

## CANADIAN WATERFOWL MANAGEMENT PLAN - QUEBEC

## 1. BREEDING POPULATIONS

The tundra of northern Ungava, vast expanses of boreal forest, rich fresh-water marshes of southwestern Quebec and the seacoasts of the east, all exhibit waterfowl breeding populations of distinctly different densities and species composition. In order to establish the size of Quebec's breeding populations, an approach more complex than that applied in the Atlantic provinces is required because of the vastness of the area and the diversity of its avifauna.

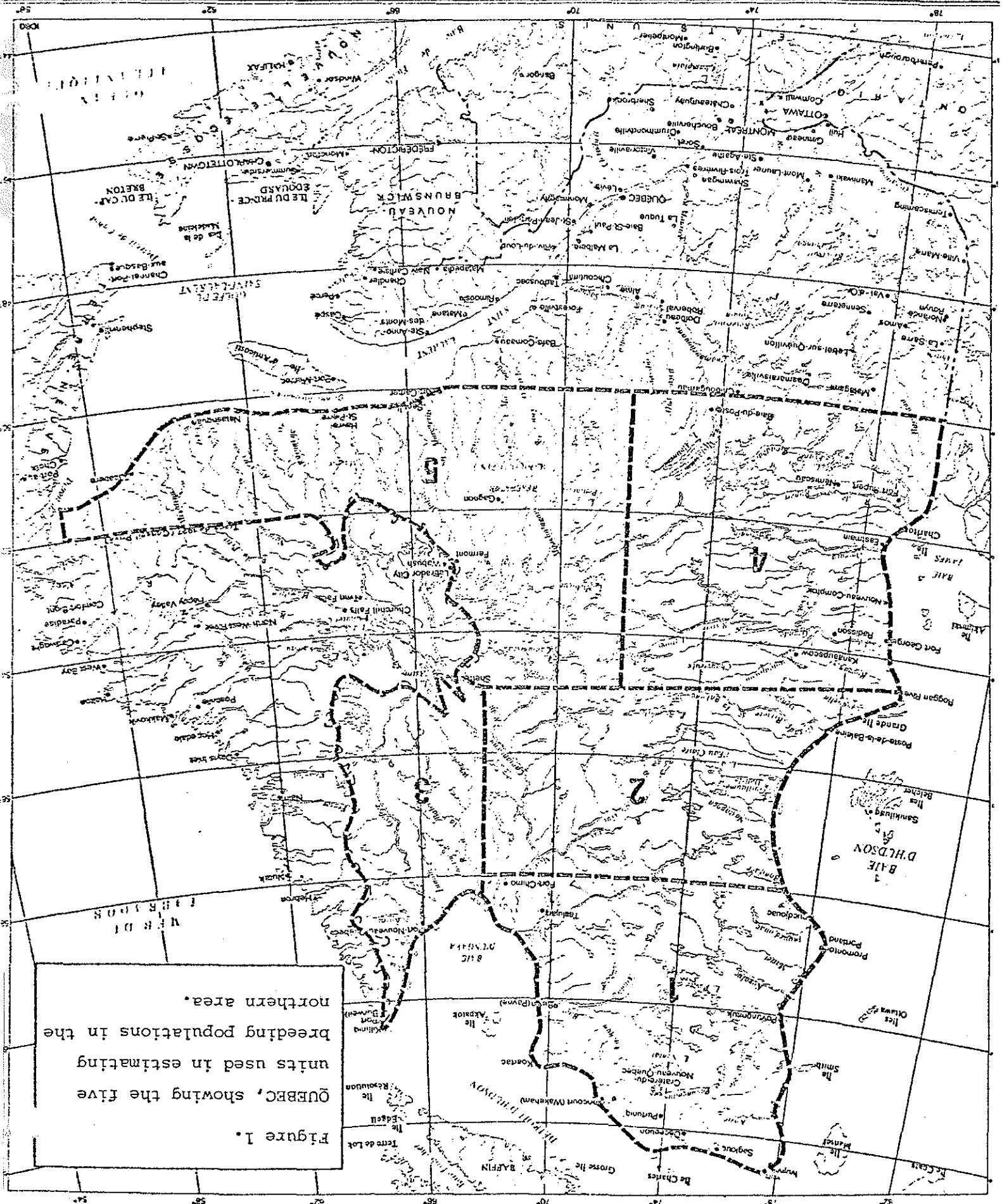
## 1.a Northern area

For the northern part of the Province (North of 50°), I have established five units which are believed to represent areas of different densities and/or species composition of breeding ducks and geese. These units were determined on the basis of the cumulative knowledge of the CWS Quebec Region personnel and their contacts, as well as from various sources in the literature (eg: Addy and Heyland 1968, Eco Recherches Ltée 1977, Eklund and Cool 1949, Gillespie and Wetmore 1974, Hydro-Québec 1976, Stewart 1968, etc., and various CWS internal reports). The size of the breeding populations in each unit were computed by multiplying the density of each species or groups of species by the surface area of that unit (Figure 1, Table 1). Those evaluations did not account for the coastal nesting Common Eider which is particularly abundant in Ungava Bay; my estimation for that species was based on an earlier survey by Cooch (1954).

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CARTE DU QUÉBEC

Figure 1.  
 QUÉBEC, showing the five  
 units used in estimating  
 breeding populations in the  
 northern area.



### 1.b Southern area

Since most of the southern portion of the Province (South of 50°) was covered by the Canada Land Inventory, I have been able to base my estimates of the breeding populations on the waterfowl classification maps. That area encompasses all or part of 33 map sheets (1:250,000), of which 24 sheets were covered by CLI and available for detailed analysis (see Figure 1).

Although a large number of waterfowl breeding studies have been conducted in southern Quebec (see Figure 2), few provided information on breeding densities. In examining densities of ducks for specific capability classes in Quebec (mainly my personal unpublished data and internal CWS reports), I obtained density values similar to those used by Erskine in his 2nd draft; in the following analyses, I have therefore used the same values as shown in his Table 2. The estimation of the total duck breeding populations was therefore quite straightforward but the breakdown of that total by species or groups of species was complicated by considerable variation in species composition both between and within map sheets. For example, there is an important gradient in the relative abundance of Black Ducks and Mallards across an east-west axis with the latter species being virtually absent in the east while representing 1/3 or more of the combined population in the west. Also, several map sheets contained large areas of both boreal forest and St. Lawrence valley marshland; as these two habitat types support breeding populations of distinctly different composition, it would have been inappropriate to apply a single extrapolation factor for each species even within a single map sheet.

Table 1. Estimated numbers of pairs of breeding waterfowl  
in Northern Quebec

SPECIES	1. Ungava Penin. (215) <sup>1</sup>	2. Hudson Bay (177)	3. Ungava Bay (101)	4. James Bay (228)	5. Caniapiscau & N. Shore (329)	TOTAL
Black Duck	-	8850 (.05) <sup>2</sup>	15150 (.15)	22800 (.1)	16450 (.05)	63250
Other dabblers *	-	1770 (.01)	1010 (.01)	2280 (.01)	3290 (.01)	8350
Mergansers **	21500 (.1)	17700 (.1)	2525 (.025)	22800 (.1)	8225 (.025)	72750
Scoters ***	53750 (.25)	8850 (.05)	5050 (.05)	-	-	67650
Other diving ducks ****	81700 (.38)	885 (.005)	505 (.005)	22800 (.1)	16450 (.05)	136500
Canada Geese	161250 (.75)	88500 (.5)	25250 (.25)	57000 (.25)	82250 (.25)	414250
						762760

<sup>1</sup> Surface area of unit in  $10^3 \text{ km}^2$

<sup>2</sup> Density of breeding pairs per  $\text{km}^2$

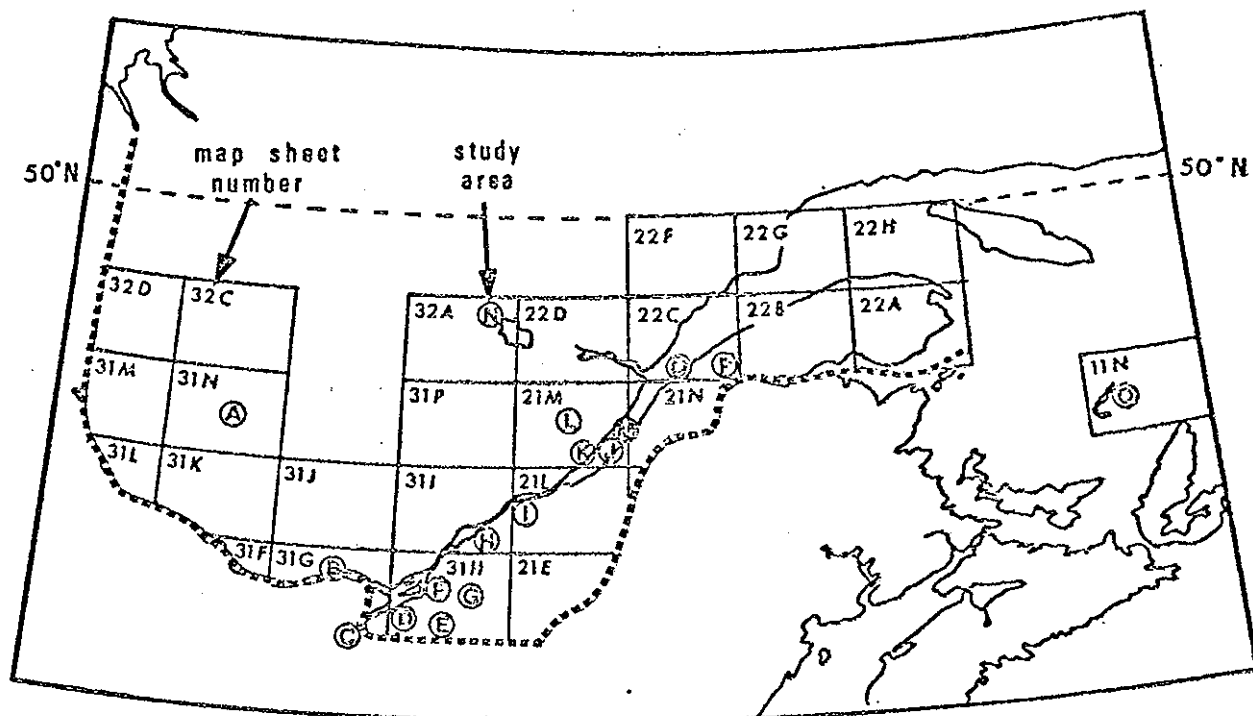
\* Includes mainly Green-winged Teal, Pintail, Mallard

\*\* Includes Common and Red-breasted Mergansers

\*\*\* Includes Common and Surf Scoters

\*\*\*\* Includes Oldsquaw, Common Goldeneye, Greater and Lesser Scaup. Also includes 14,170 pairs of Common Eiders in the total; that estimate covers the entire coast of the northern area and could not be broken down by unit.

Figure 2. Southern Quebec showing coverage by Canada Land Inventory - Waterfowl capability maps and the sites where studies of breeding waterfowl were conducted



<u>MAP SHEET #</u>	<u>STUDY AREA</u>	<u>REFERENCES</u>
31 N	A - Reservoirs Cabonga et Dozois	Bourget - CWS files
31 G	B - Ottawa River C - Lake St. Francis	Munro (1967), Tremblay - CWS files Reed, Bourget - CWS files Thompson (1974)
31 H	D - Lake St. Louis E - Richelieu River F - Boucherville Islands G - Contrecoeur Islands	Laperle (1974) Reed, Lehoux - CWS files Lepage (1976) Cantin <i>et al</i> (1976)
31 I	H - Lake St. Peter I - St. Lawrence River	Munro - CWS files Lehoux - CWS files
21 M	J - Ile-aux-Grues K - Cap Tourmente L - Laurentide Park M - Ste. Anne de la Pocatière N - Lake St. John	Reed - CWS files Van Dijk - CWS files Reed (1963) Reed - CWS files Reed - CWS files
22 C	O - Isle-Verte Bay P - Rivière Sud-ouest	Reed - CWS files Reed - CWS files
11 N	Q - Magdalen Islands	Chapdelaine - CWS files

Most of the waterfowl studies mentioned above provided information on the percentage contribution of the major duck species to the total breeding population of the respective area (see Figure 2); cumulatively they allowed me to establish different species composition values applicable within and between map sheets. It was found that when areas of distinctly different species composition existed within the same map sheet, these differences corresponded closely with different capability classes. Therefore, for each available map sheet, I have determined the amount of habitat available in each of the capability classes (based on the tabulation by watershed) and established the total duck breeding population for each class by applying the appropriate density values (as per Erskine). The estimated duck population within each capability class was then subdivided by species or groups of species by applying the appropriate percentage composition values. In this evaluation eiders have not been included; their abundance has been computed in a different way (see below).

To complete coverage of the southern area, it was necessary to estimate duck breeding populations for the seven map sheets not covered by the CLI (this was done on the basis of estimated breeding populations in adjacent CLI maps), for Anticosti Island and the Magdalen Islands; the population of those islands in the gulf was estimated from information provided by P. Dupuis and G. Chapdelaine (CWS). Common Eider abundance in the St. Lawrence was available from recent nest counts (Reed 1975, Chapdelaine, pers. comm). The results of duck population estimates are summarized in Table 2. Since the breeding range of the Canada Goose

Table 2. Estimated numbers of pairs of breeding waterfowl  
in southern Quebec

Species	Number of pairs
Black Duck	138 760
Mallard	28 400
Pintail	9 580
G.W. Teal	28 920
B.W. Teal	7 900
Other dabblers *	3 910
Ringneck	26 350
Common Goldeneye	16 890
Mergansers **	8 960
Common Eider	23 580
Other diving ducks ***	1 220
Total ducks	294 470
Canada Goose	22 050

\* Includes Gadwall, Wigeon, Shoveler, Wood Duck

\*\* Includes Hooded, Common and Red-Breasted Merganser

\*\*\* Includes Redhead, Greater and Lesser Scaup

extends somewhat south of  $50^{\circ}$ , an estimation of its abundance was required. I estimated that the equivalent of about 5 map sheets (ca. 87000 km<sup>2</sup>) was occupied by Canada Geese, probably at a density equivalent to the most southerly units of the northern area (0.5 adults/km<sup>2</sup>); a breeding population of 43,500 adults or 21,750 breeding pairs is indicated. To this must be added the ca. 300 breeding pairs on Anticosti Island (P. Dupuis pers. comm.) yielding a total of 22,050 pairs for the southern area.

### *1.c Discussion*

Although the estimated abundance of breeding ducks and geese relies on somewhat crude evaluations of density, they provide approximate values from which to start; they can perhaps be perfected on the basis of data which will emerge from evaluations in adjacent regions of Canada or from future surveys in Quebec.

The estimated populations of the various groups of waterfowl for the entire province are presented in Table 3.

I suspect that the numbers of Black Ducks, Green-winged Teal and Common Goldeneye may have been underestimated because these species are particularly adept in avoiding detection during aerial censuses. Also, a more detailed survey of Common Eiders in the northern area would undoubtedly reveal a larger number of breeders. On the other hand, the estimate of Oldsquaw may be too high. Nevertheless, I feel that the data provide reasonably accurate estimates on which to base subsequent appraisals.



Table 3. Estimated numbers of breeding pairs of waterfowl  
in Quebec \*

Species	Number of pairs
Black	202 010
Mallard	28 630
Pintail	11 990
G.W. Teal	34 530
B.W. Teal	7 900
Other dabblers	4 030
Ringneck & Scaups	65 800
Common Goldeneye	34 380
Mergansers	81 710
Oldsquaw	65 400
Scoters	67 650
Common Eider	37 750
Other diving ducks	1 200
Total ducks	642 980
Canada Geese	436 300
Total ducks and Geese	1 079 280

\* The estimates of "other dabblers" and "other diving ducks" from the northern area (Table 1) have been broken down by species; this was done for each unit on the basis of approximate ratios suggested by the literature.

In addition to the rather large numerical contributions that Quebec makes to the Atlantic Flyway total, particularly for species such as the Canada Goose and Black Duck, it also harbours several species which are uncommon or rare in eastern Canada. The Harlequin Duck, of which the eastern North American stock probably numbers scarcely a few thousand individuals, breeds sparsely throughout much of northern Quebec and Labrador. Also, the eastern segment of the Barrow's Goldeneye population, which from recent winter counts probably exceeds 3,000 individuals (2,500 recorded in the St Lawrence; Reed and Bourget 1977), must nest mainly in Quebec and Labrador even though no recent records exist (Bellrose 1976). A few King Eider probably nest in Ungava.

## 2. POPULATION BALANCE

### 2.a *Estimating fall flights*

To estimate the size of the waterfowl populations at the start of the hunting season, I have summed the three following parameters:

- 1) The number of breeding adults as established in the foregoing section,
- 2) the number of non breeding and unsuccessful adults (using Erskine's supposition that 1/3 of the adult population falls into this category) and 3) the estimated number of young produced.

Thus the number of individuals in the adult population for all groups has been taken as three times the number of breeding pairs. For the juvenile segment, I have examined production rates for Black Ducks, Canada Geese and Common Eiders (Reed 1975, MacInnes *et al* 1974, Reed and Milne 1974). For the Black Duck, Erskine proposed production rates of 3 or 4 young per breeding pair, but my detailed study of the species in the St. Lawrence estuary indicated a rate closer to 2. Allowing for observer interference and the particularities of my study area, the compromise value of 3 young per breeding pair is probably very close to the true production value for the whole population. In the absence of comparative data for other species of ducks (other than eiders) I have applied this same rate to them in estimating production. MacInnes *et al*'s (1974) study of Canada geese at the McConnel River, NWT, showed an identical production rate. Common Eiders, however, are far less efficient in producing young; data from the St. Lawrence estuary suggested a rate of only 0.3 young per breeding pair, which I have rounded off to 0.5 in subsequent analyses.

Thus the total fall flights could be established for the breeding populations by multiplying the number of breeding pairs by 6 for Canada Geese and all ducks except the Common Eider, and by 3.5 for the latter species.

The estimates are summarized in Table 4.

### *2.b Harvest*

Table 5 lists the mean harvest (1972-75) of ducks and geese through sport hunting in Quebec as reported by Cooch and Newell (1977) as well as the take by native people (Native Harvest Research Committee 1976, McFarland and Cooch 1976). Although the native kill of ducks was provided on a total all-species basis, the most important species are probably the sea ducks (Eiders, Scoters and Oldsquaw), the mergansers (Common and Red-breast) and the Black Duck; on that assumption I have attempted a species breakdown of the total as shown in Table 5. In addition to the harvest shown in Table 5, a certain number of eider eggs are taken by the Inuit in Ungava. Also there is an unmeasured (but probably not negligible) illegal kill of waterfowl by non-natives, and some eider eggs are still taken on the north shore of the gulf.

Table 4. Estimated fall flights of waterfowl breeding  
in Quebec

Species	Size of fall flight* (individuals)
Black Duck	1 212 060
Mallard	171 780
Pintail	71 940
G.W. Teal	207 180
B.W. Teal	47 400
Other dabblers	24 180
Ringneck and Scaups	394 800
Common Goldeneye	206 280
Mergansers	490 260
Oldsquaw	392 400
Scoters	405 900
Other diving ducks (not incl. eiders)	7 200
Common Eider	132 125
Total ducks	763 505
Canada Geese	2 617 800
Total waterfowl	6 381 305

\* Includes breeding adults, non-breeding adults and young-of-the year

Table 5.

## Waterfowl harvest in Quebec

Species	Number of birds harvested annually		
	Sport hunting	Native**	Total
Black Duck	106 524	19 315	125 839
Mallard	66 597	4 828	71 425
Pintail	19 816	9 658	29 474
G.W. Teal	45 038	4 828	49 866
B.W. Teal	41 232	-	41 232
Other Dabblers	28 960	-	28 960
<i>Total dabblers</i>	<i>308 167</i>	<i>38 629</i>	<i>346 796</i>
Common & Barrow's Goldeneye	41 226	4 828	46 054
Lesser & Greater Scaup } Ringneck	70 532	4 828	75 360
Redhead	3 484	-	3 484
Oldsquaw	8 220*	9 658	17 878
Mergansers (3 species)	21 155	9 658	30 813
Common Eider	5 807*	19 315	25 122
Scoters (3 species)	28 887*	9 658	38 545
Other Diving ducks	8 894	-	8 894
<i>Total diving ducks</i>	<i>188 205</i>	<i>57 945</i>	<i>246 150</i>
<i>TOTAL DUCKS</i>	<u><i>496 372</i></u>	<u><i>96 574</i></u>	<u><i>592 946</i></u>
Snow Geese	20 724	38 477	59 201
Canada Geese	27 740	82 881	110 351
Brant	323	7 920	8 243
<i>TOTAL GEESE</i>	<u><i>48 517</i></u>	<u><i>129 278</i></u>	<u><i>177 795</i></u>

\* Mean 1973-75

\*\* Species breakdown for Ducks is based on the assumption that Black Ducks and Eiders make up each 20% of the total duck kill, Pintail, Oldsquaw, Mergansers and Scoters make up each 10% and that Green-winged Teal, Scaup (incl. Ringneck) and Goldeneye make up each 5%.

*2.c Source of birds harvested in Quebec*

Not all of the ducks and geese harvested in Quebec are raised there. An examination of the banding records shows that some individuals of each species come from adjacent areas of Canada and some cases from the United States, but did not permit quantification, neither for all ducks nor for individuals species. It did however provide some clues which contributed to the following general appraisal.

Snow Geese, Brant, Canvasback, Bufflehead, Ruddy Duck and White-winged Scoter are "contributed" to the regional harvest by other regions. For species such as Black Ducks, Green-winged Teal, Ringnecks, Common Goldeneyes, and possibly the Mergansers (all 3 species), the total Quebec harvest may be taken almost entirely from locally raised birds, with perhaps a small contribution from Labrador. The Canada Goose population available to the Quebec hunter is composed of home-grown birds and moult migrants, principally from Ontario. For the remaining species (Mallard, Pintail, Gadwall, Wigeon, Blue-winged Teal, Shoveler, Wood Duck, Redhead, the Scaup, Oldsquaw, Black and Surf Scoter, Common Eider) a substantial proportion of the harvest probably comes from other regions; there are indications that immigration of Blue-winged Teal, Pintail and Wood Duck is of particular importance.

On the basis of the above discussion, I tentatively propose that the Quebec sport harvest is composed of approximately 10% of birds raised outside of Quebec for Black Ducks, Green-winged Teal, Canada Geese, Goldeneye and Mergansers; of 30% for Mallard, Scaup (Lesser, Greater and Ringneck combined), Scoters and Oldsquaw; of 75% for Pintail, Blue-winged Teal, other dabblers, Common Eider and other divers.

## *2.d Distribution of the harvest of Quebec waterfowl*

Data on the distribution of recoveries of Black Ducks, Green-Winged Teal and Blue-Winged Teal are presented in Table 6. The combined data from the four stations on or near the Quebec-Ontario border in James Bay and Lake Abitibi reveal that only 3.5% of the Black Duck recoveries occurred in Quebec while 41.3% were located in Ontario. However, banding at Thurso on the Ottawa River yielded an almost equal number of recoveries in the same two provinces. In general, both teal species appear to conform to this pattern. I suggest that Quebec birds occupying breeding areas within 50-80 km of the coasts of Hudson and James Bay and the Quebec-Ontario border north of 47° N latitude move southward along that strip of land and head into Ontario before reaching areas of heavy hunting pressure along the Ottawa River. Birds occupying areas between the above strip and roughly the 74th latitude likely move south across the Ottawa river towards Lake Ontario and in so doing are exposed to heavy hunting pressure both in Quebec and Ontario.

Black Ducks banded in Lake St. John and near Isle-Verte followed a migration corridor (mainly through the Richelieu-Champlain Valley) which, while exposing them to very heavy pressure in Quebec, got them into the US with minimum exposure to other Canadian hunters. I suspect that this pattern of migration and location of harvest applies to most ducks breeding between the 67th and 74th latitude. East of that area the pattern probably follows that shown by the Baie Johan-Beetz banding; the birds moving relatively unscathed through the more sparsely populated portion of eastern Quebec only to meet up with the maritime gunners.



Distribution of recoveries of duck banded in Quebec and eastern Ontario  
at selected sites (direct recoveries only)

## % RECOVERIES

Banding station	Black Duck			Green-winged Teal			Blue-winged Teal		
	in Quebec	Other Can. provinces	US	in Quebec	Other Can. provinces	US	in Quebec	Other Can. provinces	US
Old Factory - James Bay Que.	-	-	100.0 (8) *	-	-	100 (1)	-	-	-
Goose Factory - James Bay, Ont.	4.2 (6)	24.3 (35)	71.5 (103)	-	25.6 (11)	74.4 (32)	22.2 (2)	55.6 (5)	22.2 (2)
Broquois Falls - Lake Abitibi area, Ont.	-	61.7 (29)	38.3 (18)	-	-	100.0 (1)	-	100.0 (3)	-
Lake Abitibi - Que.	4.8 (4)	63.1 (53)	32.1 (27)	-	38.5 (5)	61.5 (8)	10.0 (2)	50.0 (10)	40.0 (3)
Lake St. John, Que.	47.2 (58)	0.8 (1)	52.0 (64)	33.3 (1)	33.3 (1)	33.3 (1)	-	-	-
Churso, Ottawa River, Que.	35.1 (184)	39.3 (206)	25.6 (134)	60.0 (3)	-	40.0 (2)	40.0 (16)	55.0 (22)	5.0 (2)
Isle Verte, St. Lawrence Est., Que.	58.6 (266)	1.1 (5)	40.3 (183)	49.0 (24)	-	51.0 (25)	66.7 (2)	-	33.3 (1)
Laie Johan Beetz ** St. Lawrence Gulf, Que.	2.7 (5)	34.3 (63)	63.0 (116)	10.6 (30)	35.5 (100)	53.9 (152)	-	-	-

\* The number of parentheses represents the number of recoveries

\*\* Black Duck data from Geis et al (1971), Green-winged Teal from Moisan et al (1967).

It appears likely then that a large number of Quebec ducks, principally Blacks, are being harvested in eastern Ontario and in the Maritimes. An attempt to quantify this contribution for Black Ducks and Green-winged Teal is made in the following section.

2.e *Population balance in relation to hunting kill*

In table 7, I have attempted to estimate the contribution of Quebec's waterfowl breeding populations to flights in other eastern Canadian provinces and in the Atlantic Flyway. This has been done by subtracting the number of birds which must return in spring to maintain the initial population of breeders, which yields the number of birds potentially available to other users.

I recognize that many data of uncertain precision entered into the calculations, but the resulting values of the "exported surplus" do not generally seem to be unrealistic. As a check on those results, I have conducted a partially independent analysis for Black Ducks and Green-winged Teal, making greater use of banding data.

This has been done by breaking down the fall flight into the four components which occupy the different "corridors" outlined in the previous section and estimating the harvest from each, using the appropriate harvest rate (the harvest rates were taken from Moisan *et al* 1976 for the Green-winged while K. Newell provided recent estimates for Black Ducks). The derived harvest, representing Canadian and U.S. retrieved kill, was then broken down into regional components on the basis of the proportional distribution of band recoveries (Table 8). The results, shown in Table 9, allow a comparison of the independantly derived Quebec harvest with the value produced earlier (Table 7), and also permit an evaluation of Black Ducks and Green-winged Teal to the Ontario and Atlantic regions

Table 8. Proposed harvest distribution of Black Ducks and Green-winged Teal from different migration corridors in Quebec - from Table 5, Geis *et al* 1971, Moisan *et al* 1967

Breeding area (corridor)	Quebec		Approx. % harvest occurring in				US	
	Black	GWT	Black	GWT	Black	GWT	Black	GWT
Western Quebec	4.0	0	41.0	33.0	0	0	55.0	67.0
Ottawa River Northward	35.0	0.6	39.0	5.0	0	4.0	26.0	85.0
Central	53.0	49.0	1.0	1.0	0	35	46.0	50.0
Eastern	2.7	10.6	0	1.0	34.3	34.5	63.0	53.9

Table 7.

## Estimated influence of local harvest on waterfowl breeding populations in Quebec

Species	A Fall flt. from Que. breeding pop. (rounded nrst 1000)	B Sport harvest in Quebec (rounded nrst 100)	C <sup>1</sup> Corrected sport harvest	D Native harvest- Quebec	E (C+D) Corrected Total Que. harvest	F Harvest plus crippling loss (1.38 X E) <sup>4</sup>	G (A-F) Fall flight leaving Quebec	H <sup>2</sup> No. of survivors required to maintain stable pop.	I (G-H) Exported "surplus" for other Can. & US harvest & other mortality
Black Duck	1 212 000	106 500	95 850	19 300	115 150	158 900	1 053 100	636 300	416 700
Mallard	172 000	66 600	46 620	4 850	51 470	71 000	101 000	90 200	10 800
Pintail	72 000	19 800	4 950	9 650	14 600	20 100	51 900	37 800	14 100
G.W. Teal	207 000	45 000	40 500	4 850	45 350	62 600	144 400	108 800	35 600
B.W. Teal	47 000	41 200	10 300	-	10 300	14 200	32 800	24 900	7 900
Other dabblers	24 000	29 000	7 250	-	7 250	10 000	14 000	12 700	1 300
Scaup & Ringneck	395 000	70 500	49 350	4 850	54 200	74 800	320 200	207 300	112 900
Coldeneye	206 000	41 200	37 080	4 850	41 930	57 900	148 100	108 300	39 800
Mergansers	490 000	21 200	19 080	9 650	28 730	39 600	450 400	25 700	424 700
Scoters	406 000	28 900	20 230	9 650	29 880	41 200	364 800	213 100	151 700
Oldsquaw	392 000	8 200	5 740	9 650	15 390	21 200	370 800	206 000	164 800
Eider	132 000	5 800	4 060	4 820 <sup>3</sup>	8 880	12 300	119 700	118 900	800
Other divers	7 000	12 400	3 100	-	3 100	4 300	2 700	3 800	- 1 100
Canada Geese	2 617 800	27 700	24 930	74 590	99 520	137 300	2 480 500	1 374 300	1 106 200
								TOTAL	2 486 200

1. Sport harvest occurring in Quebec minus that portion contributed by birds raised elsewhere (see bottom p. 8)

2. Represents the adult segment of the fall flight (= 3 x no. breeding pairs) and assuming summer mortality of 5%. The stated value is then 3.15 x no. breeding prs.

3. Native harvest also corrected to account for contribution of Ontario geese and NWT eiders to native kill. For each species the correction factor used for the sport harvest was also used for the native harvest.

4. From Geis et al (1971).

Table 9.

## Estimated distribution and size of the kill of Black Ducks and Green-winged Teal from breeding areas in Quebec

Area		Estimated size of fall flight	Harvest rate	Total harvest	number of ducks harvested in				
					Quebec	Ontario	Maritimes	United States	
<b>BLACK DUCK</b>									
Eastern corridor	Ad	111 600	.13	14 508	392	-	4 976	9 140	
	Imm	111 600	.18	20 088	542	-	6 890	12 655	
Central corridor	Ad	237 300	.17	40 341	21 380	403	-	18 556	
	Imm	237 300	.29	68 817	36 473	688	-	31 656	
Ottawa R. northward	Ad	177 900	.17	30 243	10 585	11 794	-	7 863	
	Imm	177 900	.29	51 591	18 057	20 120	-	13 413	
Western corridor	Ad	78 600	.15*	11 790	472	4 834	-	6 485	
	Imm	78 600	.25*	19 650	786	8 057	-	10 808	
TOTAL (nrst.100)				257 000	88 700	45 900	11 900	110 600	
				%	100.0	34.5	17.9	4.6	43.0
<b>GREEN-WINGED TEAL</b>									
Eastern corridor	Ad	13 200	.07	924	98	10	318	498	
	Imm	13 200	.15	1 980	210	21	682	1 067	
Central corridor	Ad	70 900	.07	4 263	2 089	43	-	2 132	
	Imm	70 900	.15	9 135	4 476	91	-	4 567	
Ottawa R. northward	Ad	24 900	.07	1 743	105	87	70	1 482	
	Imm	24 900	.15	3 735	224	187	149	3 174	
Western corridor	Ad	4 800	.07	336	-	111	-	225	
	Imm	4 800	.15	720	-	238	-	482	
TOTAL				22 800	7 200	800	1 200	13 600	
				%	99.9	31.5	3.5	5.3	59.6

\* Harvest rates were not available for the western corridor; I have applied the rates shown, assuming that the relative remotness of that corridor from major harvest areas would lead to harvest rates intermediate between the eastern and central corridors.

harvests. For the Black Duck the estimates of the Quebec harvest from regionally-bred birds are encouragingly similar: 88 700 using the second method and 95 850 using the first. The Green-winged Teal estimates diverge widely ( 7 200 vs 40 500). I suspect that the divergence is due largely to: 1) an underestimate of the harvest rate (that used was derived from data collected prior to the 1960's); 2) an underestimate of the proportion of the harvest occurring in Quebec from Ottawa River corridor birds (Table 8) and 3) an unrecognized influx of moult migrants into Quebec which contribute more substantially to the local harvest than was assumed in Table 7.

I have also applied recently derived survival rates of Black Ducks (K. Newell pers. comm.: eastern corridor, Adults 64.66, Imm. 47.34; remainder of Quebec, Adults 67.30, Imm. 35.65) to the estimated fall flights shown in Table 9. That calculation indicated 633 400 survivors, a value less than 0.5% less than that estimated to maintain a stable population (column H, Table 7).

It seems clear that the data and assumptions used in estimating both the size and the dynamics of the Black Duck population are sound. Although the estimates for other species may not be as precise at present, I am confident that the model will perform equally well when updated and additional information can be added.

### 3. STAGING POPULATIONS

The two most important staging areas for waterfowl in Quebec are the St. Lawrence River (including the lower portion of its main tributaries) and James Bay. Both areas accommodate large numbers of waterfowl, but the importance of these Quebec wetlands is best illustrated by the role they play in the ecology of northern nesting geese.

For wild geese of eastern North America, migrating between the wintering quarters in the eastern United States and the breeding grounds of northeastern Canada, the St. Lawrence River serves as an important stopping-off point. In Quebec, the rich alluvial plain of the St. Lawrence valley, now mainly under agriculture, contrasts with the areas of forest and mountains to the north (the Laurentian Mountains) and to the south (the Appalachian Mountains). Its attractiveness to migrating waterfowl is enhanced by the milder climate and the presence of a large volume of water, ensuring a longer ice-free period. That situation is particularly advantageous to geese migrating northward in the spring; they can undertake early the first long flight of their journey and yet be assured of relatively hospitable weather and feeding conditions. They can then remain to build up reserves until weather conditions in the far north permit departure on the last stage of the journey.

The St. Lawrence estuary is occupied by the entire world population of Greater Snow Geese (estimated at 180,000 to 190,000 individuals in 1976 and 1977) in both spring and fall. Annually about 30% of their time is spent in the St. Lawrence. Atlantic Brant makes extensive use



of the gulf and estuary in the spring; during a survey in late May 1977, 36% of the entire stock was located in that area. James Bay also serves as a major stopping-off point for Brant and Lesser Snow Geese in both spring and fall. Although the Quebec portion of James Bay is on the extreme eastern margin of the Lesser Snow Goose migration corridor, it is utilized by at least 5% of the population (Courcelles 1978).

Local breeders and migrant ducks intermingle in St. Lawrence, rendering an evaluation of the area's importance as a duck staging area difficult. Nevertheless, it appears evident that the St. Lawrence serves as a major stopping-off point for most of Quebec's duck breeding populations as well as some from other regions (for example, Canvasback which breed mainly in the prairies, stage on the St. Lawrence in the southwest corner of Quebec).

The St. Lawrence and James Bay also serve as moulting areas for ducks. Important moult migrations are made by Common and Surf Scoters to the gulf and estuary of the St. Lawrence where they join Common Eider and Common Goldeneye from nearby breeding areas. Greater Scaup, possibly from northern Quebec, assemble in the river portion of the St. Lawrence (roughly Quebec City westward) during late summer where, at least in some years, they undergo the wing moult. Large numbers of moulting scoters and Black Ducks are found in James Bay. Large numbers of Canada Geese from northern Ontario also migrate to northern Quebec to moult. Green-winged Teal appear in appreciable numbers in the tidal marshes near Cap Tourmente in August to moult.

#### 4. WINTERING POPULATIONS

A recent evaluation of the overwintering waterfowl population in southern Quebec revealed the presence of more than 171 000 ducks (Reed and Bourget 1977). The data are summarized in Table 10 and Figure 3 . It was concluded that several species were underestimated in the study and that the true duck population must have exceeded 250 000 birds. The importance of the gulf and estuary of the St Lawrence to Common Eiders, Oldsquaw and Goldeneye (including the bulk of the eastern North American stock of the Barrow's Goldeneye) is obvious. That area must be considered one of the major duck wintering sites of the North Atlantic.

Few, if any ducks winter in interior northern Quebec but undoubtedly a certain number of Common and King Eiders may be found off the coasts of Ungava Bay, Hudson Strait and Hudson Bay; no estimates of their numbers is available.

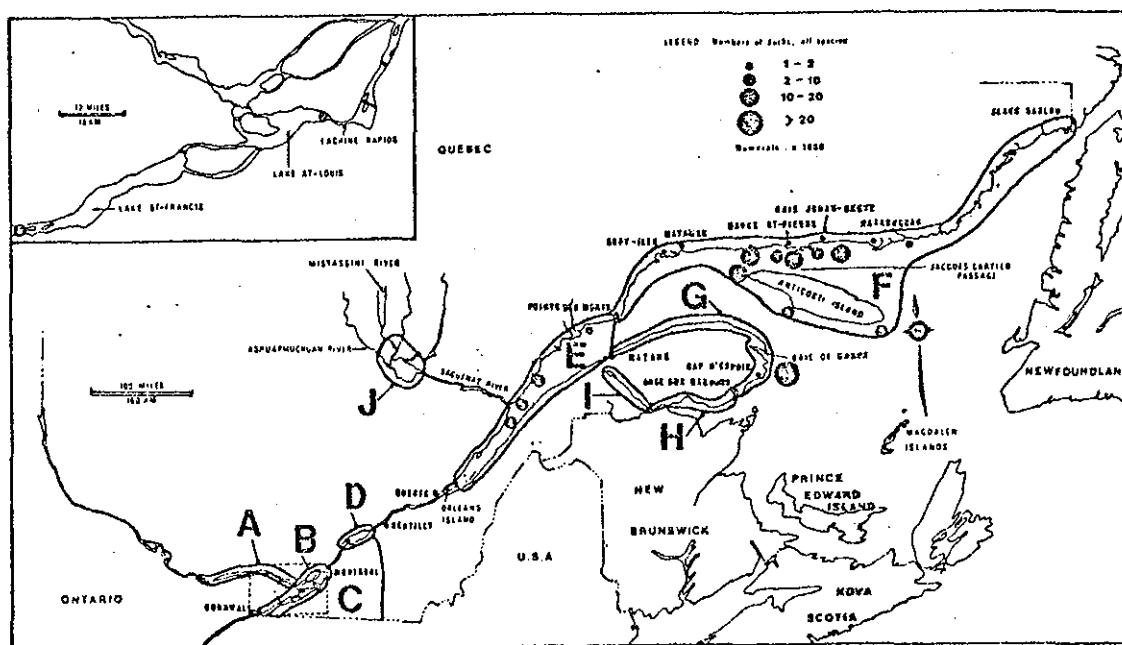
Table 10. Numbers of ducks found overwintering in southern Quebec (1974-76) (from Reed and Bourget 1977)

Species	Regions									Total
	Ottawa River	Montreal	Eastern Townships	Estuary	North shore	Gaspésie	Baie des Chaleurs	Matapédia River	Lake St. John	
Black Duck ( <i>Anas ribripes</i> )	56	506	71	1906				4		2543
Common Goldeneye ( <i>Bucephala clangula</i> )	160	2908	164	8328 <sup>1</sup>	979 <sup>1</sup>	332	111	12	8	13002
Barrow's Goldeneye ( <i>Bucephala islandica</i> )	1		4	1394	869	260	19			2547
Bufflehead ( <i>Bucephala albeola</i> )		1	2	69		1				73
Oldsquaw ( <i>Clangula hyemalis</i> )				6451	2411	46782	48			55692
Surf Scoter ( <i>Melanitta perspicillata</i> )					185					185
Common Eider ( <i>Somateria mollissima</i> )				9	91035	505				91549
Common Merganser ( <i>Mergus merganser</i> )	16	5300	196	19		5	5	7	2	5550
Red-breasted Merganser ( <i>Mergus serrator</i> )			2	91	74	98	23	1		289
Miscellaneous duck species <sup>2</sup>	1	72	12	3	1					89
Sub total — Ducks	234	8787	451	18270	95554	47983	206	24	10	171519
Great Cormorant ( <i>Phalacrocorax carbo</i> )						21	91			112
Black Guillemot ( <i>Cepphus grylle</i> )				78		57	42			177
<b>Total</b>	<b>234</b>	<b>8787</b>	<b>451</b>	<b>18348</b>	<b>95554</b>	<b>48061</b>	<b>339</b>	<b>24</b>	<b>10</b>	<b>171808</b>

<sup>1</sup>May include some *B. islandica*.

<sup>2</sup>Miscellaneous duck species by order of importance are as follows: Ottawa River, Mallard (*Anas platyrhynchos*); Montreal, Mallard, Pintail (*Anas acuta*), Canvas-back (*Aythya valisineria*), Redhead (*Aythya americana*), Lesser Scaup (*Aythya affinis*), Ring-necked Duck (*Aythya collaris*), American Wigeon (*Anas americana*); Eastern Townships, Mallard, Hooded Merganser (*Lophodytes cucullatus*); Estuary, Harlequin Duck (*Histrionicus histrionicus*), Mallard; North Shore, Black Scoter (*Melanitta nigra*).

Figure 3.



Southern Quebec, showing major duck wintering sites (dark circles) and survey zones (outlined and identified by large letters). The Montreal area is shown in a larger scale on the inset at the upper left of the figure. The survey zones are (A) Ottawa River, (B) Montreal, (C) Eastern Townships, (D) Lake St. Peter, (E) St. Lawrence estuary, (F) North shore, Gulf of St. Lawrence, (G) Gaspésie, (H) Baie des Chaleurs, (I) Matapédia, (J) Lake St. John.

## 5. WATERFOWL HABITAT - PRESENT AND FUTURE

### 5.a *Summary of present situation*

Areas denoted by waterfowl capability classifications one two and three represent mainly marshes or tidal flats along the shorelines of the St. Lawrence and to a lesser extent the Ottawa River, Lake St. John, Lake Abitibi and James Bay. There are generally areas of rich marshland which support high densities of breeding ducks. Although they represent only 1% of the total surface area of southern Quebec they harbour 19% of the duck population.

Areas of categories four to seven (inclusive) represent poorer quality marshes, bogs, fens and rocky shorelines, principally inland within the boreal forest. They cover 90% of the land area and support 81% of the breeding duck population of southern Quebec. Almost all of the northern area of the province would fall into those capability classes.

### 5.b *Threats to habitat*

The two major threats to wetlands in Quebec are 1) incompatible use of the shorelines of the St. Lawrence and its chief tributaries and 2) hydroelectric development, mainly in the northern area.

Despite profound changes that have occurred along the shores of the St. Lawrence since the start of settlement in the 17th century, many large tracts of wetlands are still present. Their continued existence is threatened by ever-increasing encroachment by road and

harbour construction, by land reclamation for agriculture, industry and home development, and by cottage construction. All of these factors have been taking a gradual toll over the past several decades, the individual losses being often imperceptible but cumulatively producing a significant effect. An increasing population with escalating needs for goods and leisure activities and with "improved" technological means of modifying the landscape, has brought about an accelerated rate of loss of habitat in recent years. Some trends in human activity which appear to be emerging are 1) an expected increase in use of the St. Lawrence and its tributaries for marine transport of merchandise, 2) increased demand on shoreline or shallow water property for road construction, for agricultural reclamation and for cottage building, 3) decreased emphasis on the future construction of nuclear reactors along the St. Lawrence. The first two trends could have a very large negative effect on the capacity of the St. Lawrence to serve as a breeding or staging area for waterfowl. The third trend suggests that the negative effects of nuclear installations may not be as wide spread as anticipated. Clearly shoreline zoning is urgently required but such controls appear to be yet a long way off. Acquisition has allowed the preservation of several key areas along the St. Lawrence (see Table 11).

The construction of dams to produce electrical energy will undoubtedly increase dramatically and this mainly in areas north of 50°. The chief effects of such operations on waterfowl are the flooding-out of emergent vegetation and the dislodging of floating marshes as the reservoirs are filled. With flooding, emergent vegetation disappears

Table 11. National wildlife areas and other land devoted  
to waterfowl in Quebec

OWNED BY CANADIAN WILDLIFE SERVICE		
Name	Area (ha)	Habitat type
Baie de l'Isle Verte	248	Brackish tidal marsh and some upland
Cap Tourmente	2046	Fresh water tidal marsh and upland
Ile de l'Est (Magdalen Island)	1211	Barrier beach ponds and dunes
Iles de Contrecoeur	156	Duck nesting islands and fresh water marsh
Iles de la Paix	119	Duck nesting islands and fresh water marsh
Lac St. François	<u>1400</u> 5180	Fresh water marsh and upland
OWNED BY PROVINCIAL GOVERNMENT		
Parc Plaisance } Lac St. Pierre }	6500	Fresh water marsh

and is prevented from recolonizing the new shorelines by water level fluctuations to which it is not adapted. However, mats of floating marsh which become detached could form the nuclei of new marshes but since they represent a threat to the turbines, attempts are usually made to weight them down prior to flooding to ensure their destruction. Studies are being conducted regarding the feasibility of anchoring, rather than "drowning" such habitat; this potentially represents a means of minimizing the effects of the creation of hydroelectric reservoirs. However, even if such a management technique could be practiced on a large scale to overall results of a general decrease in the carrying capacity of the habitat would result from flooding.

Lehoux (1975) in a study of the impacts of the creation of one of the reservoirs associated with the James Bay hydroelectric project predicted that the proposed 420 sq. mi reservoir would eliminate roughly 45 sq. mi of habitat with capability classifications of 3, 4 and 5, and 375 sq. mi of habitat of class 6 and 7; in the area immediately surrounding the future reservoir an additional 69 sq. mi of habitat presently classified as 3, 4 and 5, would degrade to classes 6 and 7.

Other resource development activities of potential conflict may develop in the near future: offshore drilling for petroleum in the gulf of St. Lawrence (increased risks of pollution which would affect seaducks and their habitats), increased mining activities in the Gaspé (destruction of inland wetlands, modification of coastal areas for harbour facilities, increased pollution), construction of pipelines.