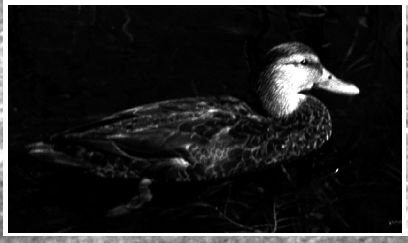
Annual report

Spring 2000

Black Duck Joint Venture Helicopter Survey in Québec



Daniel Bordage
Canadian Wildlife Service
Québec Region

Environment Canada
Canadian Wildlife Service

Environnement Canada
Service canadien de la faune

2000 Black Duck Joint Venture Helicopter Survey – Québec

Daniel Bordage[1]

Canadian Wildlife Service
Québec Region 2000

[1] Environment Canada, Canadian Wildlife Service, 1141 route de l'Église, P.O. Box 10100, Sainte-Foy (Québec), G1V 4H5
E-mail: daniel.bordage@ec.gc.ca

Observers:	Myrtle Bateman[1], Daniel Bordage[2], Gaétan Couture[3], Randy Hicks[1], Christine LePage[2] and Shirley Orichefsky[3]
Pilots:	Daniel Dubé[4], Gaétan Gagnon[4] and Chris Swannell[5]
Data entry:	Shirley Orichefsky[3]
Reviewers:	Christine LePage[2] and Ilona Mackey[2]
Cover:	Christine LePage[2]
Photos:	Daniel Bordage[2], Léo-Guy de Repentigny[2] and Christine LePage[2]

Proposed reference:

Bordage, D. 2000. 2000 Black Duck Joint Venture Helicopter Survey – Québec. Canadian Wildlife Service report, Québec Region, Environment Canada, Sainte-Foy, Québec.

To find out more about the American Black Duck and many other waterfowl species, and to follow up the Black Duck Joint Venture activities in Québec, visit our Web site at the following address:

http://www.qc.ec.gc.ca/faune/sauvagine/html/waterfowl.html

[1] Canadian Wildlife Service - Atlantic Region
[2] Canadian Wildlife Service - Québec Region
[3] Fondation Les oiseleurs du Québec inc.
[4] Canadian Coast Guard - Laurentian Region
[5] Canadian Coast Guard - Atlantic Region

Table of Contents

List of Tables

List of Figures

List of Appendices

1.0 Introduction

The main objective of the Black Duck Joint Venture (BDJV) survey is to provide statistically reliable indices of breeding population trends and relative densities of American Black Duck (hereafter, Black Duck) and other waterfowl species throughout the primary breeding range of the Black Duck. The BDJV study area in Canada includes the provinces of New Brunswick, Nova Scotia, Newfoundland (including part of Labrador), Québec (southern part) and Ontario (east-central). This huge territory was divided in 4 strata to reflect the distribution of 3 different Black Duck populations according to banding reference units, and ecozones. Stratum 1 is in the Atlantic Maritime ecozone. The 3 other strata are in the Boreal Shield ecozone which was divided approximately according to the banding reference limits in Canada. The 70°30' west meridian of longitude divides Stratum 2 (Eastern Boreal Shield) from Stratum 3 (Central Boreal Shield). 76°30' W divides Stratum 3 and the Stratum 4 (Western Boreal Shield). Strata 1 and 2 are part of the same banding reference unit. Each spring, the study area is surveyed twice, (a) by the Canadian Wildlife Service (CWS) using helicopter and (b) by the U.S. Fish and Wildlife Service (USFWS) using aircraft (usually referred as the fixed-wing survey). This report deals with the BDJV helicopter survey in Québec.

2.0 Methods

The BDJV helicopter survey covers approximately 503 800 km^2 of the Black Duck's main breeding grounds in Québec. The study area includes most of the Boreal Shield Ecozone (Bird Conservation Region [BCR] 8, Boreal Softwood Shield, and BCR 12, Boreal Hardwood Transition) and the northern part of the Atlantic Maritime Ecozone (BCR 14, Atlantic Northern Forest; Figure 1). Québec's coverage of the eastern Canada survey includes parts of Strata 1, 2 and 4, and all of Stratum 3. The survey began in 1990 with 83–10×10 km (100 km^2) plots systematically distributed within the study area. Beginning in 1996, plot size was reduced to 5×5 km (25 km^2) and a rotational plot design was implemented whereby each of the 156 plots are surveyed twice over a 4-year period. The transition to this new system was made possible without loosing long-trend analysis capability by keeping most of the southwest 5×5 km quadrants from the original set of 100 km^2 plots. In the rotational design, a letter (A, B, C or D) was randomly assigned to the plots of each stratum. Half of the plots (78) are surveyed each year beginning with Plots A and B in the first year, B and C in the second year, etc. Because the 2000 survey was the beginning of the second 4-year period, the 78 plots surveyed in 2000 were exactly the same as those surveyed in 1996 (Plots A and B).

The same survey method was used throughout the 1990–2000 period. Surveys were flown in a Bell 206L (Long Ranger) helicopter equipped with skids and bubble windows to enhance observer visibility. All waterbodies and wetlands within the plots were surveyed. Depending of the habitat and topography, surveys were flown at 15–50 m above ground level and at 60–100 km/h. The survey crew consisted of 2 observers in Stratum 1, and 3 observers in Strata 2, 3 and 4. All waterfowl observations (see Appendix 1 for scientific names of species) as well as some other aquatic birds, mammals and reptiles were

directly recorded by the front seat observer on 1:50 000 topographic maps of the plots and later entered into a computer database. Basic data recorded for each individual or group of birds observed (i.e. one record per observation) were: 1) plot identification; 2) date; 3) location of the birds (UTM); 4) species code; 5) number of males; 6) number of females; 7) number of birds of unknown sex. Indicated pairs in this report were calculated using the standardized method developed for the BDJV helicopter survey in Eastern Canada (Appendix 2).

The survey is carried out during the nest-initiation and the beginning of incubation period of the early nesting ducks. To determine the timing of the survey relative to nest initiation, we calculated a phenology index (PI) which is the ratio of the number of paired males (1 male + 1 female) to that of unattended males (lone and flocked drakes). A PI of 1.0 is considered optimal for the American Black Duck and other species with sex ratios closed to 1.0 and should be indicative of a survey made when half the pairs involved in nest initiation and the other half had started incubation. A PI value much greater than 1.0 should indicate a survey early in the breeding season where migrants are still in the area and breeding pairs may not be on their nesting territories, which could result in an overestimation of the breeding population. On the opposite side, a very small PI should indicate a late survey relative to the nesting phenology where some pairs may be missed because drakes are abandoning the nesting hens (for most species, incubating females cannot be counted from the helicopter). The latter situation leads to underestimation of the indicated pair numbers.

3.0 Spring Conditions

After consecutive warm and dry spring seasons in 1998 and 1999, the relatively mild temperatures in late March 2000 gave way to conditions that remained near normal for the rest of the season in the study area. Precipitation was below average for most of the study area except in the southwestern section where precipitation was well above average. Spring arrived late in eastern Quebec, particularly in Stratum 2 where the survey was delayed by more than a week because most lakes were still frozen by the third week of May. In 2000, 10 plots had some lakes completely frozen during the survey (4 plots with 50% or more of lakes frozen within the plots). Since we began to record ice conditions in 1995, only 1996 had more plots with frozen lakes than in 2000. In 1996, 19 plots had frozen lakes and 3 of those plots had 50% or more of their lakes completely frozen.

4.0 Results

Every plot was surveyed by experienced observers. Daniel Bordage, Christine LePage and Shirley Orichefsky covered most of the plots in Québec; Gaétan Couture replaced S. Orichefsky for most of the Stratum 2 plots; the 4 plots of Stratum 1 were covered by Myrtle Bateman and Randy Hicks. The survey was undertaken between 4 May and 2 June 2000 (1990–1999 average = 7–29 May; Table 1). Temperatures and times on plots were similar to those recorded in previous years. The Lake Saint-Jean ice thaw which usually gives us an idea of spring conditions in central Québec (Stratum 3) was one day earlier this year than in 1999 (1990–1999 average = 10 May; Table 1).

Numbers of indicated pairs are shown in Table 2 for all loons, geese and ducks species breeding in the study area and that were consistently observed during the survey. With almost half a million indicated pairs of ducks, 2000 had the highest count on record since the beginning of the survey in 1990. Both the total IP numbers of dabblers (*Cairinini* and *Anatini*) and of divers (*Aythyini* and *Mergini*) were also the highest ever recorded. Among the 18 species of ducks, we noted record high number of indicated pairs in 2000 for Wood Duck, Green-winged Teal, Black Duck, Mallard, Blue-winged Teal and American Wigeon. The Northern Pintail was the only dabbler species whose 2000 numbers were below those of some previous years, but this species is an uncommon breeder in the area. Among divers, Ring-necked Duck, Greater Scaup, unidentified scaup and Common Goldeneye were all observed in record high numbers this year. The year 2000 was the only one along with 1996 to have more dabblers than divers. The highest number of indicated pairs of Canada Goose since 1990 was also observed in 2000.

The number of indicated pairs of ducks in 2000 was 20% above last year estimate (19% for dabblers and 20% for divers) and 67% above the 1990–1999 mean (93% for dabblers and 46% for divers; Table 3). The number of indicated pairs of the most abundant duck species, the Black Duck, was 1.9% above last year estimate and 67% above 1990–1999 average. One of the largest increases recorded this year for a common breeding duck species was for the Green-winged Teal (122% from 1999 and 189% from the 1990–1999 mean). The number of Canada Goose indicated pairs surveyed in 2000 was 6.6% above last year estimate and 95% above long term average (1990–1999). The Common Loon and the Hooded Merganser were the only two species which had lower indicated pair estimates this year compared to last year's (both species were 13% below 1999 estimates). Among the 20 species of waterfowl and loons observed, the 10 most abundant species had 2000 indicated pair estimates greater than the long term average; however, 5 out of the 10 least abundant species had 2000 IP estimates below the long term average.

Each year we also estimate the size of clutches in Canada Goose nests observed from the helicopter. The number of nests recorded per 100 km^2 in 2000 was the highest since 1990 but the average clutch size (4.61 eggs) was just slightly above the 1990–1999 long term average (4.40 eggs).

The phenology index was 1.77 for Black Duck in 2000 (1990–2000 mean = 1.77; Table 5). This value indicates quite good survey timing with most breeding birds in pairs. The high value for Green-winged Teal (5.09) might indicate that the surveys was done early in the nesting season for this species with migrant pairs still present.

The 1990–2000 trends of the various species surveyed are shown in Figures 2 to 27. Overall total number of ducks showed an increase in the last 2 years following a fairly stable 9-year period (Figure 2). This pattern was observed both for dabblers and divers but was less obvious for the latter. The Common Loon, the Canada Goose and most of the duck species showed substantially larger breeding pair populations in recent years.

The number of Common Loon indicated pairs seems to have leveled since 1995 to a breeding population twice that observed in 1990–1992 (Figure 3). Following a steady

decline from 1990 to 1995, the Canada Goose breeding population had increased considerably since the hunting season was closed in 1995 (Figure 4). Both the Atlantic (Strata 3 and 4) and the North Atlantic Population (Stratum 2) showed a similar rising trend since 1995 but the NAP did not seem to have declined between 1990 and 1995 as the AP did (Figure 5). The number of nests recorded (stated as number counted per 100 km^2 to account for differential yearly sampling effort) also showed a big increase in the last 2 years but with more inter-year variability (Figure 6). On the other hand, the clutch size estimated from the air did not vary much around the long term average of 4.40 eggs/nest (Figure 7). The Green-winged Teal IP number in 2000 was well above the quite stable population figures recorded during the 10 previous years (Figure 9). The Black Duck breeding population keeps rising after low population levels in 1993–1995 which were preceded by a steady decline from 1990–1993 (Figure 10). Mallard IP numbers rose quite consistently since 1990 (Figure 11). The second most abundant waterfowl species in the study area, the Ring-necked Duck, attained record high population levels in the last two years after 9 years of stable numbers (Figure 15). The Common Goldeneye (Figure 22) and the Hooded Merganser (Figure 25) showed a similar trend pattern. The Lesser Scaup (Figure 17) and the Bufflehead (Figure 24) have experienced the most dramatic declines in the last eleven years. However, these two species are uncommon breeders in the study area and the precision of the annual estimates are poor (large SE).

5.0 Discussion

The BDJV helicopter survey allows us to evaluate breeding population trends and relative abundance of 20 species of loons and waterfowl in southern Québec. A look at the trends figures reveals acceptable year-to-year variations as well as fairly smooth tracks of yearly population changes for most species. The precision of annual indicated pairs estimates (see SE) is good for many surveyed species. Annual coefficients of variation were below 10% for Black Duck and usually below 20% for many other abundant species. Moreover, many observed trends were as expected or in accordance with other data. As an example, high numbers of Green-winged Teal were expected this year because a big fall flight of this species was observed in southern Québec in 1999. It is also interesting to see that the steady downward trend of the Canada Goose breeding population was stopped in 1995, the first year of the sport hunting ban on this species. It is even more interesting to see that the population recovered very well since then. However, some data deviate from the overall trends. In this regard, the year 1996 remains a special year for many species. The 1996 survey occurred very early in relation to the breeding season. As an example, the PI for Black Duck was a record high 5.22 in 1996. Consequently, indicated pair estimates of many early-nesting species were overestimated in 1996 whereas those for late-nesting species were underestimated. This highlights two important points to consider when interpreting survey results. Firstly, the BDJV survey is planned to get the most reliable data for Black Duck, an early-nesting species. Secondly, IP estimates should be viewed as underestimates of the real number of breeding pairs because observers from the helicopter, as in any single-visit survey, cannot see all the birds. Nevertheless, after eleven years, the BDJV helicopter survey proved to be a valuable and effective tool for evaluating population trends and relative abundance of Common Loon and waterfowl species breeding in southern Québec.

Table 1. Sample plot size, sampling effort, habitat and weather conditions recorded during the Black Duck Joint Venture Helicopter Survey in Québec 1990–2000.

	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Plot size (km)	10×10	10×10	10×10	10×10	10×10	10×10	5×5	5×5	5×5	5×5	5×5
Surveyed area (km^2)	8300	8300	8300	4300	4300	3500	1950	1950	1950	1950	1950
Sampling effort (%)	1.6	1.6	1.6	0.9	0.9	0.7	0.4	0.4	0.4	0.4	0.4
Beginning of survey	2 May	4 May	8 May	10 May	10 May	11 May	6 May	12 May	5 May	6 May	4 May
End of survey	24 May	23 May	27 May	28 May	4 June	1 June	24 May	6 June	29 May	31 May	2 June
Saint-Jean Lake ice thaw	9 May	7 May	15 May	10 May	20 May	14 May	12 May	7 May	3 May	8 May	7 May
Mean temperature (°C) (min–max)	8 (-4–21)	8 (-4–22)	11 (-4–29)	9 (0–30)	10 (-3–24	8 (1–18)	5 (-8–14)	8 (1–18)	13 (2–22)	13 (-2–25)	9 (-5–25)
Mean time on plot (min.) (min–max)	87 (42–192)	83 (20–147)	81 (33–134)	87 (32–145)	97 (40–161)	92 (44–168)	24 (13–44)	34 (17–59)	31 (14–51)	36 (20–58)	36 (19–64)

Table 2. Breeding population estimates from the Black Duck Joint Venture Helicopter Survey in Québec 1990–2000.

Species	Population estimate (total indicated pairs / 503 800 km^2)										
	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
LOONS											
Common Loon	11 673	10 568	8 970	14 997	18 980	23 463	10 851	25 319	18 860	24 286	21 185
GEESE											
Canada Goose	18 800	17 817	17 572	14 294	14 763	12 091	22 477	17 052	22 477	35 137	37 462
DABBLERS											
Wood Duck	3 133	1 167	676	1 054	3 632	5 038	2 325	2 325	1 292	4 134	5 684
Green-winged Teal	17 449	18 309	11 243	7 030	16 051	7 053	23 252	14 468	11 109	18 860	41 854
American Black Duck	111 389	93 479	83 803	63 209	64 732	65 422	106 056	94 947	107 736	155 145	158 116
Mallard	8 663	5 775	6 697	6 913	11 365	9 932	18 860	9 818	8 267	19 635	25 578
Northern Pintail	430	123	369	117	0	0	2 067	258	0	0	258
Blue-winged Teal	553	430	676	586	1 172	288	517	1 033	517	775	1 550
American Wigeon	676	492	246	469	1 289	576	1 033	1 550	0	775	7 173
Subtotal	142 293	119 775	103 709	79 378	98 241	88 309	154 111	124 400	128 921	199 324	238 465
DIVERS											
Ring-necked Duck	54 983	50 933	45 219	44 756	55 301	55 562	40 821	55 289	39 012	67 690	83 967
Greater Scaup	246	860	1 290	1 757	703	288	1 033	258	0	0	4 909
Lesser Scaup	1 782	5 837	1 966	586	2 812	0	517	517	0	0	258
undentified scaup	553	123	307	0	2 226	1 295	258	0	0	0	4 134
Black Scoter	430	1 966	1 229	1 172	0	720	517	258	258	775	775
Surf Scoter	1 966	2 949	2 335	3 398	2 578	1 727	1 809	3 875	8 009	5 942	5 684
Common Goldeneye	42 884	44 482	37 109	40 421	46 748	35 698	39 271	42 371	32 295	49 605	57 614
Barrow's Goldeneye	922	2 396	1 536	1 406	117	864	1 033	1 292	2 842	517	258
Bufflehead	4 546	4 731	3 318	351	2 226	576	3 617	2 067	0	517	1 292
Hooded merganser	11 981	11 305	7 127	9 842	14 411	15 258	12 660	12 660	12 918	26 611	23 252
Common Merganser	42 209	47 984	41 410	28 002	35 852	32 531	26 094	40 046	33 845	34 620	41 079
Red-breasted Merganser	799	1 352	676	2 109	2 929	1 152	0	0	0	0	342
Subtotal	162 629	174 917	143 522	133 800	165 903	145 670	127 629	158 632	129 179	186 277	223 481
Total ducks	304 922	294 692	247 231	213 178	264 144	233 979	281 740	283 032	258 101	385 601	461 946

Table 3. Change (%) between the number of indicated pairs observed in 2000 compared to 1999 and 1990-1999 mean; species in decreasing 1990–2000 mean IP population estimates from the Black Duck Joint Venture Helicopter Survey in Québec 1990–2000.

		Mean IP Density / 100 km^2		Mean IP Population (503 800 km²)		% Change in 2000 compared to	
#	Species	1990–1999	1990–2000	1990–1999	1990–2000	1999	1990–1999 mean
1	American Black Duck	18.8	19.9	94 592	100 367	+1.9	+67
2	Ring-necked Duck	10.1	10.7	50 957	53 957	+24	+65
3	Common Goldeneye	8.2	8.5	41 088	42 591	+16	+40
4	Common Merganser	7.2	7.3	36 259	36 697	+19	+13
5	Canada Goose	3.8	4.1	19 248	20 904	+6.6	+95
6	Common Loon	3.3	3.4	16 797	17 196	-13	+26
7	Green-winged Teal	2.9	3.4	14 483	16 971	+122	+189
8	Hooded Merganser	2.7	2.9	13 477	14 366	-13	+73
9	Mallard	2.1	2.4	10 593	11 955	+30	+141
10	Surf Scoter	0.69	0.73	3 459	3 661	-4.3	+64
11	Wood Duck	0.49	0.55	2 478	2 769	+38	+129
12	Bufflehead	0.44	0.42	2 195	2 113	+150	-41
13	Lesser Scaup	0.28	0.26	1 402	1 298	+[1]	-82
14	American Wigeon	0.14	0.26	710	1 298	+825	+910
15	Barrow's Goldeneye	0.26	0.24	1 292	1 198	-50	-80
16	Greater Scaup	0.13	0.20	644	1 031	+[1]	+663
17	Red-breasted Merganser	0.18	0.17	902	851	+[1]	-62
	undentified scaup	0.09	0.16	476	809	+[1]	+768
18	Black Scoter	0.15	0.15	732	736	0	+5.8
19	Blue-winged Teal	0.13	0.15	655	736	+100	+137
20	Northern Pintail	0.07	0.07	336	329	+[1]	-23
	Dabblers	24.6	26.7	123 846	134 266	+19	+93
	Divers	30.3	31.6	152 816	159 240	+20	+46
	Total ducks	54.9	58.3	276 662	293 506	+20	+67

[1] This species was observed in 2000 but not in 1999.

Table 4. Number of Canada Goose nests and clutch size estimates from the Black Duck Joint Venture Helicopter Survey in Québec 1990–2000.

	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Number of nests	27	39	37	19	12	9	9	5	8	15	18
Number of nests / 100 km²	0.33	0.48	0.45	0.44	0.28	0.26	0.46	0.26	0.41	0.77	0.92
Nb. of nests with recorded clutch size	19	37	26	12	11	7	6	4	5	14	18
Mean clutch size (SE)	4.32 (0.31)	4.62 (0.20)	4.23 (0.26)	4.17 (0.49)	4.73 (0.33)	4.00 (0.44)	5.67 (0.21)	4.25 (0.75)	4.60 (0.51)	3.79 (0.41)	4.61 (0.29)

Table 5. Phenology indices (PI) of duck species observed during the Black Duck Joint Venture Helicopter Survey in Québec 1990–2000.

Species	Phenology Index										
	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
DABBLERS											
Wood Duck	0.88	3.25	2.67	0.50	0.35	1.92	3.50	0.60	0.25	0.60	1.57
Green-winged Teal	6.03	10.15	3.94	0.96	1.63	0.88	6.09	0.57	0.62	1.28	5.09
American Black Duck	2.44	1.81	2.08	0.78	1.15	1.13	5.22	1.16	0.88	1.03	1.77
Mallard	1.06	0.49	0.56	0.10	0.35	0.23	0.35	0.27	0.20	0.28	0.62
Northern Pintail	-[1]	-[1]	1.00	0[2]	-[1]	-[1]	0.20	-[1]	-[1]	-[1]	-[1]
Blue-winged Teal	2.00	6.00	2.67	1.50	4.00	-[1]	-[1]	0[2]	-[1]	-[1]	2.00
American Wigeon	3.50	3.00	0.33	0[2]	1.25	3.00	-[1]	0.50	-[1]	-[1]	-[1]
DIVERS											
Ring-necked Duck	3.42	3.27	2.53	1.85	1.18	1.21	1.33	1.68	1.67	3.14	2.64
Greater Scaup	1.00	2.50	1.00	1.17	0[2]	0[2]	-[1]	0[2]	-[1]	-[1]	1.67
Lesser Scaup	0.90	4.26	1.63	-[1]	0.75	-[1]	-[1]	0[2]	-[1]	-[1]	0[2]
Undentified scaup	-[1]	1.00	4.00	-[1]	1.00	-[1]	-[1]	-[1]	-[1]	-[1]	2.67
Black Scoter	-[1]	30.00	0.33	2.00	-[1]	-[1]	1.00	-[1]	-[1]	-[1]	0[2]
Surf Scoter	1.30	5.33	2.11	1.43	0.79	-[1]	-[1]	-[1]	5.00	3.60	8.00
Common Goldeneye	1.77	1.73	1.65	0.87	0.92	1.31	1.35	0.68	0.97	1.54	1.67
Barrow's Goldeneye	2.67	3.50	1.00	1.00	-[1]	1.00	3.00	0.67	0.33	-[1]	-[1]
Bufflehead	7.57	4.69	3.78	-[1]	2.25	3.00	0.60	5.00	-[1]	-[1]	1.50
Hooded merganser	1.09	1.81	1.29	1.76	0.93	1.29	1.47	2.36	1.00	1.39	1.57
Common Merganser	1.38	1.68	1.23	1.20	1.20	0.82	1.14	1.22	0.81	1.08	1.60
Red-breasted Merganser	0.80	2.00	-[1]	6.00	0.85	1.00	-[1]	-[1]	-[1]	-[1]	-[1]

[1] No unattended male observed.
[2] At least one unattended male observed but no paired male observed.

Figure 1. Study area of the Black Duck Joint Venture helicopter survey in Québec 1990–2000.

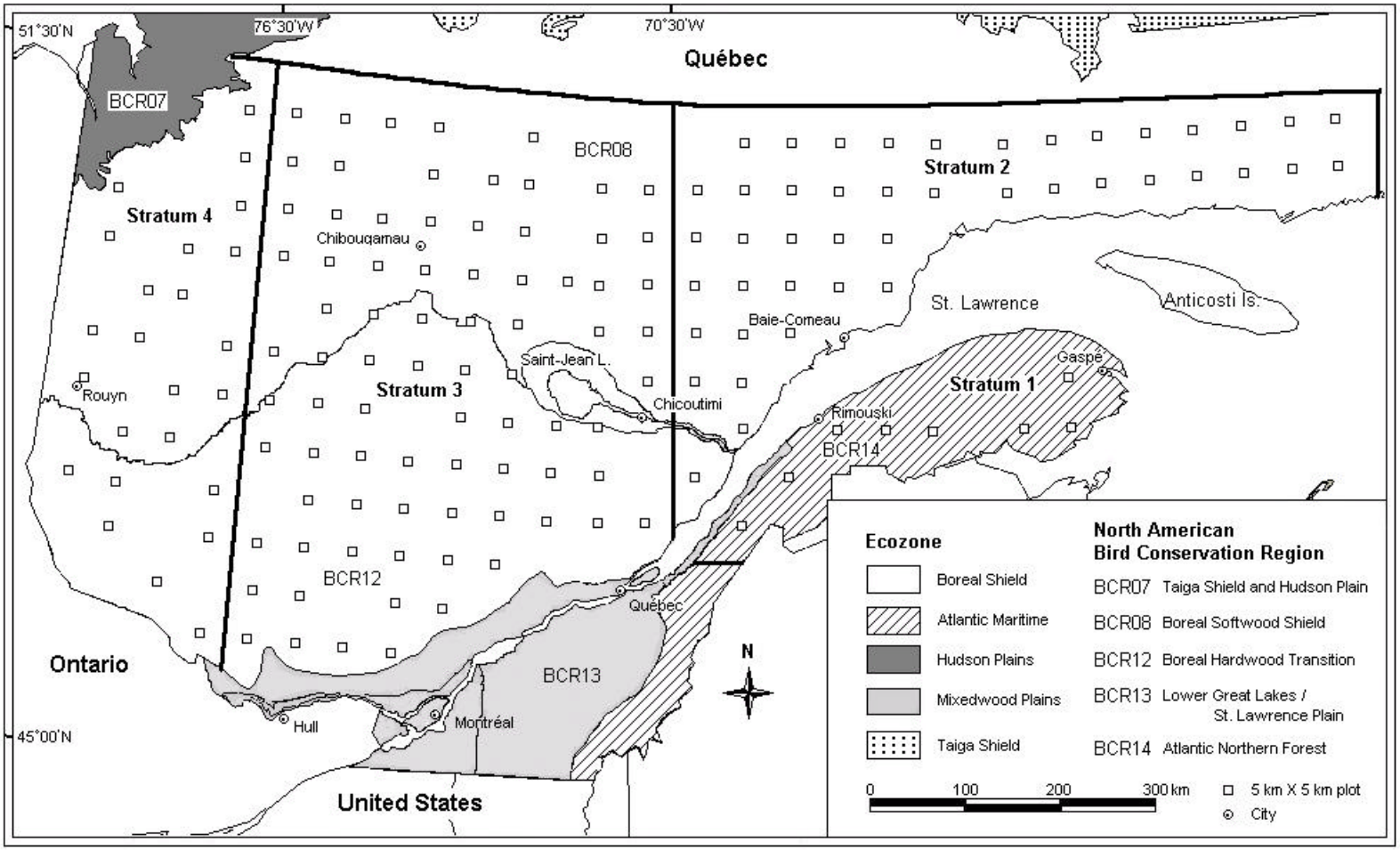


Figure 2. Trend in the breeding waterfowl population of southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2000.

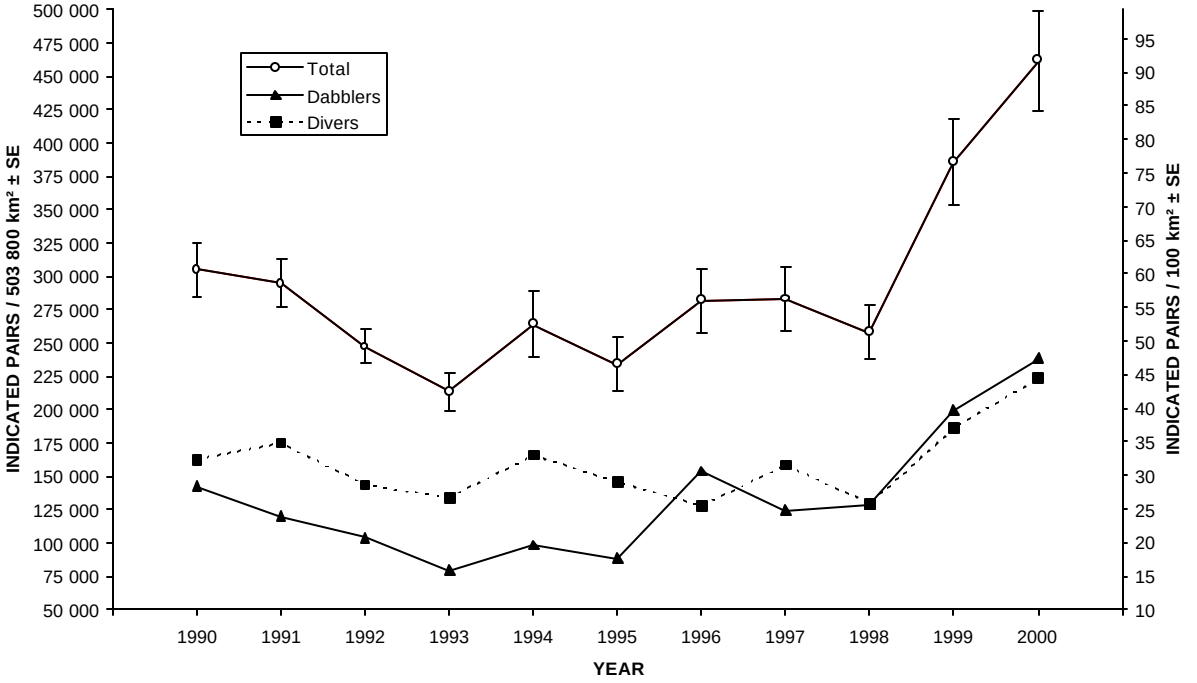


Figure 3. Trend in the Common Loon breeding population of southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2000.

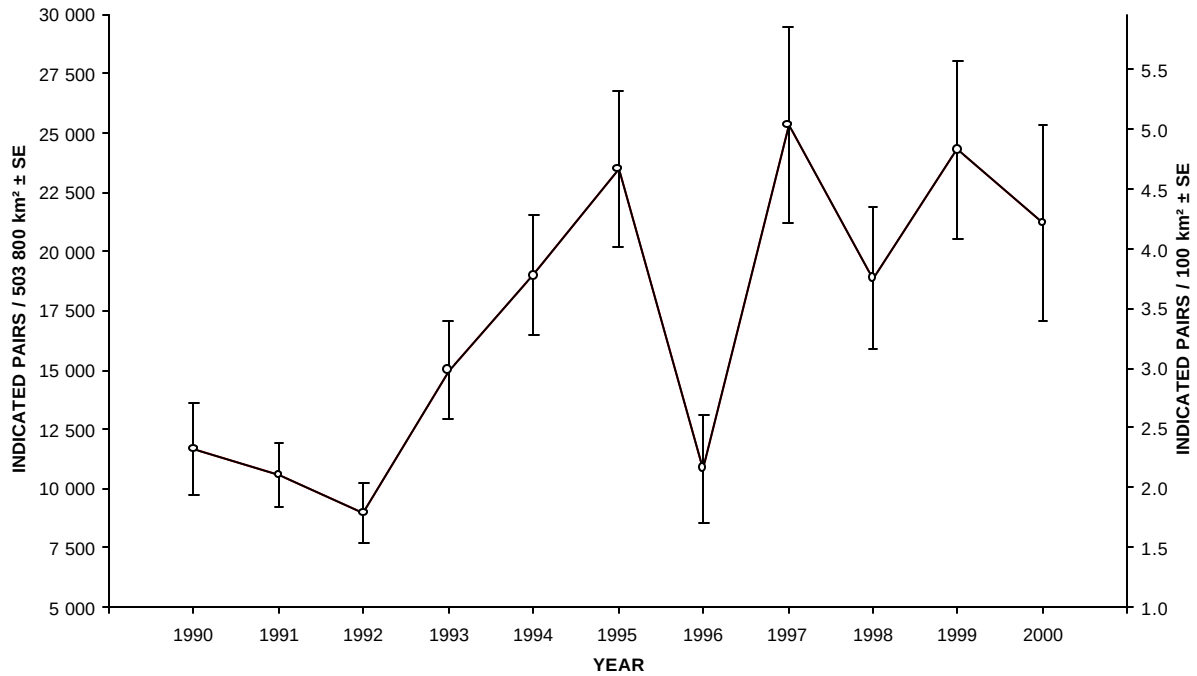


Figure 4. Trend in the Canada Goose breeding population of southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2000.

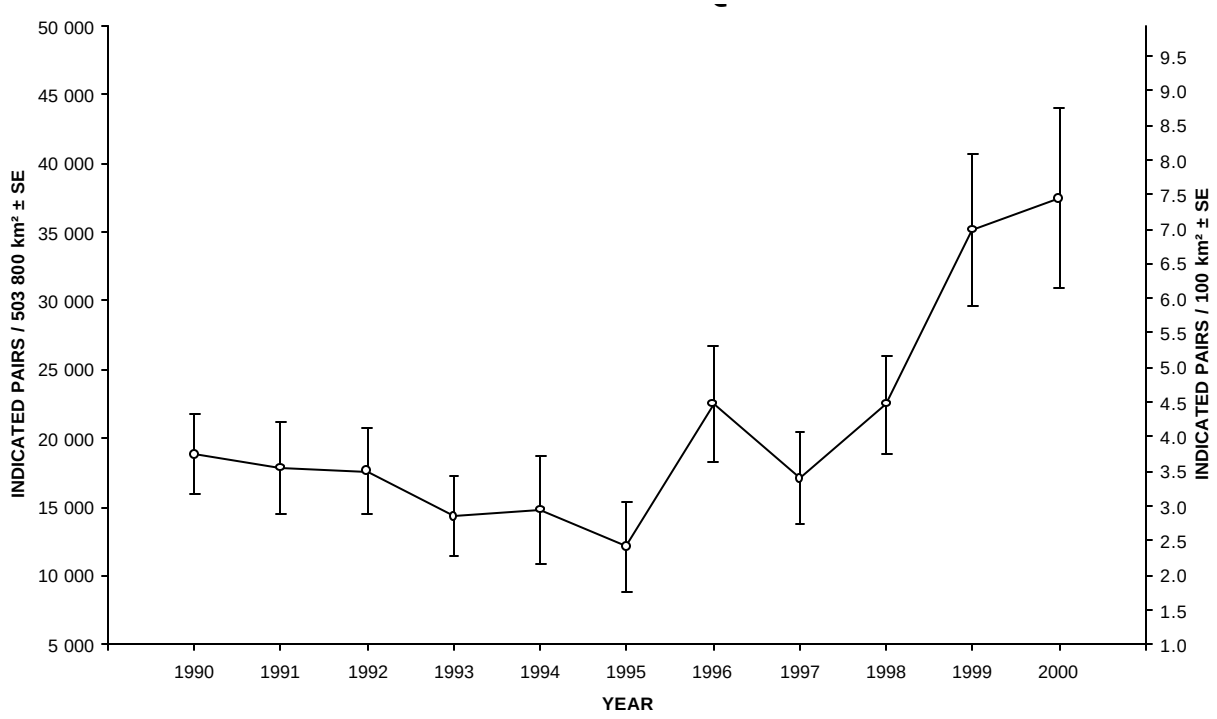


Figure 5. Trend in the Atlantic and North Atlantic Canada Goose populations in southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2000.

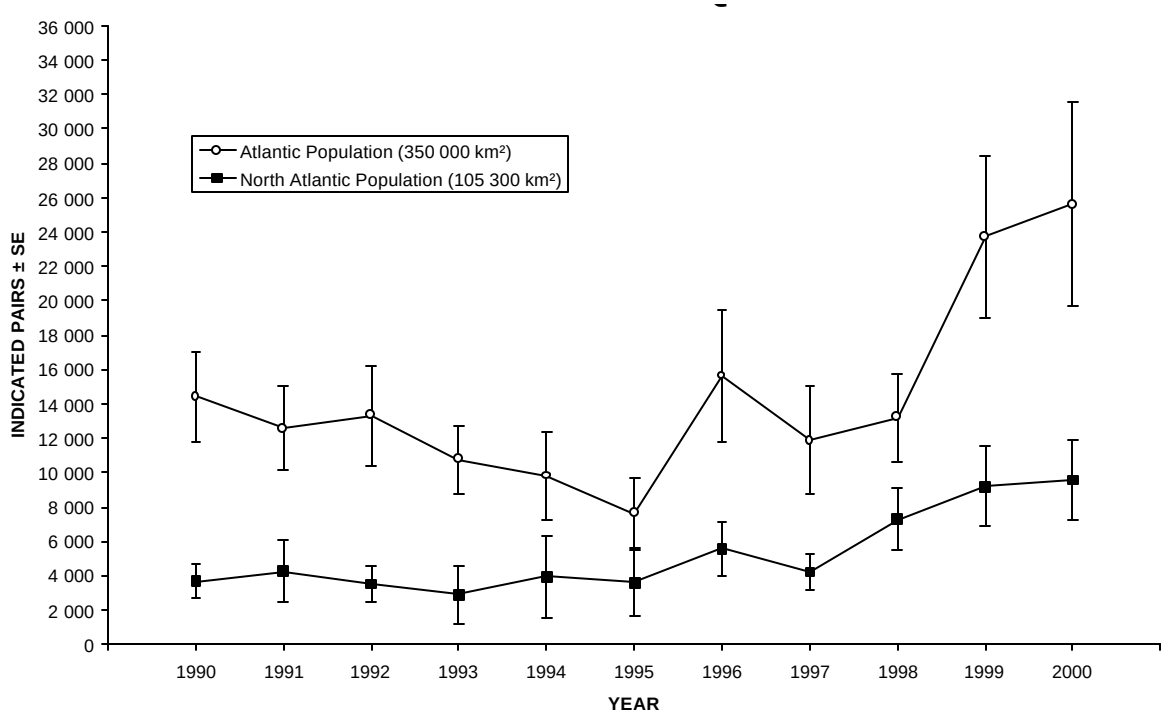


Figure 6. Trend in the number of nests of Canada Goose in southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2000.

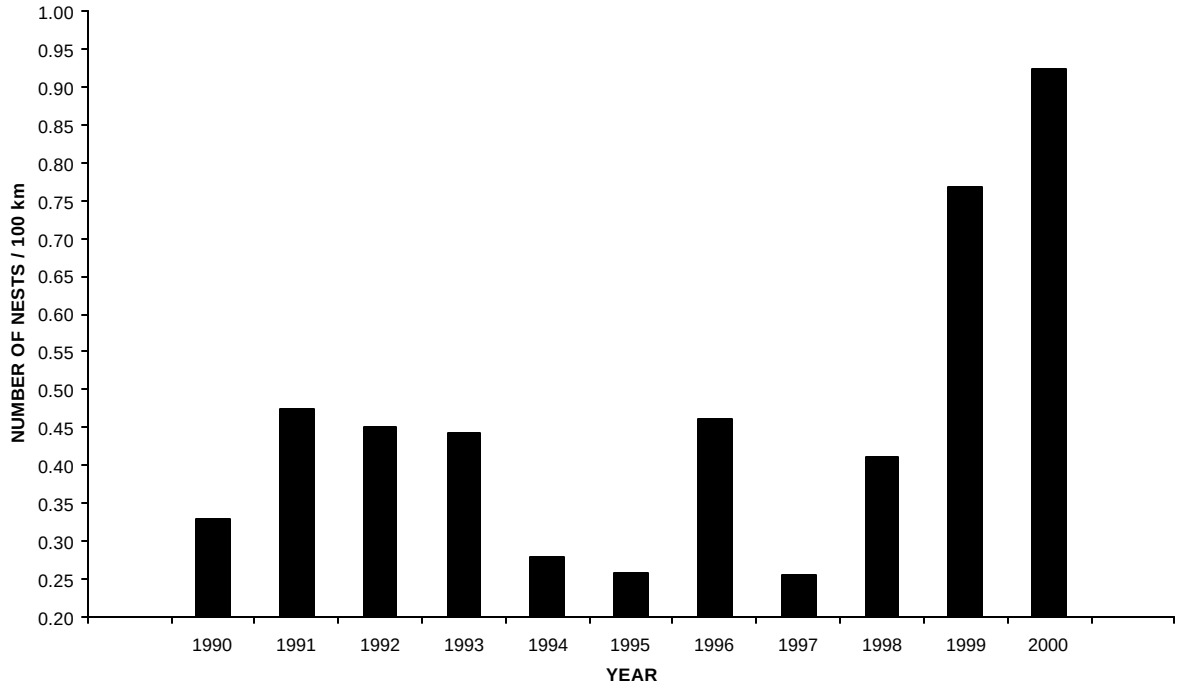


Figure 7. Trend in the Canada Goose clutch size in southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2000.

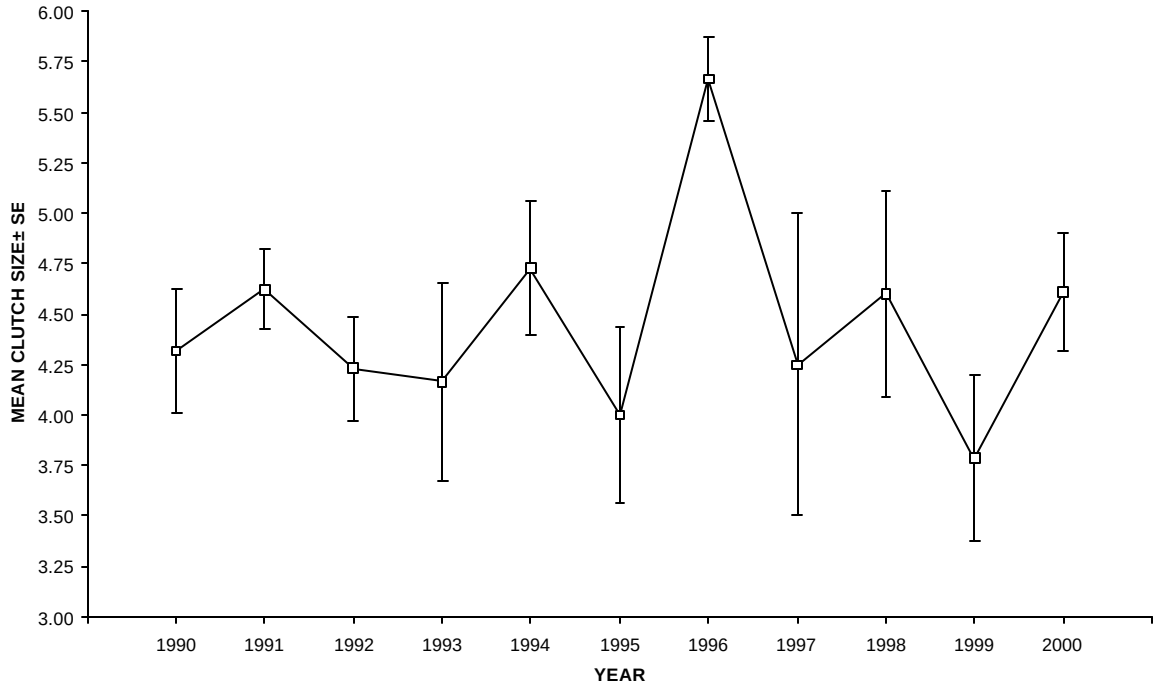


Figure 8. Trend in the Wood Duck breeding population of southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2000.

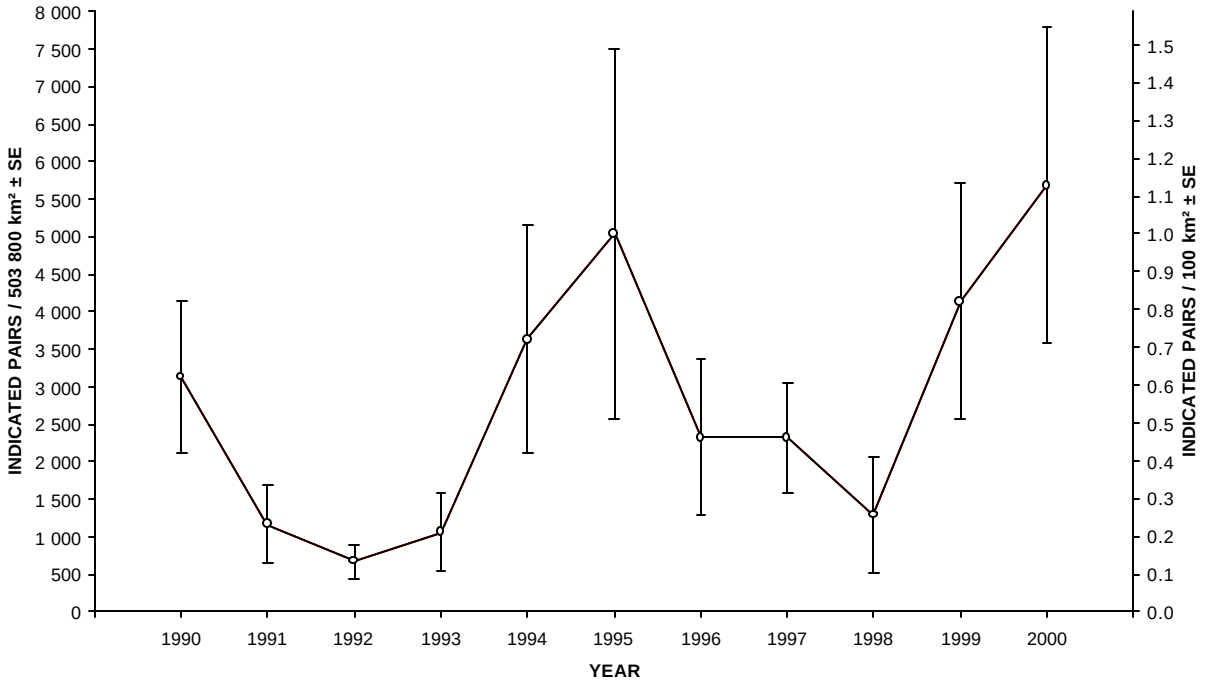


Figure 9. Trend in the Green-winged Teal breeding population of southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2000.

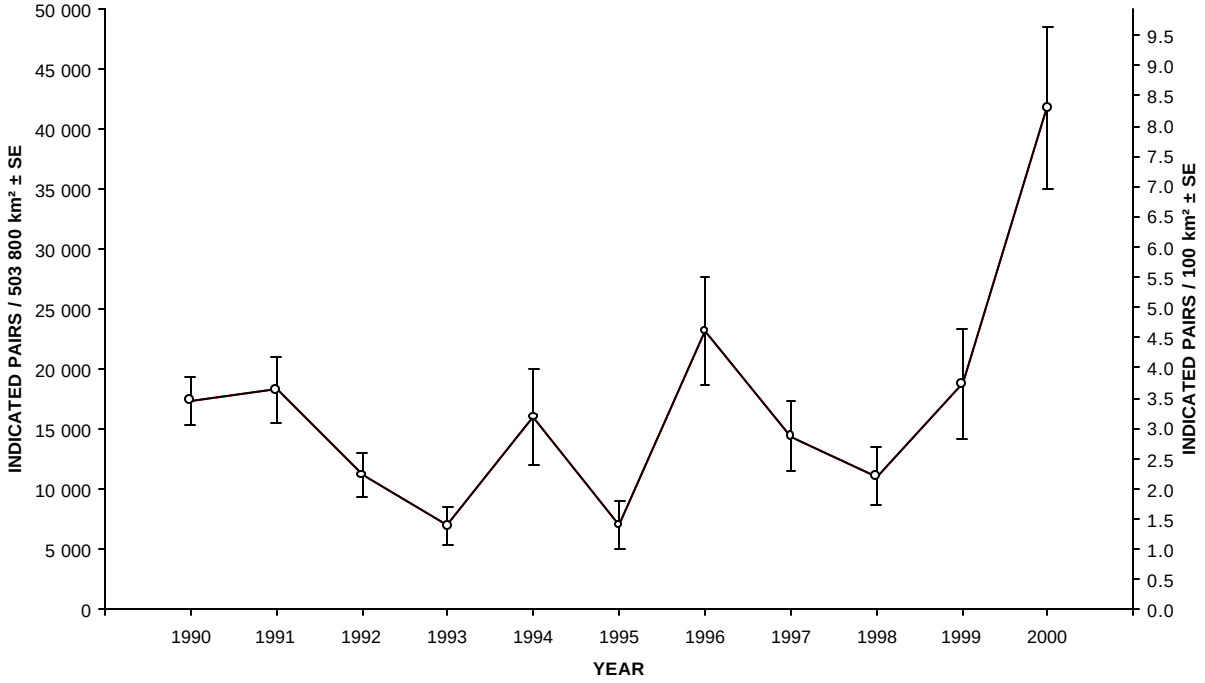


Figure 10. Trend in the American Black Duck breeding population of southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2000.

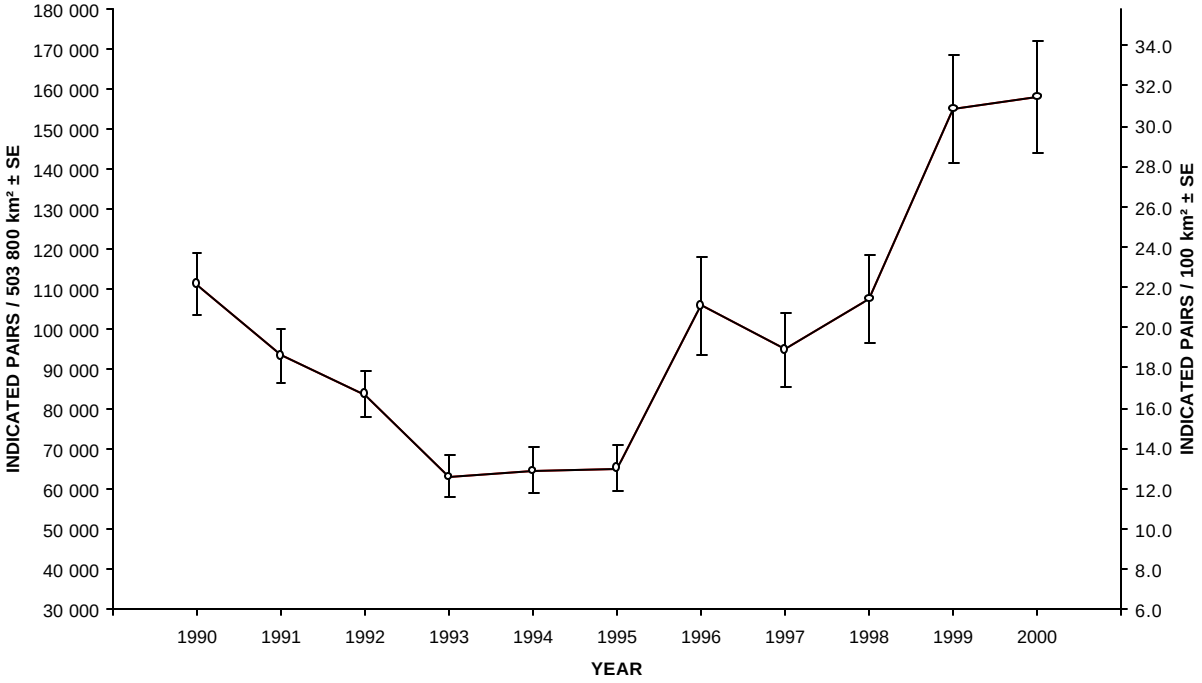


Figure 11. Trend in the Mallard breeding population of southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2000.

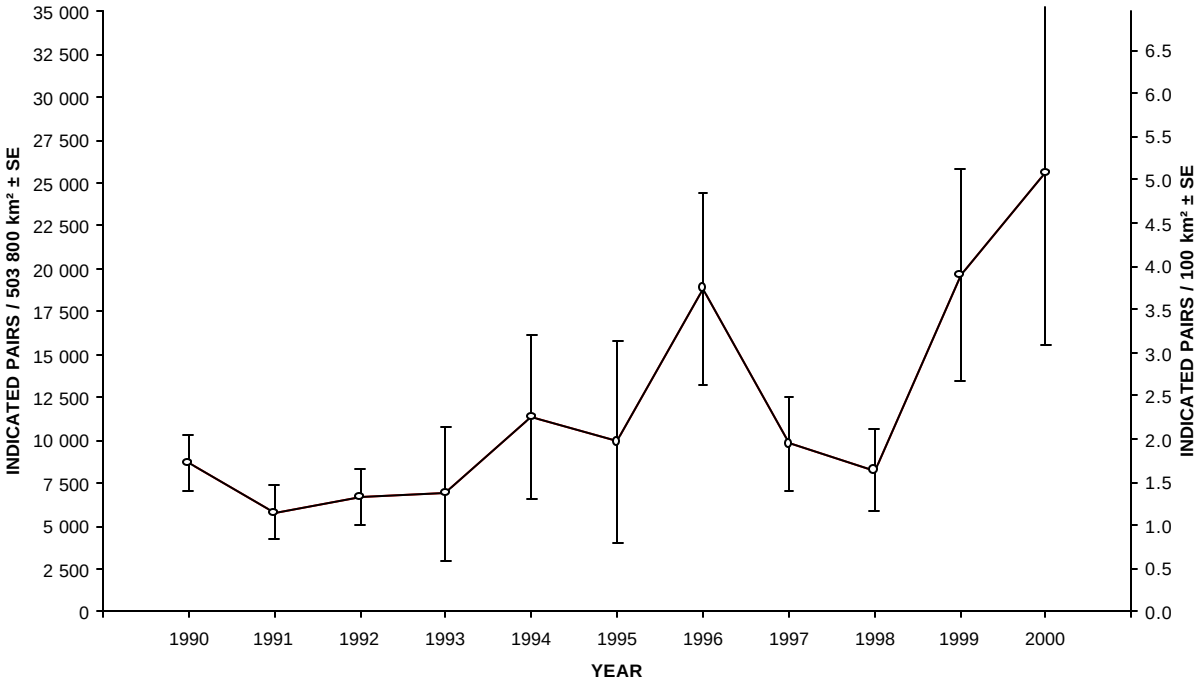


Figure 12. Trend in the Northern Pintail breeding population of southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2000.

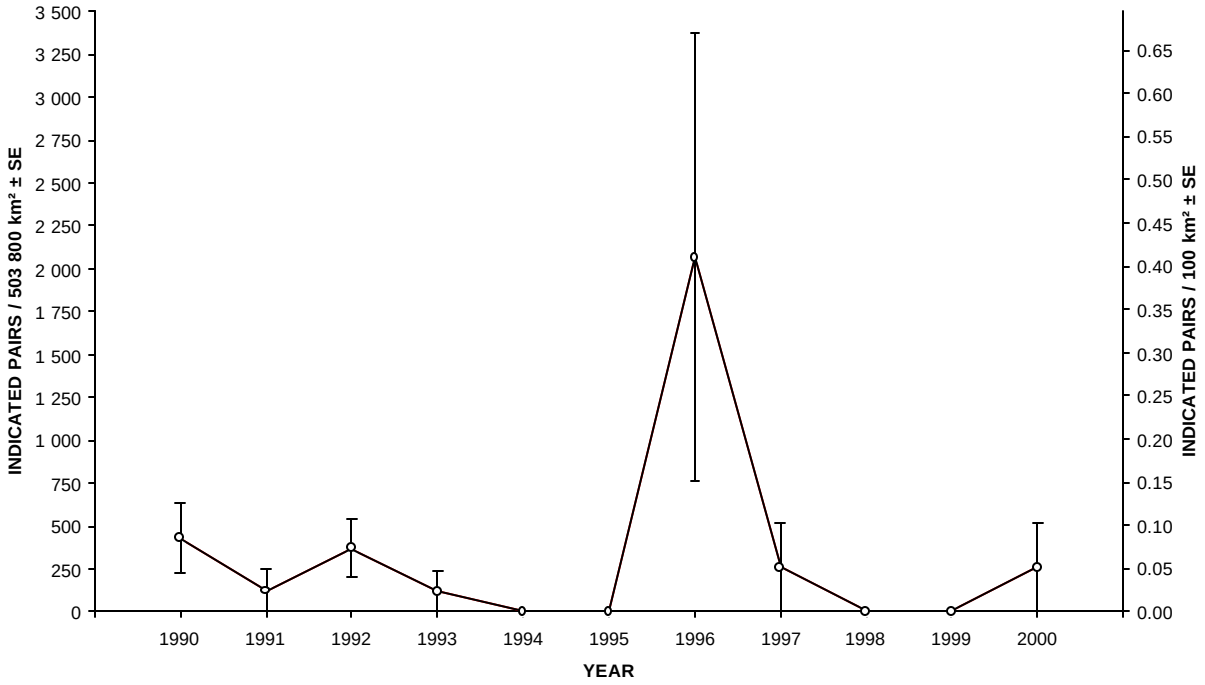


Figure 13. Trend in the Blue-winged Teal breeding population of southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2000.

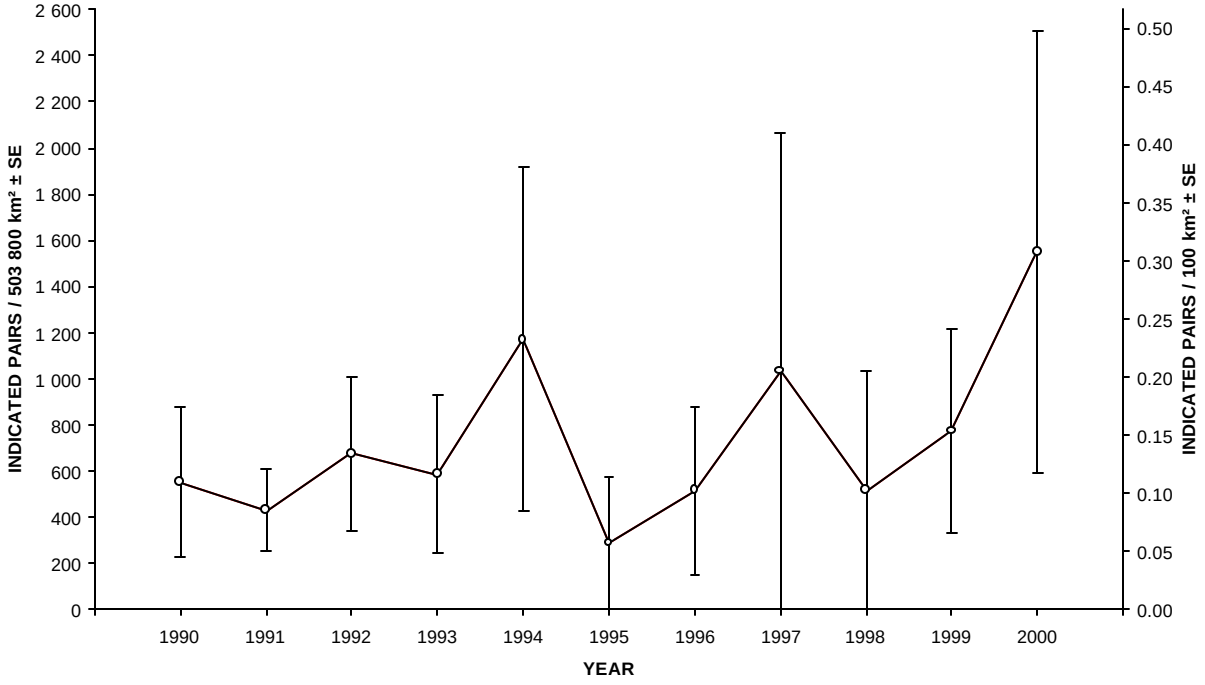


Figure 14. Trend in the American Wigeon breeding population of southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2000.

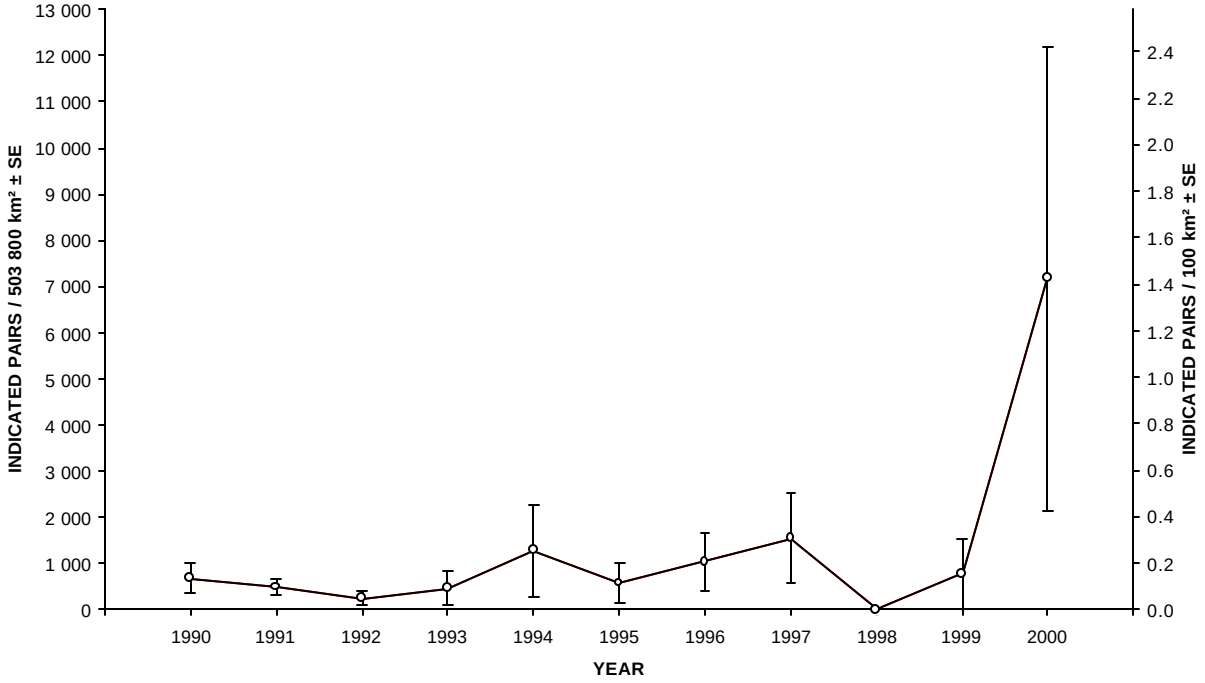


Figure 15. Trend in the Ring-necked Duck breeding population of southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2000.

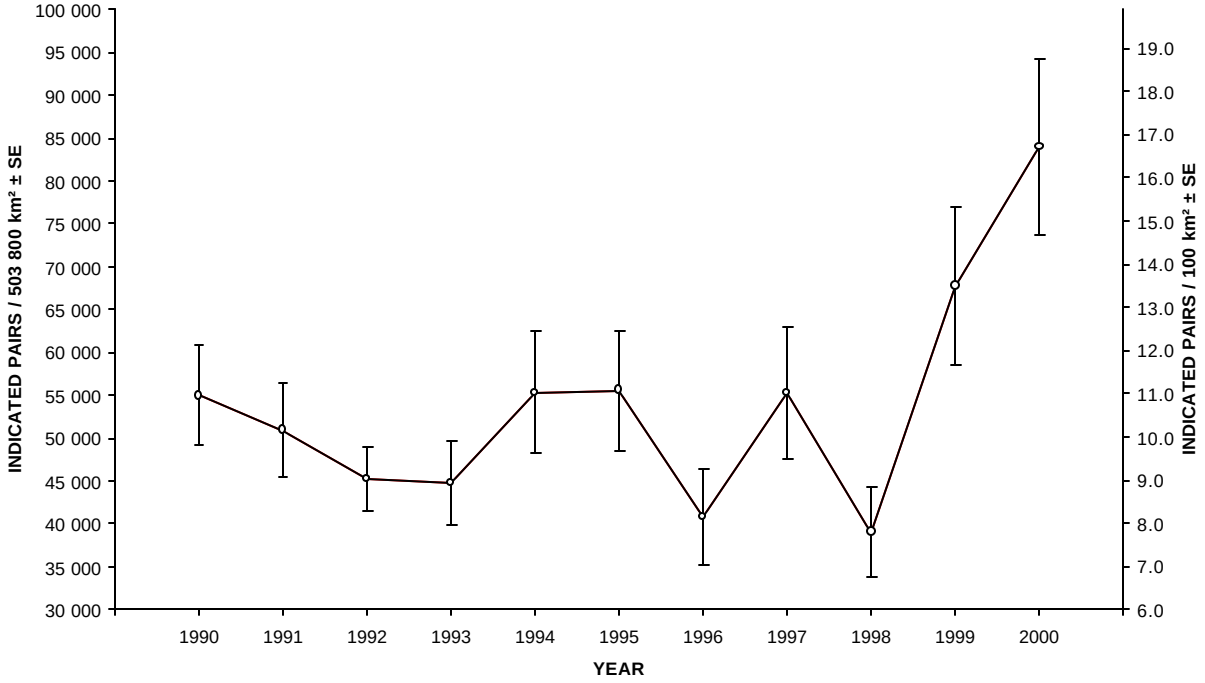


Figure 16. Trend in the Greater Scaup breeding population of southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2000.

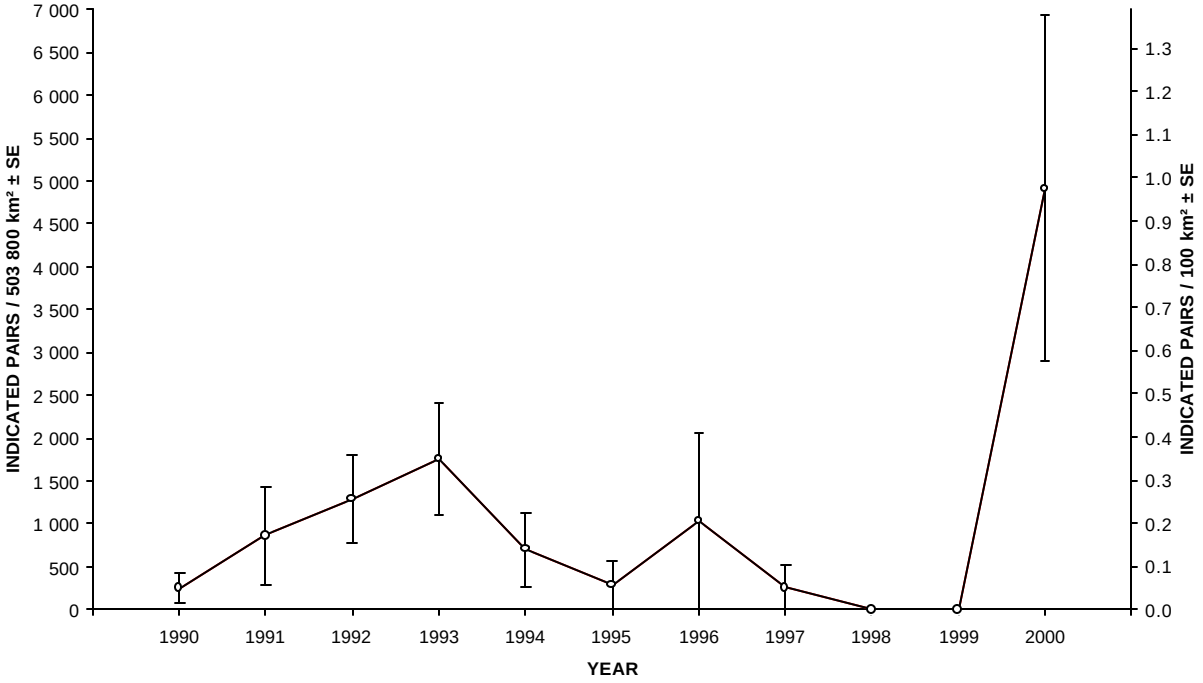


Figure 17. Trend in the Lesser Scaup breeding population of southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2000.

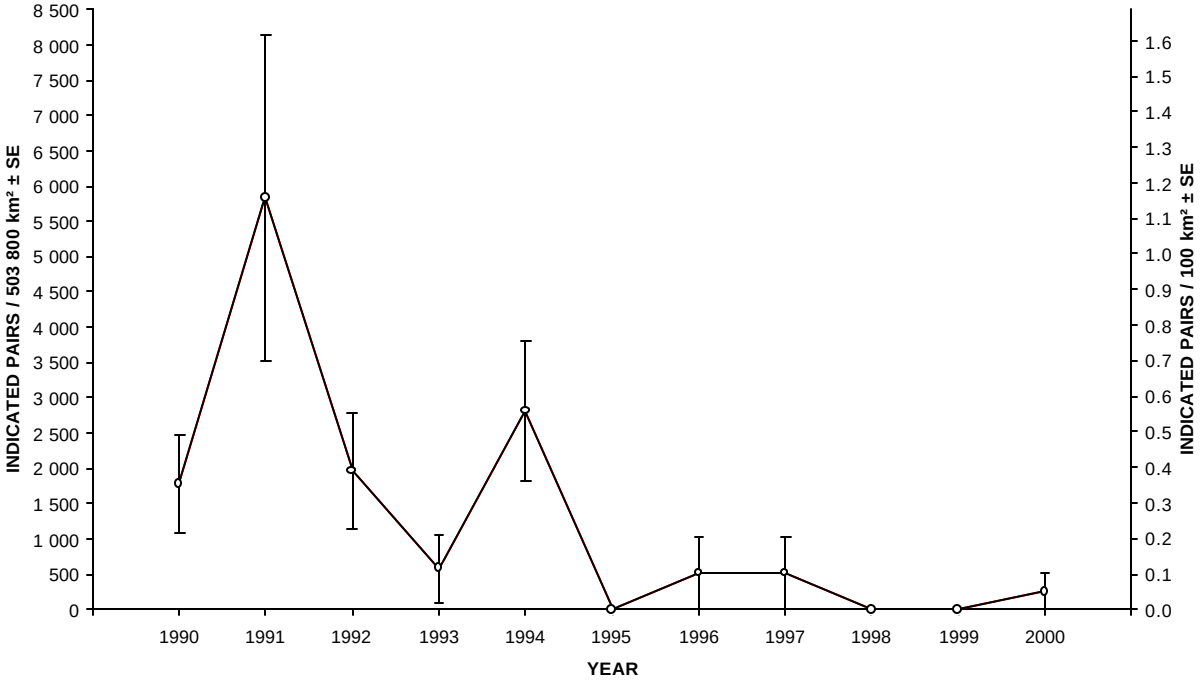


Figure 18. Trend in the unidentified scaup breeding population of southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2000.

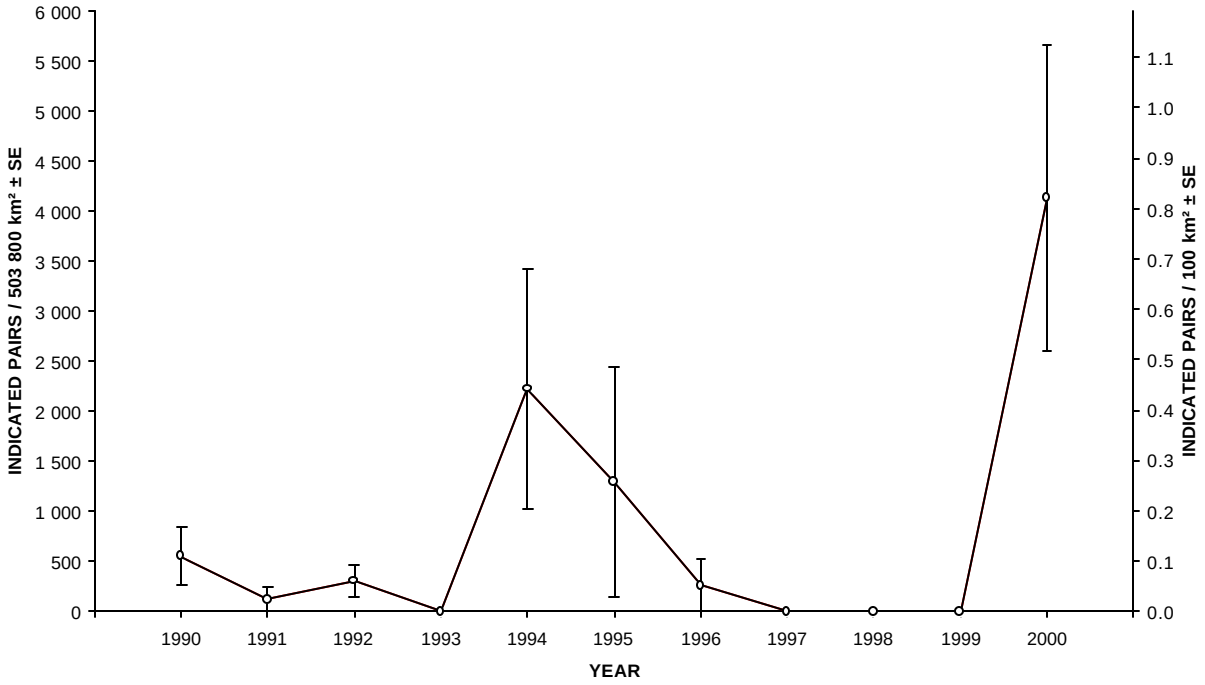


Figure 19. Trend in the scaup breeding population of southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2000 ; LESC = Lesser Scaup, GRSC = Greater Scaup, USCA = unidentified scaup, solid line = total scaup.

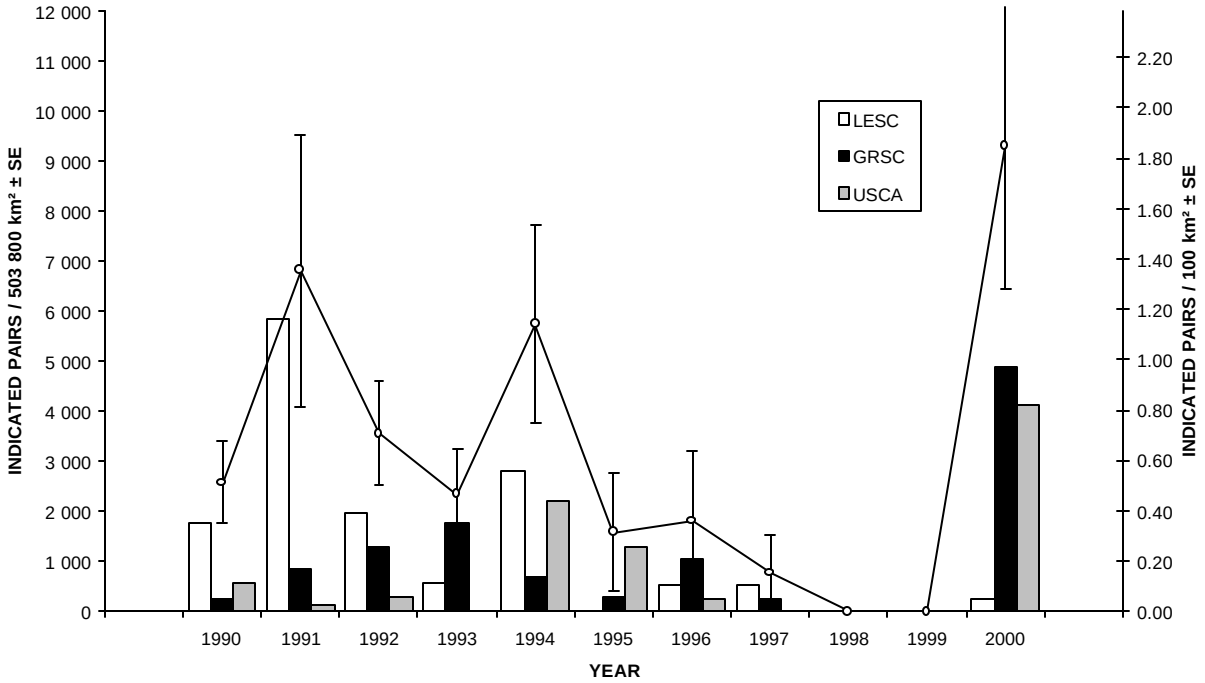


Figure 20. Trend in the Black Scoter breeding population of southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2000.

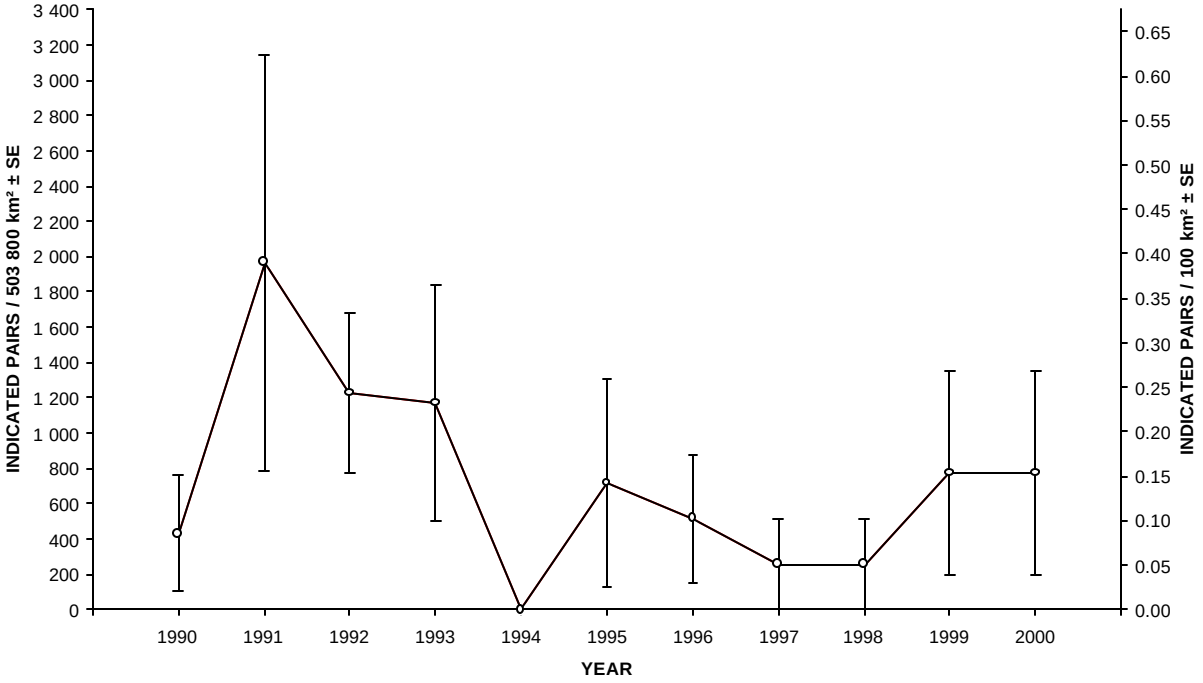


Figure 21. Trend in the Surf Scoter breeding population of southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2000.

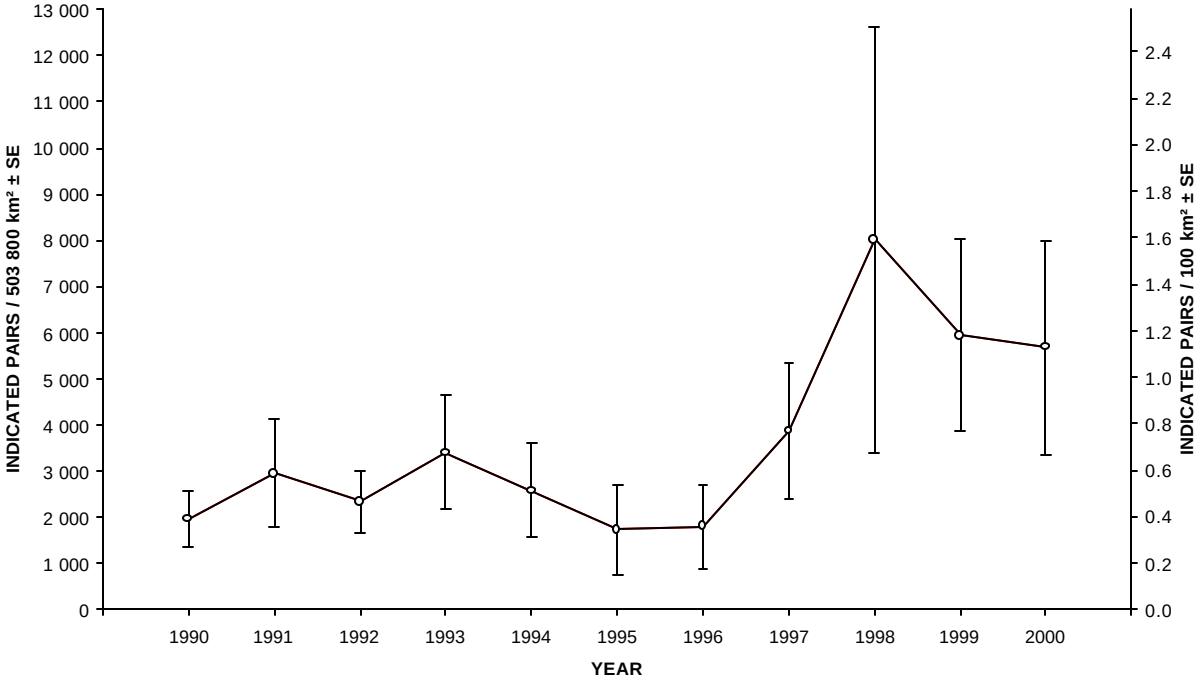


Figure 22. Trend in the Common Goldeneye breeding population of southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2000.

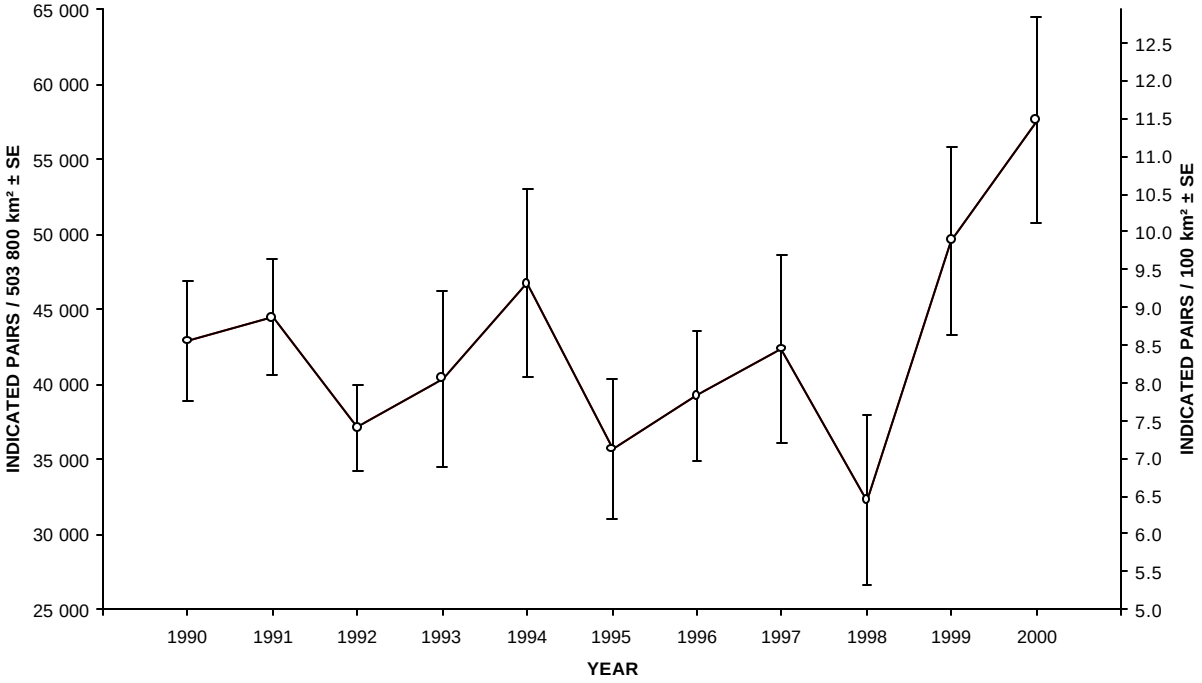


Figure 23. Trend in the Barrow's Goldeneye breeding population of southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2000.

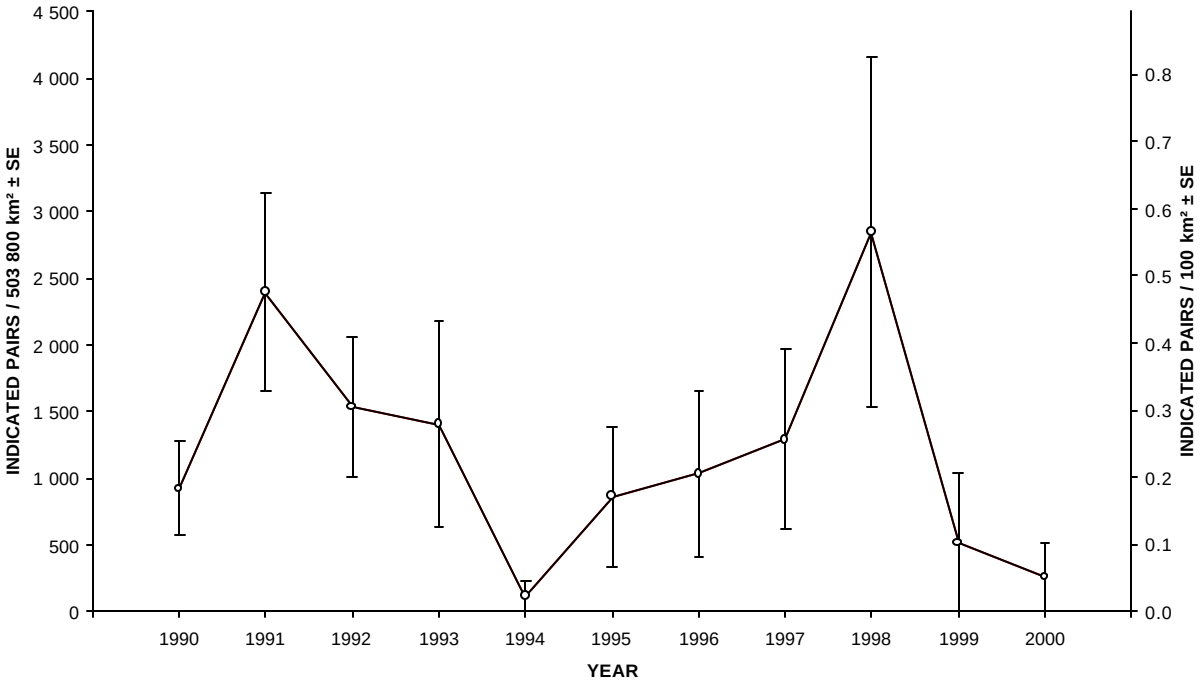


Figure 24. Trend in the Bufflehead breeding population of southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2000.

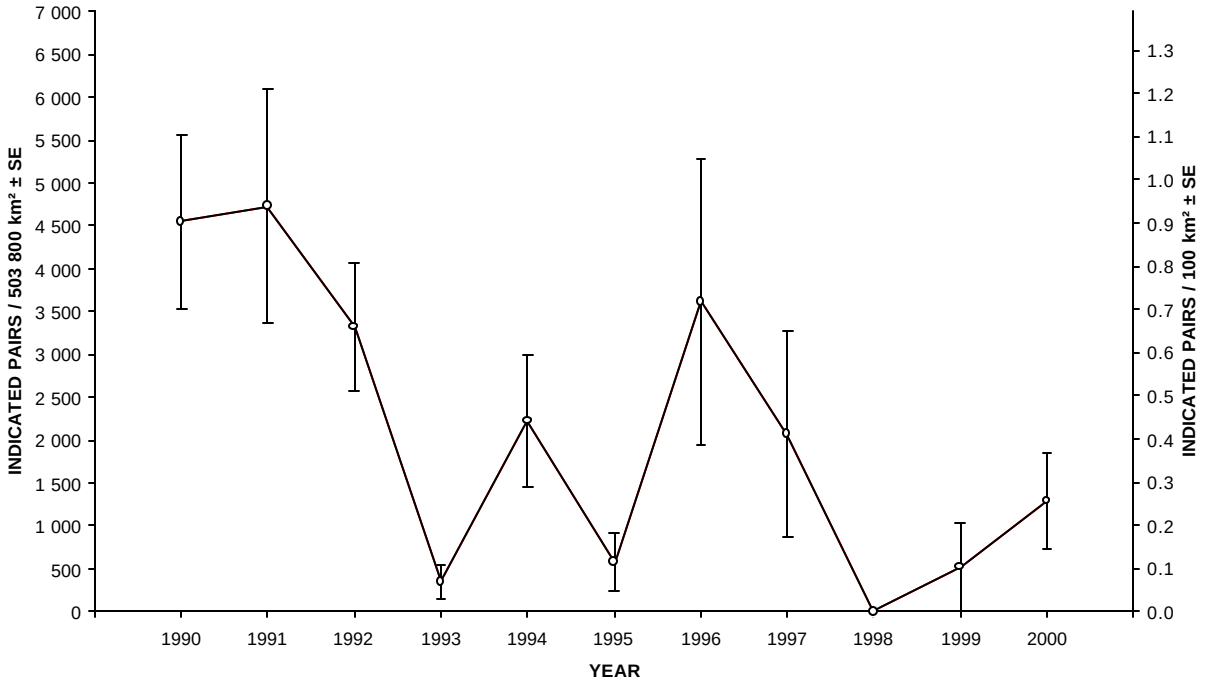


Figure 25. Trend in the Hooded Merganser breeding population of southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2000.

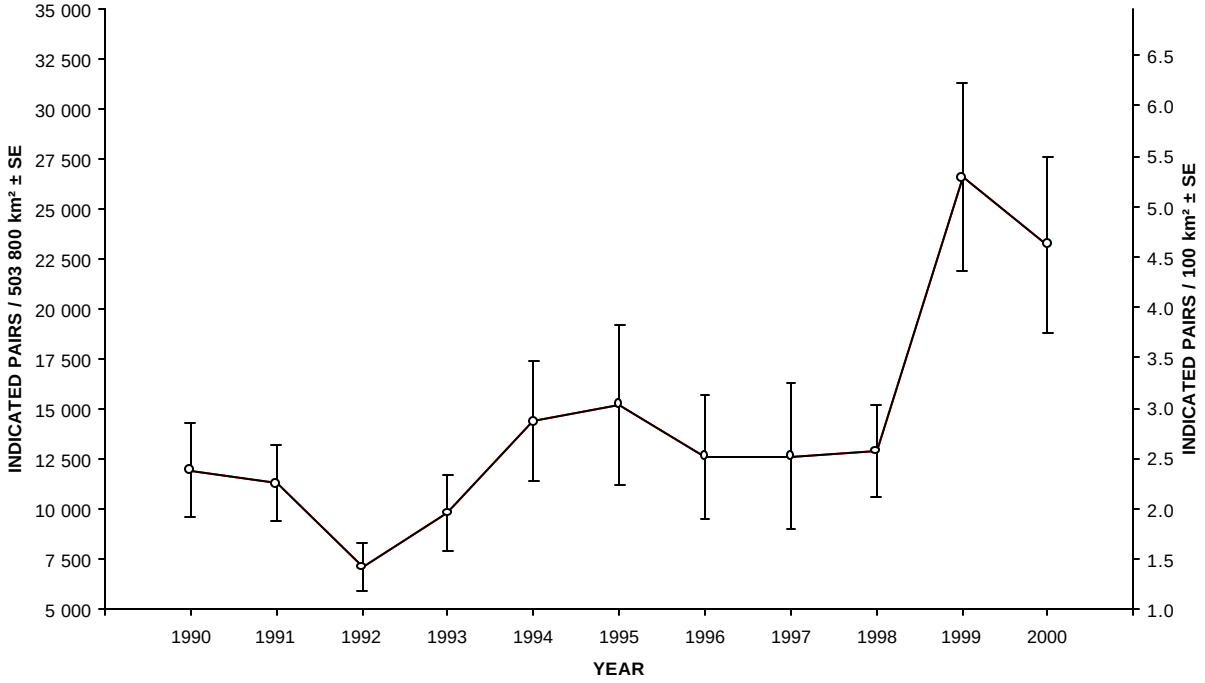


Figure 26. Trend in the Common Merganser breeding population of southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2000.

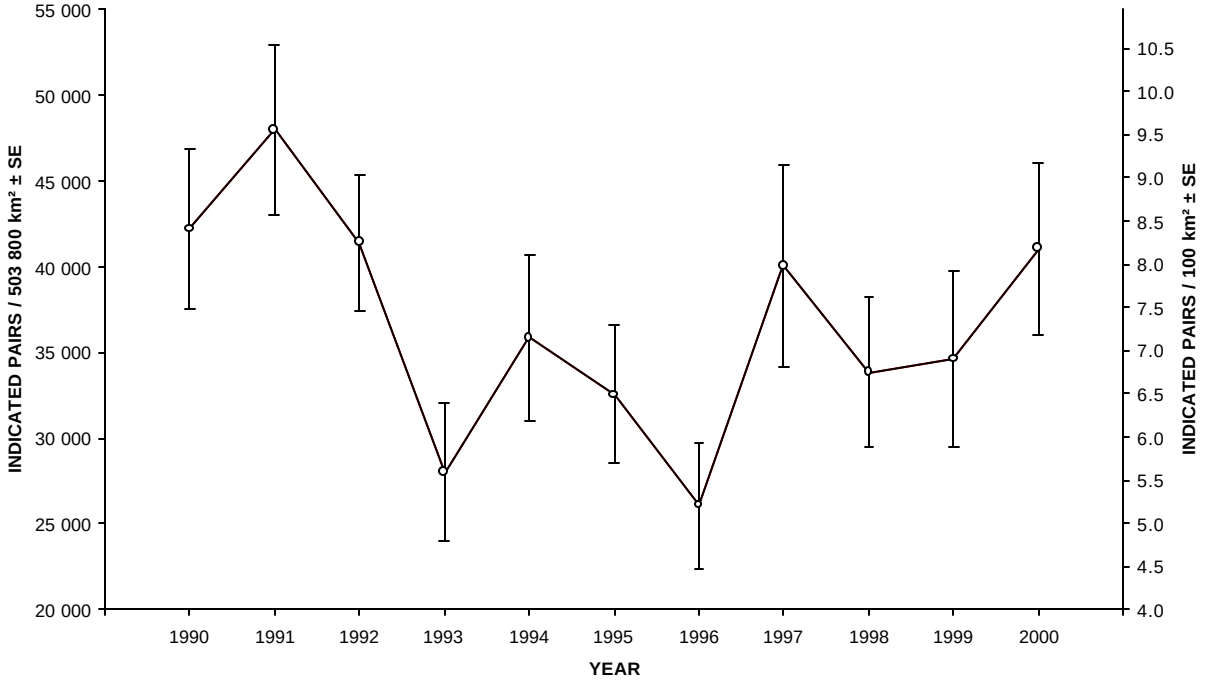
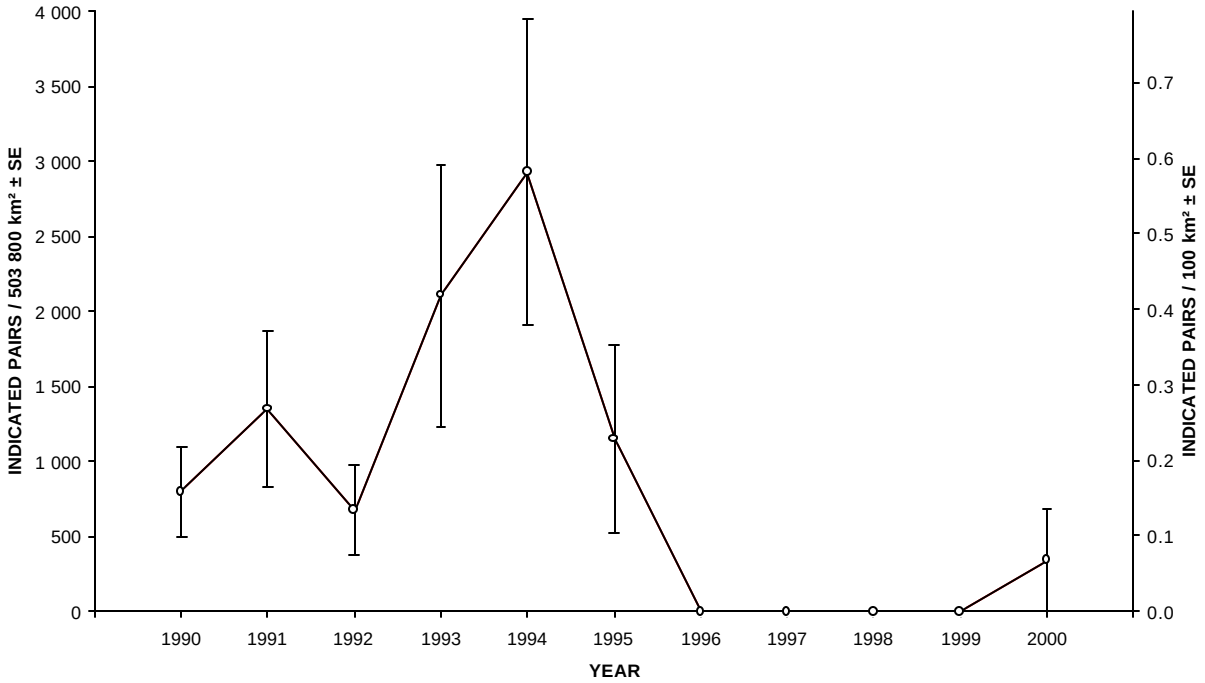


Figure 27. Trend in the Red-breasted Merganser breeding population of southern Québec recorded from the Black Duck Joint Venture helicopter survey 1990–2000.



Appendix 1. English, French, and Scientific names of species covered by the Black Duck Joint Venture helicopter survey in southern Québec.

English	French	Scientific
Common Loon	Plongeon huard	*Gavia immer*
Canada Goose	Bernache du Canada	*Branta canadensis*
Wood Duck	Canard branchu	*Aix sponsa*
Green-winged Teal	Sarcelle d'hiver	*Anas crecca*
American Black Duck	Canard noir	*Anas rubripes*
Mallard	Canard colvert	*Anas platyrhynchos*
Northern Pintail	Canard pilet	*Anas acuta*
Blue-winged Teal	Sarcelle à ailes bleues	*Anas discors*
American Wigeon	Canard d'Amérique	*Anas americana*
Ring-necked Duck	Fuligule à collier	*Aythya collaris*
Greater Scaup	Fuligule milouinan	*Aythya marila*
Lesser Scaup	Petit Fuligule	*Aythya affinis*
Black Scoter	Macreuse noire	*Melanitta nigra*
Surf Scoter	Macreuse à front blanc	*Melanitta perspicillata*
Common Goldeneye	Garrot à œil d'or	*Bucephala clangula*
Barrow's Goldeneye	Garrot d'Islande	*Bucephala islandica*
Bufflehead	Petit Garrot	*Bucephala albeola*
Hooded Merganser	Harle couronné	*Lophodytes cucullatus*
Common Merganser	Grand Harle	*Mergus merganser*
Red-breasted Merganser	Harle huppé	*Mergus serrator*

Appendix 2. Standardized method of calculating indicated pair (IP) from Black Duck Joint Venture helicopter survey in Eastern Canada.

Sighting Combination[1]				Number of Indicated Pairs (IP)					
				Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
M	F	U	T	Dabbler (except Black Duck)	American Black Duck	Diver (except Ring-necked Duck)	Ring-necked Duck	Canada Goose	Common Loon
1	0	0	1	1	1	1	1	1	1
0	1	0	1	0	1	0	0	1	1
0	0	1	1	0	1	0	0	1	1
2	0	0	2	2	1.5	2	2	1	1
1	1	0	2	1	1.5	1	1	1	1
1	0	1	2	1	1.5	1	1	1	1
0	2	0	2	0	1.5	0	0	1	1
0	1	1	2	0	1.5	0	0	1	1
0	0	2	2	0	1.5	0	0	1	1
3	0	0	3	3	3	3	3	1	0
2	1	0	3	2	3	2	2	1	0
2	0	1	3	2	3	2	2	1	0
1	2	0	3	1	3	1	1	1	0
1	1	1	3	1	3	1	1	1	0
1	0	2	3	1	3	1	1	1	0
0	3	0	3	0	3	0	0	1	0
0	2	1	3	0	3	0	0	1	0
0	1	2	3	0	3	0	0	1	0
0	0	3	3	0	3 (2)[2]	0	0	1	0
4	0	0	4	4	4	4	4	0	0
3	1	0	4	0	4	3	3	0	0
3	0	1	4	3	4	3	3	0	0
2	2	0	4	2	4	2	2	0	0
2	1	1	4	2	4	2	2	0	0
2	0	2	4	2	4	2	2	0	0
1	3	0	4	1	4	1	1	0	0
1	2	1	4	1	4	1	1	0	0
1	1	2	4	1	4	1	1	0	0
1	0	3	4	1	4	1	1	0	0
0	4	0	4	0	4	0	0	0	0
0	3	1	4	0	4	0	0	0	0
0	2	2	4	0	4	0	0	0	0
0	1	3	4	0	4	0	0	0	0
0	0	4	4	0	4	0	0	0	0
1	x	x	>4	0	0	0	1	0	0
2	x	x	>4	0	0	0	2	0	0
3	x	x	>4	0	0	0	3	0	0
4	x	x	>4	0	0	0	4	0	0
>4	x	x	>4	0	0	0	0	0	0

[1] M: male ; F: female ; U: unknown sex; T: total.

[2] Number in parenthesis is for Newfoundland data where different.

Canada

North American Waterfowl
Management Plan

Black Duck
Joint Venture