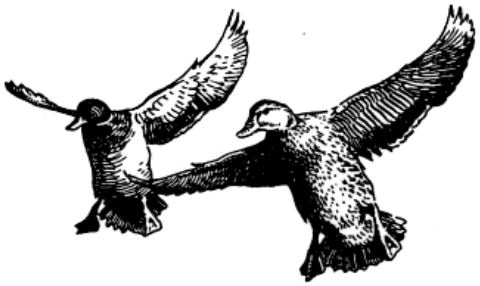
# WATERFOWL PRODUCTION SURVEY
# SOUTHERN SASKATCHEWAN
# 2001








U.S. Department of the Interior
Fish and Wildlife Service
and
Environment Canada
Canadian Wildlife Service

TITLE: Waterfowl Production and Habitat Survey for Southern Saskatchewan

STRATA SURVEYED: 30, 31, 32, 33, 34, and 35

DATES: July 6-19, 2001

DATA SUPPLIED BY: United States Fish and Wildlife Service


Air Crew

Strata 30, 31, 32, and 33

Pilot/Observer – Philip P. Thorpe, Flyway Biologist, USFWS

Pilot/Observer – Karen S. Bollinger, Flyway Biologist (TR), USFWS

Strata 34 and 35

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ABSTRACT: Well-below average precipitation fell across most of the reporting area in June and July. No improvement occurred to upland or wetland habitat conditions in most of the survey area and drought-like conditions existed over a large portion of the unit. Pond indices were down 35%, 33%, and 3% from 2000, the 10-year, and the long-term means, respectively. The overall brood index was up 5% from last year and 17% from the 10-year mean, but remained below the long-term mean (-22%). The late-nesting index was 29%, 1%, and 19% below 2000, the 10-year mean, and the long-term mean, respectively. Overall, poor recruitment is expected out of most of Southern Saskatchewan with fair duck recruitment coming out of the southeast.


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METHODS: The procedures followed in conducting the July Waterfowl Production and Habitat Survey are described in the Standard Operating Procedures for Aerial Waterfowl Breeding Population and Habitat Surveys in North America, Section IV, revised 1987. There were no changes made this year in operating procedures. Survey coverage was complete and all data are considered comparable to previous years (Table 1). A Cessna 206 and a Cessna 206 equipped with amphibious floats were used to survey strata 30-33 and strata 34-35, respectively. A GPS/voice recording system was used to collect data (Thorpe 2000). During the period 6-19 July, approximately 65 and 17 hours of flight time were required to complete the transect flights in strata 30-33 and 34-35, respectively. While surveying Southern Saskatchewan, both crews were delayed two days due to weather.

WEATHER AND HABITAT CONDITIONS: Although June is generally the wettest month in Saskatchewan, this year it was one of the driest. Since the May survey, precipitation amounts continued to be well-below average (40-60% of average) over most of the survey area and record dry conditions persisted in the northwest part of stratum 32 (Agriculture and Agri-food Canada 2001). On the northern and southern edges of the survey area conditions improved to only below-average precipitation amounts (60-80% of average) (Sask Water 2001). The bright spot in

the survey unit is the southeast corner, which had average conditions. During June and July, precipitation fell mainly from isolated thunderstorms.

A normal decline in pond numbers from May to July occurred in all strata; however, the decline in strata 30-31 was magnified by an already considerable decline from the previous year. This left many semipermanent wetlands that were low in May; dry in July. The combined pond index was down 35% from July 2000 and 33% from the 10-year mean, but remained about the same as the long-term mean (LTM) (Table 2).

According to the July 16 Crop Report (Saskatchewan Agriculture and Food 2001), topsoil, pasture, and hayland was rated as poor over most of the central and northern strata, poor to fair in the south-central and southwest, and fair to good in the southeast. Stations from across the survey area reported that drought-like conditions existed for 50% of the stations in the south, 98% of the stations in the central region, and 76% in the north. Temperatures during June and July were generally 1-2$^{o}$ C below normal.

PRODUCTION INDICES: The overall brood index was up slightly from last year and up 17% from the 10-year mean but was down 22% from the LTM (Table 3). The composition of duck broods ($n$ = 590) by age class (Gollup and Marshall 1954) was as follows: Class I, 28.2% ($n$ = 163); Class II, 47.7% ($n$ = 276); Class III, 24.2% ($n$ = 140); unclassified, 1.9% ($n$ = 11). The weighted average brood size among the intact Class II and III broods observed during our survey ($n$ = 316) was 5.5, which is slightly higher than last year ($\bar{x}$ = 5.2) and the LTM ($\bar{x}$ = 5.2), but about the same as the 10-year mean ($\bar{x}$ = 5.4) (Table 3). The coot brood index was 6% below the 2000 index but remained 41% and 26% above the 10-year mean and LTM, respectively (Table 3). The 2001 coot brood index was the 12$^{th}$ highest on record (Appendix 1).

LATE-NESTING INDICES: The late-nesting index (LNI) is a rough measure of renesting effort, or potential broods that will hatch after our survey (Henny et al. 1972). This year's total LNI was 29% below 2000 and 19% below the LTM (Table 3). The dabbling species LNI was down 25% from 2000 and 21% from the LTM. The divers total LNI was down 41% from last year. When the brood index and total LNI are combined (165.6), 2000 ranks 23$^{rd}$ or about average since 1955 (Appendix 1).

DISCUSSIONS: Although poor conditions existed throughout most of the Southern Saskatchewan survey area, the brood index and average brood size both showed a slight increase this year (statistically this may not be a significant increase). Significant or not, one would expect that the brood index and average brood size would be down in such a dry year because of poor nesting and brood habitat (i.e., few seasonals and overall lower density of wetlands). The southeast part of the Province had better habitat conditions and contributed to some of the increase (or stabilization) in the index (stratum 34 was up 34% from last year). More surprising were the increases from 2000 in stratum 32 (21%) and 33 (50%). Although the southeast part of stratum 32 did have fair to good habitat conditions, this area comprised only a small portion of the stratum and did not contain a disproportionate number of broods, as one would expect. Rather, the increase in the overall brood index of stratum 32 seemed to result mainly from broods observed in the dry part of the stratum. Stratum 33 generally had poor habitat conditions and few attractive wetland basins; in fact, stratum 33 ponds were down 54% from last July and 44% from this May. Given these circumstances, the increase in the duck brood index may reflect an actual slight increase from last year or it could be caused by survey bias A common bias

associated with the July survey occurs when vegetation hides broods in wet years and results in an underestimated brood index because of lower visibility rates by observers. In dry years, with most seasonal wetlands dry, broods are exposed on artificial (dugouts, reservoirs, etc.,) and drawndown semipermanent wetlands and observer visibility rates are higher and result in more broods seen and counted. Further ground comparison studies would be useful to explain some of the biases with the survey or develop useable visibility correction factors. All other indices associated with the survey were lower and reflected the lower quality habitat available to waterfowl this year.

ACKNOWLEDGMENTS: Thanks to the Manitoba crew for data collection in strata 34-35. Also, thanks to Dan Nieman, Canadian Wildlife Service, for habitat updates and brood information. Thanks to Karen Bollinger for making comments that improved this report.

Submitted by Philip P. Thorpe, July 30, 2001

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Table 1. Survey design and July 2001 coverage for Southern Saskatchewan.

| | Stratum | | | | | | |
|---|---|---|---|---|---|---|---|
| | 30 | 31 | 32 | 33 | 34 | 35 | Total |
| Survey design: | | | | | | | |
| Square miles in stratum | 18,570 | 21,086 | 37,911 | 11,345 | 13,164 | 9,044 | 111,120 |
| Square miles in sample- waterfowl/ponds | 76.50 | 72.00 | 285.75 | 45.00 | 87.75 | 63.00 | 630.00 |
| Linear miles in sample | 612 | 576 | 2,286 | 360 | 702 | 504 | 5,040 |
| Number of transects in sample | 4 | 5 | 14 | 6 | 5 | 6 | 40 |
| Number of segments in sample | 34 | 32 | 127 | 20 | 39 | 28 | 280 |
| Expansion factor | 242.745 | 292.861 | 132.672 | 252.111 | 150.017 | 143.556 | |
| July 2001 coverage: | | | | | | | |
| Square miles in sample- waterfowl/ponds | 76.50 | 72.00 | 285.75 | 45.00 | 87.75 | 63.00 | 630.00 |
| Linear miles in sample | 612 | 576 | 2,286 | 360 | 702 | 504 | 5,040 |
| Number of transects in sample | 4 | 5 | 14 | 6 | 5 | 6 | 40 |
| Number of segments in sample | 34 | 32 | 127 | 20 | 39 | 28 | 280 |
| Expansion factor | 242.745 | 292.861 | 132.672 | 252.111 | 150.017 | 143.556 | |

Table 2. Long-term trend in July pond estimates[1] (thousands) by stratum with comparisons against the previous year, the 10-year mean (1991-2000), the long-term mean (1955-2000), and May 2001 pond estimates [2] for Southern Saskatchewan.

| | Stratum | | | | | | |
|---|---|---|---|---|---|---|---|
| Year | 30 | 31 | 32 | 33 | 34 | 35 | Total |
| 1955 | 138.6 | 332.1 | 374.5 | 120.5 | 668.5 | 449.0 | 2,083.2 |
| 1956 | 120.9 | 186.8 | 210.1 | 34.8 | 346.5 | 216.2 | 1,115.3 |
| 1957 | 59.0 | 136.8 | 127.6 | 18.9 | 260.8 | 77.4 | 680.5 |
| 1958 | 57.0 | 82.8 | 69.1 | 18.4 | 127.9 | 46.1 | 401.3 |
| 1959 | 40.1 | 95.9 | 123.0 | 31.5 | 155.6 | 74.1 | 520.2 |
| 1960 | 47.3 | 104.0 | 136.8 | 16.9 | 229.7 | 102.5 | 637.2 |
| 1961 | 41.0 | 35.6 | 51.1 | 10.3 | 32.8 | 22.4 | 193.2 |
| 1962 [3] | 29.9 | 40.0 | 62.6 | 12.4 | - | - | 144.8 |
| 1963 | 93.0 | 97.2 | 227.8 | 41.6 | 177.5 | 89.4 | 726.5 |
| 1964 | 33.5 | 82.5 | 99.2 | 13.1 | 141.9 | 144.3 | 514.5 |
| 1965 | 112.4 | 188.7 | 289.1 | 88.7 | 167.5 | 69.5 | 915.9 |
| 1966 | 149.0 | 320.8 | 239.9 | 72.9 | 164.3 | 105.2 | 1,052.1 |
| 1967 | 86.4 | 136.5 | 192.6 | 44.6 | 101.1 | 50.2 | 611.6 |
| 1968 | 66.3 | 96.2 | 88.5 | 15.9 | 41.1 | 20.2 | 328.2 |
| 1969 | 125.4 | 151.8 | 357.0 | 63.0 | 86.6 | 159.2 | 943.1 |
| 1970 | 278.3 | 365.8 | 568.2 | 70.1 | 219.3 | 209.6 | 1,711.4 |
| 1971 | 159.1 | 277.5 | 335.9 | 41.9 | 171.7 | 91.6 | 1,077.7 |
| 1972 | 116.5 | 189.7 | 154.8 | 25.2 | 108.0 | 107.4 | 701.6 |
| 1973 | 153.1 | 442.7 | 145.3 | 21.7 | 103.5 | 52.4 | 918.6 |
| 1974 | 262.5 | 309.9 | 455.3 | 57.5 | 252.5 | 175.0 | 1,512.7 |
| 1975 | 216.7 | 299.6 | 391.1 | 69.1 | 282.5 | 281.9 | 1,540.8 |
| 1976 | 165.1 | 254.5 | 414.3 | 55.2 | 266.7 | 211.5 | 1,367.3 |
| 1977 | 101.6 | 187.4 | 183.0 | 19.9 | 154.1 | 72.2 | 718.1 |
| 1978 | 82.1 | 177.8 | 240.1 | 50.4 | 165.3 | 135.7 | 851.4 |
| 1979 | 159.6 | 230.8 | 274.2 | 46.9 | 169.2 | 155.8 | 1,036.4 |
| 1980 | 77.3 | 109.8 | 90.4 | 21.9 | 63.0 | 32.7 | 395.1 |
| 1981 | 75.7 | 87.0 | 96.3 | 22.9 | 52.2 | 29.6 | 363.7 |
| 1982 | 130.9 | 197.1 | 372.5 | 122.0 | 86.0 | 55.4 | 963.9 |
| 1983 | 134.8 | 313.9 | 237.5 | 44.1 | 366.3 | 99.1 | 1,195.7 |
| 1984 | 126.8 | 218.8 | 140.1 | 21.7 | 103.4 | 41.9 | 652.6 |
| 1985 | 186.2 | 292.9 | 173.8 | 20.9 | 177.5 | 55.8 | 907.1 |
| 1986 | 188.0 | 218.8 | 170.0 | 36.3 | 171.3 | 90.0 | 874.3 |
| 1987 | 126.8 | 183.3 | 123.7 | 27.7 | 115.1 | 63.0 | 639.6 |
| 1988 | 120.4 | 126.5 | 94.1 | 36.6 | 41.3 | 23.4 | 442.2 |
| 1989 | 101.2 | 108.4 | 129.6 | 36.3 | 51.6 | 31.9 | 459.0 |
| 1990 | 101.2 | 135.0 | 135.5 | 21.7 | 96.3 | 48.8 | 538.5 |
| 1991 | 187.4 | 210.6 | 722.3 | 165.6 | 228.5 | 177.1 | 1,691.5 |
| 1992 | 87.6 | 101.6 | 132.5 | 24.5 | 135.5 | 77.4 | 559.1 |
| 1993 | 237.9 | 271.5 | 301.0 | 47.6 | 281.1 | 136.8 | 1,276.0 |
| 1994 | 248.8 | 314.5 | 501.6 | 74.1 | 256.5 | 110.4 | 1,506.0 |
| 1995 | 122.1 | 252.7 | 237.6 | 77.9 | 261.8 | 115.4 | 1,067.6 |
| 1996 | 227.2 | 306.0 | 464.4 | 82.4 | 380.1 | 206.4 | 1,666.6 |
| 1997 | 158.8 | 271.8 | 430.8 | 86.0 | 310.4 | 169.8 | 1,427.5 |
| 1998 | 158.0 | 325.7 | 311.9 | 73.4 | 476.2 | 320.0 | 1,665.2 |
| 1999 | 201.2 | 405.6 | 684.6 | 47.4 | 205.5 | 149.4 | 1,697.1 |
| 2000 | 124.1 | 201.5 | 299.9 | 52.1 | 446.5 | 313.8 | 1,437.9 |
| 2001 | 70.6 | 103.4 | 160.4 | 23.7 | 319.5 | 263.3 | 940.9 |
| 10-year mean | 175.3 | 266.2 | 408.7 | 73.1 | 298.2 | 177.7 | 1399.1 |
| Long-term mean | 133.0 | 209.7 | 257.7 | 48.7 | 197.8 | 121.5 | 968.5 |
| Percent Change from: | | | | | | | |
| 2000 | -43% | -49% | -47% | -54% | -28% | -16% | -35% |
| 10-year mean | -60% | -61% | -61% | -68% | 7% | 48% | -33% |
| long-term mean | -47% | -51% | -38% | -51% | 62% | 117% | -3% |
| May ponds 2001 | 139.7 | 202.4 | 378.9 | 42.0 | 480.1 | 292.8 | 1535.9 |
| Percent change: | | | | | | | |
| May to July 2001 | -49% | -49% | -58% | -44% | -33% | -10% | -39% |

[1] July ponds are raw counts multiplied by an expansion factor (Table 1) and are not adjusted for visibility bias.

[2] May ponds are raw counts multiplied by an expansion factor (Table 1) and are adjusted using a visibility correction factor of 1.13 for strata 30-33 and 0.70 for strata 34-35.

[3] Incomplete coverage, not included in long-term mean calculation.

Table 3. Status of waterfowl brood and late-nesting indices (thousands, unadjusted for visibility bias) by stratum with comparisons against the previous year , the 10-year mean (1990-2000) [1], and the long-term mean (1955-2000) [2] for Southern Saskatchewan, July 2001.

| | Stratum | | | | | | 2001 | 2000 | 10-year | Long-term | Percent Change from: | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Species | 30 | 31 | 32 | 33 | 34 | 35 | total | total | mean | mean | 2000 | 10-year mean | Long-term mean |
| Broods: | | | | | | | | | | | | | |
| Duck brood index | 12.9 | 12.9 | 28.5 | 2.0 | 30.9 | 9.2 | 96.4 | 91.5 | 82.5 | 124.2 | 5% | 17% | -22% |
| Average brood size [3] | 5.5 | 5.1 | 5.5 | 4.3 | 6.7 | 5.9 | 5.5 | 5.2 | 5.4 | 5.2 | 5% | 2% | 6% |
| Coot brood index | 5.1 | 1.2 | 0.3 | 0.0 | 21.9 | 6.5 | 34.9 | 37.3 | 24.8 | 27.7 | -6% | 41% | 26% |
| Late nesting index: [4] | | | | | | | | | | | | | |
| Dabblers: | | | | | | | | | | | | | |
| Mallard | 2.4 | 4.1 | 7.6 | 1.5 | 5.3 | 4.3 | 25.2 | 33.2 | 21.7 | 27.6 | -24% | 16% | -9% |
| Am. Black duck | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0% | 0% | 0% |
| Gadwall | 0.0 | 0.9 | 1.9 | 0.5 | 0.8 | 1.4 | 5.4 | 9.1 | 9.2 | 9.4 | -40% | -41% | -42% |
| Am. wigeon | 0.5 | 0.3 | 0.5 | 0.0 | 0.9 | 0.7 | 2.9 | 2.5 | 2.9 | 4.6 | 16% | 0% | -36% |
| Green-winged teal | 0.5 | 0.9 | 0.5 | 0.5 | 0.5 | 0.4 | 3.3 | 5.9 | 3.8 | 3.0 | -44% | -13% | 9% |
| Blue-winged teal [5] | 0.5 | 0.9 | 2.7 | 0.0 | 2.7 | 1.6 | 8.3 | 11.5 | 11.2 | 12.2 | -28% | -26% | -32% |
| N. shoveler | 0.2 | 0.3 | 0.7 | 0.0 | 0.8 | 0.6 | 2.5 | 3.8 | 2.6 | 3.7 | -34% | -3% | -33% |
| N. Pintail | 0.7 | 1.2 | 3.1 | 0.0 | 0.3 | 0.3 | 5.5 | 4.6 | 3.2 | 7.0 | 20% | 72% | -21% |
| Subtotal: | 4.9 | 8.5 | 16.8 | 2.5 | 8.0 | 8.5 | 53.1 | 70.6 | 54.6 | 67.4 | -25% | -3% | -21% |
| Divers: | | | | | | | | | | | | | |
| Redhead | 0.0 | 0.3 | 0.4 | 0.0 | 0.2 | 0.3 | 1.1 | 1.3 | 1.7 | 2.3 | -15% | -35% | -51% |
| Canvasback | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.2 | 1.3 | 0.8 | 1.3 | -89% | -80% | -88% |
| Scaups | 0.7 | 1.2 | 1.1 | 0.5 | 0.8 | 0.1 | 4.4 | 4.2 | 2.7 | 6.5 | 3% | 64% | -33% |
| Ring-necked duck | 0.0 | 0.6 | 0.4 | 0.0 | 0.5 | 0.1 | 1.6 | 2.9 | 0.9 | 0.8 | -46% | 67% | 102% |
| Goldeneyes | 0.0 | 0.6 | 0.1 | 0.0 | 0.7 | 0.0 | 1.4 | 0.0 | 0.4 | 0.2 | 0% | 225% | 548% |
| Bufflehead | 0.2 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.5 | 2.5 | 0.5 | 0.6 | -79% | 1% | -4% |
| Ruddy duck | 0.2 | 0.9 | 0.5 | 0.0 | 2.7 | 1.7 | 6.1 | 13.6 | 7.6 | 6.3 | -55% | -20% | -4% |
| Subtotal: | 1.2 | 3.8 | 2.5 | 0.5 | 2.3 | 1.3 | 15.3 | 25.9 | 14.7 | 17.9 | -41% | 4% | -15% |
| Miscellaneous: | | | | | | | | | | | | | |
| Oldsquaw | 0.0 | 0.0 | 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 | 0% | 0% | 0% |
| Scoters | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0% | -100% | -100% |
| Mergansers | 0.5 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.8 | 0.5 | 0.2 | 0.1 | 51% | 345% | 902% |
| Subtotal | 0.5 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.8 | 0.5 | 0.2 | 0.3 | 51% | 248% | 163% |
| Total ducks | 6.6 | 12.6 | 19.4 | 3.0 | 10.2 | 9.8 | 69.2 | 97.1 | 69.6 | 85.7 | -29% | -1% | -19% |

[1] Excludes 1999, data in strata 34-35 was not collected using correct survey methodology.

[2] Based on 44 years. Excludes 1962, which had incomplete coverage, and 1999 because of incorrect data collection in strata 34-35.

[3] Calculated using only Class II and III broods observed and assumed to be complete.

[4] Only observed adult pairs and singles used.

[5] Includes cinnamon teal.

Appendix 1. Long-term trend in waterfowl brood and late-nesting indices (thousands, unadjusted for visibility bias) by species in Southern Saskatchewan, 1955-2001.

| Species/Year | 1955 | 1956 | 1957 | 1958 | 1959 | 1960 | 1961 | 1962 [1] | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Broods: | | | | | | | | | | | | | | | | | | | | |
| Duck brood index | 236.2 | 368.6 | 588.7 | 275.5 | 103.8 | 121.0 | 71.9 | 28.5 | 46.2 | 67.8 | 46.8 | 95.9 | 94.6 | 77.8 | 175.0 | 128.7 | 180.2 | 170.2 | 96.7 | 148.3 |
| Average brood size [2] | 6.7 | 6.0 | 6.2 | 4.2 | 4.1 | 4.7 | 4.6 | 5.5 | 5.4 | 5.8 | 6.0 | 5.8 | 5.4 | 5.0 | 5.6 | 5.3 | 5.2 | 5.2 | 4.7 | 5.0 |
| Coot brood index | 18.9 | 65.0 | 208.0 | 21.6 | 5.9 | 15.1 | 5.8 | 0.0 | 1.9 | 9.0 | 6.8 | 8.0 | 11.6 | 11.9 | 20.7 | 22.4 | 35.6 | 25.6 | 21.4 | 40.6 |
| Late nesting index: [3] | | | | | | | | | | | | | | | | | | | | |
| Dabblers: | | | | | | | | | | | | | | | | | | | | |
| Mallard | 90.4 | 52.3 | 27.1 | 49.7 | 23.6 | 40.8 | 5.7 | 5.9 | 15.4 | 10.9 | 29.8 | 25.8 | 14.8 | 12.4 | 30.5 | 65.4 | 37.0 | 25.6 | 33.1 | 37.2 |
| Am. Black duck | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Gadwall | 11.9 | 9.2 | 2.1 | 4.4 | 1.3 | 9.7 | 0.3 | 1.3 | 5.8 | 2.2 | 13.1 | 9.5 | 8.9 | 4.8 | 18.9 | 23.0 | 10.8 | 6.2 | 9.2 | 16.6 |
| Am. wigeon | 10.5 | 8.9 | 2.7 | 7.6 | 4.4 | 5.9 | 0.3 | 1.3 | 2.0 | 0.1 | 5.5 | 3.7 | 4.0 | 2.1 | 11.5 | 24.2 | 9.0 | 6.2 | 5.4 | 4.4 |
| Green-winged teal | 3.0 | 2.5 | 0.4 | 1.4 | 0.3 | 0.4 | 0.0 | 0.0 | 0.6 | 0.0 | 1.6 | 1.7 | 1.9 | 3.2 | 2.9 | 11.8 | 7.4 | 5.2 | 4.8 | 1.0 |
| Blue-winged teal [4] | 35.3 | 30.6 | 6.1 | 18.5 | 18.4 | 12.7 | 1.0 | 0.7 | 5.2 | 3.8 | 11.4 | 13.9 | 14.3 | 4.3 | 14.6 | 17.5 | 15.4 | 9.2 | 7.7 | 14.0 |
| N. shoveler | 10.6 | 7.2 | 1.4 | 3.8 | 1.2 | 3.9 | 0.4 | 0.3 | 1.7 | 1.1 | 6.7 | 2.7 | 3.6 | 1.4 | 6.9 | 13.2 | 6.1 | 1.8 | 3.8 | 6.2 |
| N. Pintail | 23.9 | 11.1 | 3.8 | 8.6 | 1.1 | 3.6 | 0.8 | 2.3 | 4.3 | 0.8 | 4.7 | 6.3 | 5.4 | 3.2 | 19.0 | 41.1 | 24.0 | 8.0 | 5.0 | 11.9 |
| Subtotal: | 185.6 | 121.7 | 43.6 | 93.9 | 50.3 | 77.1 | 8.4 | 11.8 | 35.0 | 19.0 | 72.8 | 63.7 | 52.9 | 31.3 | 104.4 | 196.3 | 109.8 | 62.3 | 69.1 | 91.2 |
| Divers: | | | | | | | | | | | | | | | | | | | | |
| Redhead | 4.2 | 5.5 | 0.9 | 2.4 | 0.4 | 1.7 | 0.0 | 0.3 | 1.0 | 1.1 | 2.3 | 2.1 | 2.8 | 1.5 | 2.1 | 3.5 | 1.9 | 2.6 | 2.1 | 2.7 |
| Canvasback | 5.6 | 2.6 | 0.5 | 1.8 | 0.9 | 0.4 | 0.2 | 0.0 | 0.5 | 0.3 | 0.7 | 0.3 | 1.1 | 1.4 | 0.5 | 3.9 | 2.2 | 1.1 | 2.7 | 1.7 |
| Scaups | 18.4 | 11.9 | 12.3 | 10.2 | 3.9 | 5.2 | 0.8 | 0.3 | 1.9 | 4.0 | 2.3 | 5.1 | 1.7 | 1.4 | 6.8 | 13.7 | 8.3 | 7.4 | 6.4 | 6.6 |
| Ring-necked duck | 2.4 | 0.1 | 0.2 | 0.8 | 0.7 | 0.0 | 0.1 | 0.0 | 1.1 | 0.0 | 0.5 | 0.3 | 0.3 | 0.0 | 0.1 | 0.5 | 0.0 | 0.2 | 0.9 | 1.9 |
| Goldeneyes | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.6 | 0.0 | 0.0 | 0.4 | 0.0 |
| Bufflehead | 0.8 | 0.0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.3 | 0.0 | 0.0 | 0.1 | 0.6 | 1.6 | 0.6 | 0.5 | 2.1 | 0.5 | 0.5 | 0.2 | 0.4 | 0.7 |
| Ruddy duck | 10.8 | 9.5 | 3.0 | 5.3 | 3.0 | 3.9 | 0.1 | 0.4 | 2.7 | 1.7 | 2.7 | 6.3 | 5.4 | 3.7 | 3.5 | 3.4 | 12.3 | 6.7 | 5.6 | 10.5 |
| Subtotal: | 42.3 | 29.7 | 16.8 | 20.6 | 9.4 | 12.0 | 1.7 | 0.9 | 7.2 | 7.2 | 9.0 | 15.6 | 12.0 | 8.5 | 15.1 | 27.1 | 25.1 | 18.3 | 18.4 | 24.1 |
| Miscellaneous: | | | | | | | | | | | | | | | | | | | | |
| Oldsquaw | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 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 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Scoters | 1.7 | 0.2 | 0.0 | 0.2 | 0.5 | 0.7 | 0.0 | 0.0 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.0 |
| Mergansers | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Subtotal | 1.7 | 0.2 | 0.0 | 0.2 | 0.5 | 0.7 | 0.0 | 0.0 | 0.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 | 0.0 | 0.2 | 0.0 |
| Total ducks | 229.6 | 151.7 | 60.4 | 114.7 | 60.2 | 89.8 | 10.0 | 12.7 | 43.1 | 26.3 | 81.9 | 79.3 | 64.9 | 39.9 | 119.9 | 223.4 | 134.9 | 80.6 | 87.8 | 115.4 |

[1] Incomplete survey coverage.

[2] Calculated using only Class II and III broods observed and assumed to be complete.

[3] Only observed adult pairs and singles used.

[4] Includes cinnamon teal.

Appendix 1 (continued).

| Species/Year | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Broods: | | | | | | | | | | | | | | | | | | | | |
| Duck brood index | 148.2 | 169.0 | 144.6 | 130.0 | 107.2 | 130.6 | 77.9 | 63.3 | 69.5 | 70.6 | 94.9 | 100.9 | 105.4 | 74.3 | 58.4 | 68.3 | 58.5 | 63.2 | 19.2 | 87.8 |
| Average brood size[2] | 4.7 | 4.5 | 5.2 | 4.7 | 5.3 | 4.6 | 4.3 | 4.8 | 4.5 | 4.7 | 5.3 | 5.7 | 5.2 | 4.6 | 4.7 | 4.3 | 5.4 | 5.1 | 4.8 | 6.2 |
| Coot brood index | 45.0 | 46.0 | 24.8 | 28.3 | 34.0 | 34.2 | 12.5 | 14.8 | 15.6 | 21.6 | 34.9 | 54.3 | 32.9 | 11.6 | 6.4 | 18.9 | 7.2 | 29.5 | 3.8 | 12.5 |
| Late nesting index[3]: | | | | | | | | | | | | | | | | | | | | |
| Dabblers: | | | | | | | | | | | | | | | | | | | | |
| Mallard | 45.7 | 40.3 | 36.1 | 26.4 | 51.9 | 14.2 | 15.4 | 34.6 | 32.1 | 16.2 | 20.7 | 13.3 | 7.9 | 5.4 | 8.9 | 10.7 | 23.7 | 19.6 | 13.7 | 19.5 |
| Am. Black duck | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Gadwall | 17.6 | 25.3 | 20.3 | 15.6 | 19.2 | 4.3 | 7.2 | 17.1 | 8.6 | 1.1 | 6.5 | 6.0 | 1.3 | 0.1 | 1.8 | 3.4 | 16.5 | 10.5 | 6.3 | 4.5 |
| Am. wigeon | 7.0 | 6.8 | 4.9 | 4.5 | 8.9 | 1.0 | 2.4 | 6.3 | 2.8 | 1.4 | 2.2 | 1.7 | 0.3 | 1.5 | 0.8 | 0.9 | 5.9 | 3.7 | 3.4 | 2.7 |
| Green-winged teal | 4.8 | 7.4 | 2.6 | 2.9 | 6.9 | 2.1 | 2.7 | 3.1 | 3.8 | 1.5 | 1.8 | 2.8 | 0.3 | 0.8 | 0.5 | 1.2 | 3.0 | 0.7 | 0.5 | 1.9 |
| Blue-winged teal [4] | 12.1 | 21.4 | 22.4 | 9.3 | 21.6 | 8.7 | 8.9 | 13.4 | 14.4 | 12.2 | 7.5 | 9.8 | 1.6 | 4.6 | 2.2 | 3.3 | 13.0 | 6.8 | 6.6 | 6.3 |
| N. shoveler | 9.4 | 14.9 | 4.8 | 3.0 | 5.7 | 1.2 | 2.7 | 4.8 | 4.4 | 0.1 | 1.7 | 0.9 | 0.3 | 0.7 | 0.1 | 1.1 | 4.5 | 1.6 | 1.1 | 1.6 |
| N. Pintail | 15.2 | 15.3 | 13.8 | 8.1 | 9.1 | 4.4 | 4.1 | 4.3 | 4.8 | 2.7 | 3.4 | 1.4 | 0.7 | 1.5 | 0.4 | 0.8 | 3.0 | 3.0 | 1.3 | 2.4 |
| Subtotal: | 111.8 | 131.4 | 104.8 | 69.7 | 123.4 | 35.9 | 43.5 | 83.7 | 70.8 | 35.3 | 43.7 | 35.9 | 12.2 | 14.5 | 14.6 | 21.3 | 69.6 | 45.9 | 33.1 | 38.9 |
| Divers: | | | | | | | | | | | | | | | | | | | | |
| Redhead | 7.1 | 8.1 | 4.4 | 2.9 | 5.5 | 3.2 | 1.5 | 2.7 | 3.7 | 0.6 | 1.9 | 0.4 | 0.1 | 0.2 | 0.0 | 0.7 | 1.4 | 3.1 | 0.5 | 1.3 |
| Canvasback | 2.2 | 2.8 | 5.7 | 1.6 | 2.0 | 1.0 | 0.6 | 0.3 | 1.3 | 1.0 | 0.7 | 0.8 | 1.0 | 0.0 | 0.0 | 0.1 | 0.7 | 0.6 | 1.1 | 0.3 |
| Scaups | 10.1 | 12.4 | 13.7 | 11.2 | 24.6 | 3.7 | 5.1 | 12.4 | 13.7 | 8.7 | 6.5 | 3.1 | 2.2 | 0.6 | 1.4 | 1.8 | 1.5 | 3.9 | 1.9 | 1.8 |
| Ring-necked duck | 1.1 | 1.9 | 1.2 | 1.6 | 3.1 | 0.8 | 0.3 | 1.0 | 0.9 | 0.0 | 1.0 | 0.5 | 0.4 | 0.8 | 0.0 | 0.9 | 0.0 | 0.5 | 0.8 | 0.5 |
| Goldeneyes | 0.0 | 0.0 | 0.0 | 0.2 | 0.6 | 0.0 | 0.2 | 0.0 | 0.9 | 0.0 | 0.2 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 1.5 | 0.6 | 0.3 |
| Bufflehead | 1.6 | 1.8 | 1.7 | 0.7 | 2.1 | 0.5 | 0.0 | 0.6 | 0.7 | 0.0 | 0.1 | 0.2 | 0.0 | 0.5 | 0.0 | 0.0 | 0.0 | 0.4 | 0.4 | 0.3 |
| Ruddy duck | 10.6 | 16.0 | 9.9 | 5.4 | 13.0 | 2.5 | 2.7 | 5.2 | 13.9 | 3.5 | 7.0 | 6.9 | 2.3 | 1.5 | 1.9 | 1.4 | 6.4 | 7.4 | 4.2 | 5.2 |
| Subtotal: | 32.7 | 42.9 | 36.6 | 23.6 | 50.8 | 11.6 | 10.4 | 22.2 | 35.1 | 13.8 | 17.5 | 11.9 | 6.2 | 3.6 | 3.3 | 4.9 | 10.0 | 17.4 | 9.5 | 9.7 |
| Miscellaneous: | | | | | | | | | | | | | | | | | | | | |
| Oldsquaw | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 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 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Scoters | 1.1 | 0.0 | 0.8 | 1.4 | 0.7 | 0.7 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.0 |
| Mergansers | 0.0 | 0.0 | 0.0 | 0.3 | 0.0 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 | 0.0 | 0.2 |
| Subtotal | 1.1 | 0.0 | 0.8 | 1.6 | 0.7 | 1.1 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 | 0.2 | 0.2 |
| Total ducks | 145.6 | 174.2 | 142.3 | 94.9 | 174.9 | 48.6 | 53.9 | 106.0 | 105.9 | 49.1 | 61.2 | 47.9 | 18.6 | 18.1 | 17.9 | 26.6 | 79.5 | 63.3 | 42.8 | 48.8 |

[1] Incomplete survey coverage.

[2] Calculated using only Class II and III broods observed and assumed to be complete.

[3] Only observed adult pairs and singles used.

[4] Includes cinnamon teal.

Appendix 1 (continued).

| Species/Year | 1995 | 1996 | 1997 | 1998 | 1999[5] | 2000 | 2001 |
|---|---|---|---|---|---|---|---|
| Broods: | | | | | | | |
| Duck brood index | 78.9 | 129.3 | 161.3 | 67.3 | 82.3 | 91.5 | 96.4 |
| Average brood size[2] | 5.6 | 5.9 | 5.6 | 5.5 | 6.6 | 5.4 | 6.3 |
| Coot brood index | 6.7 | 63.5 | 48.5 | 19.8 | 41.5 | 37.3 | 34.9 |
| Late nesting index[3]: | | | | | | | |
| Dabblers: | | | | | | | |
| Mallard | 11.8 | 34.0 | 23.8 | 26.6 | 106.8 | 33.2 | 25.2 |
| Am. Black duck | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Gadwall | 7.5 | 17.7 | 5.5 | 11.1 | 36.8 | 9.1 | 5.4 |
| Am. Wigeon | 2.1 | 4.6 | 1.7 | 1.9 | 3.6 | 2.5 | 2.9 |
| Green-winged teal | 1.3 | 10.1 | 4.2 | 9.1 | 16.5 | 5.9 | 3.3 |
| Blue-winged teal [4] | 7.6 | 31.9 | 10.2 | 15.0 | 37.0 | 11.5 | 8.3 |
| N. shoveler | 2.4 | 5.7 | 1.8 | 2.4 | 11.7 | 3.8 | 2.5 |
| N. Pintail | 3.0 | 3.8 | 5.9 | 4.3 | 6.6 | 4.6 | 5.5 |
| Subtotal: | 35.7 | 107.9 | 53.0 | 70.4 | 219.0 | 70.6 | 53.1 |
| Divers: | | | | | | | |
| Redhead | 1.5 | 3.1 | 1.8 | 2.7 | 10.4 | 1.3 | 1.1 |
| Canvasback | 0.9 | 0.5 | 1.3 | 0.7 | 0.9 | 1.3 | 0.2 |
| Scaups | 2.3 | 4.4 | 2.0 | 2.8 | 7.2 | 4.2 | 4.4 |
| Ring-necked duck | 1.3 | 2.1 | 0.2 | 0.2 | 3.8 | 2.9 | 1.6 |
| Goldeneyes | 0.0 | 0.4 | 0.5 | 0.0 | 0.3 | 0.0 | 1.4 |
| Bufflehead | 0.0 | 0.5 | 0.5 | 0.7 | 0.0 | 2.5 | 0.5 |
| Ruddy duck | 7.1 | 13.6 | 9.4 | 8.0 | 31.6 | 13.6 | 6.1 |
| Subtotal: | 13.1 | 24.8 | 15.7 | 15.1 | 54.2 | 25.9 | 15.3 |
| 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 | 0.2 | 0.0 | 0.0 | 0.0 |
| Mergansers | 0.0 | 0.2 | 0.3 | 0.2 | 0.4 | 0.5 | 0.8 |
| Subtotal | 0.0 | 0.2 | 0.3 | 0.5 | 0.4 | 0.5 | 0.8 |
| Total ducks | 48.8 | 133.0 | 69.0 | 86.0 | 273.6 | 97.1 | 69.2 |

[1] Incomplete survey coverage.
[2] Calculated using only Class II and III broods observed and assumed to be complete.
[3] Only observed adult pairs and singles used.
[4] Includes cinnamon teal.
[5] Late nesting data for strata 34 and 35 was not collected according to survey methodology, 1999 data are not used in averages or comparisons.