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Fourth and fifth tours of inspection of Quebec heronries, 1980–81

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Abstract

We counted the nests of 53 heronries in 1980 and 56 in 1981. More than three-quarters of the colonies visited have been included in previous inventories. In 1980, the number of occupied nests had increased in slightly over half of the heronries for which we already had data. The opposite occurred in 1981. As those fluctuations were generally small, we can conclude that, for the third and fourth consecutive years, the Great Blue Heron populations of Quebec remained relatively stable.

During these two years, Great Blue Heron nesting seems to have been normal in most heronries. The average number of young herons produced per successful brood in a colony was 2.3 ($S_{\bar{X}} = 0.1$) in 1980 and 2.4 ($S_{\bar{X}} = 0.1$) in 1981; the average number of young per occupied nest was approximately 2.2 ($S_{\bar{X}} = 0.1$) for both years.

Introduction

Inspection tours of Quebec heronries started in 1977 (DesGranges *et al.* 1979, DesGranges and Laporte 1981). Volunteers as well as professional ornithologists have participated in this joint effort co-ordinated by the Quebec office of the Canadian Wildlife Service (CWS). This study enables us to monitor the fluctuations in Great Blue Heron populations in Quebec. We hope in this way to detect possible changes attributable to pollution or changes in the environment, so as to take corrective measures in time.

This report concerns the changes occurring in Quebec heronries between 1979 and 1981.

Methods

The data collection methods and field sheets used have been described in a previous publication (DesGranges 1980). It will suffice to say here that the annual visit to the colonies took place during the last week in June or the first week in July. We usually inspect the heronries in the southwest of the province before those located further north.

Results

Highlights of the two tours

We visited 53 heronries in 1980 and 56 in 1981, about 15% fewer than in 1979 (Fig. 1, Tables 1 and 2). The approved method for inspection tours was followed at most heronries. The data collected at some colonies were incomplete; nevertheless, we are publishing them for information purposes. More than three-quarters of the heronries visited during the past two tours have been visited at least once since 1977, the first year of these tours of inspection.

As in 1979, the largest numbers of heronries visited were in the Outaouais region and the St. Lawrence estuary. In the latter case and along the North Shore, we continued our special effort to find and visit every colony. We hope thus to determine whether the losses noted in the colonies studied are really only moves to unvisited colonies, or whether the decline in numbers at some colonies means an actual decrease in population.

The fourth and fifth tours were carried out by 81 and 108 people respectively, compared with 76 in the third tour.

Additions to and deletions in the list of Quebec heronries

Since 1979, 35 heronries have been added to those already known in Quebec. The current total is 173 (DesGranges, in prep.). Five heronries that were sparsely populated in 1979 are now deserted. They are at Lac Robillard, Lac Clark, Glynn Lake, Île Villemomble, and Île Bouchard.

Population trends

In 1980, the number of occupied nests increased at slightly more than half of the heronries for which we already had data. The opposite took place in 1981. As these fluctuations were generally small, we can conclude that, between 1979 and 1981, Great Blue Heron populations in Quebec remained relatively stable (sign and Wilcoxon tests, $P > 0.05$).

The two most spectacular declines in 1980, at Pointe aux Outardes (66% fewer broods than in 1979) and Île du Chafaud aux Basques (−39%), were offset by remarkable increases in the number of broods in three colonies in this area, at Îlets Jérémie (43% more broods), Île Laval (+33%) and Île du Bic (+47%). Whereas the two declining colonies lost a total of 36 broods, the three growing colonies gained 51 new broods. Therefore, a large proportion of the new nesting pairs were probably former residents of the two declining colonies. Movements of birds between the various colonies in a region are probably quite frequent because, in spite of large fluctuations in the numbers of active nests in some heronries in the St. Lawrence estuary and on the North Shore, the total number of broods in this area has varied very little since 1979 (Table 3).

We did not visit enough colonies in other regions of Quebec in 2 consecutive years to allow us to discuss population fluctuations in those regions. However, we note that, for the province as a whole, the increase in numbers in many colonies offsets the losses in several places and provides a net gain for the survey over the 4 consecutive years (Table 3). From 1979 to 1980, and 1980 to 1981, the numbers of occupied nests increased by 9% and 4% for all the colonies visited during 2 consecutive years. The significance of these percentages should be treated with caution. Their numerical values should not

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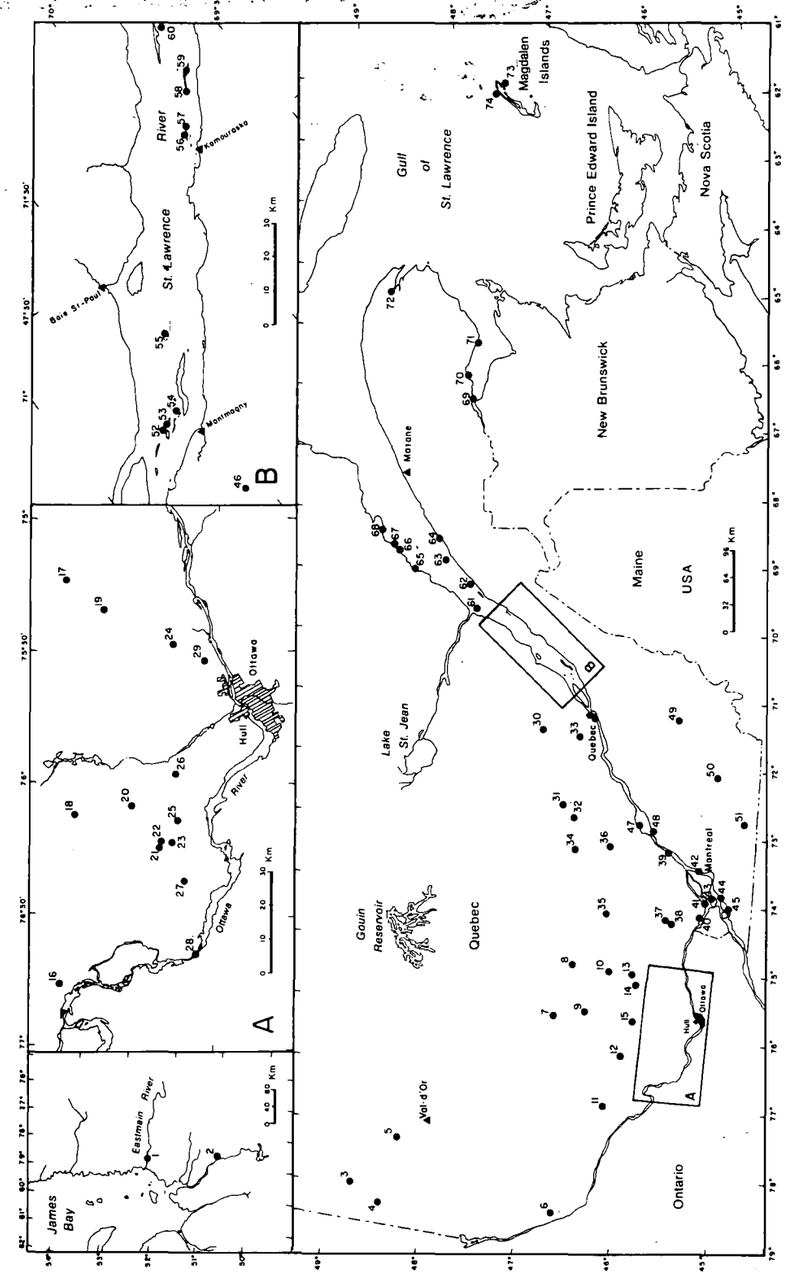

Figure 1
Southern Quebec region. Numbers indicate heronries visited in 1980 and 1981, as listed in Tables 1 and 2

be taken as complete but lead to the conclusion that the Great Blue Heron population of Quebec grew by that much in 1 year. At best they indicate that, allowing for our limited sampling, the Quebec population of this species may have increased between 1979 and 1981. The probable movements of pairs between colonies in the St.Lawrence estuary and on the North Shore call for such caution, as the same phenomenon may well have been taking place elsewhere in the province. Several new pairs could have come from declining heronries that were not surveyed, rather than being true additions to the nesting population in Quebec.

Statistics on nesting

In Tables 4 and 5, we present statistics on reproductive success in heronries for which our participants supplied mostly reliable data. Although the range of variation is fairly wide for each year, we can calculate an average number of 2.3 ($S_{\bar{X}} = 0.1$) for young herons produced per successful brood in a colony in 1980, 2.4 ($S_{\bar{X}} = 0.1$) in 1981. The average number of young herons produced per occupied nest in a colony would be about 2.2 ($S_{\bar{X}} = 0.1$) for the 2 years, which is greater than the 1.9 young per nest required, according to Henny (1972), to ensure stable populations of the Great Blue Herons breeding in northern North America. These populations as a whole produced a new generation large enough to ensure their stability, in the short term, if not an increase in Quebec populations of the species.

Egg condition

We did not make any analyses for contaminants during the fourth and fifth tours of inspection. On the other hand, we did collect eggshell fragments at 25 and 17 heronries in 1980 and 1981 respectively. Their average thicknesses, shown in Tables 1 and 2, fall between 0.285 and 0.438 mm, with averages of 0.381 mm for all colonies in 1980, and 0.360 in 1981. These annual values come close to those found in previous years.

The average thicknesses of eggshell fragments collected during the various tours of inspection seem quite uniform, considering the heteroscedasticity of the samples. By using a method of statistical analysis that takes into account both the unequal sizes of samples and some variations (Games and Howell 1976, Sokal and Rohlf 1981), we noted significant differences ($p > 0.01$) for the Lac Saint-Bernard heronry between 1978 and 1980, and for the Grande Île de Berthier heronry, where there had been significant differences among all years except 1978 and 1979.

These values are relatively uniform because of the various states of the samples measured. The fragments collected from the ground could have come from different parts of the shell, and from eggs at various stages of incubation. Because of the egg's shape, and sampling conditions that tend to eliminate fragments coming from the ends of the egg, the presence of different parts of the shell in the measured sample tells us relatively little about the variations observed within a heronry. However, the condition of the egg may be important, whether the eggshell fragments come from an infertile or fresh egg, or from a hatched egg. We can expect the calcareous part to become thinner during incubation (Kreitzer 1972).

Furthermore, although at the start of incubation, the internal shell membranes of an egg may have a relatively homogeneous structure, this becomes more complicated with the development of the chorioallantois, whose complex structure includes blood vessels (Hamilton 1952). The presence of these various dehydrated organic membranes decreases the accuracy of measurements of fragments and increases the variations in samples. Considering the reproductive results observed in most colonies, this type of fragment is likely to be the most abundant in our samples. This variation is relatively important as it masks the relationship between the concentration of DDE residues and the thickness of eggshells collected during the third tour of inspection (Laporte 1982).

To study the effect of contaminants on the calcareous part of the eggshell (Mueller and Leach 1974), it would be better to use only the thickness of the inorganic portion of these fragments. Methods are currently being tested to eliminate the internal organic membranes without affecting the calcareous part.

Causes of mortality

The collected data have enabled us to calculate both the percentage of successful broods and the average survival rate of young herons in 19 colonies visited in 1980, and 25 in 1981 (Tables 4 and 5). Of the 19 colonies, 15 (79%) did not seem to have suffered greatly from mortality in 1980, the survival of both broods and young herons being high. Only a few eggs and a few young disappeared, probably for a variety of reasons. The same situation prevailed in 22 (88%) of the 25 heronries in 1981.

At Lac Mer Bleue, Île du Chafaud aux Basques, Île aux Basques, and Île Saint-Barnabé in 1980, as well as at Île Carillon in 1981, we noted a mortality factor that substantially reduced the breeding performance of pairs. A food shortage may have led to this significant decline in the size of broods (DesGranges 1980). At Lac Marguerite in 1981, the percentage of successful broods was abnormally low. This lake had been very popular with fishermen during the nesting period (six boats per day) and people often visited the heronry (R. Alie, pers. commun.). These disturbances probably led to the desertion of several nests and the deaths of several young herons whose bodies ($n = 13$) were found on the ground.

A Great Blue Heron nest found at the mouth of the Eastmain River shows a remarkable extension of the nesting area of this species in Quebec. The eight eggs in the nest were being incubated for a good part of the summer. By early autumn, the eggs had disappeared (D. Bordage, pers. commun.). A female Great Blue Heron usually lays four or five eggs; this clutch could therefore have been laid by two females. The two herons who spent the summer in this part of the Eastmain River were perhaps females. It may be that they did not find a male to fertilize them and that they chose to lay their eggs in the same nest. These eggs would then have been infertile, which would explain of course why they never hatched in spite of a sufficiently long incubation.

Conclusion

Thanks to the co-operative efforts provided each summer since 1977 by participants in the tours of inspection, we were able to visit a large number of heronries and collect data on the population changes and reproductive success of the Great Blue Heron. After 5 years of study, we know much more about the locations and sizes of most heronries in Quebec. We also know that the populations are doing quite well, and that we have little to fear on their account, in the short term at least.

The heronries of southern Quebec have been thoroughly studied and we now have a basis for comparison in future surveys. We are therefore temporarily suspending the tours of inspection and will not be returning to the colonies until 1986, when the 10-year study will end unless we detect significant declines in populations or notable changes in their distribution at that time.

Acknowledgements

We extend sincere thanks to the many people who have helped in this project. The names of the team leaders who have participated in the tours are listed in footnotes to Tables 1 and 2. Rhéal Angers and Mario Laverdière of CWS have assisted in drafting this report, and we have discussed its contents with Charles Drolet and Iola M. Price, both of CWS.

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Table 1
Characteristics of heronries inspected in 1980

Colony	Position	Nests occupied[a] on previous inspection (pi) and year of count	Platforms on previous inspection (pi) and year of count	Nests occupied[a] in 1980	Platforms in 1980	% vacant nests pi/1980	% successful broods[b] pi/1980	Average survival of successful broods (no. young/nest)[b] pi/1980	Average thickness of shell fragments (10^{-3} cm)[c] pi/1980	Sources[d]
Northwestern Quebec										
3. Lac Macamic	48°49′N; 78°57′W	11(1979)	14(1979)	13	13	13	21/ 0	64/100	- / -	37.0(0.4)/36.7(1.0)[f]	4,17
4. Lac Duparquet	48°28′N; 79°17′W	24(1978)	26(1978)	36	40	40	8/ 10	-/ 94	- /2.3(0.2)[f]	35.8(0.1)/40.3(2.7)	3,20
5. Lac LaMotte	48°17′N; 78°08′W	- e	-	28	30	30	-/ 7	-/ 89	- /2.7(0.2)	- /39.5(1.0)	35
Outaouais										
7. Lac Marguerite	47°02′N; 75°48′W	39(1979)	44(1979)	78	79	79	11/ 1	97/ 92	2.0(0.2)/2.1(0.4)	34.2(0.7)/40.2(1.3)	4,5
9. Lac Yates	46°36′N; 75°47′W	-	?(1977)	6	8	8	-/ 25	-/100	- /2.5(0.5)	- / -	1,23
10. Lac Lacordaire	46°27′N; 75°11′W	?(1978)	?(1978)[g]	?	9	9	-/ -	-/ -	- / -	- / -	3,39
12. Lac Mer bleue	46°13′N; 76°18′W	-	12(1977)	3	6	6	-/ 50	-/100	- /1.5(0.5)	- / -	1,2,37
15. Pointe Comfort	46°06′N; 75°51′W	12(1979)	19(1979)[g]	14	24	24	37/ 42	67/ -	2.9(0.4)/ -	- / -	1,4,12
19. Lac Smallion	45°48′N; 75°21′W	-	-	1	1	1	-/ 0	-/ -	- / -	- / -	1,11
21. Glynn Lake	45°39′N; 76°15′W	3(1979)	12(1979)	0	9	9	75/100	-/ N/A	2.0(0.0)/ N/A	- / N/A	4,30
22. Compass Lake	45°39′N; 76°13′W	4(1979)	14(1979)	11	23	23	71/ 52	-/100	1.0(-)/2.0(0.4)	36.3(0.1)/ -	4,30
24. Prairie de Castor	45°37′N; 75°29′W	28(1979)	28(1979)	18	22	22	0/ 18	79/ 89	2.7(0.2)/3.0(0.2)	- / -	4,26
25. Powerline Lake	45°36′N; 76°07′W	10(1979)	12(1979)	14	15	15	17/ 7	-/100	2.5(-) /3.5(0.3)	- / -	4,30
26. Long Lake	45°36′N; 75°57′W	10(1979)	11(1979)[g]	18	18	18	9/ 0	-/100	2.5(-) /3.6(0.2)	- / -	1,4,30
27. Shawville	45°35′N; 76°22′W	-(1979)	2(1979)	6	6	6	-/ 0	-/0	- /2.5(0.2)	- / -	7
28. Île Reid	45°34′N; 76°37′W	-	-	12	12	12	-/ 0	-/100	- / -	- / -	13
29. Îles Kennedy	45°33′N; 75°32′W	?(1974)	5(1974)	9	10	10	-/ 10	-/100	- / -	- / -	1,2,13
Laurentians										
30. Petit lac Jacques-Cartier	47°24′N; 71°30′W	?(1979)	21(1979)	?	20	20	-/ -	-/ -	- / -	- / -	4,15
32. Lac Caribou	46°56′N; 72°50′W	?(1977)	15(1977)	27	28	28	-/ 4	-/ 93	- / -	- /39.5(1.3)	2,14,15
33. Sainte-Catherine	46°52′N; 71°36′W	8(1979)	13(1979)	11	13	13	31/ 15	100/ 73	- / -	- / -	4,9,15
34. Lac Verso	46°48′N; 73°26′W	3(1976)	3(1976)	-	2	2	0/ -	-/ -	- / -	- / -	8
36. Lac Saint-Bernard	46°32′N; 73°18′W	27(1979)	31(1979)	26	28	28	13/ 7	85/ 88	2.2(0.2)/2.1(0.2)	33.9(0.7)/31.3(0.7)	4,10
Southwestern Quebec										
39. Île Bouchard	45°49′N; 73°19′W	?(1979)	7(1979)	0	2	2	-/100	-/N/A	- / N/A	- / N/A	4,36
41. Baie d'Oka	45°28′N; 74°03′W	?(1979)	39(1979)	14	23	23	-/ 39	-/ 43	2.7(0.2)/1.5(0.2)	- / -	4,21
42. Île aux Hérons	45°28′N; 73°35′W	31(1979)	40(1979)	35	41	41	23/ 15	81/ 97	2.0(0.2)/3.0(0.2)	30.8(0.6)/37.1(1.2)	4,28
44. Île Saint-Bernard	45°24′N; 73°46′W	47(1979)	57(1979)	53	61	61	18/ 13	87/ 94	- /2.2(0.2)	- /31.7(-)	4,22
45. Île Villemomble	45°17′N; 74°03′W	15(1979)	15(1979)	?	4	4	0/ -	53/ -	1.0(-)/ -	37.1(0.6)/ -	4,24,36
Eastern Townships										
47. Bois du Boulé	46°15′N; 72°53′W	81(1979)	87(1979)	76	82	82	7/ 7	90/ 97	- /0.3(0.4)	32.8(0.2)/38.4(0.5)	4,29
48. Grande Île de Berthier	46°06′N; 72°57′W	237(1979)	316(1979)	302	334	334	25/ 10	77/ 84	- / -	36.0(0.6)/41.1(0.8)	4,36
50. Mont Chauve	45°22′N; 72°10′W	8(1979)	8(1979)	5	5	5	0/ 0	100/100	3.3(0.3)/2.8(0.4)	34.8(0.4)/39.7(-)	4,19
51. Cowansville	45°11′N; 72°44′W	19(1979)	21(1979)	26	26	26	10/ 0	95/ 96	1.8(0.4)/2.7(0.2)	36.6(0.3)/32.3(-)	4,31,38

(cont'd)

Table 1 (*cont'd*)
Characteristics of heronries inspected in 1980

Colony	Position	Nests occupied[a] on previous inspection (pi) and year of count	Platforms on previous inspection (pi) and year of count	Nests occupied[a] in 1980	Platforms in 1980	% vacant nests pi/1980	% successful broods[b] pi/1980	Average survival of successful broods (no. young/nest)[b] pi/1980	Average thickness of shell fragments (10^{-3}cm)[c] pi/1980	Sources[d]
Estuary										
52. Île Brothers	47°02′N; 70°40′W	0(1979)	0(1979)	1	1	–/ 0	–/0	– /3.2	– / –	4,15
53. Île à Deux Têtes	47°04′N; 70°37′W	11(1979)	33(1979)	~8[h]	9	67/ ~9	100/ –	2.0(0.3)/2.6(0.3)	34.6(0.7)/ –	4,15
54. Île à la Corneille	47°05′N; 70°35′W	3(1979)	4(1979)	~10	12	25/ ~8	100/ –	2.7(0.3)/2.4(0.3)	– / –	4,15
55. Battures aux Loups Marins	47°14′N; 70°25′W	12(1979)	12(1979)	~7	9	0/~27	82/ –	3.3(0.3)/3.0(0.3)	36.3(0.3)/ –	4,15
56. Île Brûlée	47°37′N; 69°52′W	16(1979)	18(1979)	15	15	11/ 0	69/80	2.1(0.2)/2.6(0.4)	– /41.8(1.1)	4,15,41
57. Grande Île de Kamouraska	47°38′N; 69°51′W	35(1979)	38(1979)	37	42	8/ 12	77/ 95	2.6(0.2)/2.0(0.1)	34.7(0.9)/42.0(2.8)	4,6,15
58. Île le Petit Pèlerin	47°42′N; 69°46′W	0(1979)	0(1979)	3	3	N/A/ 0	N/A/ –	N/A / –	N/A / –	4,27
59. Île le Gros Pèlerin	47°44′N; 69°41′W	12(1979)	72(1979)	10	24	83/ 58	100/100	2.5(0.3)/2.6(0.4)	34.5(0.5)/38.9(0.1)	4,15,34
60. Île du Pot à l'Eau-de-Vie	47°52′N; 69°41′W	30(1979)	30(1979)	~37	39	0/ ~5	97/ –	2.3(0.2)/1.7(0.2)	36.1(0.8)/43.0(1.6)	4,6,15
61. Île du Chafaud aux Basques	48°02′N; 69°41′W	44(1979)	46(1979)	27	28	4/ 4	91/100	2.7(0.2)/1.9(0.1)	39.4(0.4)/41.1(0.9)	4,6,15
62. Île aux Basques	48°08′N; 69°15′W	23(1979)	34(1979)	20	23	26/ 13	61/ 80	3.1(0.6)/1.8(0.2)	36.4(0.4)/40.0(3.4)	4,15,25
63. Île du Bic	48°24′N; 68°52′W	24(1979)	35(1979)	45	49	31 / 8	75/ 89	3.3(0.3)/2.0(0.1)	34.1(0.3)/34.8(2.1)	4,15,33
64. Île Saint-Barnabé	48°26′N; 68°37′W	71(1979)	73(1979)	74	91	3/ 19	89/ 77	2.4(0.1)/1.6(0.1)	33.7(0.7)/37.6(1.3)	4,6,15
North Shore										
65. Île Laval	48°45′N; 69°02′W	20(1979)	21(1979)	30	33	5/ 9	95/87	3.4(0.2)/2.9(0.4)	32.8(0.4)/36.4(1.1)	4,15,32
66. Îlets Jérémie	48°53′N; 68°44′W	27(1979)	30(1979)	~47	61	10/~23	–/ –	3.3(0.2)/2.8(0.2)	35.5(0.4)/ –	4,15
67. Pointe à Michel	48°54′N; 68°40′W	0(1979)	0(1979)	~5	6	N/A/~25	N/A/ –	N/A /3.3(0.7)	N/A / –	4,15
68. Pointe aux Outardes	49°03′N; 68°26′W	44(1979)	72(1979)	~15	49	39/~70	61/ –	1.7(0.6)/2.8(0.3)	35.7(0.5)/37.0(2.3)	4,15
Gaspé										
69. Miguasha	48°04′N; 66°14′W	53(1979)	58(1979)	54	66	9/ 18	98/ 86	1.6(0.1)/ –	40.0(0.4)/41.0(2.3)	4,40
70. Maria	48°13′N; 65°58′W	59(1979)	83(1979)	42	52	29/ 19	93/ 95	2.7(0.1)/2.1(0.3)	32.7(0.6)/36.0(–)	4,40
71. Bonaventure	48°18′N; 64°42′W	28(1979)	31(1979)	15	20	11/ 25	82/100	2.4(0.4)/2.1(0.4)	36.8(0.3)/36.0(0.5)	4,40
Magdalen Islands										
73. Île aux Loups Marins	47°38′N; 61°29′W	17(1979)	17(1979)	14	15	0/ 7	35/ 93	2.3(1.0)/3.1(0.3)	– / –	4,18
74. Grosse Île	47°37′N; 61°31′W	31(1979)	31(1979)	26	31	0/ 16	77/ 96	2.2(–) /2.8(0.2)	– / –	4,18

[a] A nest is considered occupied if there is no doubt it was used by a pair during the nesting season, even if no egg was laid or no young were produced.
[b] A brood is considered successful if at least one young heron is alive in the nest less than 10 days before the first young herons leave the colony.
[c] These measurements are of fragments from all parts of the eggshells collected (not necessarily of fragments from the belt area, as in conventional measurements).
[d] The following sources are listed in the References: (1) Chabot 1981, (2) DesGranges 1978, (3) DesGranges and Laporte 1979, (4) DesGranges and Laporte 1981. The following sources are personal communications: (5) R. Alie, (6) R. Angers, (7) T. Aniskowicz, (8) J. Benoit, (9) J. Boivin (10) D. Bordeleau, (11) M. Bourgon, (12) L. Breton, (13) J. Chabot, (14) C. Côté, (15) J.-L. DesGranges, (16) G. Desjardins, (17) F. Deslongchamps, (18) P. Drapeau, (19) J.-J. Dubois, (20) J.-Y. Gagnon, (21) M. Gélinas, (22) C. Grohe, (23) J. Lamarche, (24) G. Larivée, (25) J. Larivée, (26) G. Lauzon, (27) J.-P. Lebel, (28) P. Lessard, (29) Y. Mailhot, (30) L. Miller, (31) R. Morel, (32) A. Pelletier (Forestville), (33) A. Pelletier (Rimouski), (34) Y. Roy, (35) L. Saillant, (36) L.-M. Soyez, (37) D. St-Hilaire, (38) H. Surprenant, (39) M. Suprenant, (40) R. Tardif, (41) Y. Turcotte.
[e] A dash indicates no data available. A question mark indicates that the heronry was active, but with the number of occupied nests unknown.
[f] Standard deviation of the mean.
[g] This is a revised figure; it replaces the value which was published for a previous tour.
[h] Some colonies were visited only by helicopter. Since, under such conditions, we could not distinguish vacant nests from those that were used earlier in the summer, we use a ~ to show the data, which are only approximate.

Table 2
Characteristics of heronries inspected in 1981

Colony	Position	Nests occupied[a] on previous inspection (pi) and year of count	Platforms on previous inspection (pi) and year of count	Nests occupied[a] in 1981	Platforms in 1981	% vacant nests pi/1981	% successful broods[b] pi/1981	Average survival of successful broods (no. young/nest)[b] pi/1981	Average thickness of shell fragments (10^{-3}cm)[c] pi/1981	Sources[d]
Northwestern Quebec										
1. Rivière Eastmain	52°14′N; 78°12′W	– [e]	–	1	1	–/ 0	–/ 0	– / 0	– / –	9
2. Lac Désorsons	50°48′N; 77°40′W	–	–	7	7	–/ 0	–/ –	– / –	– / –	29
3. Lac Macamic	48°49′N; 78°57′W	13(1980)	13(1980)	14	14	0/ 0	–/100	– / –	36.7(1.0)/33.9(0.8)[f]	17
4. Lac Duparquet	48°28′N; 79°17′W	36(1980)	40(1980)	30	33	10/ 9	94/ 90	2.3(0.2)/2.4(0.2)	40.3(2.7)/ –	25
5. Lac LaMotte	48°17′N; 78°08′W	28(1980)	30(1980)	19	22	7/ 14	89/ 84	2.7(0.2)/2.9(0.4)	39.5(1.0)/37.1(1.0)	37
6. Lac Beauchêne	46°39′N; 78°52′W	–	–	10	10	–/ 0	–/ –	– / –	– / –	21
Outaouais										
7. Lac Marguerite	46°57′N; 75°48′W	78(1980)	79(1980)	56	69	1/ 19	92/ 63	2.1(0.4)/1.7(0.2)	40.2(1.3)/39.1(0.4)	4
8. Lac Jean	46°41′N; 75°08′W	–	–	?	3	–/ –	–/ –	– / –	– / –	1,20
11. Lac Acob	46°18′N; 77°19′W	–	–	–	7	–/ –	–/ –	– / –	– / –	1,32
13. Lac Robillard	46°10′N; 75°07′W	14(1979)	19(1979)	0	20	38/100	100/ N/A	3.0(0.0)/ N/A	2.3(0.3)/ N/A	1,2,13
14. Lac du Sourd	46°09′N; 75°17′W	2(1979)[g]	3(1979)[g]	–	4	33/ –	50/ –	– / –	– / –	11
16. Lac Angus Roy	45°55′N; 76°46′W	–	–	10	14	–/ 29	–/100	– /3.4(0.2)	– / –	16
17. Lac Clark	45°54′N; 75°14′W	5(1979)	10(1979)	0	2	50/100	–/ N/A	– / N/A	– / N/A	2,11
18. Lac Bohême	45°53′N; 76°08′W	–	20(1977)	6	12	–/ 50	–/ 83	– /3.2(0.2)	– / –	1,39
20. Ruisseau Motherwell	45°44′N; 76°05′W	–	30(1974)	17	20	–/ 15	–/ 88	– /2.5(0.3)	– / –	1,3,18
23. Lac Curley	45°37′N; 76°13′W	–	–	24	26	–/ 18	–/100	– /2.9(0.1)	– / –	3,18
24. Prairie de Castor	45°37′N; 75°29′W	18(1980)	22(1980)	14	20	18/ 30	89/ 86	3.0(0.2)/2.7(0.2)	– / –	3,26,18
25. Powerline Lake	45°36′N; 76°07′W	14(1980)	15(1980)	15	17	7/ 12	100/100	3.5(0.3)/2.8(0.3)	– / –	3,18
26. Long Lake	45°36′N; 75°57′W	18(1980)	18(1980)	15	20	0/ 25	100/100	3.6(0.2)/2.7(0.2)	– / –	3,18
27. Shawville	45°35′N; 76°22′W	6(1980)	6(1980)	17	18	0/ 6	100/100	2.5(0.2)/2.8(0.2)	– / –	5
28. Île Reid	45°33′N; 76°38′W	12(1980)	12(1980)	18	20	0/ 10	100/ 94	– /2.3(0.2)	– / –	3,18
Laurentian										
30. Petit lac Jacques-Cartier	47°24′N; 71°30′W	?	20(1980)	17	20	–/ 15	–/ 94	– /2.6(0.2)	– / –	22
31. Lac Mékinac	47°03′N; 72°40′W	–	–	2	2	–/ 0	–/100	– / –	– / –	15
32. Lac Caribou	46°56′N; 72°50′W	27(1980)	28(1980)	13	21	4/ 38	93/ –	– / –	39.5(1.3)/38.5(1.9)	15
33. Sainte-Catherine	46°52′N; 71°36′W	11(1980)	13(1980)	4	5	15/ 20	73/ –	– / –	– / –	8
34. Lac Verso	46°48′N; 73°26′W	–	2(1980)	0	1	–/100	–/ –	– / –	– / –	7
35. Lac Tinkler	46°33′N; 74°21′W	–	–	?	10	–/ –	–/ –	– / –	– / –	35
36. Lac Saint-Bernard	46°32′N; 73°18′W	26(1980)	28(1980)	17	20	7/ 15	88/ 94	2.1(0.2)/2.7(0.2)	31.3(0.7)/41.0(–)	10
37. Lac Dye	45°51′N; 74°19′W	5(1979)	8(1979)	7	11	38/ 36	100/ 86	2.2(0.2)/3.2(0.5)	– / –	2,24
38. Lac de la Montagne	45°50′N; 74°20′W	–	–	–	5	–/ –	–/ –	– / –	– / –	24
Southwestern Quebec										
40. Île Carillon	45°31′N; 74°17′W	149(1979)	152(1979)	108	141	2/ 23	69/ 97	– /1.8(0.1)	35.1(0.4)/ –	2,12
41. Baie d'Oka	45°28′N; 74°03′W	14(1980)	23(1980)	14	19	39/ 26	43/ 75	1.5(0.2)/ –	– / –	2
42. Île aux Hérons	45°28′N; 73°35′W	35(1980)	41(1980)	30	33	15/ 9	97/100	3.0(0.2)/2.0(0.2)	37.1(1.2)/32.9(0.2)	28
43. Île Dowker	45°24′N; 73°54′W	–	–	22	23	–/ 4	–/ 77	– /2.3(0.3)	– /40.5(0.6)	31
44. Île Saint-Bernard	45°24′N; 73°46′W	53(1980)	61(1980)	93	102	13/ 9	94/ 89	2.2(0.2)/ –	31.7(–)/34.6(0.4)	38
45. Île Villemomble	45°17′N; 74°03′W	?(1980)	4(1980)	0	0	–/ N/A	–/ N/A	– / N/A	– / N/A	31

(cont'd)

Table 2 (*cont'd*)
Characteristics of heronries inspected in 1981

Colony	Position	Nests occupied[a] on previous inspection (pi) and year of count	Platforms on previous inspection (pi) and year of count	Nests occupied[a] in 1981	Platforms in 1981	% vacant nests pi/1981	% successful broods[b] pi/1981	Average survival of successful broods (no. young/nest)[b] pi/1981	Average thickness of shell fragments (10^{-3}cm)[c] pi/1981	Sources[d]
Eastern Townships										
46. Lac aux Castors	46°48'N; 70°34'W	12(1979)	14(1979)	10	10	14/ 0	75/100	- /2.3(0.6)	- / -	2,40
48. Grande Île de Berthier	46°06'N; 72°57'W	302(1980)	334(1980)	316	352	10/ 10	84/ 79	- / -	41.1(0.8)/28.5(0.4)	38
49. Lac des Ours	45°51'N; 71°11'W	-	-	-	25	-/ -	-/ -	- / -	- / -	34
50. Mont Chauve	45°22'N; 72°10'W	5(1980)	5(1980)	10	10	0/ 0	100/100	2.8(0.4)/1.9(0.3)	39.7(-)/ -	19
51. Cowansville	45°11'N; 72°44'W	26(1980)	26(1980)	25	26	0/ 4	96/ 52	2.7(0.2)/3.1(0.3)	32.3(-)/ -	41
Estuary										
52. Île Brothers	47°02'N; 70°40'W	1(1980)	1(1980)	1	1	0/ 0	100/ 0	3.0 / N/A	- / -	23
53. Île à Deux Têtes	47°04'N; 70°37'W	~8(1980)[h]	9(1980)	4	6	~9/ 33	-/ 0	2.6(0.3)/ N/A	- / -	23
54. Île à la Corneille	47°05'N; 70°35'W	~10(1980)	12(1980)	10	10	~8/ 0	-/ 50	2.4(0.3)/1.8(0.5)	- /32.0(1.0)	23
55. Battures aux Loups Marins	47°14'N; 70°25'W	~7(1980)	9(1980)	8	8	~27/ 0	-/ 50	3.0(0.3)/2.0(0.4)	- / -	23
56. Île Brûlée	47°37'N; 69°52'W	15(1980)	15(1980)	18	19	0/ 5	80/ 94	2.6(0.4)/2.5(0.4)	41.8(1.1)/ -	30
57. Grande Île de Kamouraska	47°38'N; 69°51'W	37(1980)	42(1980)	15	15	12/ 0	95/ 93	2.0(0.1)/2.0(0.6)	42.0(2.8)/ -	6
58. Île le Petit Pèlerin	47°42'N; 69°46'W	3(1980)	3(1980)	7	7	0/ 0	-/100	- /3.4(0.3)	- / -	23
59. Île le Gros Pèlerin	47°44'N; 69°41'W	10(1980)	24(1980)	4	10	58/ 60	100/100	2.6(0.4)/2.5(0.5)	38.9(0.1)/ -	36
61. Île du Chafaud aux Basques	48°02'N; 69°41'W	27(1990)	28(1980)	45	45	4/ 0	100/ 91	1.9(0.1)/2.5(0.2)	41.1(0.9)/41.6(0.1)	23
62. Île aux Basques	48°08'N; 69°15'W	20(1980)	23(1980)	25	28	13/ 18	80/ 92	1.8(0.2)/2.2(0.3)	40.0(3.4)/43.4(0.7)	25
North Shore										
65. Île Laval	48°45'N; 69°02'W	30(1980)	33(1980)	42	46	9/ 9	87/ 76	2.9(0.4)/2.4(0.3)	36.4(1.1)/35.1(0.5)	33
68. Pointe aux Outardes	49°03'N; 68°26'W	~15(1980)	49(1980)	4	18	~70/78	-/ 50	2.8(0.3)/ -	37.0(2.3)/ -	27
Gaspé										
70. Maria	48°13'N; 65°58'W	42(1980)	52(1980)	92	104	19/ 12	95/ 91	2.1(0.3)/2.0(0.2)	36.0(-)/37.5(0.5)	42
71. Bonaventure	48°18'N; 64°42'W	15(1980)	20(1980)	11	19	25/ 42	100/ -	2.1(0.4)/ -	36.0(-)/41.3(0.2)	42
72. Rivière York	48°48'N; 64°31'W	-	-	12	14	-/ 14	-/ 83	- /2.4(0.3)	- /35.0(0.2)	14

[a] A nest is considered occupied if there is no doubt it was used by a pair during the nesting season, even if no egg was laid or no young were produced.

[b] A brood is considered successful if at least one young heron is alive in the nest less than 10 days before the first young herons leave the colony.

[c] These measurements are of fragments from all parts of the eggshells collected (not necessarily of fragments from the belt area, as in conventional measurements).

[d] 1980 data sources are listed in Table 1. Other sources are listed in the References: (1) Chabot 1981, (2) DesGranges and Laporte 1981, (3) Drapeau 1981, or are personal communications from: (4) R. Alie, (5) B.T. Aniskowicz, (6) C. Banville, (7) J. Benoit, (8) B. Bergeron, (9) D. Bordage, (10) D. Bordeleau, (11) L. Breton, (12) D. Carrière, (13) J. Chabot, (14) L. Collin, (15) C. Côté, (16) G. Desjardins, (17) F. Deslongchamps, (18) P. Drapeau, (19) J.-J. Dubois, (20) R. Dubois, (21) J. Fink, (22) C. Fortin, (23) M. Frenette, (24) H. Gouin, (25) P. Laporte, (26) G. Lauzon, (27) F. Leduc, (28) P. Lessard, (29) M. Letendre, (30) A. Morin, (31) P. Mousseau, (32) R. Pariseau, (33) A. Pelletier, (34) S. Poulin, (35) M. Renaud, (36) Y. Roy, (37) L. Saillant, (38) L.-M. Soyez, (39) D. St-Hilaire, (40) S. St-Onge, (41) H. Surprenant, (42) R. Tardif.

[e] A dash indicates no data available. A question mark indicates that the heronry was active, but with the number of occupied nests unknown.

[f] Standard deviation of the mean.

[g] This is a revised figure; it replaces the value which was published for a previous tour.

[h] Some colonies were visited only by helicopter. Since, under these conditions, we could not distinguish vacant nests from nests that were used earlier in the summer, we use a ~ to show the data, which are only approximate.

Table 3
Comparative number of occupied nests in colonies inspected in two consecutive years

Region	Years	Colonies inspected in each year*	Occupied nests 1st year	Occupied nests 2nd year	Change (%) 1977–78	1978–79	1979–80	1980–81
Northwestern Quebec	1979–80	1	11	13			+ 18	
	1980–81	3	77	63				− 18
Outaouais	1977–78	3	44	23	− 48			
	1978–79	6	54	80		+ 48		
	1979–80	7	106	143			+ 35	
	1980–81	6	146	134		—		− 8
Laurentian	1977–78	1	35	29	− 11			
	1978–79	3	75	119		+ 59		
	1979–80	2	35	37			+ 6	
	1980–81	3	64	34				− 31
Southwestern Quebec	1977–78	1	50	50	0			
	1978–79	0	—	—		—		
	1979–80	2	62	72			+ 16	
	1980–81	3	102	137				+ 34
Eastern Townships	1977–78	2	70	166	+ 137			
	1978–79	2	166	259		+ 56		
	1979–80	4	345	409			+ 19	
	1980–81	3	333	351				± 5
Estuary	1977–78	4	74	53	− 28			
	1978–79	5	68	77		+ 13		
	1979–80	13	281	294			+ 5	
	1980–81	10	138	137				− 1
North Shore	1978–79	1	47	44		− 6		
	1979–80	4	91	97			+ 7	
	1980–81	2	45	46				+ 2
Gaspé	1977–78	3	83	105	+ 27			
	1978–79	2	105	84		− 20		
	1979–80	3	140	111			− 21	
	1980–81	2	57	103				+ 81
Magdalen Islands	1977–78	1	24	16	− 33			
	1978–79	1	16	17		+ 6		
	1979–80	2	48	40			− 17	
Total	1977–78	15	380	442	+ 16			
	1978–79	20	531	680		+ 28		
	1979–80	38	1119	1216			+ 9	
	1980–81	32	962	1005				+ 4

* This figure includes only those heronries for which such data are available.

Table 4
Reproductive success in several Quebec heronries in 1980

Colony*	Hatched clutches	Successful broods† (%)	Av. survival successful broods (young/nest)	Av. survival hatched clutches (young/nest)	Platforms not used in 1980 (%)
Lac Duparquet	36	94	2.3	2.2	10
Lac LaMotte	28	89	2.7	2.4	7
Lac Mer bleue	3	100	1.5	1.5	50
Prairie de Castor	18	89	3.0	2.7	18
Shawville	6	100	2.5	2.5	0
Lac Saint-Bernard	26	88	2.1	1.9	7
Île aux Hérons	35	97	3.0	2.9	15
Île Saint-Bernard	53	94	2.2	2.1	13
Mont Chauve	5	100	2.8	2.8	0
Grande Île de Kamouraska	37	95	2.0	1.9	12
Île le Gros Pèlerin	10	100	2.6	2.6	58
Île du Chafaud aux Basques	27	100	1.9	1.9	4
Île aux Basques	20	80	1.8	1.4	13
Île du Bic	45	89	2.0	1.8	8
Île Saint-Barnabé	74	77	1.6	1.2	19
Maria	42	95	2.1	2.0	19
Bonaventure	15	100	2.1	2.1	25
Île aux Loups Marins	14	93	3.1	2.9	7
Grosse Île	26	96	2.8	2.7	16

* This list comprises colonies for which participants supplied mostly reliable data.
† A brood is considered successful if at least one young heron is alive in the nest less than 10 days before the first young herons leave the colony.

Table 5
Reproductive success in several Quebec heronries in 1981

Colony*	Hatched clutches	Successful broods† (%)	Av. survival successful broods (young/nest)	Av. survival hatched clutches (young/nest)	Platforms not used in 1981 (%)
Rivière Eastmain	1	0	0.0	0.0	0
Lac Duparquet	30	90	2.4	2.2	9
Lac LaMotte	19	84	2.9	2.4	14
Lac Marguerite	56	63	1.7	1.1	19
Lac Angus Roy	10	100	3.4	3.4	29
Lac Bohême	6	83	3.2	2.7	50
Ruisseau Motherwell	17	88	2.5	2.2	15
Lac Curley	24	100	2.9	2.9	8
Long Lake	15	100	2.7	2.7	25
Prairie de Castor	14	86	2.7	2.3	30
Powerline Lake	15	100	2.8	2.8	12
Shawville	17	100	2.8	2.8	6
Île Reid	18	94	2.3	2.2	10
Petit lac Jacques-Cartier	17	94	2.6	2.4	15
Lac Saint-Bernard	17	94	2.7	2.5	15
Lac Dye	7	86	3.2	2.8	36
Île Carillon	108	97	1.8	1.7	23
Île aux Hérons	30	100	2.0	2.0	9
Lac aux Castors	10	100	2.3	2.3	0
Île Brûlée	18	94	2.5	2.4	5
Grande Île de Kamouraska	15	93	2.0	1.9	0
Île le Gros Pèlerin	4	100	2.5	2.5	60
Île du Chafaud aux Basques	45	91	2.5	2.3	0
Île Laval	42	76	2.4	1.8	9
Rivière York	12	83	2.4	2.0	14

* This list comprises colonies for which participants supplied mostly reliable data.
† A brood is considered successful if at least one young heron is alive in the nest less than 10 days before the first young herons leave the colony.