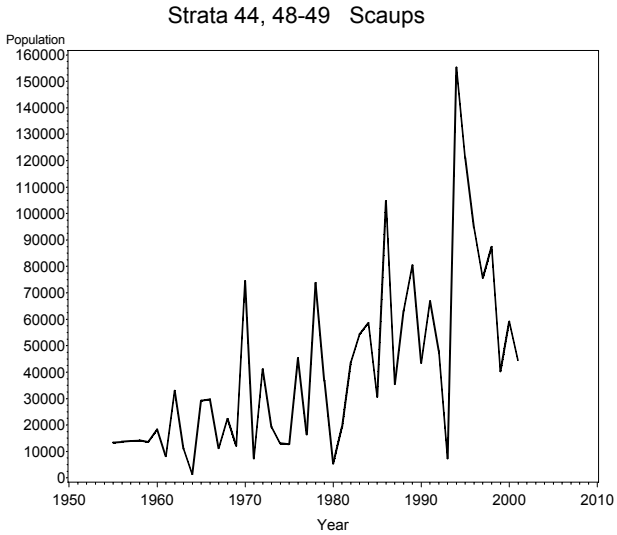


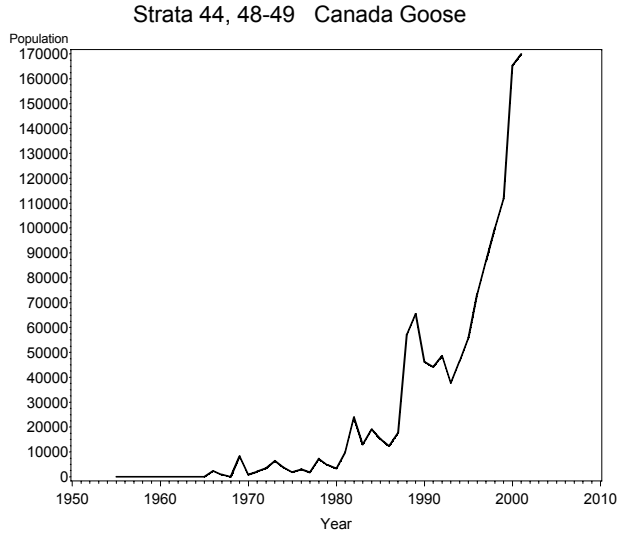
Figure 1. Population indices for the individual waterfowl species and ponds on an annual basis.











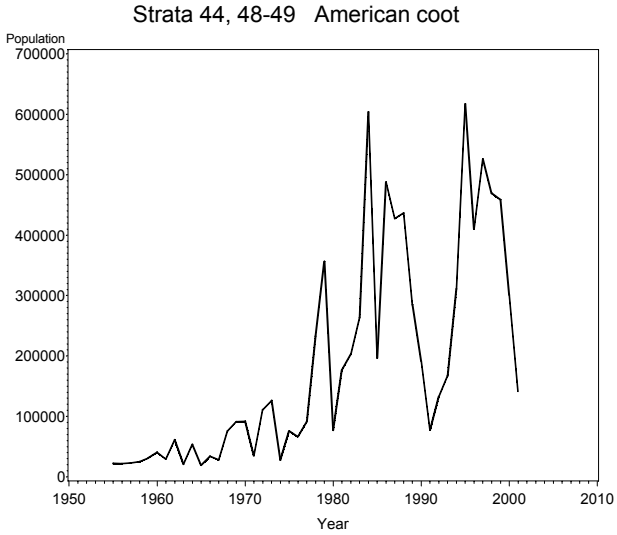
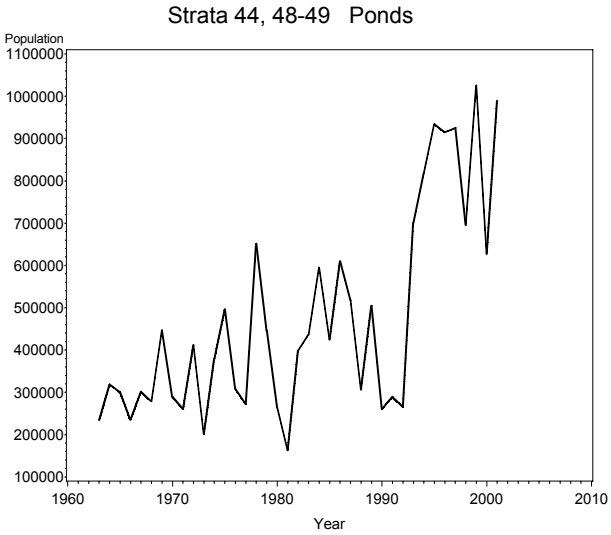


Figure 1 continued.



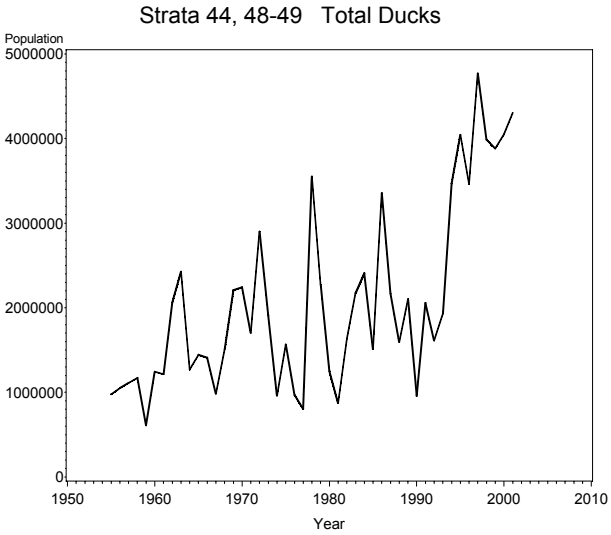


Figure 1 continued.

Table 4. Status of waterfowl breeding population estimates (thousands, adjusted for visibility bias) by species and stratum with comparisons against the previous year, the previous 10-year mean, and the long-term mean. (from1958) for North Dakota.

	Stratum								% Change From		
Species/Ponds	43	45	46	47	2001 Total	2000 Total	10-Year Mean	Long-Term Mean	2000	10-Year Mean	Long-Term Mean
Ducks											
Dabblers											
Mallard	88.3	838.8	471.0	86.2	1484.3	1482.8	968.4	564.4	0.1%	53.3%	163.0%
Am. black duck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	--	--
Gadwall	91.6	429.4	246.0	13.3	780.3	1236.3	685.1	351.3	-36.9%	13.9%	122.1%
Am. wigeon	7.7	39.2	34.0	1.6	82.5	98.0	67.3	43.5	-15.8%	22.6%	89.8%
Am. green-winged teal	19.2	19.5	6.0	0.0	44.7	44.4	45.7	34.7	0.6%	-2.1%	28.9%
Blue-winged teal	48.3	995.5	603.6	41.4	1688.7	2848.5	1345.0	841.2	-40.7%	25.6%	100.8%
N. shoveler	33.2	466.8	163.9	18.6	682.5	647.0	413.5	263.4	5.5%	65.0%	159.1%
N. pintail	37.6	241.4	95.1	2.9	377.0	262.8	286.1	345.2	43.5%	31.8%	9.2%
Subtotal	326.0	3030.4	1619.6	164.0	5140.0	6619.8	3811.0	2443.5	-22.4%	34.9%	110.4%
Divers											
Redhead	8.0	170.4	37.5	10.5	226.4	306.1	193.7	134.9	-26.0%	16.9%	67.8%
Canvasback	0.8	62.1	3.6	0.0	66.5	20.8	38.4	28.9	219.1%	73.2%	130.1%
Scaups	6.6	57.8	66.0	0.0	130.3	178.2	102.2	67.1	-26.9%	27.5%	94.2%
Ring-necked duck	2.6	3.9	6.9	0.0	13.3	6.2	13.3	7.9	114.4%	0.1%	68.6%
Goldeneyes	0.0	0.0	0.0	0.0	0.0	1.3	0.2	0.2	-100.0%	-100.0%	-100.0%
Bufflehead	0.5	4.2	0.5	0.0	5.2	3.2	2.6	1.2	61.3%	103.2%	322.3%
Ruddy Duck	4.5	124.1	56.4	0.0	185.0	212.3	108.8	89.1	-12.8%	70.1%	107.6%
Subtotal	23.0	422.3	170.8	10.5	626.7	728.1	459.0	329.4	-13.9%	36.5%	90.3%
Miscellaneous											
Oldsquaw	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	--	--
Eiders	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	--	--
Scoters	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	-100.0%	-100.0%
Mergansers	0.0	0.0	0.7	0.0	0.7	7.5	1.5	0.9	-91.1%	-56.7%	-22.6%
Subtotal	0.0	0.0	0.7	0.0	0.7	7.5	1.6	0.9	-91.1%	-58.0%	-23.6%
Total Ducks	349.0	3452.8	1791.1	174.5	5767.4	7355.4	4271.7	2773.7	-21.6%	35.0%	107.9%
Canada Goose	27.4	81.7	74.0	1.0	184.1	161.6	63.2	19.2	14.0%	191.5%	856.8%
Am. coot	62.1	197.8	55.9	3.9	319.6	912.6	806.8	402.6	-65.0%	-60.4%	-20.6%
Ponds	86.2	414.9	222.1	26.9	750.2	734.3	859.1	726.7	2.2%	-12.7%	3.2%

Table 5. Long-term trend in adjusted May pond estimates (thousands) by stratum with comparisons against the previous year, the previous 10-year mean, and the long-term mean (from 1974) for North Dakota. Estimates prior to 1974 were not adjusted for visibility bias.

	Stratum				
Year	43	45	46	47	Total
1961	11.8	38.2	26.3	9.6	85.8
1962	25.5	132.6	97.1	17.4	272.6
1963	41.6	206.2	150.9	17.4	416.1
1964	29.4	107.2	41.4	10.4	188.5
1965	51.3	199.4	103.8	13.9	368.4
1966	55.7	265.5	182.9	36.5	540.6
1967	50.1	311.7	168.8	29.9	560.6
1968	54.0	141.1	109.9	11.7	316.8
1969	89.5	326.2	169.9	31.6	617.2
1970	101.5	473.0	152.4	29.2	756.1
1971	109.4	365.5	87.4	17.0	579.3
1972	130.9	338.2	148.0	35.3	652.4
1973	88.4	167.4	54.0	11.8	321.6
1974	64.7	950.9	179.3	57.3	1252.2
1975	104.9	703.4	286.0	41.4	1135.8
1976	84.0	505.1	221.8	37.4	848.2
1977	88.2	179.2	60.1	12.8	340.3
1978	123.7	304.2	195.2	14.2	637.3
1979	87.0	447.4	268.5	32.9	835.8
1980	65.4	179.5	89.4	11.1	345.5
1981	70.3	208.4	55.2	9.7	343.5
1982	140.5	443.2	183.4	19.0	786.0
1983	80.0	398.1	147.5	23.3	648.9
1984	113.9	554.6	269.2	27.7	965.4
1985	115.0	355.5	126.6	17.6	614.6
1986	120.0	381.2	201.7	25.8	728.8
1987	134.5	281.2	170.4	15.1	601.1
1988	94.7	135.4	74.8	8.7	313.6
1989	116.4	198.6	117.5	15.5	448.0
1990	72.8	64.9	39.5	8.0	185.2
1991	72.4	59.1	36.1	7.7	175.3
1992	119.6	146.7	47.9	9.4	323.6
1993	106.4	167.3	163.0	18.4	455.1
1994	203.2	412.0	275.5	27.9	918.7
1995	197.0	581.6	348.0	34.1	1160.6
1996	193.9	545.0	386.1	55.8	1180.7
1997	163.0	558.8	393.3	42.4	1157.6
1998	159.4	462.4	359.0	64.0	1044.8
1999	137.5	895.5	361.3	45.6	1439.9
2000	105.1	363.2	242.4	23.6	734.3
2001	86.2	414.9	222.1	26.9	750.2
10-year Mean	145.7	419.2	261.3	32.9	859.1
Long-term Mean	116.0	388.2	196.2	26.2	726.7
Percent Change:					
From 2000	-17.9%	14.2%	-8.4%	13.8%	2.2%
From 10-year Mean	-40.8%	-1.0%	-15.0%	-18.3%	-12.7%
From Long-term Mean	-25.7%	6.9%	13.2%	2.7%	3.2%

Table 6. Survey design for North Dakota, May 2001.

	Stratum				
	43	45	46	47	Total
Survey design					
Square miles in stratum	19,835	26,625	14,238	7,821	68,519
Square miles in sample	175.5	310.5	270.0	45.0	801.0
Linear miles in sample	702	1,242	1,080	180	3,204
Number of transects in sample	5	7	8	6	26
Number of segments in sample	39	69	60	10	178
Expansion factor	113.0199	85.74879	52.73333	173.8000	---
Current year coverage					
Square miles in sample	175.5	310.5	270.0	45.0	801.0
Linear miles in sample	702	1,242	1,080	180	3,204
Number of transects in sample	5	7	8	6	26
Number of segments in sample	39	69	60	10	178
Expansion factor	113.0199	85.74879	52.73333	173.8000	---

Appendix 2. Long-term trend in adjusted waterfowl breeding population estimates (thousands) in North Dakota.

Species/Ponds	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
Ducks										
Dabblers										
Mallard	402.4	162.2	288.5	225.9	238.1	512.8	271.1	430.2	507.1	545.0
Am. black duck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gadwall	44.8	13.4	85.2	56.4	156.2	213.8	86.0	226.8	269.5	216.2
Am. wigeon	24.7	24.9	22.8	5.0	3.8	16.4	4.6	5.9	18.6	27.9
Am. green-winged teal	4.5	0.0	0.0	6.8	0.0	2.2	0.0	3.3	60.9	26.9
Blue-winged teal	528.7	316.4	519.5	295.6	755.2	686.6	584.5	913.5	1041.7	1106.1
N. shoveler	62.9	45.3	184.8	106.8	271.5	221.0	102.8	289.4	290.4	403.8
N. pintail	330.4	62.8	632.7	244.9	429.6	320.7	230.3	478.6	495.3	544.9
Subtotal	1398.3	625.0	1733.4	941.4	1854.5	1973.5	1279.2	2347.6	2683.5	2870.8
Divers										
Redhead	34.1	15.3	88.9	39.3	91.2	97.4	58.5	117.1	203.1	163.1
Canvasback	30.7	6.9	13.2	3.1	2.2	14.7	17.2	19.0	53.6	26.5
Scaups	11.7	22.1	40.7	18.3	77.7	15.1	3.0	14.0	15.5	22.1
Ring-necked duck	0.0	0.0	2.9	0.0	0.0	0.9	0.0	0.0	2.5	0.0
Goldeneyes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0
Bufflehead	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.0
Ruddy Duck	1.6	23.8	44.3	23.3	27.5	18.2	5.4	9.0	33.4	41.8
Subtotal	78.1	68.1	190.0	84.0	198.6	146.3	84.1	159.3	309.4	253.6
Miscellaneous										
Oldsquaw	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eiders	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Scoters	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mergansers	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.2	0.2	0.0
Subtotal	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.2	0.2	0.0
Total Ducks	1476.4	693.1	1923.4	1025.5	2053.1	2120.0	1363.3	2507.2	2993.2	3124.4
Canada Goose	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0
Am. coot	59.0	94.4	82.0	51.1	104.0	47.4	14.2	93.8	150.5	203.3
Ponds										

Species/Ponds	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
Ducks										
Dabblers										
Mallard	434.6	462.6	736.6	769.3	674.0	547.2	458.4	566.5	368.0	292.1
Am. black duck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gadwall	352.9	323.1	373.9	372.2	353.6	223.2	213.6	330.1	76.5	103.0
Am. wigeon	8.3	40.5	30.0	28.1	29.1	36.0	44.1	72.8	62.3	31.7
Am. green-winged teal	12.4	67.0	138.6	23.4	51.0	38.0	75.0	59.4	17.4	7.4
Blue-winged teal	749.7	902.9	712.7	1238.1	780.3	588.7	1171.3	1051.4	357.0	282.2
N. shoveler	194.8	304.0	454.9	219.4	289.9	129.7	219.5	225.2	89.7	71.2
N. pintail	169.4	693.7	831.6	690.0	749.1	257.1	487.1	455.6	208.6	91.1
Subtotal	1922.2	2793.9	3278.5	3340.4	2926.9	1819.9	2669.0	2761.1	1179.5	878.6
Divers										
Redhead	93.3	177.1	153.5	123.7	126.9	94.6	110.7	214.8	63.6	31.9
Canvasback	17.3	58.9	24.7	14.7	30.2	28.5	63.0	39.3	15.3	10.3
Scaups	16.6	36.3	28.3	28.2	30.4	41.9	37.3	70.3	54.1	19.7
Ring-necked duck	0.0	0.6	2.8	1.1	0.7	0.0	0.6	1.2	1.1	1.4
Goldeneyes	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0
Bufflehead	0.0	0.0	1.8	0.0	2.6	0.5	0.0	0.0	0.7	0.0
Ruddy Duck	15.5	45.2	86.0	47.0	55.1	40.7	167.0	125.1	22.8	21.1
Subtotal	142.8	318.0	297.1	214.7	247.1	206.1	378.5	450.7	157.7	84.4
Miscellaneous										
Oldsquaw	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eiders	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Scoters	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mergansers	0.0	2.9	0.0	0.0	1.4	0.7	0.7	0.0	0.0	0.0
Subtotal	0.0	2.9	0.0	0.0	1.4	0.7	0.7	0.0	0.0	0.0
Total Ducks	2065.0	3114.7	3575.6	3555.1	3175.4	2026.7	3048.2	3211.8	1337.2	963.0
Canada Goose	0.0	0.0	0.0	0.0	0.0	3.8	0.9	3.3	2.2	3.8
Am. coot	127.5	131.3	192.3	147.7	178.8	124.7	368.9	512.9	104.2	74.8
Ponds							1252.2	1135.8	848.2	340.3

Appendix 2 (continued). Long-term trend in adjusted waterfowl breeding population estimates (thousands) in North Dakota.

Species/Ponds	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Ducks										
Dabblers										
Mallard	506.6	641.4	485.4	308.6	466.5	398.9	550.3	361.4	487.8	582.6
Am. black duck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gadwall	243.9	369.2	224.3	255.6	381.2	435.0	528.8	274.0	287.7	275.9
Am. wigeon	69.4	47.4	84.0	119.2	41.5	45.1	38.7	58.9	30.9	44.1
Am. green-winged teal	20.5	25.4	92.4	39.2	52.6	16.4	16.2	58.9	20.1	33.5
Blue-winged teal	737.4	826.5	888.4	252.8	906.3	545.7	861.0	547.0	871.8	579.4
N. shoveler	277.5	447.3	181.9	264.1	377.4	194.3	273.3	153.2	244.7	255.5
N. pintail	588.5	517.3	291.8	135.2	369.4	329.4	375.5	198.9	260.0	191.6
Subtotal	2443.7	2874.5	2248.2	1374.7	2594.9	1964.8	2643.7	1652.3	2202.9	1962.8
Divers										
Redhead	191.8	198.3	122.7	75.2	258.2	226.3	170.3	116.9	103.5	99.0
Canvasback	17.0	42.7	28.5	31.9	32.4	12.4	50.9	20.1	36.3	28.7
Scaups	99.8	199.2	47.7	107.5	103.9	92.6	120.8	102.1	129.4	91.4
Ring-necked duck	2.2	8.4	3.6	0.0	11.6	103.0	12.2	3.5	11.6	3.2
Goldeneyes	0.0	0.0	0.0	0.0	0.0	2.5	1.4	0.0	0.0	1.0
Bufflehead	1.0	2.4	1.4	1.0	0.7	3.7	7.1	0.5	0.8	0.0
Ruddy Duck	123.3	98.0	111.4	237.6	357.1	184.8	251.8	111.9	170.1	113.9
Subtotal	435.0	549.0	315.4	453.2	763.9	625.2	614.4	355.0	451.7	337.2
Miscellaneous										
Oldsquaw	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eiders	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Scoters	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mergansers	0.0	0.0	0.0	0.0	0.3	6.3	2.7	0.5	0.0	0.5
Subtotal	0.0	0.0	0.0	0.0	0.3	6.3	2.7	0.5	0.0	0.5
Total Ducks	2878.7	3423.5	2563.6	1827.9	3359.1	2596.3	3260.8	2007.8	2654.6	2300.5
Canada Goose	0.9	2.7	3.7	7.4	22.4	10.5	13.7	11.3	17.0	12.3
Am. coot	389.6	1358.1	396.0	374.7	561.3	411.0	898.9	309.7	313.2	530.3
Ponds	637.3	835.8	345.5	343.5	786.0	648.9	965.4	614.6	728.8	601.1

Species/Ponds	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Ducks										
Dabblers										
Mallard	354.9	404.0	142.2	261.8	364.1	374.1	900.7	1063.9	1100.5	1377.7
Am. black duck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gadwall	294.9	296.3	296.0	197.9	388.7	285.8	433.3	757.4	806.3	893.8
Am. wigeon	40.8	15.6	22.9	20.9	44.1	13.9	71.4	92.0	78.9	83.2
Am. green-winged teal	28.3	9.5	26.7	9.1	14.1	9.0	60.5	45.9	90.6	79.0
Blue-winged teal	553.9	338.5	230.4	233.4	401.4	303.1	1088.8	1463.1	1764.1	1544.6
N. shoveler	118.4	158.7	67.1	75.2	114.7	175.1	507.8	573.6	653.8	492.2
N. pintail	149.7	109.0	61.8	49.3	112.1	126.9	375.5	424.9	351.5	418.1
Subtotal	1541.1	1331.5	847.1	847.7	1439.2	1288.0	3438.0	4420.8	4845.8	4888.7
Divers										
Redhead	55.2	133.4	17.0	14.7	78.8	102.2	155.0	218.2	257.9	216.5
Canvasback	19.2	39.2	10.1	8.6	17.3	19.8	56.1	42.0	58.6	69.2
Scaups	83.0	38.8	43.6	89.9	23.0	36.6	109.6	108.5	91.5	115.5
Ring-necked duck	10.5	10.9	9.6	5.0	10.3	0.4	15.7	44.4	12.1	11.2
Goldeneyes	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0
Bufflehead	0.5	2.1	0.5	3.2	3.3	2.5	4.7	3.6	1.8	2.0
Ruddy Duck	12.6	55.3	62.5	14.0	29.5	33.9	105.6	78.6	72.8	180.2
Subtotal	181.1	279.7	143.3	135.5	162.0	195.4	447.3	495.3	494.7	594.6
Miscellaneous										
Oldsquaw	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eiders	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Scoters	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
Mergansers	0.0	0.7	4.3	3.2	0.0	0.3	0.5	1.4	0.3	0.9
Subtotal	0.0	0.7	4.3	3.7	0.0	0.3	0.5	1.4	0.3	0.9
Total Ducks	1722.2	1611.9	994.7	986.9	1601.3	1483.7	3885.8	4917.5	5340.8	5484.3
Canada Goose	18.0	34.9	26.6	18.0	32.1	21.2	40.9	55.5	51.8	69.5
Am. coot	429.1	246.8	161.7	58.1	84.1	113.9	608.0	1675.9	1241.9	1715.3
Ponds	313.6	448.0	185.2	175.3	323.6	455.1	918.7	1160.6	1180.7	1157.6

Appendix 2 (continued). Long-term trend in adjusted waterfowl breeding population estimates (thousands) in North Dakota.

Species/Ponds	1998	1999	2000	2001
Ducks				
Dabblers				
Mallard	1267.7	1490.9	1482.8	1484.3
Am. black duck	0.0	0.0	0.0	0.0
Gadwall	932.9	918.4	1236.3	780.3
Am. wigeon	101.0	69.1	98.0	82.5
Am. green-winged teal	48.4	55.5	44.4	44.7
Blue-winged teal	1734.6	2068.0	2848.5	1688.7
N. shoveler	360.6	535.0	647.0	682.5
N. pintail	281.2	459.1	262.8	377.0
Subtotal	4726.4	5596.1	6619.8	5140.0
Divers				
Redhead	327.6	259.8	306.1	226.4
Canvasback	49.4	42.3	20.8	66.5
Scaups	148.0	120.8	178.2	130.3
Ring-necked duck	7.0	20.6	6.2	13.3
Goldeneyes	0.0	0.0	1.3	0.0
Bufflehead	1.1	0.3	3.2	5.2
Ruddy Duck	143.3	217.3	212.3	185.0
Subtotal	676.4	661.0	728.1	626.7
Miscellaneous				
Oldsquaw	0.0	0.0	0.0	0.0
Eiders	0.0	0.0	0.0	0.0
Scoters	0.0	0.0	0.0	0.0
Mergansers	0.5	0.7	7.5	0.7
Subtotal	0.5	0.7	7.5	0.7
Total Ducks	5403.3	6257.9	7355.4	5767.4
Canada Goose	76.5	104.5	161.6	184.1
Am. coot	767.9	889.9	912.6	319.6
Ponds	1044.8	1439.9	734.3	750.2

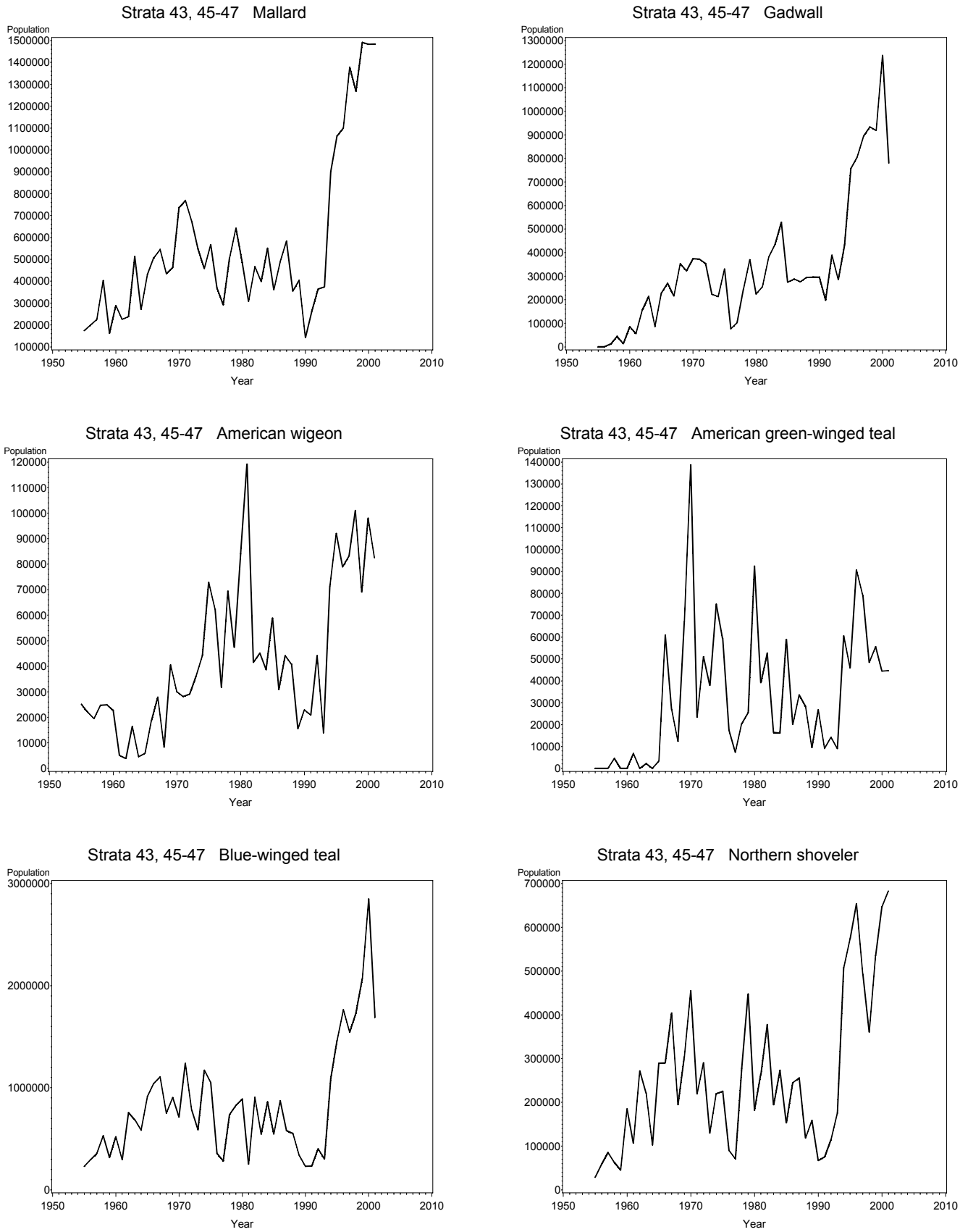


Figure 2. Population indices for the individual waterfowl species and ponds on an annual basis.

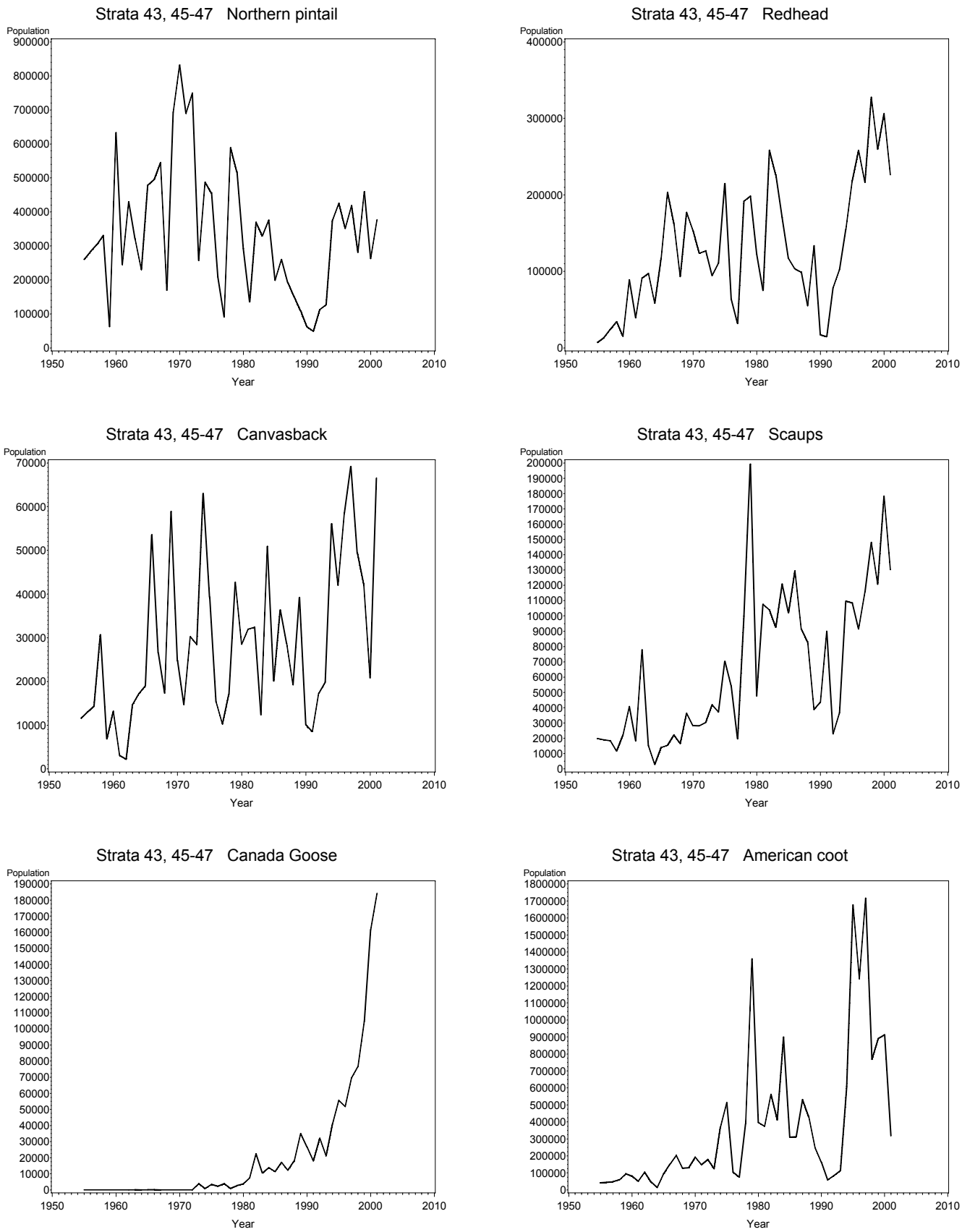
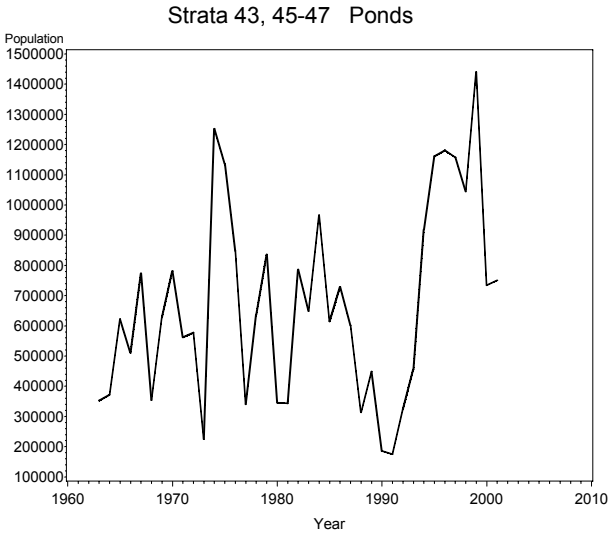


Figure 2 continued.



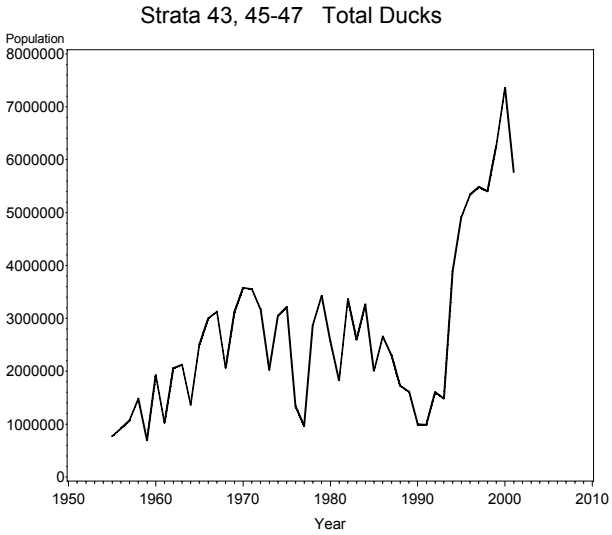


Figure 2 continued.