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A Waterfowl Ecological Nesting Study at Iles-de-la-Paix, Lake St. Louis, Québec

Annual Progress Report 1968
Project number 060

by

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Department of Indian Affairs and Northern Development

May, 1969

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A WATERFOWL ECOLOGICAL NESTING STUDY AT ILES-DE-LA-PAIX, LAKE ST. LOUIS, QUEBEC, 1968

I- Introduction

Breeding biology studies are a necessary tool to understand wildlife ecological requirements. Good replication of such studies in time and place is essential to the preparation of comprehensive resource management programs.

The acquisition and creation of Iles-de-la-Paix as a National Wildlife Area on November 29, 1967, by the Canadian Wildlife Service made it necessary to undertake a waterfowl ecological nesting study of the area to determine the waterfowl population breeding on these islands, its nesting success and production rate in relation to the available habitat, and to formulate a management plan.

This study was initiated mainly to provide answers for management purposes. However, it has a broad enough interest to contribute significantly to our waterfowl knowledge in general, and more particularly to the

utilization of islands and green timber habitat by nesting waterfowl, especially members of the dabbling ducks or Anatinae.

The surface feeding ducks in general are ground nesters which have relatively low nesting densities on the mainland. On islands, nesting densities are remarkably higher. This tendancy has long been recognized. In Europe (Clarke, 1895; Witherby et al, 1939) have described the tendancy for certain duck species to select islands as nest sites. In North America (Hammond and Mann, 1956; Parnell and Quay, 1962; Duebbert, 1966; Townsend, 1966) have given various descriptions of island nesting dabblers.

For the two main species of interest in the present study, the black duck and the mallard, their island nesting habits have facilitated several nesting studies (Allen, 1893; Gross, 1945; Stotts and Davis, 1960; Reed, 1964; Coulter and Miller, 1968; Young, 1968).

Another particularity of the present study is that it involves the use of green timber habitat by nesting waterfowl. With the exception of the wood duck, we know

relatively little of the use of this ecotype by nesting dabblers. It is rather recently that reports have started to appear (Coulter and Miller, 1968; Cowardin et al, 1967; Prince, 1968; Stotts and Davis, 1960).

This progress report presents the results obtained during the 1968 waterfowl breeding season. The data are few and distributed over five species of ducks. It is therefore too early to make any significant interpretation from them. Also, very little reference has been made to pertinent litterature at this point, even though a literature review was undertaken.

II- Methods of Study

The bulk of the field work was carried between April 30 and June 30, although periodic visits were made until October, 1968.

Breeding pair counts were made by canoe along the island shoreline from mid-April to mid-May. Birds were recorded by species and as singles, pairs and groups.

Systematic nest searching was conducted until the end of May. Following that, the study area was covered

at random although I visited the entire area at regular intervals. For each nest found, the following information was noted:

1° nesting cover and habitat

2° nest description

3° location

4° date and time

5° presence or absence of parents

6° flushing distance and behaviour

7° number of eggs (or young)

8° approximate stage of incubation

9° pertinent remarks

Items 4 to 8 were also recorded on subsequent visits to a nest. Each nest was numbered and its location marked with numbered thumb tacks, paint mark on tree, or with wooden pickets in open areas. When eggs were left uncovered by a hen, I covered them with nesting material. A portable candler was used to determine the stage of incubation based on criteria described by Weller (1956).

Brood surveys were conducted with a helicopter at

three week intervals from the end of May to the end of July.

Between June 10 and 21, attempts were made to trap incubating hens in order to band and color mark them. A drop trap, made of 2'x 2' wooden frame covered with one inch mesh netting was used. After installing the trap over a nest, sufficient length of time was allowed for the female to return, after which the trap was tripped. This was done by tying a fine rope to the trap and extending it some 30 to 50 feet away depending on the nest location and the apparent state of wariness of the hen. Various colors of airplane dope were used to mark each captured bird.

Marsh vegetation was studied using 4x10 foot quadrats regularly placed along transect lines. The vegetation is described in terms of associations rather than percent composition. The forest was randomly studied and only the dominant tree species were obtained in 1968.

III- Description of the Study Area

1. Location

Iles-de-la-Paix are located along the south shore of Lake St. Louis in Beauharnois and Châteauguay counties, Québec. The islands parallel the south shore of the lake between Beauharnois to the west and Lery to the east. They are approximately 20 miles from downtown Montréal and are accessible via No. 3 highway. The islands are situated between longitudes $74^{o}58'$ and $75^{o}49'$ and latitudes $45^{o}19'$ and $45^{o}21'$ (Fig. 1).

2. Physiography and geology

Iles-de-la-Paix belong to the St. Lawrence flood plain. The fourteen low alluvial islands separated by narrow channels extend over a distance of five miles by approximately half a mile in width and have a surface area of some 280 acres. The faces of the islands' north shore especially are regularly shaped by erosion caused by wave and ice action. The islands are flat, have a very gentle slope and reach an altitude of ± 72 feet above sea level (Fig. 2).

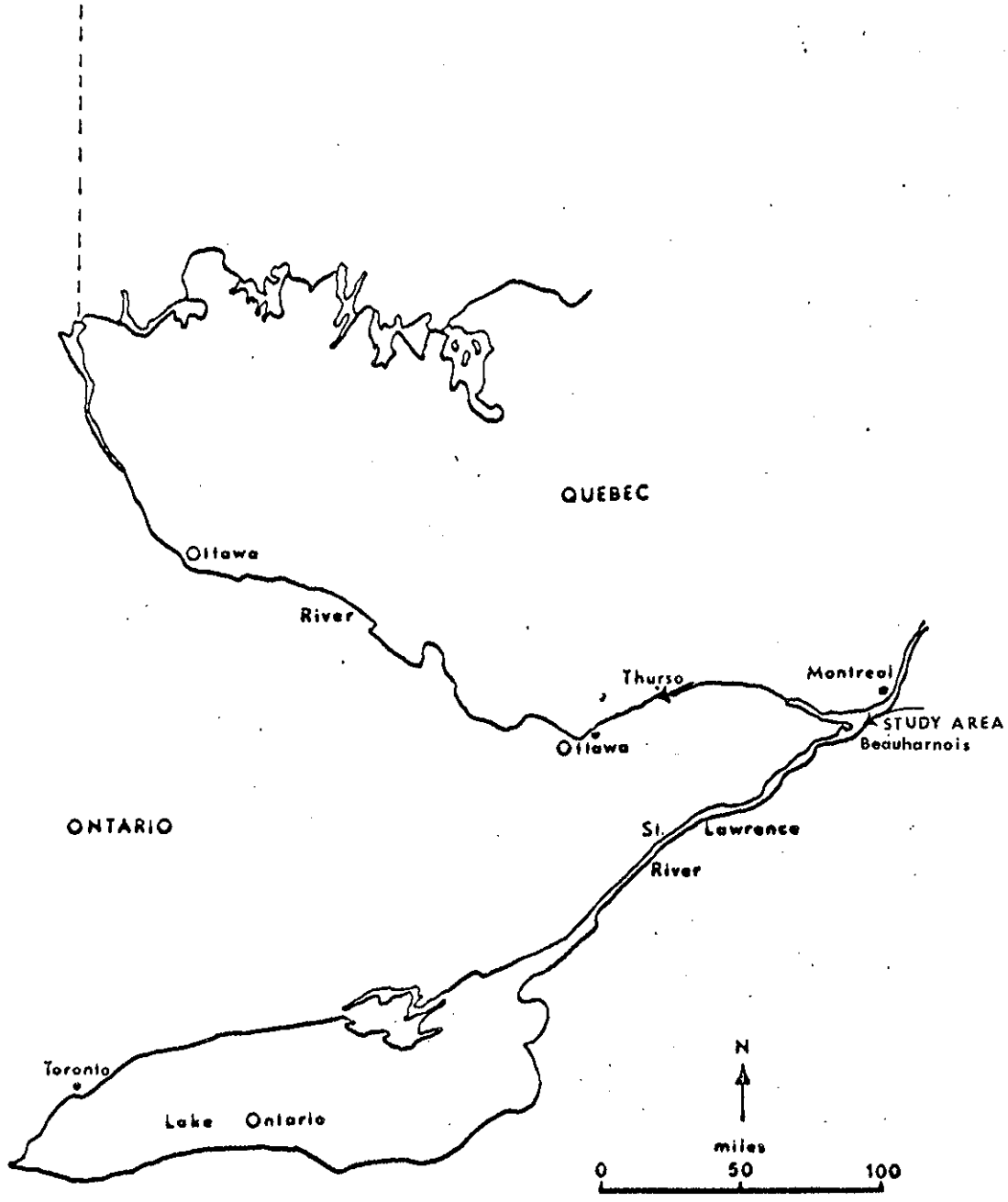

Fig. 1. Location of the study area.

Fig. 2. Topography of the study area. Scale: 1 mi. = 2.5 in.

The geological formations that identify the study area belong to the paleozoic era (Clark 1952). Ile du Large and the south west ends of Ile à Thomas and Ile à Tambault are characterized by sandstone of the Cambrian period. The rest of the Iles-de-la-Paix complex belongs to the ordovician period which is here characterized by dolomits.

3. Hydrology

Lake St. Louis, an enlargement of the St. Lawrence River, is 14 miles long, covers 57 square miles and is some 69 feet above sea level. Its shoreline, including the islands, is some 90 miles long, most of which is developed with the exception of Iles-de-la-Paix and some other small islands. Maximum depth attains 90 feet and the mean depth lies between eight and twelve feet.

The green water of the St. Lawrence, which enters from the Beauharnois Canal and Les Cèdres, mixes with the silty brown water of the Ottawa River flowing between Vaudreuil and Ste-Anne-de-Bellevue, then on each side of Ile Perrot. Another tributary, the Chateauguay River,

enters southeast of Iles-de-la-Paix. Small other tributaries contribute very little to the lake water.

Daily records of the water level from Pointe-Claire on the north shore of Lake St. Louis have been kept since 1915. Detailed analysis of water level variations is beyond the scope of this report, but will be done at the completion of the study. Comparing means does not have much chance in helping us to understand the influence of water level variations on nesting waterfowl. However, an idea of possible water level effect on the nesting habitat was gained by comparing the highest level recorded from April to July in any one year from 1915 to 1968. In 12 years out of 53, the water level rose higher in May than in April; similarly, the same was true in four years in both June and July. It is also interesting to note that in eight years out of 54, the water level stayed as high as 72 feet until June or later, thus rendering ground nesting virtually impossible over most of the area.

4. Climate

Lake St. Louis climate belongs to the cold-humid zone D^{1}b of Köppen as modified by Ackerman (1941).

Weather data recorded at Montréal International Airport on the northwest shore of Lake St. Louis and published by the Department of Transport in the Canadian Weather Review are summarized in Table 1.

From the Climates of Canada for Agriculture (1966), a summary of long term average climate characteristics for the Montréal area were obtained and are shown in Table 2.

5. Soil and vegetation

Iles-de-la-Paix are low alluvial islands basically characterized by a clay soil topped by a layer of various thickness of either pure sand along the north shore to sandy clay along the south shore. The sand beaches found along the north shore are also covered at various places with a layer of shell remains of fresh water snails and clams. The soil of the forested area varies

Table 1. Mean monthly temperature and precipitation at the Montréal International Airport, Dorval, Québec, 1963 to 1968.

Month	Mean Temperature °F	Mean Snow Fall inches	Total Precipitation inches
January	15.1	19.6	2.60
February	13.3	18.5	2.03
March	27.6	8.9	2.29
April	42.5	0.9	2.32
May	54.0	2.3	2.12
June	65.6	0.0	2.76
July	70.0	0.0	2.95
August	65.3	0.0	4.37
September	58.0	0.0	2.96
October	48.6	0.5	2.43
November	35.0	10.5	4.12
December	20.1	20.9	3.01
Monthly ~~Annual~~ Mean	42.9	6.8	2.83

Table 2. Summary of climate characteristics for the Montréal Area.

Degree-days above 42°F		3,400
Growing season	- start	April 17
	- end	October 28
Frost season (32°)	- spring	May 10
	- fall	September 30
Mean frost free period (days)		145
Mean temperatures (°F)	- annual minimum	-20
	- January	14
	- July	69
Moisture (inches)	- potential evapotranspiration	23
	- deficiency	1
	- May-September precipitation	16
	- annual precipitation	37
	- actual evapotranspiration	22

greatly from clay to sand, which at places is covered by a rich layer of black organic top soil as seen in Ile du Large.

Iles-de-la-Paix consist of three main habitat types, namely forest and shrub, wet meadow and/or compact marsh and open marsh (Fig. 3).

Forest and shrub cover approximately 60% of the area. The deciduous forest belongs to the Upper St. Lawrence

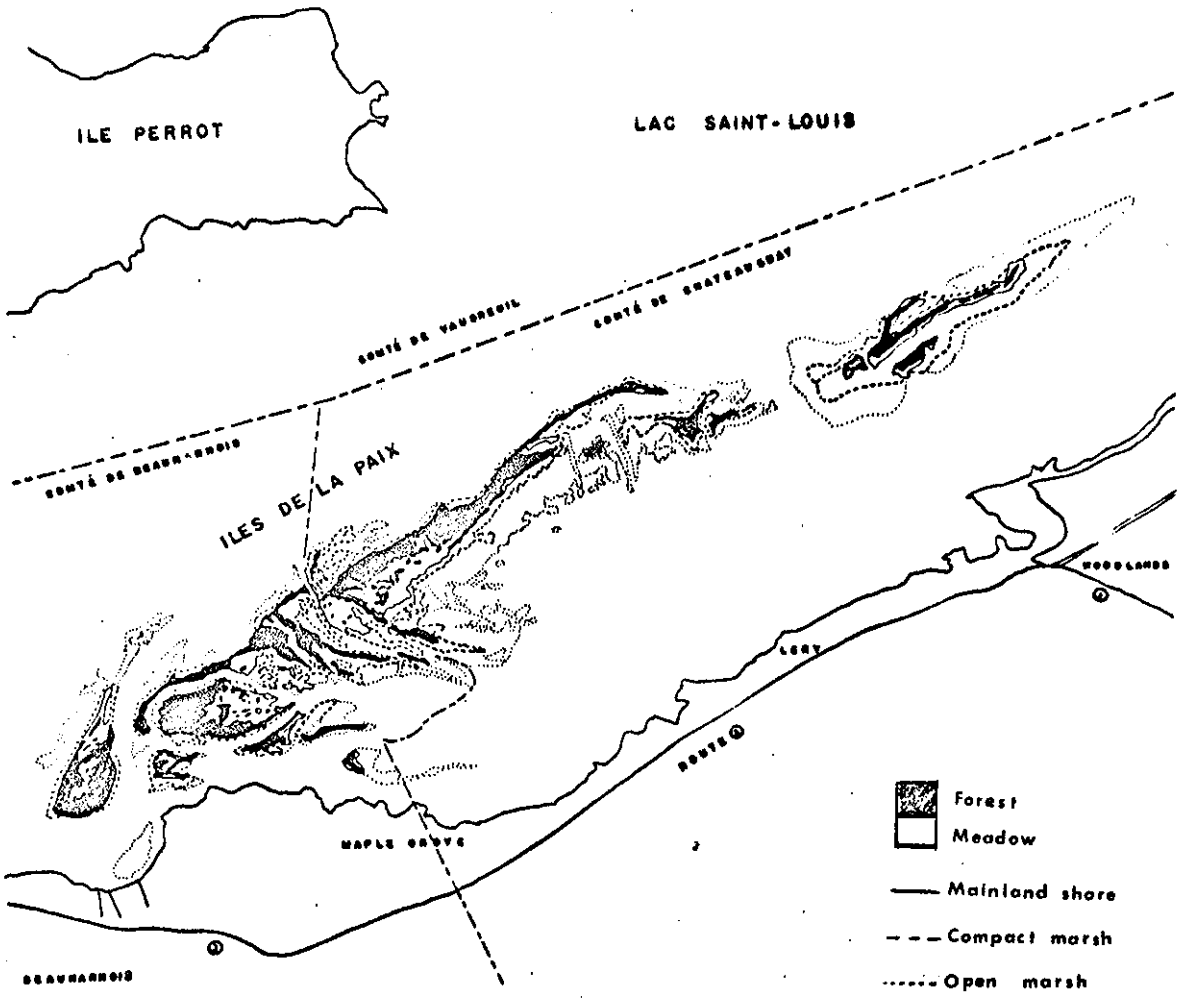

Fig. 3. Cover map reproduced from Morency-Cartier (1966).

section of the Great-Lakes-St. Lawrence region (Rowe, 1959).

The dominant cover type is composed of silver and red maple, red and black ash, american and slippery elm, basswood, oaks and shagback hickory. In more sandy substratum, black willow clearly dominates. The low growing woody plants forming the understory are primarily composed of dogwood, cranberry, buttonbush, hawthorns, riverbank grape, Virginia creeper, red-berried elder and american black currant (or gooseberry). The dominant herbaceous plants on the forest floor are nettle, spotted Touch-me-Not and various other herbaceous plants. Also found are dragonroot in humid open forest and poison ivy in the center of the forest (Morency-Cartier, 1966).

The shrub zone contains several species of willows, alder, hawthorns, dogwood and buttonbush.

The remaining part of the islands is wet meadows and compact marshes where the following herbaceous plants were found: blue-joint grass, reed grass, spotted Touch-me-Not, spike loosestrife, smartweed, pectinate spartina, goldenrod, aster, common milkweed and sedge.

The emergent aquatic plants that characterize the marshes surrounding the islands include various associations of sofstem, hardstem and river bulrush. Among these are anchored almost pure stands of broad-leaved and narrow-leaved cattail. Three-square bulrush is found over sandy substratum, particularly along the north shore of some islands. Along edges of channels and in shallow and protected water areas grow various emergent associations of sweet flag, broad-leaved and sessile-fruited arrowhead, flowering rush, pickerel-weed, bur-reed, spike rushes and smartweeds.

The floating and submerged vegetation found with the above emergents include lesser and ivy-leaved duckweed, frogbit, white and yellow water lily, coontail and Canada waterweed.

Furthermore, according to Pageau and Lévesque (1963) over ten square miles of Lake St. Louis surface is covered by dense beds of wild celery together with several species of pondweeds, water plantain, mud plantain and water milfoil.

IV- The Breeding Waterfowl at Iles-de-la-Paix

1. Breeding species

During 1968, five species of ducks were found nesting on the study area. These were the mallard, black duck, pintail, green-winged teal and blue-winged teal. Besides, three other species of dabblers could have been possible nesters, namely american widgeon, shoveler and wood duck.

2. Estimates of the breeding populations

Estimates of the waterfowl breeding populations were determined through various lines of approach. One, by using the figures obtained during the breeding pair counts conducted in the spring; a second, by calculating the highest number of active nests per day during the breeding season with allowances for hens in the renesting interval (i.e., hens whose nests were abandoned or destroyed during the incubation period and which had to wait a certain period for physiological reasons before renesting); finally, by back-dating brood data, the hatching date of some broods did not correspond to the hatching date of successful nests and were therefore added.

A maximum population index was arbitrarily calculated by using the highest figure for any one species, either from the breeding pair counts or from a combination of the active nests and broods not represented in the former (Table 3).

The number of pairs determined by the breeding pair counts appears low for the black duck and possibly the mallard. These surveys were made at a time when some sections of the forest were still flooded. Any loafing drakes or pairs using these areas unaccessible by canoe would have been missed. On the other hand, the number of blue-winged teal counted by the same method could be too high or else I have missed over half of the blue-winged teal nests. Considering the type of nesting cover used by this species, it is quite conceivable that some nests were not found. Another possibility is that some drakes, paired to females nesting along the adjacent mainland (between 500 feet to a mile away), had to spend their waiting periods close to the islands due to lack of loafing areas and a high degree of disturbance along the south shore of the lake. Finally, since the majority

of blue-winged teal observed were males, a third possibility exists that some of them were excess drakes.

Table 3. Breeding population index

Species	Breeding pair counts	Active nests/ day (1)	Back-dating brood (2)	Total 1 & 2	Index
Black Duck	20	26	-	26	26
Mallard	9	10	1	10	10
B.-w. Teal	12	5	2	7	12
Pintail	6	4	1	5	6
G.-w. Teal	-	2	-	2	2
Shoveler	2	-	1	1	2
A. widgeon	2	-	-	-	2
Wood Duck	-	-	1	1	1
Total	51	~~46~~ 47	6	~~52~~ 53	~~61~~ 62

The potential breeding population at Iles-de-la-Paix during 1968 could have been 62 breeding pairs. Considering the unreliability of the breeding pair counts, the figures obtained by adding active nests and back-dated broods, probably give a more reliable population estimate, although

some broods may have originated from the mainland. However, the ~~52~~ 47 breeding pairs thus calculated should represent a minimum breeding population. (6 broods could have originated from the mainland; thus minimum breeding population should be 47 pairs)

3. Distribution of nests and nesting densities

The nesting habitat on the islands can be separated in two broad ecotypes, namely forest and meadow. In the forest, nest sites were either in trees or on the forest floor, while in meadow the nests were on the ground. During the season a total of 68 nests were found. Their distribution per ecotype is presented in Table 4.

In trees, the nests were placed at height up to six feet, but the majority (85.6%) were not higher than three feet (Table 5).

Iles-de-la-Paix include some fourteen individual islands that vary in size from 0.8 to 77.2 acres. Ile du Rapide which is privately owned was not studied. Nests were found on all islands (Fig. 4) and in general small islands had a higher nesting density per surface area than large islands (Table 6). The overall nesting density for all species combined was 0.24 duck-nest

Table 4. Nest distribution by ecotype

Species	Forest		Meadow	Total nests	
	Tree	Ground		N	%
Black Duck	23	15	-	38	55.8
Mallard	10	4	3	17	25.0
B.-w. Teal	1	2	2	5	7.4
Pintail	-	1	3	4	5.8
G.-w. Teal	-	2	-	2	2.9
Black or Mallard	1	1	--	2	2.9
Total	35	25	8	68	99.8
Percentage	51.4	36.7	11.7		

Table 5. Height at which nests were located in trees

Intervals in ft	Black Duck	Mal-lard	B.-w. Teal	Black or Mallard	Total	
					N	%
0.5 - 1.5	8	3	1	-	12	34.2
2.0 - 3.0	13	4	-	1	18	51.4
3.5 - 4.5	1	-	-	-	1	2.8
5.0 - 6.0	1	3	-	-	4	11.4
Total	23	10	1	1	35	99.8

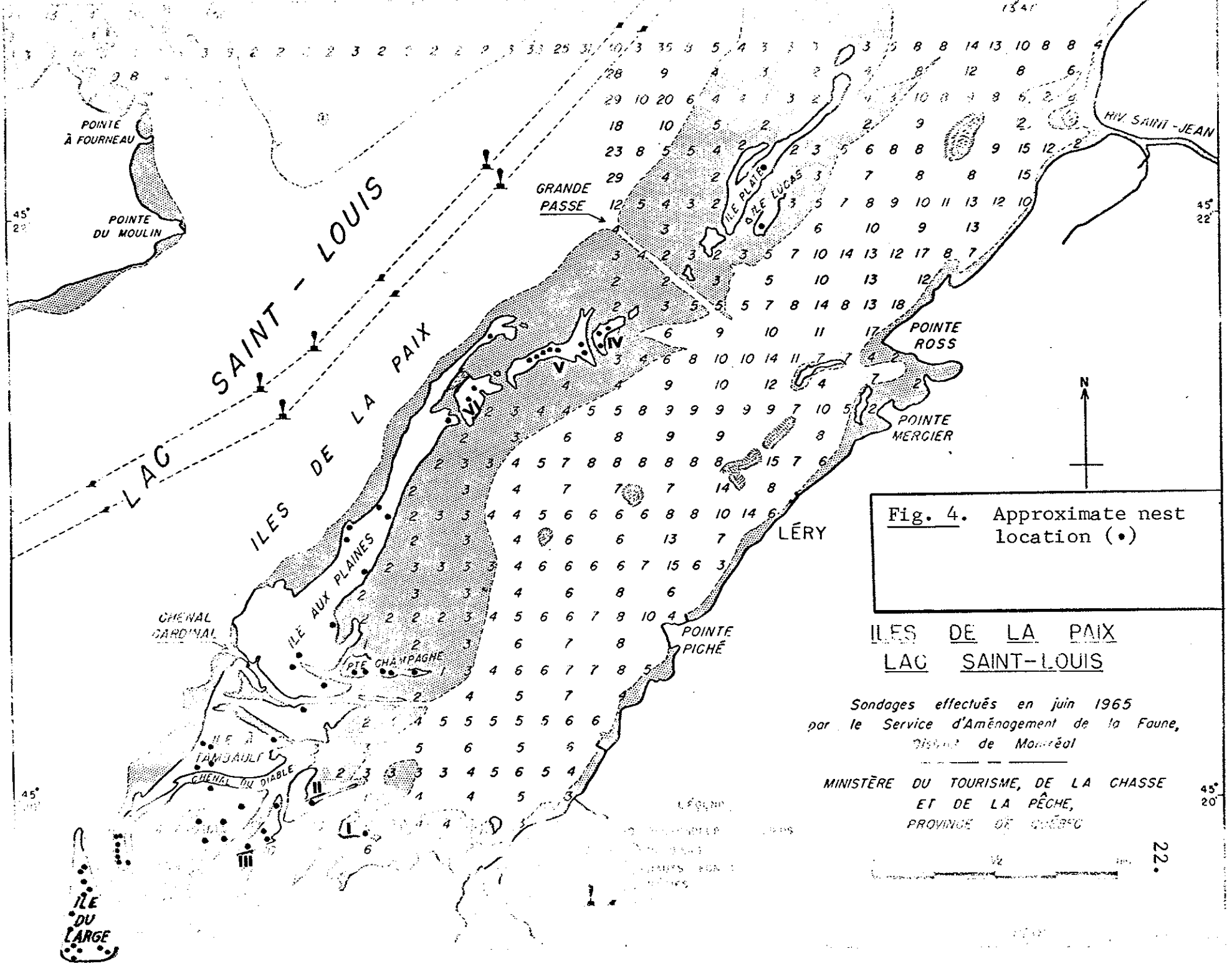

Fig. 4. Approximate nest location (•)

ILES DE LA PAIX
LAC SAINT-LOUIS

Sondages effectués en juin 1965 par le Service d'Aménagement de la Faune, District de Montréal

MINISTÈRE DU TOURISME, DE LA CHASSE ET DE LA PÊCHE, PROVINCE DE QUÉBEC

per acre and the overall nest density for black duck was 0.13 nest per acre.

Table 6. Waterfowl nest density per acre and for each island (all species)

Name of island	Acreage	No. of nests	Density/acre
Ile No. IV	0.8	3	3.75
Ile No. VI	0.8	2	2.50
Ile No. V	1.2	7	5.83
Ile Lucas	1.3	1	0.77
Ile aux Veaux(#1)	1.4	1	0.71
Pte Champagne	3.2	5	1.56
Ile Plate	4.0	1	0.25
Ile No. III	4.4	4	0.90
Ile No. II	11.2	1	0.08
Ile du Large	36.0	13	0.36
Ile à Thomas	68.8	6	0.08
Ile aux Plaines	76.0	10	0.13
Ile à Thambault	77.2	14	0.18
Total	286.3	68	0.24

4. Nesting cover and nest sites

On Iles-de-la-Paix, the luxuriant vegetation of summer and fall is almost completely destroyed by ice and high water in the spring. Thus ground nesting cover for early nesting birds is absent in the forest. It is not surprising under these conditions to see over 51% of all nests associated with trees, either in clusters, crotches and tree cavities. On the forest floor the only cover available early in the breeding season is low woody cover such as accumulations of dead branches and vines usually found at the base of trees. Also found at this period, but in smaller quantity, are accumulations of dead vegetation and organic debris carried to various places by the high water. Some nests were even located at the foot of trees without any cover. New herbaceous vegetation on the forest floor, especially various grasses and nettle, provides cover for late nesting or renesting birds some time around mid-May.

The meadows remain flooded for a longer period of time and usually new plant growth has started to develop

before the ducks are able to nest there. The first nest initiation there in 1968 was on May 19. The plants used as cover in that ecotype are primarily blue-joint grass, reed grass and some cattail.

The distribution of nests per cover-type is presented in Table 7. Since tree cluster and crotch are considered to be of similar quality, they are grouped together.

A series of photographs showing some of the various nest sites is presented at the end of this report.

5. Nesting chronology

The navigation channel in Lake St. Louis is the first to open in the spring. This will usually occur around the third week of March. By April 1st, the center of the lake becomes free as well as small channels flowing between islands. Other water areas are found along the shoreline as the water level raises and floods the upper land. The ice completely disappears between April 12 and 19 (Table 8) as obtained from the Department of Transport of Canada.

The presence of ice however does not seem to affect

Table 7. Nest distribution per cover-type

Cover-type	Black Duck	Mal-lard	B.-w. Teal	Pin-tail	G.-w. Teal	Blk or Mallard
Tree cluster and crotch	15 (39.5)*	7 (41.2)	-- --	-- --	-- --	1 --
Low woody cover	11 (28.9)	3 (17.6)	-- --	-- --	1 --	-- --
Hollow tree hole	8 (21.1)	3 (17.6)	1 --	-- --	-- --	-- --
Base of tree	1 (2.6)	1 (5.9)	-- --	1 --	-- --	-- --
Herbaceous growth forest floor	3 (7.9)	-- --	2 --	-- --	1 --	-- --
Herbaceous growth meadow	-- --	3 (17.6)	-- 2 --	-- 3 --	-- --	-- --
Miscellaneous	--	--	--	--	--	1

* Figure in brackets () represents percentage

the start of nesting as birds started to arrive at least three to four weeks before the ice was all gone and they started to nest in 1968 a few days before the ice had completely disappeared. Weather conditions no doubt play a greater role in the start of laying. Comparing mean

Table 8. Dates of ice disappearance over Lake St. Louis, 1960-1968.

1960	April 17
1961	April 14
1962	April 19
1963	April 19
1964	April 16
1965	April 17
1966	April 12
1967	April 15
1968	April 12
Variation : ± 3.5 days (April 12 to 19)	

monthly temperatures for March and April (Table 9) shows that 1968 averages were higher than the 1963-68 ones. Therefore the nest initiation in 1968 could be considered at least slightly earlier than normal. In fact, the first egg laid was around April 8 or 9 by a mallard and April 11 by a black duck.

Black duck and mallard started to lay their last clutch on June 1 and June 8 respectively. Their laying

Table 9. Mean monthly temperatures (°F) for March and April as recorded at the Montréal International Airport, 1963-1968.

Year	March	April
1963	25.0	42.0
1964	30.0	43.0
1965	28.0	41.0
1966	31.0	42.0
1967	22.0	40.0
1968	30.0	47.0
Mean (1963-1968)	27.6	42.5

period was almost nine weeks. The other three species had a nesting chronology somewhat similar to each other and were therefore lumped together. The earliest laying attempt was on May 8 and the latest on June 18, for a laying period of six weeks.

Laying peaks for both the black duck and the mallard was attained between April 12-25 (Table 10). A second peak of smaller amplitude was reached between May 10 and 23. This one probably represented later clutches (renests)

Table 10. Number of clutches started by two week-intervals

Species	March 29-April 11	April 12-April 25	April 26-May 9	May 10-May 23	May 24-June 6	June 7-June 20
Blk Duck	1(2.8)*	20(57.1)	4(11.4)	6(17.1)	4(11.4)	--
Mallard	1(8.3)	5(41.6)	--	3(25.0)	2(16.6)	1(8.3)
Others	--	--	2(18.1)	6(54.5)	2(18.1)	1(9.1)

* Figure in brackets () represents percentages.

from hens that lost their earlier ones. Laying peak for the other three species was reached between May 10 and 23.

The hatching period for black duck and mallard extended from May 12 to July 4, i.e., a period of 54 days. Their hatching peak was reached between May 10 and 23. For the other three species together the hatching period varied between June 8 and July 9, for a hatching period of 32 days. Their hatching peak occurred between June 7 and 20 (Table 11).

6. Rate and time of laying

Searching for nests began on April 30, 1968, and by that date over 50% of black duck and mallard nests were

Table 11. Number of nests hatched by two week-intervals

Species	May 10-May 23	May 24-June 6	June 7-June 20	June 21-July 4	July 5-July 18
Blk Duck	12 (52.2)	4 (17.4)	4 (17.4)	3 (13.0)	--
Mallard	3(60.0)	--	--	2(40.0)	--
Others	--	--	5(62.5)	2(25.0)	1(12.5)

* Figure in brackets () represents percentages.

initiated. Furthermore, in order to reduce disturbance to a minimum, nests were not visited often. Therefore, data on rate and time of laying are lacking.

7. Clutch size

A frequency distribution of the number of eggs in complete clutches is given in Table 12. The standard deviation was not calculated due to the small size of the sample.

8. Incubation period

The data on incubation period are also lacking for reasons similar to those mentioned earlier under rate and time of laying. I have complete data on only eleven

Table 12. Waterfowl clutch size per species

Clutch size	Black Duck	Mallard	B.-w. Teal	Pintail	G.-w. Teal
7	1	--	--	1	--
8	3	1	--	1	--
9	12	3	--	1	--
10	8	6	1	--	--
11	5	1	3	--	--
12	--	--	--	--	2
Total	29	11	5	3	2
Mean	9.4	9.6	11.0	8.0	12.0

nests. Two black duck nests were incubated during 25 days, and two others during 26 days. One mallard incubated for 26 days. The five blue-winged teal nests had an average incubation period of 23.2 days with a variation from 22 to 24 days. One green-winged teal incubated for 24 days.

9. Brood raising

Marshes surrounding Iles-de-la-Paix, except for a few small bays and for a fringe of persistent aquatics along some sections of the lake shore and of Ile Perrot,

represent the only remaining brood raising habitat of value in Lake St. Louis. It is doubtful if hens that hatch young on the islands go somewhere else to rear them. However, some broods hatched outside the islands could well be brought up in Iles-de-la-Paix marshes. The fact remains that these marshes probably act as a self contained unit for the waterfowl breeding on Iles-de-la-Paix.

The study area thus seems to offer excellent opportunity to trap and mark nesting females for later identification. The purposes of this will be to determine:

1° homing (in case of long term study)

2° renesting

3° brood movement and habitat utilization

4° brood survival and more particularly the percentage of broods reaching the Class III stage

5° summer recruiting rate of broods that do not originate from the islands.

In 1968, I tried to capture fourteen (14) incubating females. Ten were trapped, banded and marked with various colors of airplane dope. The paint was applied on the

upper back (lower neck) so that hens could be later identified even if reluctant to fly. Seven of these marked females successfully hatched young. However, none of them could be seen again in later brood surveys carried by helicopter. Following marking, we sighted some of the marked females on seven occasions before hatching took place. These females were seen from one to eleven days after marking. By then, the marks were getting less visible. I feel that the thickness of the contour feathers where the paint was applied gradually absorbed it, and within a relatively short period the marks were barely visible. In the future, paint will be applied to the upper wing surface.

Brood mobility could not be assessed. However, most brood observations indicated that the birds stayed rather close to the island shoreline. Only in the first hours of daylight in the morning did I observe broods in open or semi-open areas and away from the thicker escape cover found along the shoreline.

Brood data are real scanty and therefore survival cannot be determined. A total of 55 broods were seen

during four brood surveys including a few individual records made during the regular field work. Of these, only 35 broods (63%) could be properly aged and classed using Gollop and Marshall's guide (1954). These are summarized in Table 13.

Table 13. Number of ducklings per brood observed

Species	Class I	Class II	Class III
Black Duck	6.1 (11)*	5.6 (6)	4.3 (3)
Mallard	6.0 (1)	6.0 (4)	--
B.-w. Teal	7.0 (2)	7.0 (1)	6.0 (2)
Pintail	5.0 (1)	6.0 (1)	3.0 (1)
Unknown	8.5 (2)	--	--

* Figure in brackets () represents number of broods seen

The species composition obtained from the breeding pair counts and the brood surveys was compared, using the most representative survey in each case, i.e., May 14 for the breeding pair count and July 22 for the brood survey. In the latter, broods and broody females were counted (Table 14).

Table 14. Correlation (percent) between the breeding species composition obtained from breeding pair and brood counts.

Species	Breeding Pairs May 14		Brood Survey July 22	
	N	%	N	%
Black Duck	20	39.2	10	38.4
Mallard	9	17.6	3	11.5
B.-w. Teal	12	23.5	7	26.9
Pintail	6	11.7	2	7.7
G.-w. Teal	--	--	--	--
Shoveler	2	3.9	1	3.8
A. widgeon	2	3.9	--	--
Wood Duck	--	--	1	3.8
Unknown	--	--	2	7.7
Total	51	99.8	26	99.8

It is interesting to note that good correlation exists between the species composition determined from these two methods, even though no adjustments were made for the hatching success of each species and the possible habitat preference for the various species. For instance, comparing the mallard success (35.7%) to the blue-winged

teal success (100%) could give the latter a false breeding population index if only brood records were examined. As for habitat selection, not enough is known at least for brood rairing habitat, to be of any help in data interpretation.

V. Nesting Success and Production

1. Observer interference

Observer interference is a factor to be taken into consideration when conducting nesting study of this nature. Breeding females, especially during the laying period, have the tendency to desert their nests when disturbed; they are more faithful to their nest during the incubation period. In this study, 10.3% (7 nests) were deserted following observer interference. I feel that this percentage could have been higher if the study had been carried differently. I started the nest searching on April 30 when almost 50% of all nests were already completed. In fact only 15 nests (22%) were found while hens were in the laying process. Of these, two deserted following a first visit. The remaining

five desertions were from incubating females. They abandoned their nest following intensive trapping efforts. I have no indication, however, of the increased predation that could have resulted because of my activities on the islands.

2. Nesting success

Nests known to have been deserted due to observer interference were omitted from the calculations presented in Table 15. Hens that hatched one young or more were considered successful.

Kalmbach (1939) analyzed the results of 22 waterfowl studies and pointed out that the nesting success varied between 36% and 85% with an average of 60%. Sowls (1955) reported a nesting success of 35% for several species of ducks at Delta, Manitoba. In Chesapeake Bay, Maryland, Stotts and Davis (1960) found black duck nest success to average 38% (varying from 32% to 63%) (in Munro, 1968)). At Ile-aux-Pommes, Québec, Reed (1966) reported nesting success for the black duck to average 47.7% (varying from 34.8% to 59.4%). The nesting success obtained

Table 15. Waterfowl nest success

Fate of clutch	Black Duck	Mallard	B.-w. Teal	Pin-tail	G.-w. Teal	Blk or Mallard	Total
Hatched	23	5	5	2	1	--	36
	(63.9)*	(35.7)	(100.0)	--	--	--	(59.0)
Destroyed	10	8	--	--	1	2	21
	(27.7)	(57.1)	--	--	--	--	(34.4)
Deserted	3	1	--	--	--	--	4
	(8.3)	(7.1)	--	--	--	--	(6.5)
Total	36	14	5	2	2	2	61
Deserted due to observer inter-ference	2	3	--	2	--	--	7
	(5.2)	(17.6)	--	--	--	--	(10.3)
Grand Total	38	17	5	4	2	2	68

* Figure in brackets () represents percentages.

for this species at Iles-de-la-Paix (63.9%) compares very favorably with that obtained in other studies. Nesting success for mallard (35.7%) even though low, still compares with values given by Sowls (1955).

3. Predation

The nests destroyed by predators amounted to 34.4%

(21 nests) of all nests found. At least twelve of these nests or 57% were destroyed by crows, although I feel that this percentage could well be higher. Causes of other nest destruction could not be ascertained. The mink was suspected as a possible predator on a few instances. Although no nest was knowingly destroyed by fox, one dead fox was found on Ile à Thomas (May 1, 1968) and an old abandoned fox burrow was found on the same island. No post mortem examination of the dead fox was made to determine the cause of death as the body was in an advanced stage of decay. No other fox activity could be detected on the islands. Before the era of snow mobiles, foxes were reported as very common on the islands during the winter. Nowadays they are rarely seen. The raccoon, which is a known egg predator, had been reported on the islands prior to this study, but no raccoon activity was found there during 1968.

4. Nesting success in relation to nesting cover

Nesting success per cover-type could give a relative indication of protection offered to a nest. However, when stratified by species, the results become too

fragmentary to warrant any valid interpretation. Some idea could be obtained for black duck and for all species combined (Table 16). In calculating the nesting success per cover-type, any loss due to observer interference was excluded.

Table 16. Waterfowl nest success per cover-type

Cover-type	Black Duck	Mallard	B.-w. Teal	Pin-tail	G.-w. Teal	Total
Tree cluster and crotch	15 (60.0)**	7 --	-- --	-- --	-- --	22 (54.5)*
Low woody cover	10 (90.0)	1 --	-- --	-- --	1 --	12 (83.3)
Hollow tree hole	7 (42.8)	3 --	1 --	-- --	-- --	11 (36.3)
Base of tree	1 (0.0)	1 --	-- --	1 --	-- --	3 (66.6)
Herbaceous Growth forest floor	3 (66.6)	-- --	2 --	-- --	1 --	6 (66.6)
Herbaceous growth meadow	-- --	2 --	2 --	1 --	-- --	5 (100.0)

* Percentages calculated only for black duck and for all species combined

** Figure in brackets () represents percentages

5. Nesting success in relation to degree of nest concealment

A second measure of protection offered to a nest was determined using the degree of nest concealment. To do this I classified the nesting cover for each nest under three categories:

- very good : when hen and nest were well camouflaged on top and along sides
- good to fair: when hen and nest were only partly hidden
- poor : when hen and nest were almost completely exposed.

This measure is arbitrary and very subjective, and therefore results have to be used with caution (Table 17). Again, nest loss due to observer interference was omitted from the calculations.

Table 17. Waterfowl nest success per degree of nest concealment - all species combined -

Degree of nest concealment	No. of nests	% hatched
Very good	15	93.3
Good to fair	26	53.8
Poor	19	42.1

Interpretation of nesting success per cover-type and per degree of nest concealment would be ideal if significant correlation could be made between cover-type and nest concealment. Due to certain limitations in determining the degree of nest concealment and the limited amount of data on hand concerning the number of nests found per cover-type, such interpretation is not possible.

6. Nesting success in relation to water level fluctuations

In 1968, no egg loss was caused solely by flooding. However, six nest sites were flooded at the end of June following a rise in water level. Four of these nests fortunately hatched or would have hatched (one deserted) before the water level started to rise. The other two nests, even though deserted before the flood, were not expected to hatch until after the second week of July.

7. Egg success

The percentage of ducklings produced from the number of all eggs laid is presented in Table 18.

Table 18. Waterfowl egg success

Fate of eggs	Black Duck	Mallard	B.-w. Teal	Pintail	G.-w. Teal	Total
Hatched	185 (61.1)*	37 (31.8)	53 (96.3)	16 (66.6)	12 (50.0)	303 (58.0)
Destroyed	60 (19.8)	39 (33.6)	-- --	-- --	12 (50.0)	111 (21.3)
Deserted other than observer	21 (6.9)	9 (7.7)	--	--	--	30 (5.7)
Deserted due to observer	14 (4.6)	26 (22.4)	-- --	8 (33.3)	-- --	48 (9.2)
Infertile or addled	11 (3.6)	5 (4.3)	2 (3.7)	-- --	-- --	18 (3.4)
Broken by accident	6 (1.9)	-- --	-- --	-- --	-- --	6 (1.1)
Pesticide analysis	6 (1.9)	-- --	-- --	-- --	-- --	6 (1.1)
Total	303 (99.8)	116 (99.8)	55 (100.0)	24 (99.9)	24 (100.0)	522 (99.8)

* Figure in brackets () represents percentages

A total of 331 eggs were laid in 36 successful clutches (all species combined). Of these, 303 (91.5%) hatched, 17 (5.1%) were infertile or addled and 11 (3.4%) were either collected for pesticide analysis or broken accidentally.

8. Production

In the production rate, I have used the breeding population (46 breeding pairs) determined from the number of active nests per day (Table 3) since these represent the most accurate data on hand. The figures from back-dated broods were omitted since the initial number of ducklings produced was not known (Table 19).

Production rate, as it measures the nesting effort of a whole breeding population, is better expressed in terms of female success rate rather than successful females that hatch young. Looking at the black duck figures, the successful hens produced an average of 8.04 ducklings. When expressed in terms of female success rate the figure comes down to 7.10 ducklings per breeding hen. This is remarkably higher than what has been found by Reed (1968). Comparing the number of ducklings produced per nesting female from 1963 to 1967 he obtained an average of 5.34 ducklings (varying from 3.71 to 6.33). Stotts and Davis (1960) estimated the black duck female success rate at 5.10 ducklings. For all species combined,

Table 19. Production rate determined for successful hens, total breeding pairs and percent success rate per nesting female.

Species	Nesting attempts	Breeding pairs	Successful clutches	Ducklings produced	Ducklings/ successful hen	Ducklings/ breeding pair	% female success rate
Blk Duck	38	26	23	185	8.04	7.10	88.4
Mallard	17	9	5	37	7.40	4.11	45.5
B.-w. Teal	5	5	5	53	10.60	10.60	100.0
Pintail	4	4	2	16	8.00	4.00	50.0
G.-w. Teal	2	2	1	12	12.00	6.00	50.0
Total	66	46	36	303	8.41	6.58	~~77.4~~ 78.2

46 breeding pairs produced 303 ducklings for a female success rate of 6.58 ducklings. Also, 77.4% of the total breeding pairs successfully hatched young. For black duck and mallard this percentage was 88.4 and 45.5 respectively.

VI- Management

I have mentioned on several occasions throughout this report that interpretation of the data gathered in 1968 was difficult to make. This should not however preclude a preliminary assessment of the habitat value for nesting waterfowl.

There are some limiting factors thought to affect one way or another maximum utilization of Iles-de-la-Paix area by nesting waterfowl. The most obvious ones are as follows:

1° flooding of the greater proportion of the islands;

2° lack of nest sites above the high water line early in the breeding season;

3° excessive density of trees and shrubs;

4° lack of ground litter;

5° lack of ground cover once the water has recessed from forested areas;

6° lack of interspersion of water and nesting habitat;

7° human disturbance.

These factors do not all act simultaneously, neither are they all present on each individual island. Corrective measures could be applied to lessen the effect of some of these factors, but not all of them can be corrected. Some of these measures were already presented in a "Preliminary Management Plan" (Laperle, M., 1968, C.W.S. type. report). A first management technique to be tried was the blasting of potholes in meadows or compact marsh to create interspersion of water and nesting habitat. This work was to be carried in November 1968. Due to heavy snow falls in the early part of November, the project was postponed until the fall of 1969.

A second management procedure concerned the improvement and establishment of nest sites that could be available early in the nesting season irrespective of

the water level. This phase of the work was carried in March 1969. Nest sites were improved or constructed on the following islands (Fig. 5):

a) Island No. II

b) Southwest point of Ile à Tambault

c) Southwest section of Ile aux Plaines

d) Island No. V

A total of 63 nest sites were provided on the above management units. These were mainly of two types: artificial chicken wire baskets filled with hay, and improved natural sites. The wire baskets were installed in tree clusters. Natural sites consisted in providing access to tree clusters and crotches that were filled with dead branches and other debris, filling rotten tree stumps and tree crotches above high water line and opening small tree cavities to dimensions suitable for nesting waterfowl. In all instances, hay was added. A summary of the nest sites installed or improved is presented in Table 20.

Besides, ten wood duck nest boxes will be added in the spring of 1969, i.e., as soon as the ice is gone.

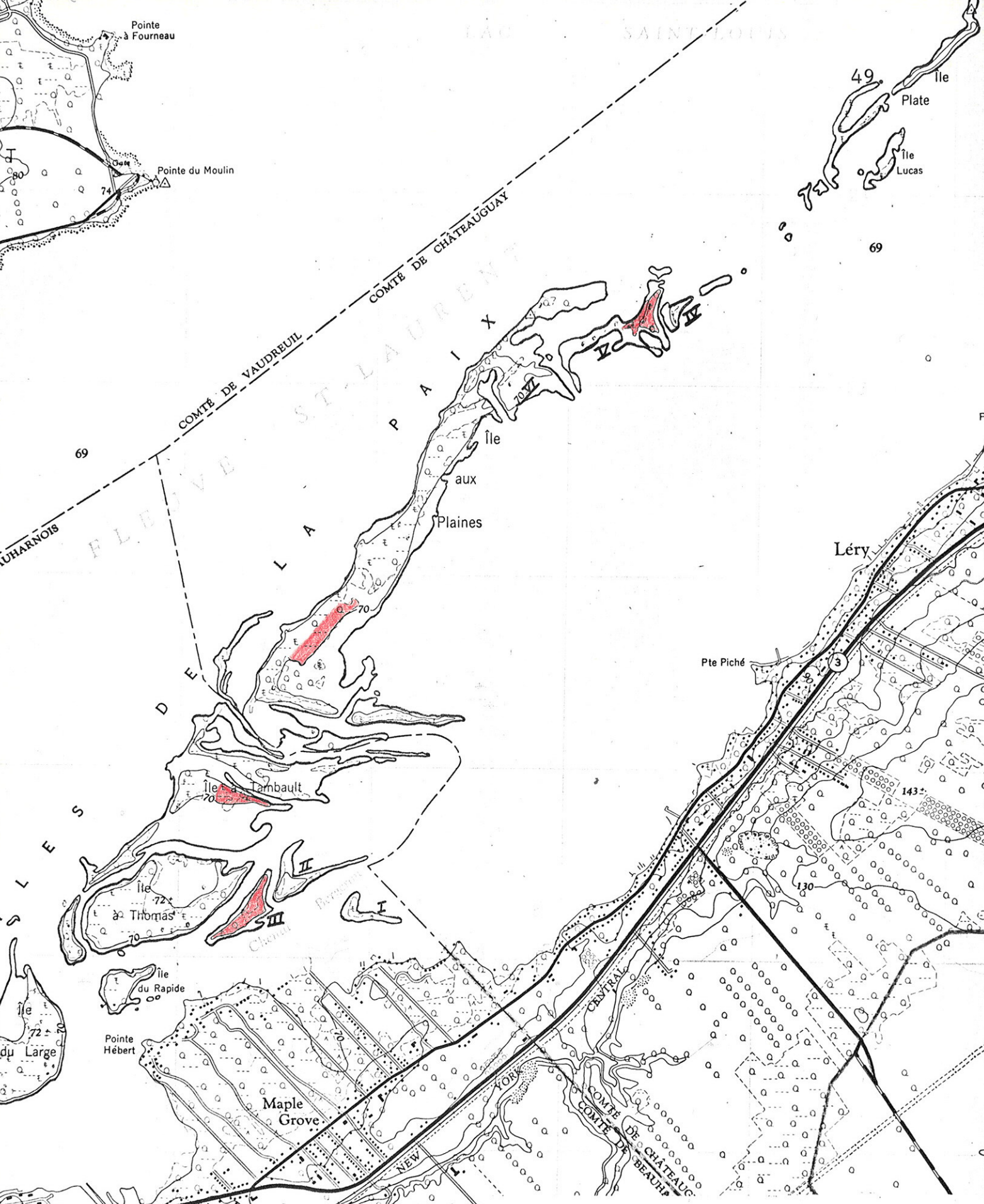

Fig. 5. Management units (nest sites)
Scale: 1 mi. 2.5 in.

Table 21. Location, types and number of nest sites installed or improved.

Location	Artificial structures	Improved natural	Total
Island No. II	16	2	18
Ile à Tambault	7	6	13
Ile aux Plaines	7	11	18
Island No. V	3	11	14
Total	33	30	63

Finally, a third corrective measure could have been tried before the 1969 breeding season. It concerned the thinning of the forest on Ile à Thomas and some dense shrub zones on Ile aux Plaines. This too had to be postponed until next year.

Other management implications may become more obvious after the 1969 breeding season has passed and the data analyzed.

VII- Conclusion and Recommendations

Data obtained during 1968 have revealed that Iles-de-la-Paix support a fair waterfowl breeding population

despite the fact that the area is severely affected by flood and subjected to several other limiting factors.

The limited information gained on the breeding biology and brood survival could be due partly to my own inexperience and lack of planning. The project was initially devised to get species composition, general habitat utilization and brood density. Results obtained after the first week of nest research were so encouraging that the project was gradually expanded.

Continuation of this project in 1969 is essential in order to gather the necessary information for the preparation of a management plan for the islands as well as obtaining pertinent data that could be of significant interest in understanding various aspects of the waterfowl breeding ecology.

Through reassessment of the objectives, refinement of methods and techniques as well as a review of the available literature on similar studies, I hope to be able to obtain better and more consistent data during 1969.

Ste-Foy, Québec,
May, 1969.

Marcel Laperle,
Wildlife Biologist.

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Photo 1. Black duck nest in cluster of silver maple.

Photo 2. Mallard nest in black willow crotch.

Photo 3. A black duck nest was located under this pile of dead branches.

Photo 4. Accumulation of vines such as this provided excellent nesting cover.

Photo 5. Blue-winged teal nest in tree cavity.

Photo 6. Black duck nest at base of tree. Note absence of cover.

Photo 7. Dead vegetation carried in tree crotch by high water in the spring was selected as nest site in few occasions.

Photo 8. Black duck nest in herbaceous growth.

Photo 9. Chicken wire basket filled with hay installed in tree cluster.

Photo 10. Rotten tree trunk open to ground level was filled, thus providing for another nesting site above the high water line.

Photo 11. Tree cavity enlarged to dimension suitable for nesting waterfowl.

Photo 12. V-shaped crotch was filled to form more acceptable nest site.

APPENDIX A

English and scientific names of birds mentioned in the text.

English	Scientific
Black duck	*Anas rubripes*
Mallard	*Anas platyrhynchos*
Wood duck	*Aix sponsa*
Pintail	*Anas acuta*
Green-winged teal	*Anas carolinensis*
Blue-winged teal	*Anas discors*
American widgeon	*Mareca americana*
Shoveler	*Spatula clypeata*
Common crow	*Corvus brachyrhynchos*

APPENDIX B

English and scientific names of mammals mentioned in the text.

English	Scientific
Red fox	*Vulpes vulpes*
Raccoon	*Procyon lotor*
Mink	*Mustela vison*

APPENDIX C

English and scientific names of plants mentioned in the text.

English	Scientific
Alder	*Alnus rugosa*
American black currant	*Ribes americanum*
American elm	*Ulmus americana*
Aster	*Aster* sp.
Basswood	*Tilia americana*
Black ash	*Fraxinus nigra*
Black willow	*Salix nigra*
Blue-joint grass	*Calamagrostis canadensis*
Broad-leaved arrowhead	*Sagittaria latifolia*
Broad-leaved cattail	*Typha latifolia*
Burreed	*Sparganium eurycarpum*
Button-bush	*Cephalanthus* sp.
Canada water-weed	*Elodea canadensis*
Common milkweed	*Asclepias incarnata*
Coontail	*Ceratophyllum demersum*
Cranberry	*Viburnum* sp.
Dogwood	*Cornus stolonifera*
Dragon-root	*Arisaema Dracontium*

English	Scientific
Flowering rush	Butomus umbellatus
Frogbit	Hydrocharis morsus-ranae
Goldenrod	Solidago sp.
Hardstem bulrush	Scirpus acutus
Hawthorns	Crataegus sp.
Ivy-leaved duckweed	Lemna trisulca
Lesser duckweed	Lemna minor
Mud plantain	Heteranthera dubia
Narrow-leaved cattail	Typha angustifolia
Nettle	Laportea canadensis
Oaks	Quercus spp.
Pectinate spartina	Spartina pectinata
Pickerel-weed	Pontederia cordata
Poison ivy	Rhus radicans
Pondweeds	Potamogeton spp.
Red ash	Fraxinus pennsylvanica
Red-berried elder	Sambucus canadensis
Red maple	Acer rubrum
Reed grass	Phragmites communis
Riverbank grape	Vitis riparia
River bulrush	Scirpus fluviatilis

English	Scientific
Sedge	*Carex* sp.
Sessile-fruited arrowhead	*Sagittaria rigida*
Shagback hickory	*Carya ovata*
Silver maple	*Acer saccharinum*
Slippery elm	*Ulmus rubra*
Smartweeds	*Polygonum* spp.
Softstem bulrush	*Scirpus validus*
Spike loosestrife	*Lythrum Salicaria*
Spike rushes	*Eleocharis* spp.
Spotted-Touch-me-Not	*Impatiens capensis*
Sweet flag	*Acorus Calamus*
Tree-square bulrush	*Scirpus americanus*
Virginia creeper	*Parthenocissus quinquefolia*
Water milfoil	*Myriophyllum exalbescens*
Water plantain	*Alisma gramineum*
White water lily	*Nymphaea tuberosa*
Wild celery	*Vallisneria americana*
Willows	*Salix* spp.
Yellow water lily	*Nuphar* sp.