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TECHNICAL REPORT I -

WATERFOWL BREEDING AND STAGING SURVEYS

ON THE UNGAVA PENINSULA: 1987 - 1988

PREPARED FOR:

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JULY 1988

05-0900

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1.0 INTRODUCTION

Thirty-four species of waterfowl have been recorded from the study region (Table 1.1). This report focuses on the more common species within the three major categories of waterfowl; 1) Geese and Swans: Canada goose, 2) Diving ducks (divers): greater scaup, lesser scaup, black scoter, surf scoter, white-winged scoter, common goldeneye, common merganser and red-breasted merganser, and 3) Dabbling ducks (dabblers): black duck and green-winged teal.

Breeding densities of waterfowl throughout the Ungava peninsula are relatively low but the cumulative production of this vast area is significant. Labrador alone, contributes approximately 40% to the Atlantic Flyways stocks. Local harvests of these species are an important source of food and recreational activity.

Waterfowl return from southern wintering areas during April and May. They typically concentrate for a short period in ice-free areas (staging areas) along coastal bays and inlets and on interior lakes and rivers until breeding sites become ice free. Waterfowl utilize the lakes, ponds, rivers, bogs, marshes and estuarine habitats of the Ungava peninsula for nesting and raising their young. The breeding season extends from May through July. By August the young are fledged and both parents and young leave the breeding grounds and move to fall staging areas along the coast and on interior ponds

Table 1.1 Waterfowl species recorded in the study region.

GEESE AND SWANS	Anserinae	
Snow Geese	<u>Branta</u> <u>caerulescens</u>	r
Canada Goose	<u>Branta</u> <u>canadensis</u>	c B m
White-fronted Goose	<u>Branta</u> <u>bernicla</u>	r
Barnacle Goose	<u>Branta</u> <u>leucopsis</u>	r
Tundra Swan	<u>Cygnus</u> <u>columbianus</u>	r
DABBLING DUCKS	Anatini	
Wood duck	<u>Aix</u> <u>sponsa</u>	r
Green-winged Teal	<u>Anas</u> <u>crecca</u>	c B m
American Black Duck	<u>Anas</u> <u>rubripes</u>	c B m
Mallard	<u>Anas</u> <u>platyrhynchos</u>	r B m
Northern Pintail	<u>Anas</u> <u>acuta</u>	c B m
Blue-winged Teal	<u>Anas</u> <u>discors</u>	u B m
Northern Shoveller	<u>Anas</u> <u>clypeata</u>	r
Gadwall	<u>Anas</u> <u>strepera</u>	r.
Eurasian Wigeon	<u>Anas</u> <u>penelope</u>	r
American Wigeon	<u>Anas</u> <u>americana</u>	u B m
Eurasian Green-winged Teal	<u>Anas</u> <u>crecca</u> <u>crecca</u>	r
DIVING DUCKS	Aythyini	
Canvasback	<u>Aythya</u> <u>valisineria</u>	r
Ring-necked Duck	<u>Aythya</u> <u>collaris</u>	u B m
Greater Scaup	<u>Aythya</u> <u>marila</u>	c B m
Lesser Scaup	<u>Aythya</u> <u>affinis</u>	c B m
Common Eider	<u>Somateria</u> <u>mollissima</u>	c R
King Eider	<u>Somarteria</u> <u>spectabilis</u>	u m
Harlequin Duck	<u>Histrionicus</u> <u>histrionicus</u>	u B m
Oldsquaw	<u>Clangula</u> <u>hyemalis</u>	c b m
Black Scoter	<u>Melanitta</u> <u>nigra</u>	c b m
Surf Scoter	<u>Melanitta</u> <u>perspicillata</u>	c B m
White-winged Scoter	<u>Melanitta</u> <u>fusca</u>	c b m
Common Goldeye	<u>Bucephala</u> <u>clangula</u>	c B m
Barrow's Goldeneye	<u>Bucephala</u> <u>islandica</u>	u m
Bufflehead	<u>Bucephala</u> <u>albeola</u>	u m
Hooded Merganser	<u>Lophodytes</u> <u>cucullatus</u>	r
Common Merganser	<u>Mergus</u> <u>merganser</u>	u B m
Red-breasted Merganser	<u>Mergus</u> <u>serrator</u>	c B m
Ruddy Duck	<u>Canard</u> <u>roux</u>	r

*Status: c-common, u-uncommon, r-rare, m-migrant, w-winter, R-resident, B-breeds, b-breeds but more common as a migrant.

Source: Pilgrim 1978, Goudie and Whitman 1987, Godfrey 1986, B. Mactavish pers. comm., CWS wing-return data 1968-1986.

and lakes. Ducks and geese may be present on staging grounds from late August through October. Most waterfowl have left the region by November.

Waterfowl surveys were conducted in 1987 and 1988 as part of the biophysical baseline studies for the Goose Bay Environmental Impact Statement (EIS). These surveys were performed in order to obtain a better understanding of the spatial and temporal distribution of waterfowl, and changes in waterfowl breeding densities within the areas that will be affected by current and future NATO low-level flying activities at Goose Bay, Labrador. Most of the information obtained from these surveys was briefly summarised in the Natural Environment section (Chapter 4) of the EIS. This technical report describes the survey methods and results in greater detail than was possible in the EIS.

The 1987-1988 surveys enabled breeding pair densities of the more common waterfowl species in the region to be estimated. Comparisons of these results with the results from similar surveys conducted in Labrador by the Canadian Wildlife Service (CWS) in 1980-1982 (Goudie and Whitman 1987), just prior to the commencement of low-level flying, allowed preliminary assessment of the relative changes in waterfowl populations that may have resulted from military activities. Supporting information on these changes was obtained by comparing waterfowl breeding densities inside and outside of low-level flying training areas (LLTAs).

Major fall and spring staging areas were also identified. A staging site is a location where waterfowl gather en route to and from breeding and wintering grounds. Certain staging sites may be occupied by very large flocks of waterfowl for several weeks. By identifying sites where waterfowl are concentrated, it may be possible to recommend mitigative measures that will reduce the disturbance to waterfowl and lessening the probability of bird strikes by military airfcraft.

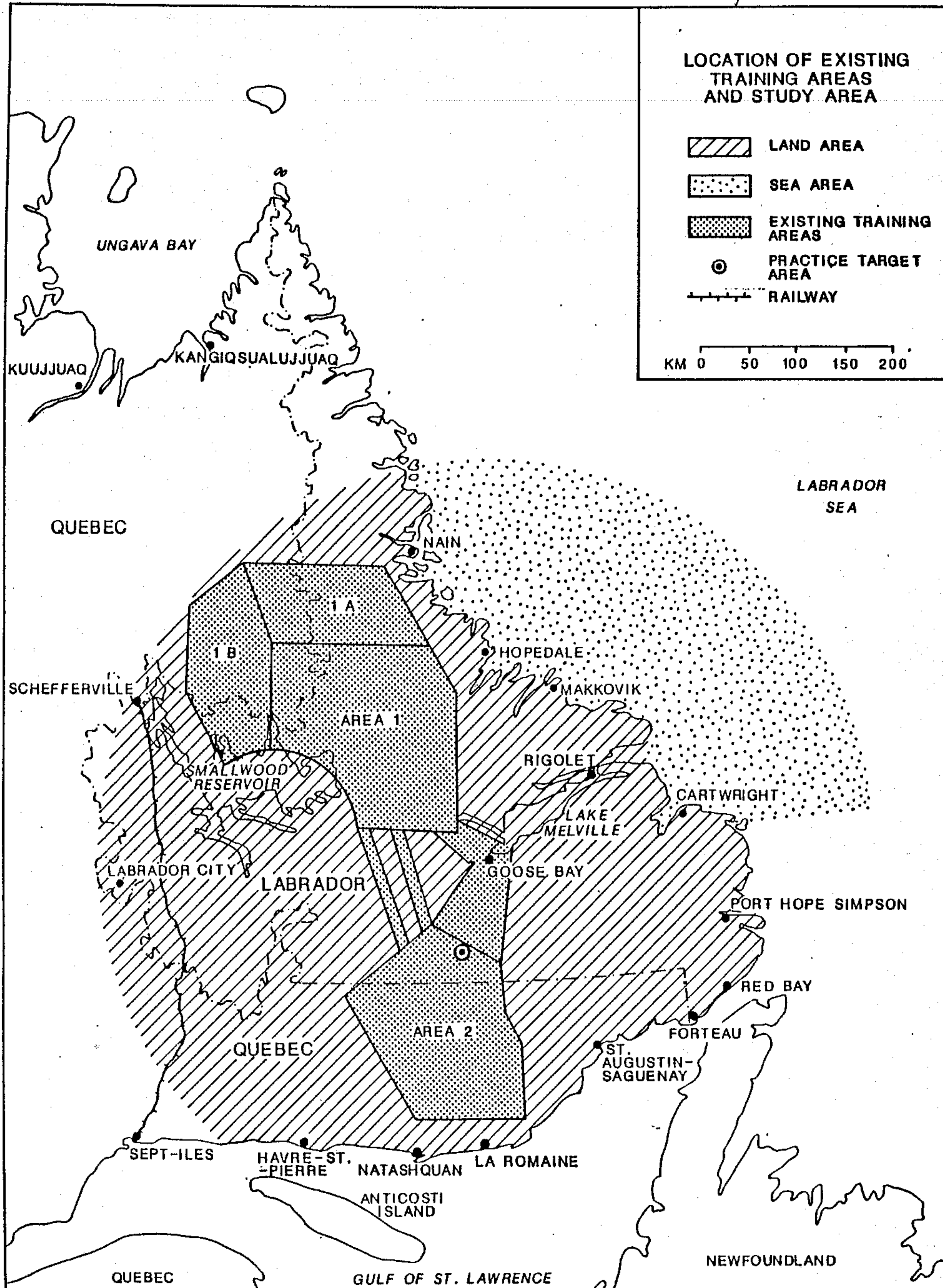
2.0 STUDY AREA

The study region for the EIS has been defined as the area within a 250 nautical mile radius around Goose Bay. There are currently two low-level flight training areas within the study region that are connected by "tunnels" and "corridors" (Figure 2.1).

The study area has long, harsh winters with snow cover from November to May. With the exception of the North Shore of Quebec, much of the remaining coastline is generally ice-covered for five months. Summers tend to be short and temperatures are lower along the coast due to the cold Labrador current. Coastal fog is quite common.

Previous studies (Goudie and Whitman 1987) have shown that waterfowl distribution is correlated to eco-regions as defined by Lopoukhine et al. (1977). This

Figure 2.1


LOCATION OF EXISTING TRAINING AREAS AND STUDY AREA
LAND AREA
SEA AREA
EXISTING TRAINING AREAS
PRACTICE TARGET AREA
RAILWAY
KM 0 50 100 150 200
UNGAVA BAY
KUUJJUAQ
KANGIQSUALUJJUAQ
QUEBEC
LABRADOR SEA
NAIN
1 A
1 B
HOPEDALE
MAKKOVIK
SCHEFFERVILLE
AREA 1
RIGOLET
SMALLWOOD RESERVOIR
CARTWRIGHT
LAKE MELVILLE
LABRADOR CITY
LABRADOR
GOOSE BAY
PORT HOPE SIMPSON
RED BAY
AREA 2
FORTEAU
QUEBEC
ST. AUGUSTIN-SAGUENAY
SEPT-ILES
HAVRE-ST.-PIERRE
NATASHQUAN
LA ROMAINE
ANTICOSTI ISLAND
NEWFOUNDLAND
QUEBEC
GULF OF ST. LAWRENCE

classification is based on climate as reflected by the dominant vegetation of an area. The study area includes several of these ecoregions (Figure 2.2). In this study, waterfowl were surveyed in the following ecoregions:

Eagle Plateau: Waterfowl capabilities within this region are relatively high with extensive string and blanket bogs surrounded by black spruce (*Picea mariana*) and larch (*Larix laricina*) of poor form. Lakes are particularly common.

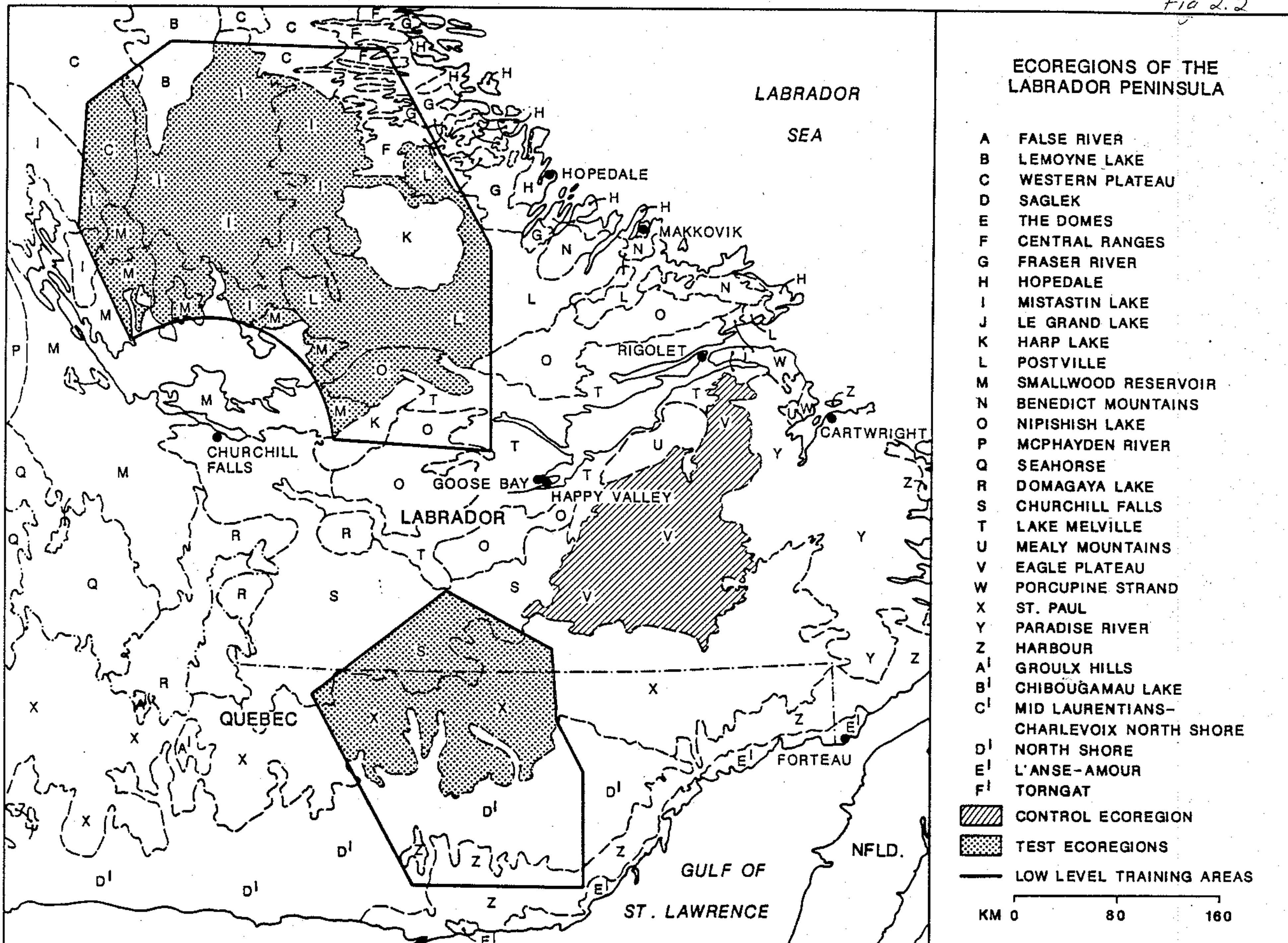
Mistastin Lake: Broad river valleys with some forest growth along slopes in this region which contains the northern continental tree limit.

St. Paul: Broad river valleys dissecting rolling hills of merchantable black and white spruce (*Picea glauca*) with fewer bogs than are found to the north of this region.

Smallwood Reservoir: Prior to the construction of the Smallwood Reservoir this area was rated to have the greatest population of waterfowl in Labrador. Numerous bogs are found here with black spruce-lichen woodlands on well-drained sites.

Churchill Falls: Dominated by upland plains with wide valleys, numerous string bogs and small ponds in exposed bedrock.

Fig 2.2



ECOREGIONS OF THE
LABRADOR PENINSULA
A FALSE RIVER
B LEMOYNE LAKE
C WESTERN PLATEAU
D SAGLEK
E THE DOMES
F CENTRAL RANGES
G FRASER RIVER
H HOPEDALE
I MISTASTIN LAKE
J LE GRAND LAKE
K HARP LAKE
L POSTVILLE
M SMALLWOOD RESERVOIR
N BENEDICT MOUNTAINS
O NIPISHISH LAKE
P MCPHAYDEN RIVER
Q SEAHORSE
R DOMAGAYA LAKE
S CHURCHILL FALLS
T LAKE MELVILLE
U MEALY MOUNTAINS
V EAGLE PLATEAU
W PORCUPINE STRAND
X ST. PAUL
Y PARADISE RIVER
Z HARBOUR
A' GROULX HILLS
B' CHIBOUGAMAU LAKE
C' MID LAURENTIANS-CHARLEVOIX NORTH SHORE
D' NORTH SHORE
E' L'ANSE-AMOUR
F' TORNGAT
CONTROL ECOREGION
TEST ECOREGIONS
LOW LEVEL TRAINING AREAS
KM 0 80 160
LABRADOR SEA
HOPEDALE
MAKKOVIK
RIGOLET
CARTWRIGHT
CHURCHILL FALLS
GOOSE BAY
HAPPY VALLEY
LABRADOR
QUEBEC
FORTEAU
NFLD.
GULF OF ST. LAWRENCE

Postville: A diversified vegetation and physiography with enriched swamp/marsh deltas amid sand and gravel plains and uplands.

Nipishish Lake: Rolling plateau dominated by drumlins with kames and eskers found in the valleys. There are numerous large lakes with organic terrain dominated by fens.

Western Plateau: Large lakes comprise 30% of this region but they are relatively unproductive because of the harsh climate.

3.0 METHODS

Two types of surveys were conducted, breeding pair surveys and staging surveys. Breeding pair surveys were conducted to provide an indication of the abundance of waterfowl in the area while staging surveys indentified areas of waterfowl concentration. Breeding pair surveys were conducted from 7-11 June 1987. Fall staging surveys were conducted from 24-30 August 1987 and 1-9 October 1987. Spring staging surveys were conducted from 13-19 May 1988.

3.1 BREEDING PAIR SURVEYS

Breeding pair surveys included transect and plot surveys. Both of these provide an indication of the abundance of waterfowl within the region; however, aerial surveys do not produce a total count due to the difficulty in detecting all individuals from the air. Since the visibility of any given species from the air is constant, transect surveys do yield an index of abundance which can be multiplied by the appropriate air/ground correction factor to provide an estimate of the breeding densities. Plot surveys were used to obtain total counts to use in calculating air/ground correction factors.

Transect survey routes and plot locations were chosen to provide coverage of areas previously surveyed by Goudie and Whitman (1987). The 1987 surveys covered 8 ecoregions previously described and illustrated in Figure 2.2.

Following methods used by Goudie and Whitman (1987), birds were identified to species where possible, and were categorized as a breeding pair, lone birds (male, female, or unspecified), female on nest, female with brood or an unaccompanied brood.

3.1.1 Plots Surveys

Four 6 km x 6 km plots were intensively surveyed to obtain total counts for use in calculating air/ground correction factors for the transect surveys (Figure 3.1). These plot surveys also allowed a more accurate censusing in areas of high breeding concentrations. Because of variability in habitat productivity within an ecoregion, the small size of the plots can produce significant errors when extrapolating the results to an entire ecoregion.

Bell 206B Jet Ranger or 206L Long Range helicopters, with two observers were used to survey plots in the following areas: Snegamook Lake, West MicMac Lake, Woods Lake, and Lake 1155 (Figure 3.1). These sites were chosen after consultation with CWS personnel (I. Goudie, pers. comm.). Waterfowl sightings were plotted on 1:50,000 topographic maps.

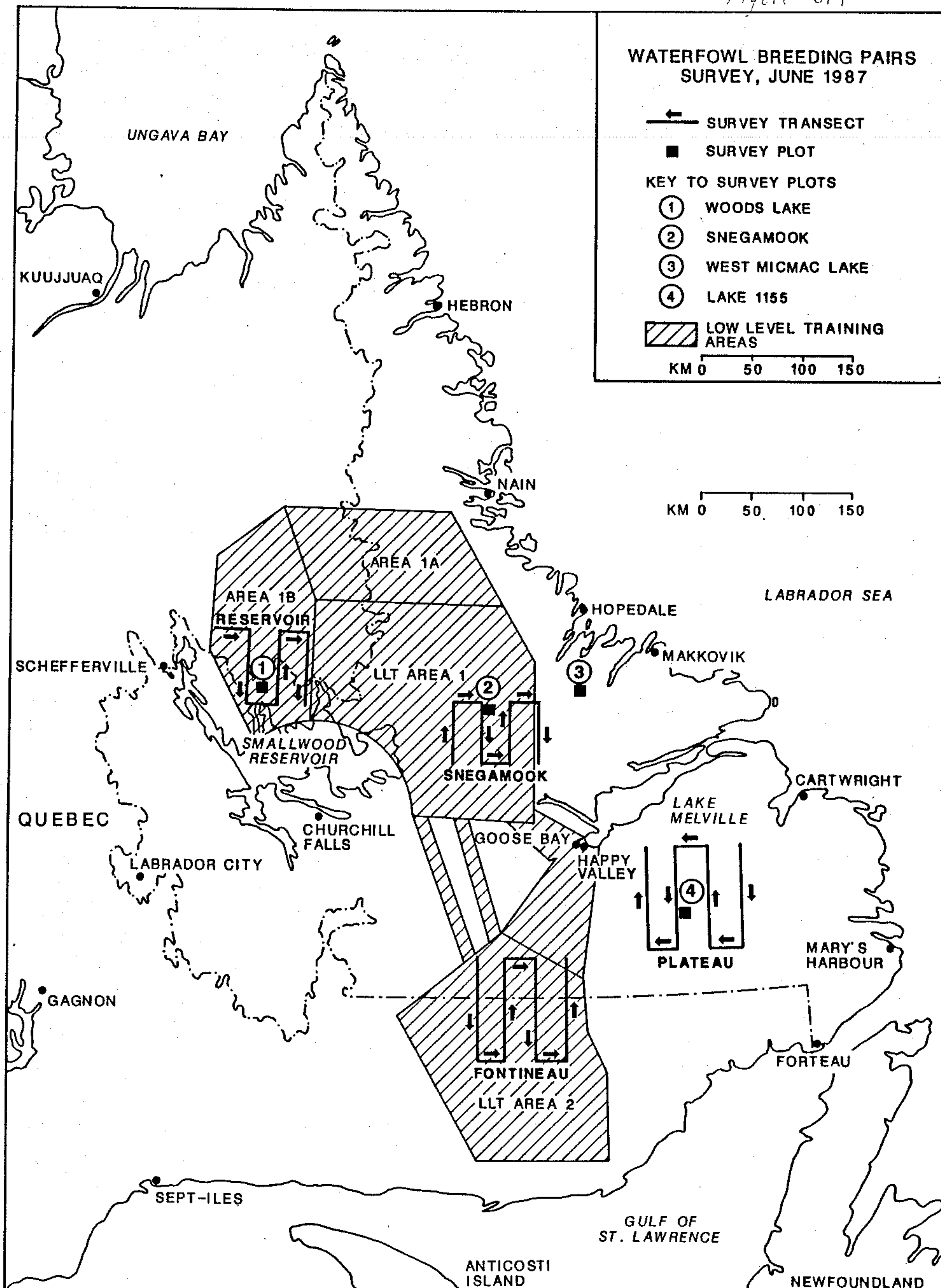
3.1.2 Transects Surveys

Four transect surveys were conducted; three within the LLTAs and one outside of the LLTAs (Figure 3.1). The Reservoir transect covered the Western Plateau, Mistastin Lake and Smallwood Reservoir ecoregions. The Snegamook transect covered the Postville and Nipishish Lake ecoregions, while the Fontineau transect provided coverage of Churchill Falls and St. Paul ecoregions.

The Plateau transect covered Eagle Plateau ecoregion which served as the control transect (i.e. outside of the LLTA).

Grid patterns, oriented north and south with transects 30 km apart, were flown in a DeHavilland Beaver aircraft equipped with floats, with two observers and a pilot. The survey altitude was maintained between 30 and 60 m above ground level (AGL) at a speed of 160 km/h covering a total distance of 1520 km (760 km^2). Waterfowl locations and numbers were plotted on 1:250,000 topographic maps.

Figure 3.1



WATERFOWL BREEDING PAIRS SURVEY, JUNE 1987
SURVEY TRANSECT
SURVEY PLOT
KEY TO SURVEY PLOTS
1 WOODS LAKE
2 SNEGAMOOK
3 WEST MICMAC LAKE
4 LAKE 1155
LOW LEVEL TRAINING AREAS
KM 0 50 100 150
UNGAVA BAY
KUUJJUAQ
HEBRON
NAIN
KM 0 50 100 150
AREA 1A
AREA 1B
RESERVOIR
LABRADOR SEA
HOPEDALE
MAKKOVIK
SCHEFFERVILLE
LLT AREA 1
SMALLWOOD RESERVOIR
SNEGAMOOK
CARTWRIGHT
LAKE MELVILLE
QUEBEC
CHURCHILL FALLS
GOOSE BAY
HAPPY VALLEY
LABRADOR CITY
PLATEAU
MARY'S HARBOUR
GAGNON
FONTINEAU
LLT AREA 2
FORTEAU
SEPT-ILES
GULF OF ST. LAWRENCE
ANTICOSTI ISLAND
NEWFOUNDLAND

3.1.3 Breeding Density Estimates

To assess whether changes in waterfowl breeding densities had occurred between the time of CWS surveys in 1980-1982 and the 1987 surveys, expected breeding densities for 1987 were calculated for individual waterfowl species within the LLTA ecoregions. Expected densities were calculated on the assumption that changes in breeding density for ecoregions inside the LLTA should be the same as for ecoregions in control areas (outside of the LLTA), if there have been no effects from low-level flying on waterfowl or waterfowl habitat. A comparison of expected to observed breeding densities therefore provides an index of magnitude and direction of changes that have occurred since the start of low-level flying. The assumptions and calculations of this method are explained in greater detail in Appendix A.

3.2 WATERFOWL STAGING SURVEYS

3.2.1 Fall Staging Surveys

The areas surveyed on fall staging surveys were selected on the basis of habitat quality, communications with CWS personnel, and logistical considerations.

These surveys were flown in a non-systematic manner, concentrating on larger inland waterways and shorelines as well as the coastal bays. A DeHavilland Beaver with three observers flew at 30 to 60 m AGL, maintaining a speed of 160 km/h. Since the objective was to locate concentrations of waterfowl, identification was by species group only (i.e. geese, dabbling and diving ducks). Locations were recorded on 1:250,000 topgraphic maps.

3.2.2 Spring Staging Surveys

Information concerning potential spring staging sites to be surveyed was obtained by consulting hunters and trappers from Labrador City, Churchill Falls, Goose Bay, Cartwright and Nain. In addition, water systems identified as important fall staging sites were considered for inclusion in the spring survey route.

Surveys were conducted to coincide with the spring breakup of rivers, lakes and estuaries. A Cessna 206 with two observers was flown at 30 - 60 m AGL at 160 - 210 km/h. The lower air speed was used when encountering birds and the higher speed was used for quick transit over ice and land. Exact routes within the survey areas were dictated by the location of ice-free water. All waterfowl seen, regardless of distance from the plane, were recorded and plotted on 1:250,000 topographic maps.

4.0 RESULTS

4.1 Breeding Pair Surveys

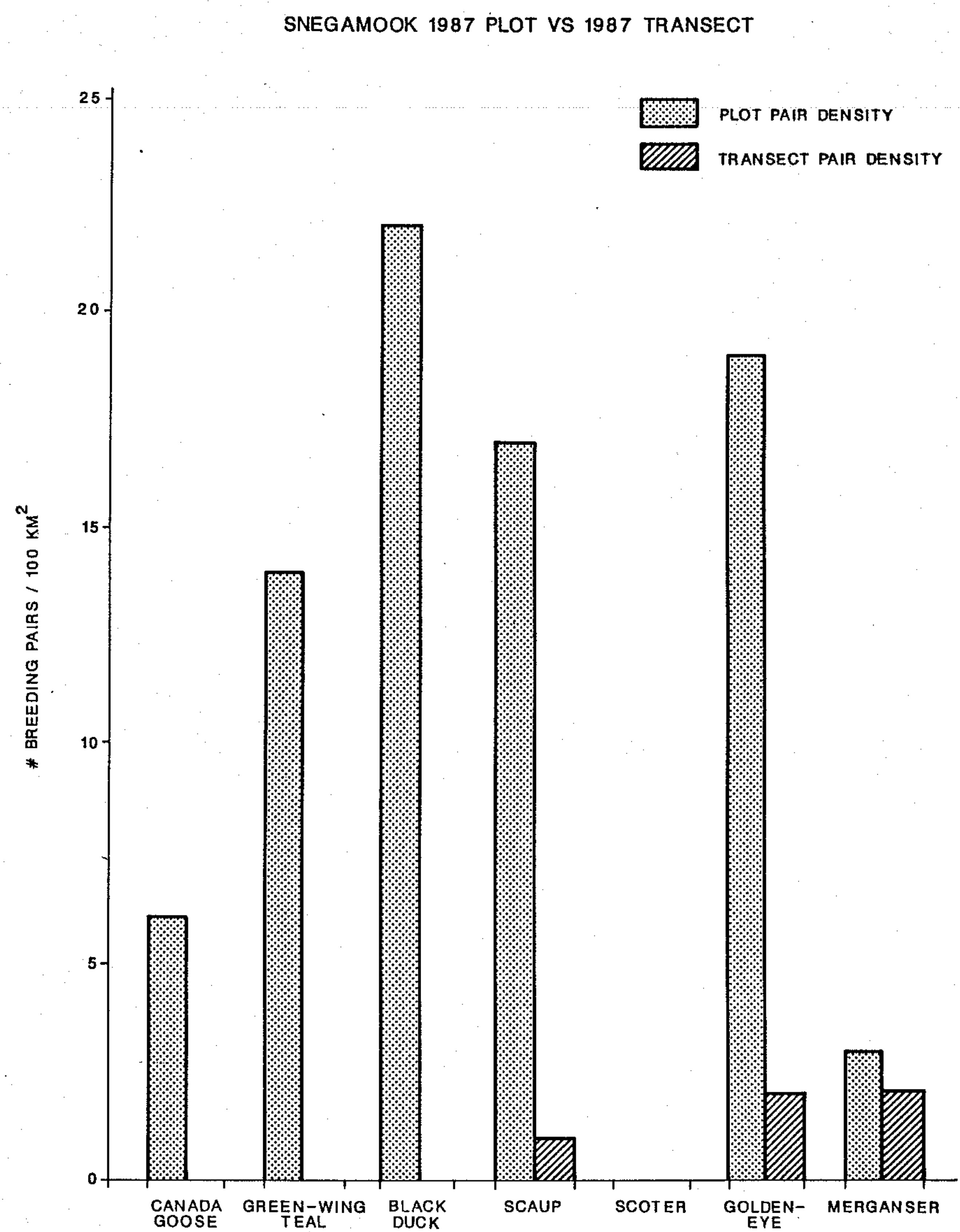
Results from the breeding pair surveys appear in Appendix B. Plot and transect survey data were treated separately in the analysis due to inherent differences in the methods and because a preliminary examination of these data suggested that these methods yielded quite different results.

4.1.1 Methodological Constraints

The original intent of the plot surveys was to determine air/ground correction factors that could be applied to the transect results to provide accurate breeding density estimates. Also, by applying these correction factors, the 1987 breeding density estimates would be comparable with the 1980-1982 estimates of Goudie and Whitman (1987). However, some of the 1987 transect surveys detected numbers of waterfowl which were too few to enable accurate air/ground correction factors to be calculated. For example, Canada geese, green-winged teal and black duck were observed in plot surveys but not in transect surveys at Snegamook Lake (Figure 4.1).

Another problem was that correction factors used in the 1980-1982 CWS analysis of breeding pair density may not have been valid because 1981 plot data was used to calculate air/ground correction factors for 1980 transect data. Not only had one year elapsed

Figure 4.1



COMPARISON OF TRANSECT VERSUS PLOT BREEDING PAIR DATA (FOR POSTVILLE ECOREGION) AT SNEGAMOOK (REGION AND LAKE) JUNE, 1987 between these two survey methods, but low-level flying had started in some areas, including Snegamook Lake (I. Goudie, pers. comm.). This disturbance may have already affected pair densities before the establishment of baseline data at these sites. Therefore, uncorrected data from 1980 and 1987 transect surveys were used in the analyses presented in this report. These comparisons were valid since the purpose of the analysis was to detect relative differences in waterfowl abundance. Also, if the air/ground visibility difference for a species is constant, which it is assumed to be, then corrected data is not required.

In order to compare 1980 and 1987 survey data for the same ecoregion within the LLTA, an examination of control (i.e. outside of the LLTA) data for 1980 and 1987 was necessary to account for inter-year variation. This procedure, known as blocking, eliminates the effect of year-to-year variability and yields more information on the difference in habitat quality for waterfowl. Expected densities are then calculated as described earlier and in Appendix A. It was assumed that the primary potential change in habitat quality was related to the advent of low-level flying.

Of the areas which were surveyed by aerial transects, there was sufficient coverage to make meaningfull comparisons in five of the eight ecoregions (Mistastin, St. Paul, Smallwood Reservoir, Churchill Falls, and Postville) (Table 4.1). One concern of

Table 4.1 Breeding pairs survey coverage by ecoregion in the study area, 7-11 June 1987. Coverage of corresponding ecoregions from the 1980 survey by CWS are presented for comparison (Goudie and Whitman 1987).

Ecoregion	Total Area (km^2)	S. Fudge and Associates 1987		Canadian Wildlife Service 1980	
		Coverage (km^2)	% Surveyed	Coverage (km^2)	% Surveyed
Eagle Plateau	14,950	115	0.80	241	1.60
Churchill Falls	27,100	40	0.15	342	1.30
St. Paul	66,700	151	0.23	223	0.30
Western Plateau	54,700	17.5	0.03	---	0
Mistastin Lake	41,910	103	0.25	118	0.28
Smallwood Reservoir	37,300	44.5	0.12	710	1.90
Postville	18,140	93	0.51	145	0.80

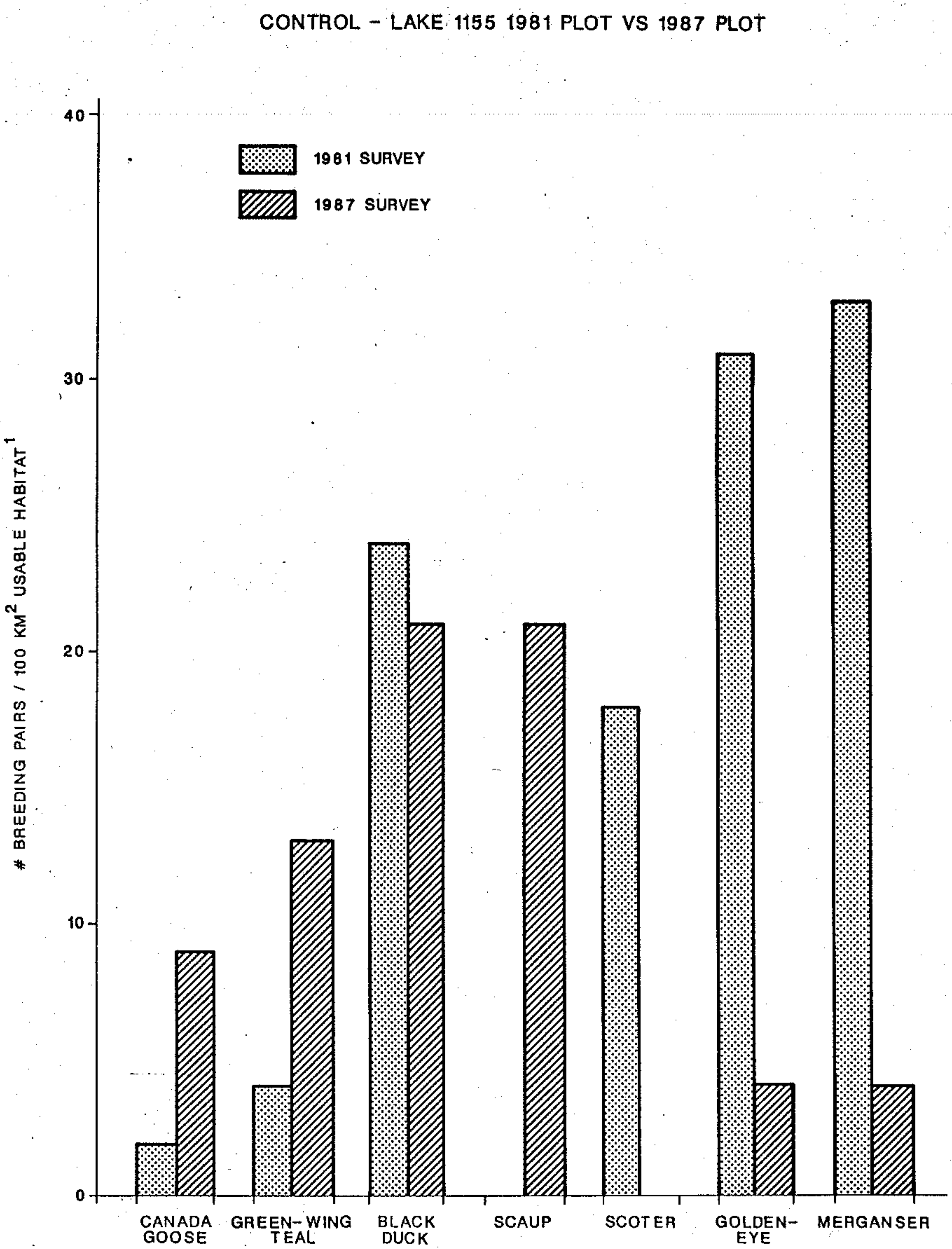
this analysis is that differences in abundance between test areas (i.e. inside the LLTAs) and those of the control may be exaggerated because the birds may have been displaced from the test to the control areas, although the occurrence of such a displacment is difficult to determine.

4.1.2 Plot Surveys

The plot surveys for breeding pairs of waterfowl were compared between years (i.e. 1981 versus 1987) and between the control and LLTAs. Changes in species abundance over the six year interval at the control lake (Lake 1155) are summarized in Figure 4.2. Canada geese and green-wing teal had more than doubled and scaup had moved into the area in relatively high densities. Slight declines were evident in the black duck but significant declines in the goldeneye and mergansers were found. Scoters were apparently no longer present on this plot in the Eagle Plateau ecoregion.

Changes in relative abundance of waterfowl species at Lake 1155 between 1981 and 1987 formed the basis from which expected values were derived for 1987 waterfowl densities in test area plots. The Snegamook plot in 1987 contained considerably fewer Canada geese and scaup then expected (Figure 4.3). Green-wing teal and goldeneye occurred in higher densities than expected, while black duck and mergansers were unchanged.

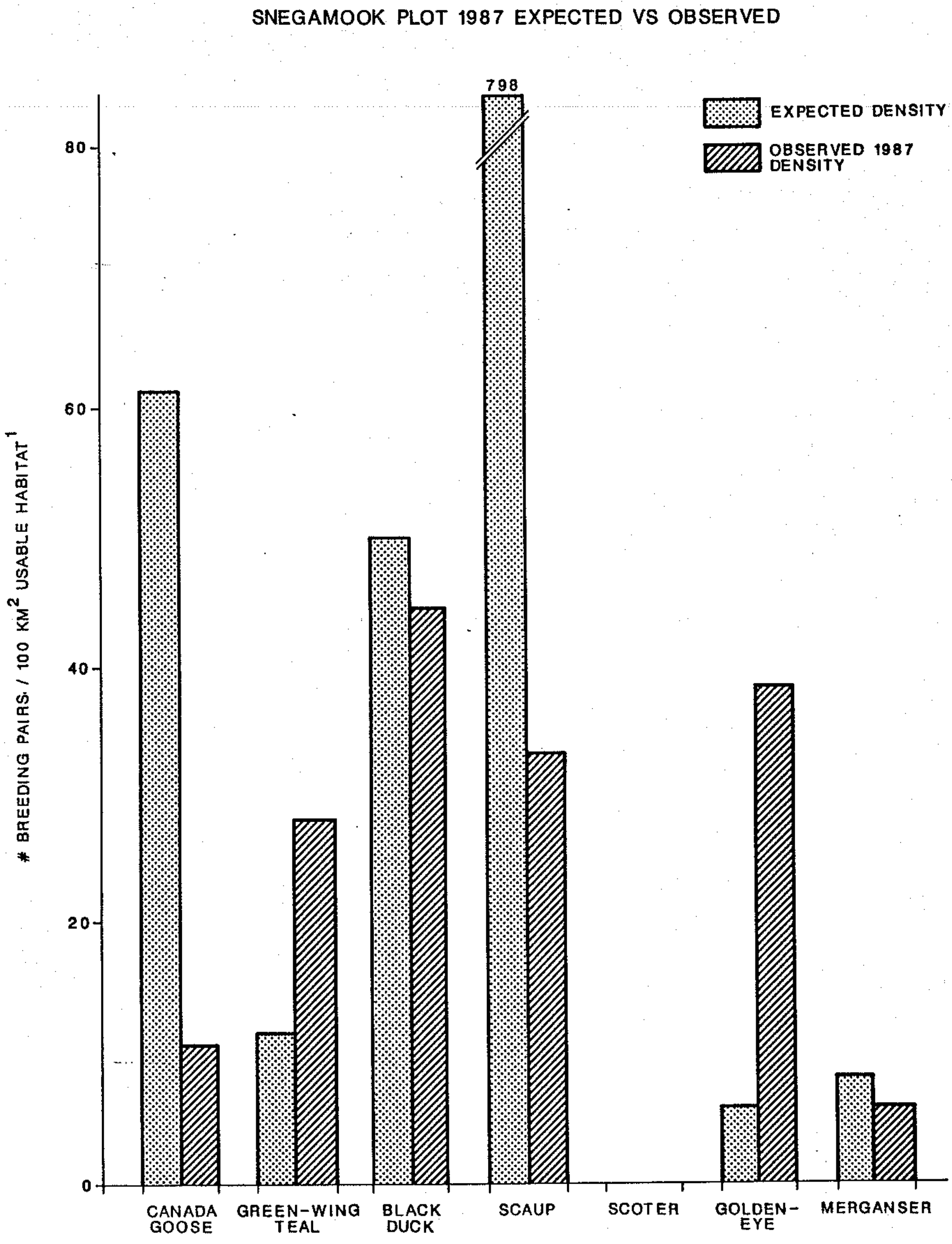
Figure 4.2



COMPARISON OF PLOT SURVEY DATA FROM LAKE 1155 FOR 1981 AND 1987

[1]USABLE HABITAT DEFINED AS 55% FOR 1987 DATA

Figure 4.3



COMPARISON OF EXPECTED[1] TO OBSERVED DENSITY OF WATERFOWL AT SNEGAMOOK PLOT (POSTVILLE ECOREGION) WITHIN THE LLTA.

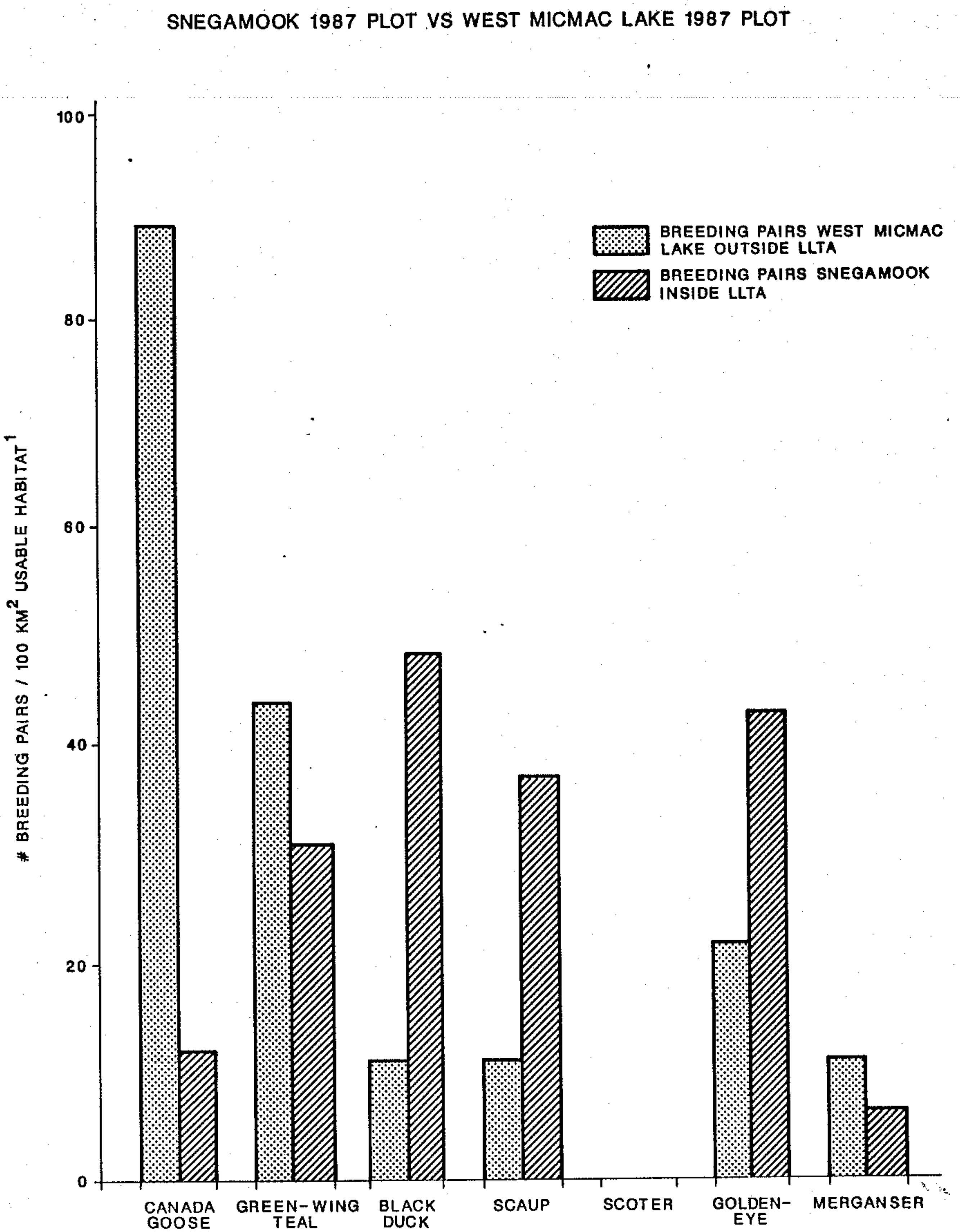
[1]DENSITY 1987 SNEGAMOOK PLOT EXPECTED = DENSITY LAKE 1155 (1987) X DENSITY SNEGAMOOK PLOT (1980) / DENSITY LAKE 1155 (1981)

The West Micmac Lake plot (outside the LLTA) and the Snegamook Lake plot are both in the Postville ecoregion but are separated by approximately 85 km (Figure 3.1). A direct comparison between these two site revealed that Canada geese, green-winged teal and mergansers were much lower within the LLTA (Figure 4.4). However, densities of black duck, scaup and goldeneye were higher within the LLTA and scoter were absent from both blocks.

A comparison of the Snegamook plot survey results from 1981 and 1987, indicated that Canada geese, black duck, goldeneye and merganser breeding pair densities had declined in this area by 1987 (Figure 4.5). Green-winged teal and scaup were present at higher densities in 1987. No scoter were observed in either survey.

A direct comparison of 1981 and 1987 plot results for Woods Lake (within the Smallwood Reservoir ecoregion) was not possible because the area surveyed in 1981 had been altered by subsequent large scale flooding. A comparison of the average densities of two nearby sites in 1981 with the 1987 Woods Lake data indicates that all waterfowl species have declined in abundance (Figure 4.6).

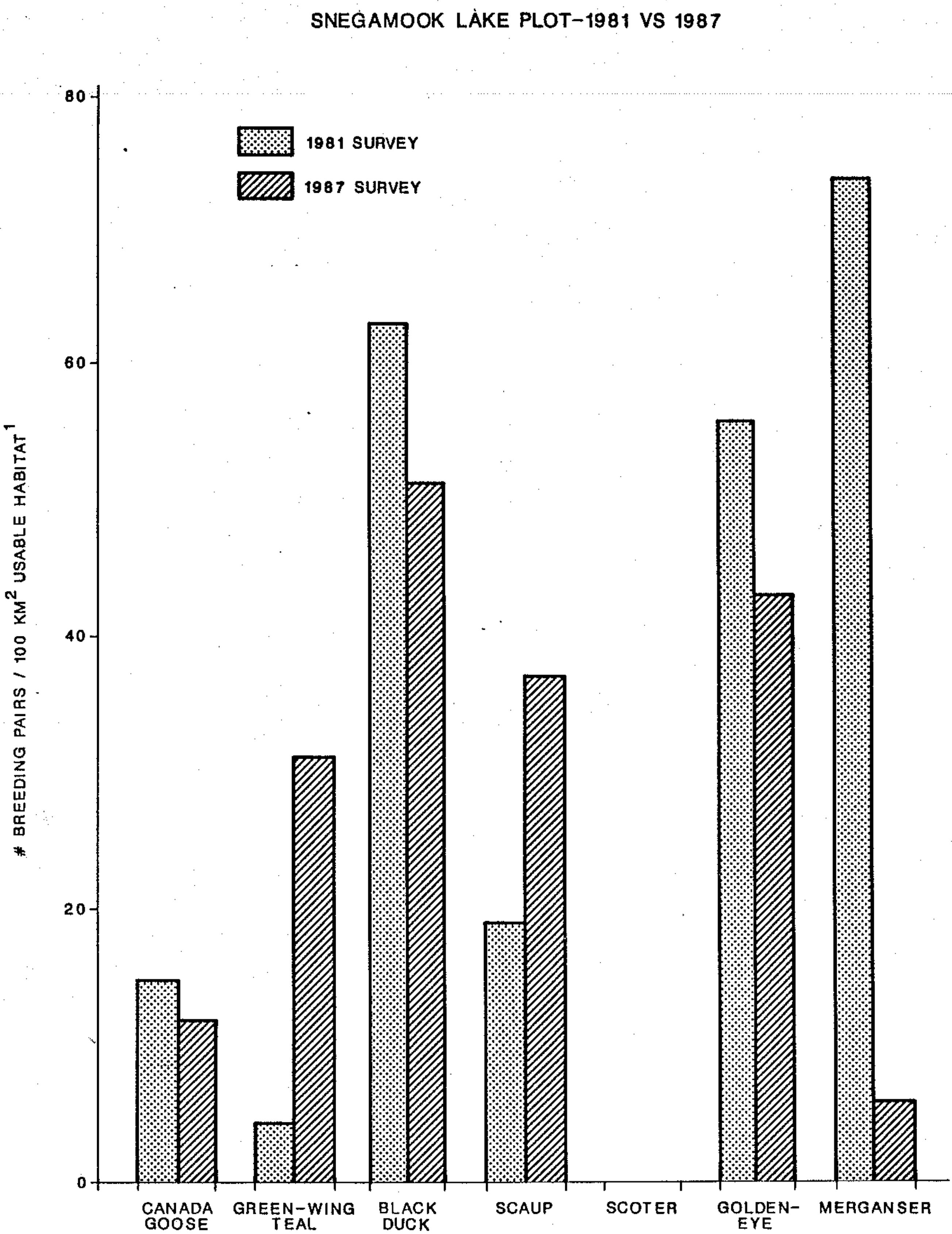
Figure 4.4



COMPARISON OF 1987 PLOT SURVEY DATA FOR SNEGAMOOK LAKE (WITHIN LLTA) AND WEST MICMAC LAKE (OUTSIDE LLTA) IN THE POSTVILLE ECOREGION, JUNE 1987

[1]USABLE HABITAT DEFINED AS 45% FOR SNEGAMOOK LAKE AND 25% FOR WEST MICMAC LAKE

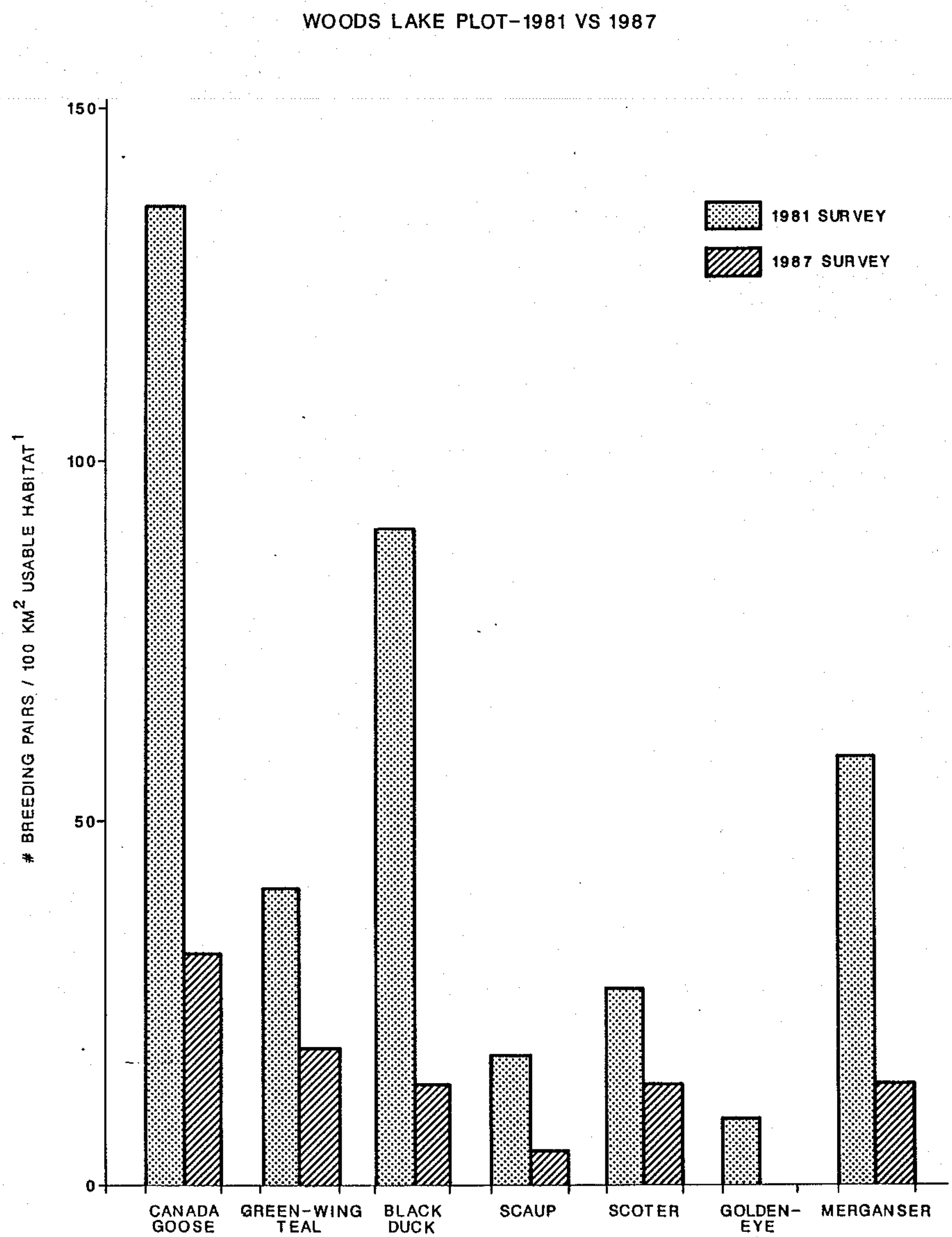
Figure 4.5



COMPARISON OF SNEGAMOOK LAKE PLOT, 1981 AND 1987 SURVEYS IN THE POSTVILLE ECOREGION

[1]USABLE HABITAT DEFINED AS 45% FOR 1987

Figure 4.6



COMPARISON[1] OF THE 1981[2] AND 1987 BREEDING PAIR DENSITIES FOR WOODS LAKE IN THE SMALLWOOD RESERVOIR ECOREGION

[1] DIRECT PLOT COMPARISON WAS NOT POSSIBLE DUE TO FLOODING HENCE RESULTS FROM TWO NEARBY 1981 PLOTS (A3 & A7) WERE AVERAGED FOR THE ANALYSIS

[2] LOW LEVEL TRAINING BEGAN HERE IN 1981

4.1.3 Transect Surveys

Although the transect surveys are less accurate in terms of describing the waterfowl abundance or diversity for a given location, they tend to assess more accurately the importance of one area over another within a given ecoregion. The control area for transect analysis was located outside the LLTA on the Eagle Plateau (Figure 3.1). The transect data indicated that green-winged teal, scaup and goldeneye were relatively more abundant in 1987, Canada goose and black duck densities in the control area were unchanged, and there were declines in scoters and mergansers (Figure 4.7).

Transect and plot results suggest similar trends for most species, except for goldeneye which have increased according to transect data and declined according to the plot data.

Comparisons of expected to observed breeding densities within and outside of the LLTA were also made for each ecoregion. Figure 4.8 illustrates this comparison across the five ecoregions for expected versus observed densities of merganser breeding pairs. This species was present at expected levels or slightly higher than expected within the LLTA. Goldeneye, however, were observed in lower abundance within the LLTA (Figure 4.9). Scaup were variable in their expected breeding densities (Figure 4.10), while scoters appear to be expanding their range as no pairs were observed in the study area in 1980, but they were present in 1987 (Figure 4.11).

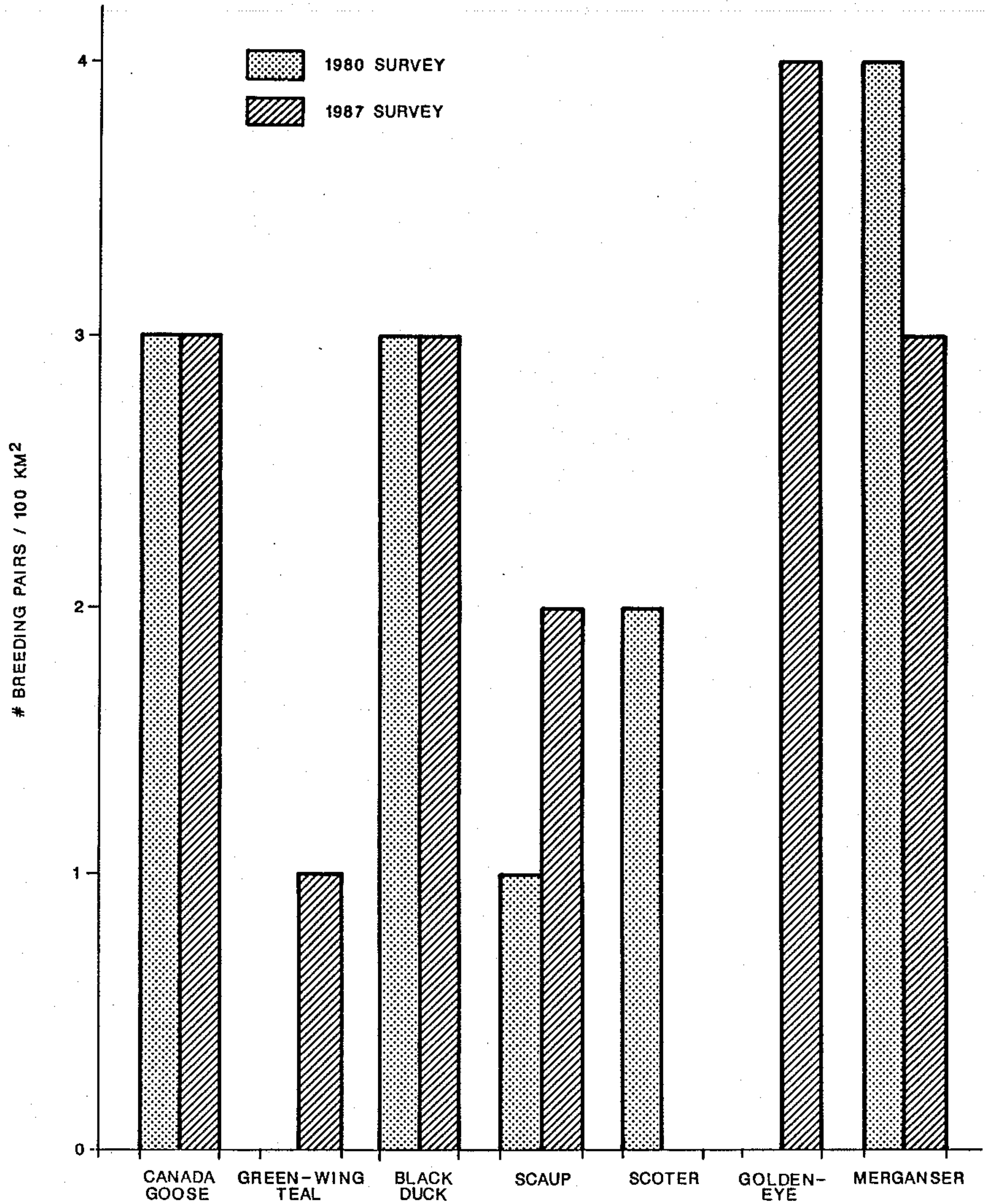
The nature of a transect survey does not allow for species confirmation on all sightings, therefore analyses were also performed for broader categories of waterfowl. Observations for merganser, goldeneye, scaup and scoter were combined and expected values derived for diving ducks (Figure 4.12). It was evident that diving ducks had increased or were maintaining breeding densities within four of the five ecoregions in the LLTA. Only the Postville ecoregion exhibited a lower than expected breeding density of divers within the LLTA.

The results of the 1987 transect data indicated declines in the breeding densities of green-winged teal for all ecoregions within the LLTA (Figure 4.13). Black duck results are variable and show no consistent change (Figure 4.14). A general decline in breeding densities for these two species within the LLTA is also evident when they are combined as dabbling ducks (Figure 4.15).

Overall, Canada goose breeding pair densities had increased slightly within the LLTAs, but there was considerable variability between ecoregions (Figure 4.16). Canada geese were not observed in the Postville ecoregion.

Figure 4.7

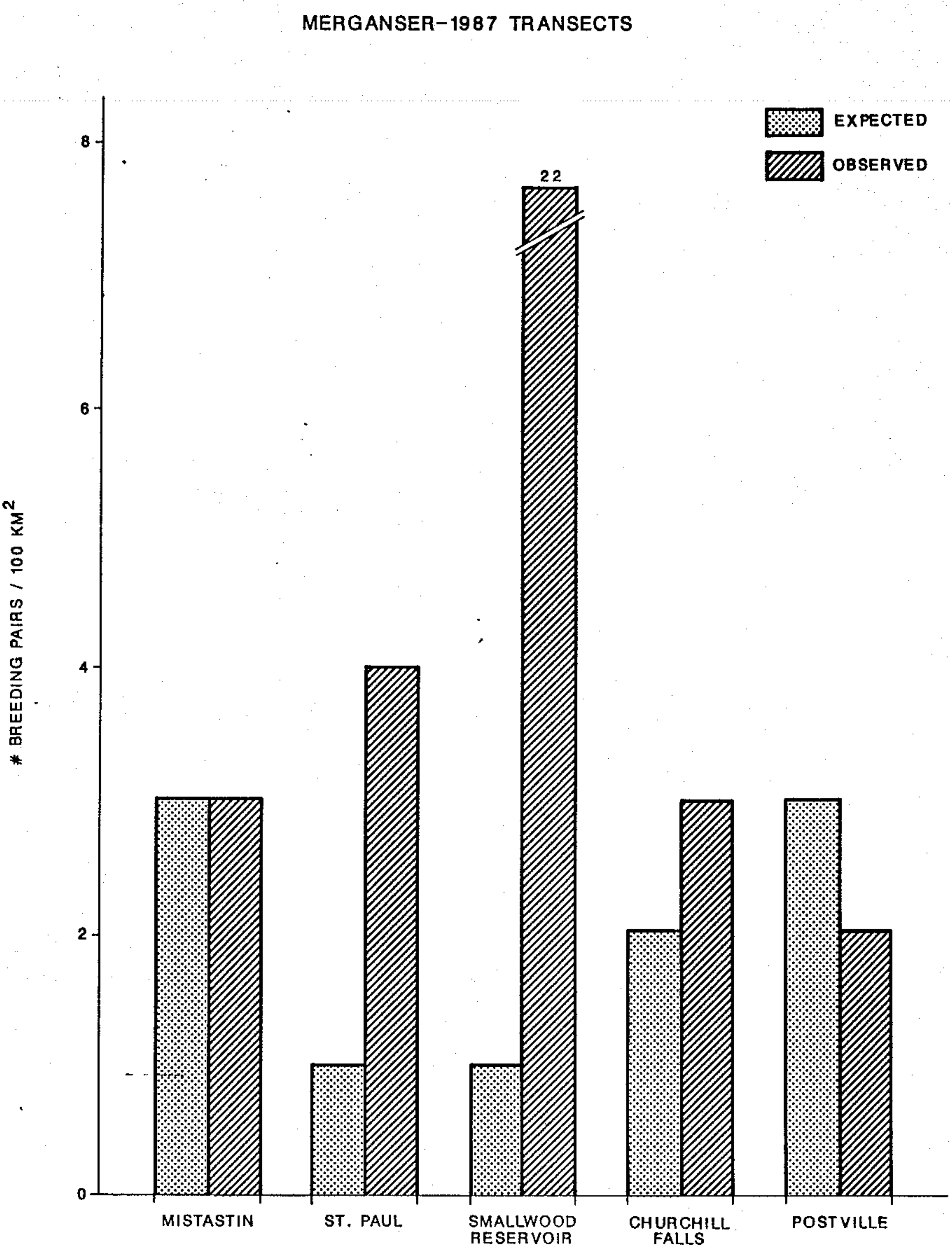
CONTROL - PLATEAU 1980 TRANSECT VS 1987 TRANSECT



COMPARISON OF TRANSECT SURVEY DATA FROM PLATEAU FOR 1980 AND 1987

NOTE: DATA HAS NOT BEEN CORRECTED FOR AIR/GROUND DIFFERENCES

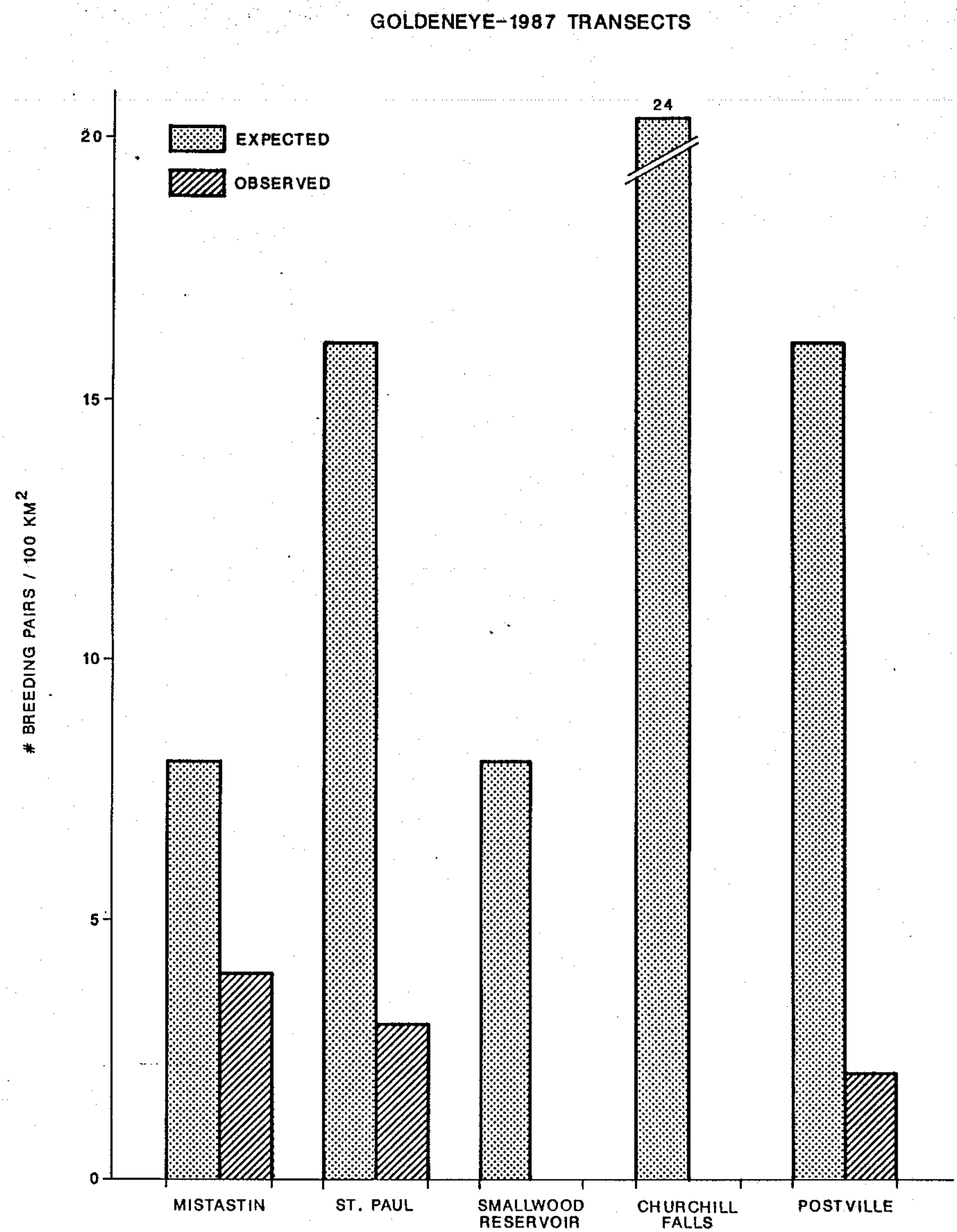
Figure 4.8



COMPARISON OF EXPECTED[1] TO OBSERVED BREEDING DENSITIES OF MERGANSER FOR FIVE ECOREGIONS WITHIN THE LLTA

[1] DENSITY ECOREGION 'X' (1987) EXPECTED = $\frac{\text{DENSITY PLATEAU (1987)} \times \text{DENSITY ECOREGION 'X' (1980)}}{\text{DENSITY PLATEAU (1980)}}$

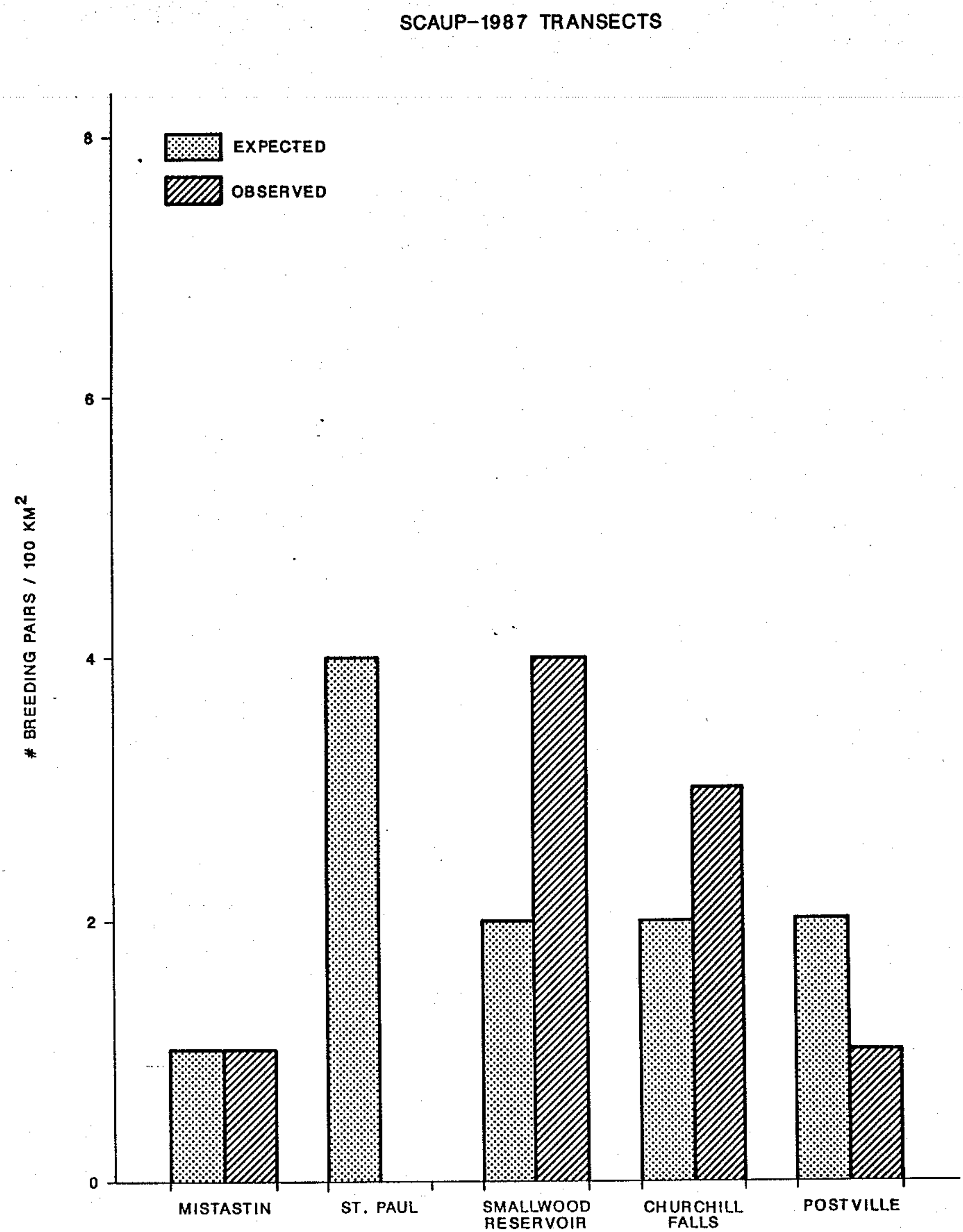
Figure 4.9



COMPARISON OF EXPECTED[1] TO OBSERVED BREEDING DENSITIES OF GOLDENEYE FOR FIVE ECOREGIONS WITHIN THE LLTA

[1] DENSITY ECOREGION 'X' (1987) EXPECTED = $\frac{\text{DENSITY PLATEAU (1987) x DENSITY ECOREGION 'X' (1980)}}{\text{DENSITY PLATEAU (1980)}}$

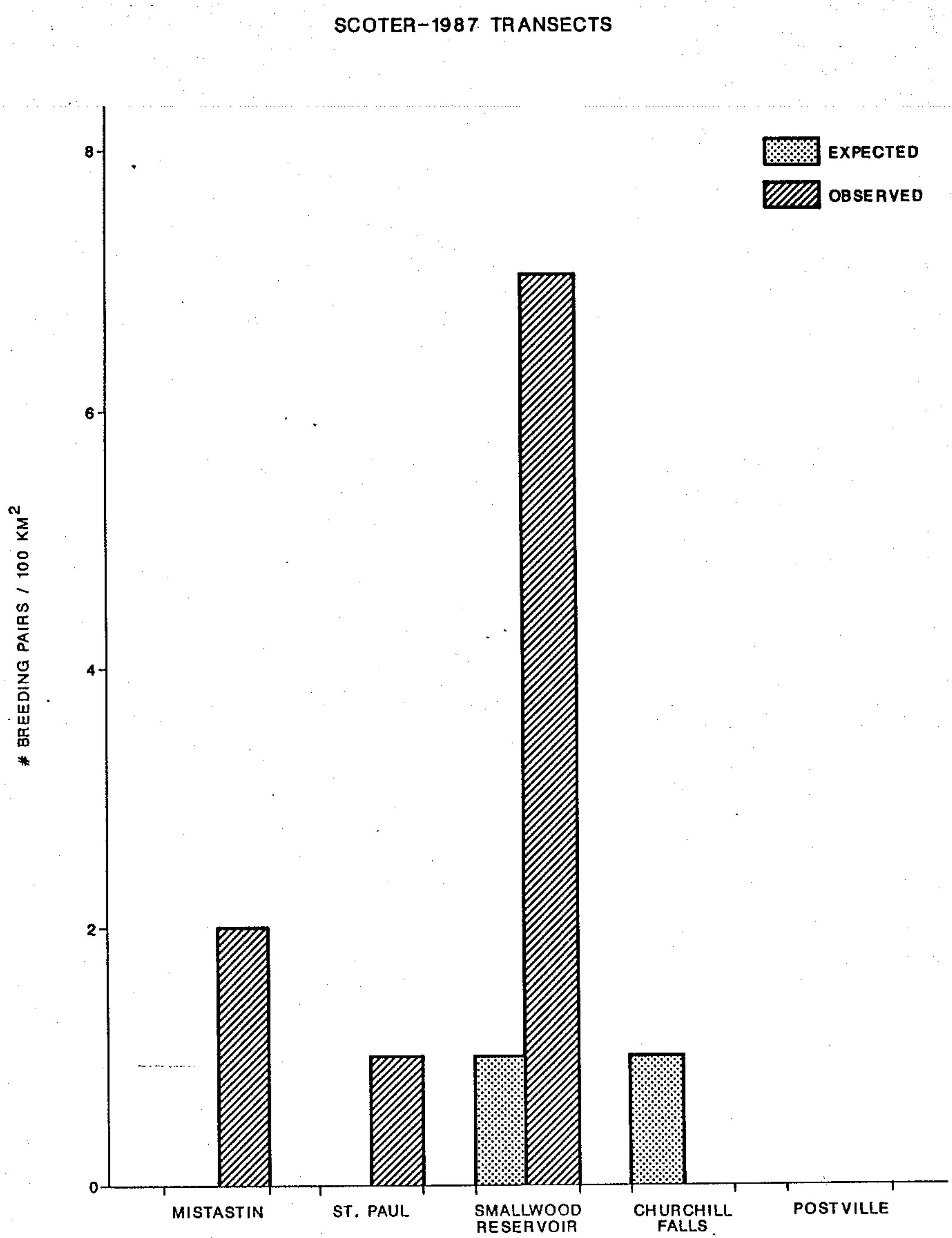
Figure 4.10



COMPARISON OF EXPECTED[1] TO OBSERVED BREEDING DENSITIES OF SCAUP FOR FIVE ECOREGIONS WITHIN THE LLTA

[1] DENSITY ECOREGION 'X' (1987) EXPECTED = $\frac{\text{DENSITY PLATEAU (1987)} \times \text{DENSITY ECOREGION 'X' (1980)}}{\text{DENSITY PLATEAU (1980)}}$

Figure 4.11

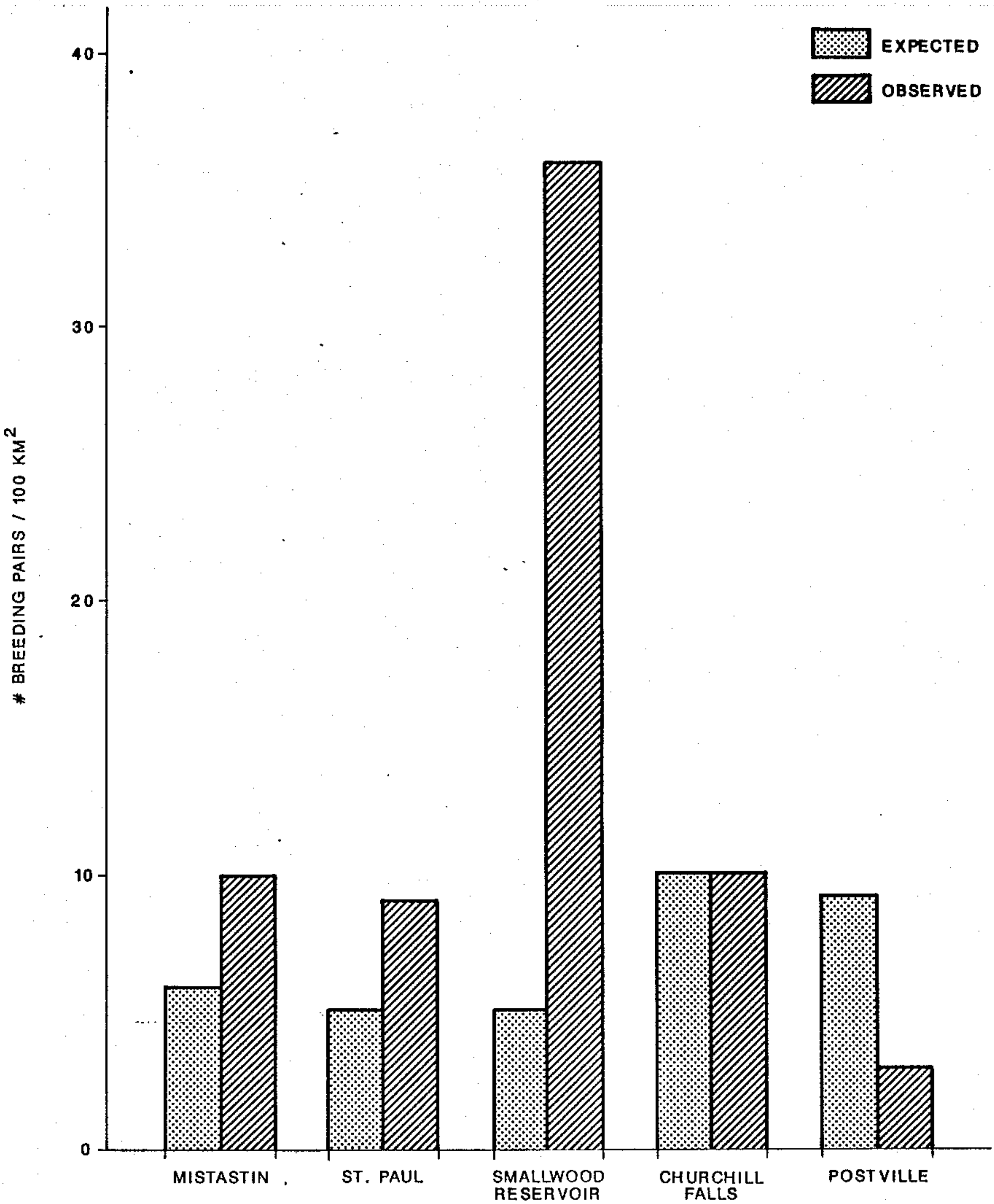


COMPARISON OF EXPECTED[1] TO OBSERVED BREEDING DENSITIES OF SCOTER FOR FIVE ECOREGIONS WITHIN THE LLTA

[1]DENSITY ECOREGION 'X' (1987) EXPECTED = $\frac{\text{DENSITY PLATEAU (1987) x DENSITY ECOREGION 'X' (1980)}}{\text{DENSITY PLATEAU (1980)}}$

Figure 4.12

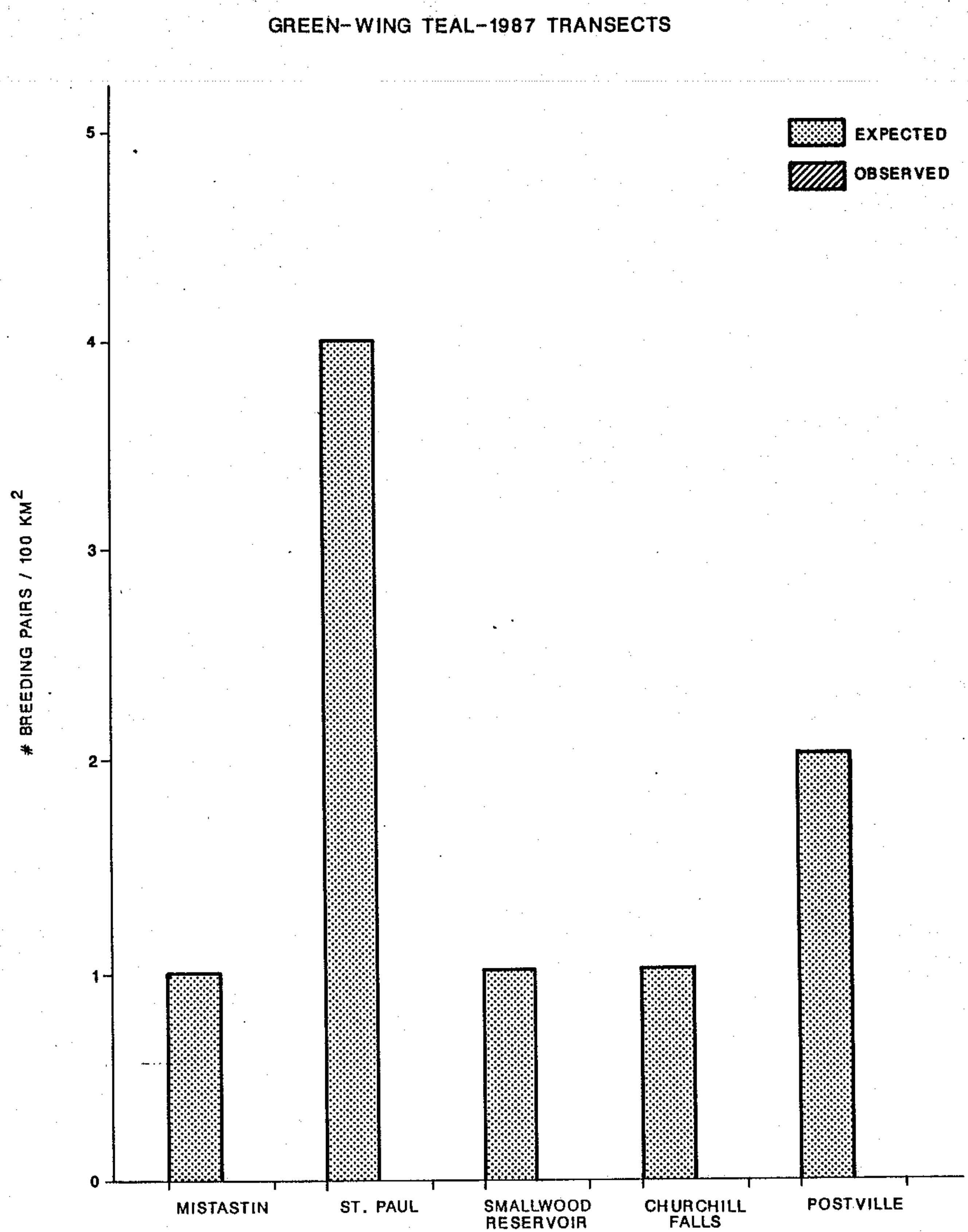
DIVERS-1987 TRANSECTS



COMPARISON OF EXPECTED[1] TO OBSERVED BREEDING DENSITIES OF DIVERS FOR FIVE ECOREGIONS WITHIN THE LLTA

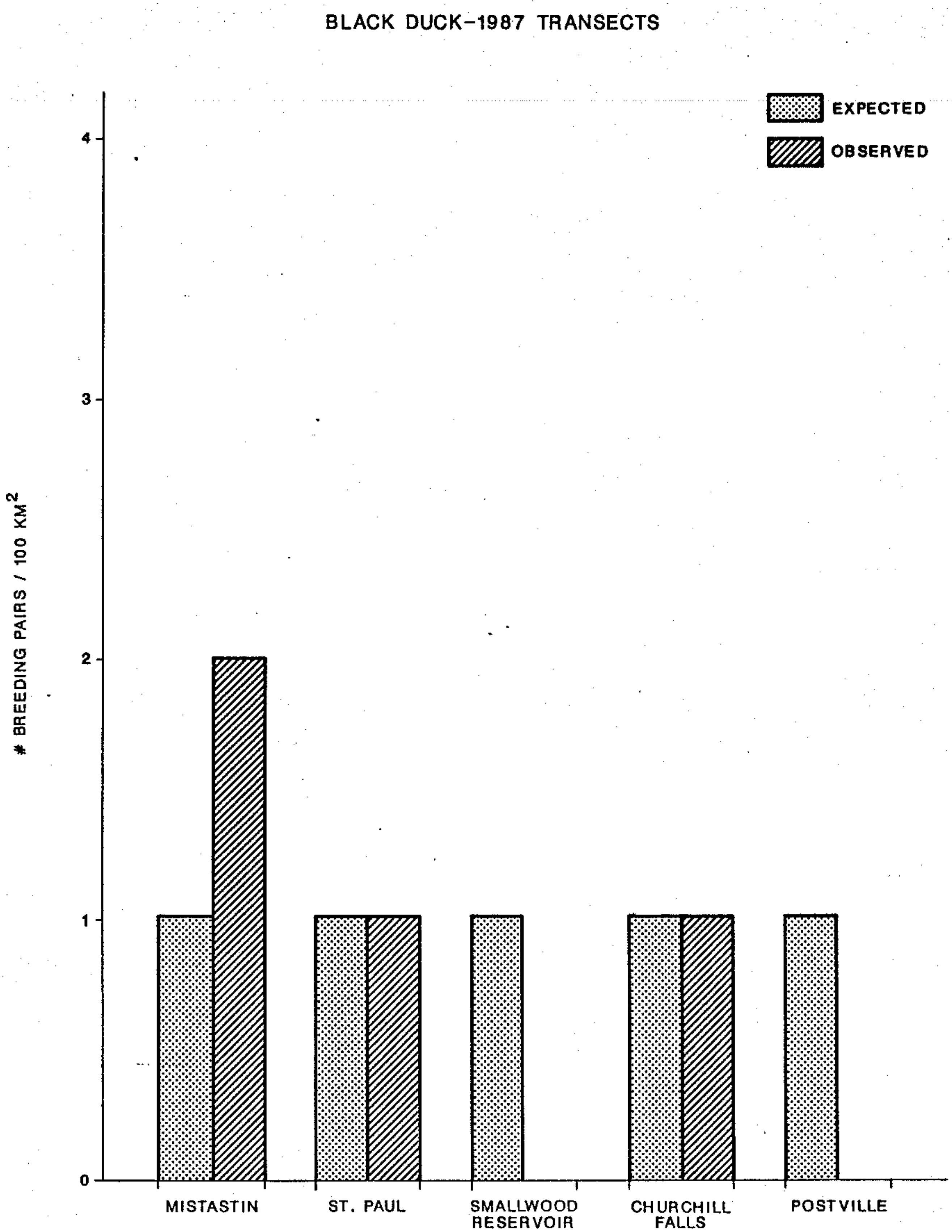
[1]DENSITY ECOREGION 'X' (1987) EXPECTED = $\frac{\text{DENSITY PLATEAU (1987)} \times \text{DENSITY ECOREGION 'X' (1980)}}{\text{DENSITY PLATEAU (1980)}}$

Figure 4.13



COMPARISON OF EXPECTED TO OBSERVED[1] BREEDING DENSITIES OF GREEN - WING TEAL FOR FIVE ECOREGIONS WITHIN THE LLTA

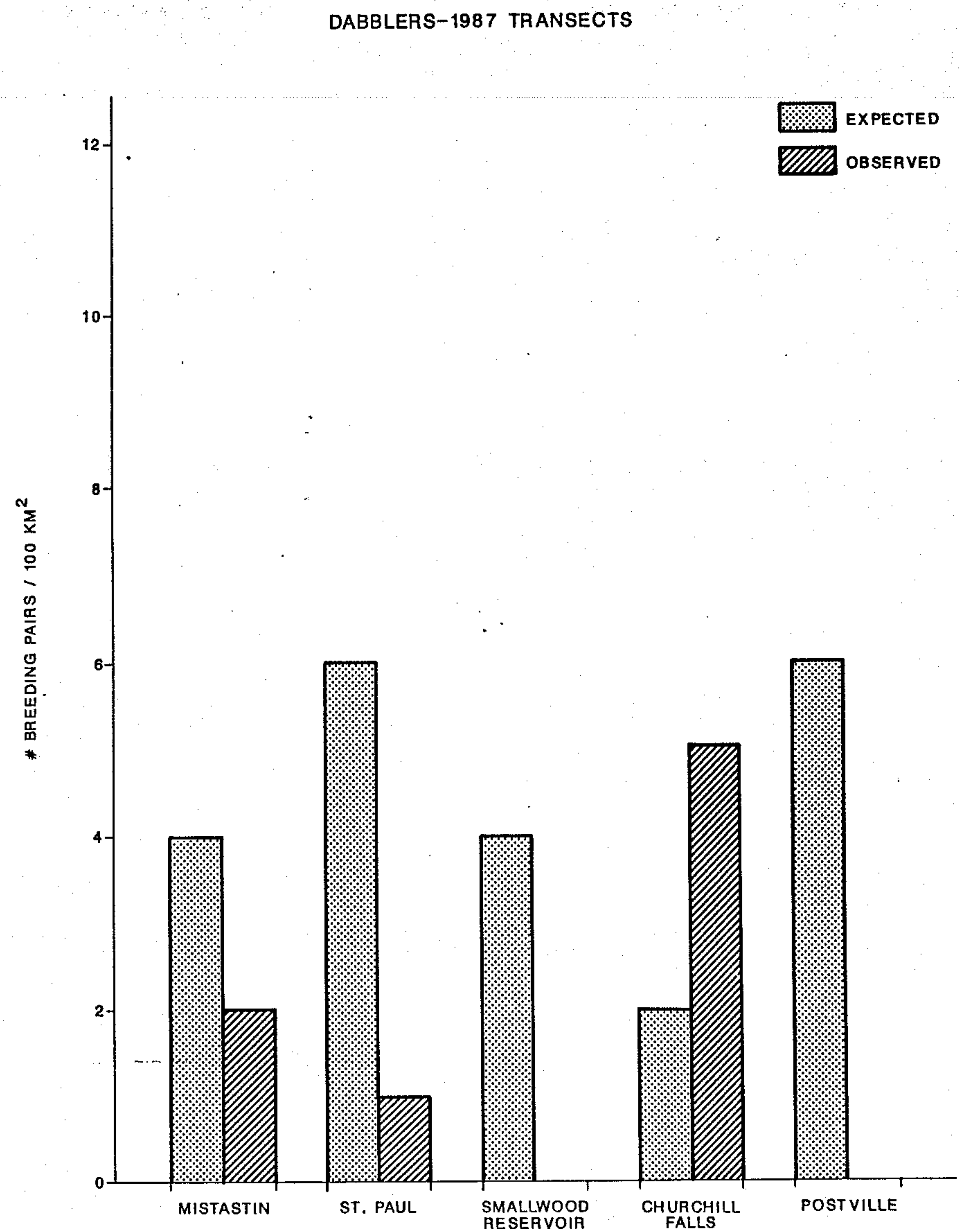
[1]DENSITY ECOREGION 'X' (1987) EXPECTED = $\frac{\text{DENSITY PLATEAU (1987) x DENSITY ECOREGION 'X' (1980)}}{\text{DENSITY PLATEAU (1980)}}$



COMPARISON OF EXPECTED[1] TO OBSERVED BREEDING DENSITIES OF BLACK DUCK FOR FIVE ECOREGION WITHIN THE LLTA

[1]DENSITY ECOREGION 'X' (1987) EXPECTED = $\frac{\text{DENSITY PLATEAU (1987)} \times \text{DENSITY ECOREGION 'X' (1980)}}{\text{DENSITY PLATEAU (1980)}}$

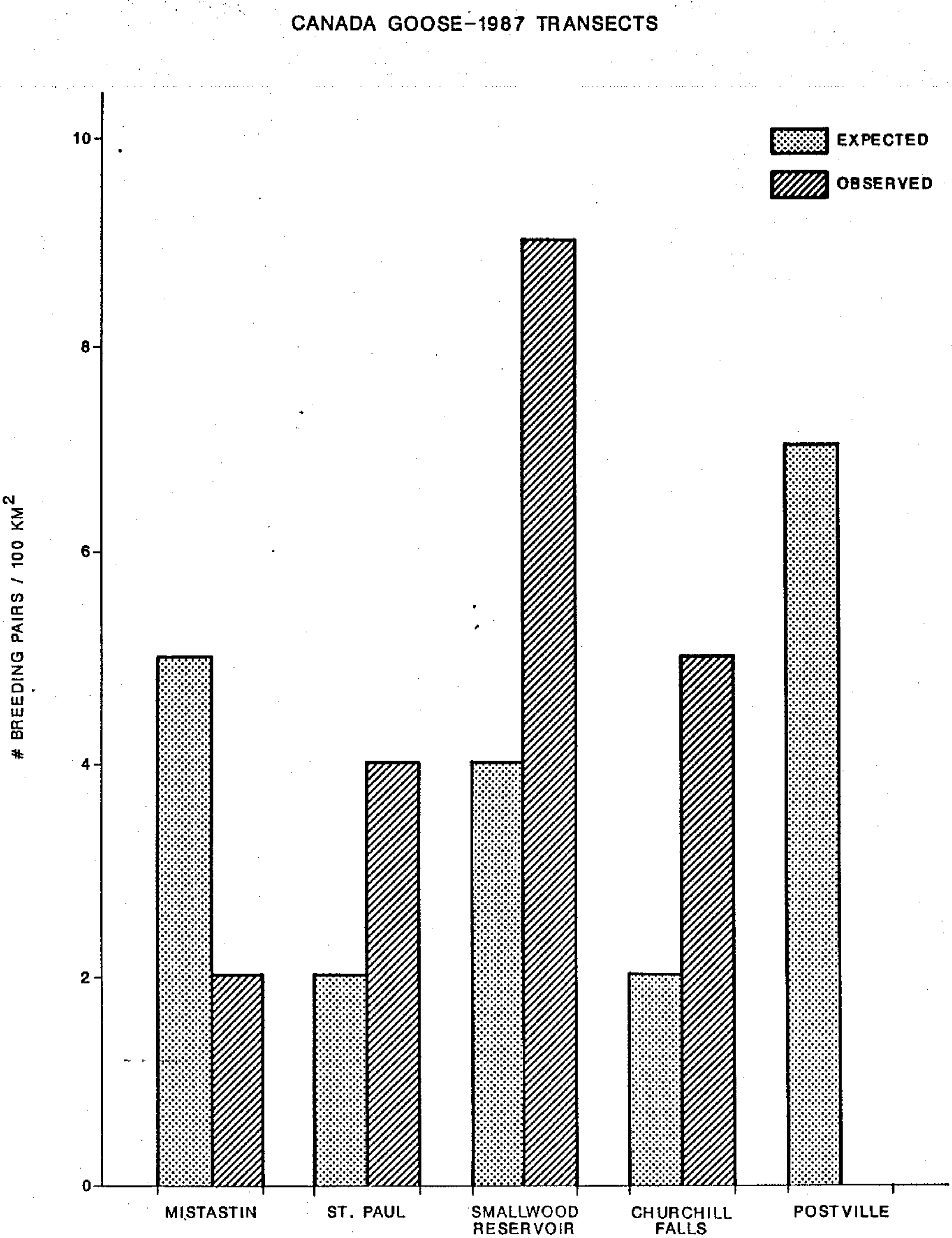
Figure 4.15



COMPARISON OF EXPECTED[1] TO OBSERVED BREEDING DENSITIES OF DABBLERS FOR FIVE ECOREGIONS WITHIN THE LLTA

[1]DENSITY ECOREGION 'X' (1987) EXPECTED = $\frac{\text{DENSITY PLATEAU (1987)} \times \text{DENSITY ECOREGION 'X' (1980)}}{\text{DENSITY PLATEAU (1980)}}$

Figure 4.16



COMPARISON OF EXPECTED[1] TO OBSERVED BREEDING DENSITIES OF CANADA GOOSE FOR FIVE ECOREGIONS WITHIN THE LLTA

[1]DENSITY ECOREGION 'X' (1987) EXPECTED = $\frac{\text{DENSITY PLATEAU (1987)} \times \text{DENSITY ECOREGION 'X' (1980)}}{\text{DENSITY PLATEAU (1980)}}$

4.2 STAGING SURVEYS

4.2.1 Fall Staging Surveys

The Lake Melville/Groswater Bay survey first conducted on 25 August 1987, revealed that waterfowl were concentrated in the Rigolet-Groswater Bay area with approximately equal numbers of geese, dabblers, and divers (Figure 4.17). Six weeks later, on 4 October, Groswater Bay was still supporting high numbers of waterfowl (mainly Canada geese), but numbers had also increased along the shore of Lake Melville (Figure 4.18). On 8 October, the number of birds in this area were similar to the previous survey except that there was increase in divers and a decrease in Canada geese (Figue 4.19). A large flock (>5000) of Canada geese was present in Groswater Bay during these last two surveys.

Snegamook Lake has previously been identified as an important area for moulting black ducks in 1980-82 by the CWS (I. Goudie, pers. comm.). It is uncertain whether the low numbers of waterfowl observed during the fall staging surveys in 1987 were a result of the general decline in black duck numbers, an early migration from the area, or the occurence of low-level flying activities in the area.

On 27 August the route flown followed the Naskaupi River, around Snegamook Lake and then north-east to the coast (Figure 4.20). At that time concentrations of waterfowl were already appearing in the bays along the coast. During other investigations at Snegamook Lake on the 30 August, less than 100 birds were observed. Approximately the same route flown on 27

Figure 4.17

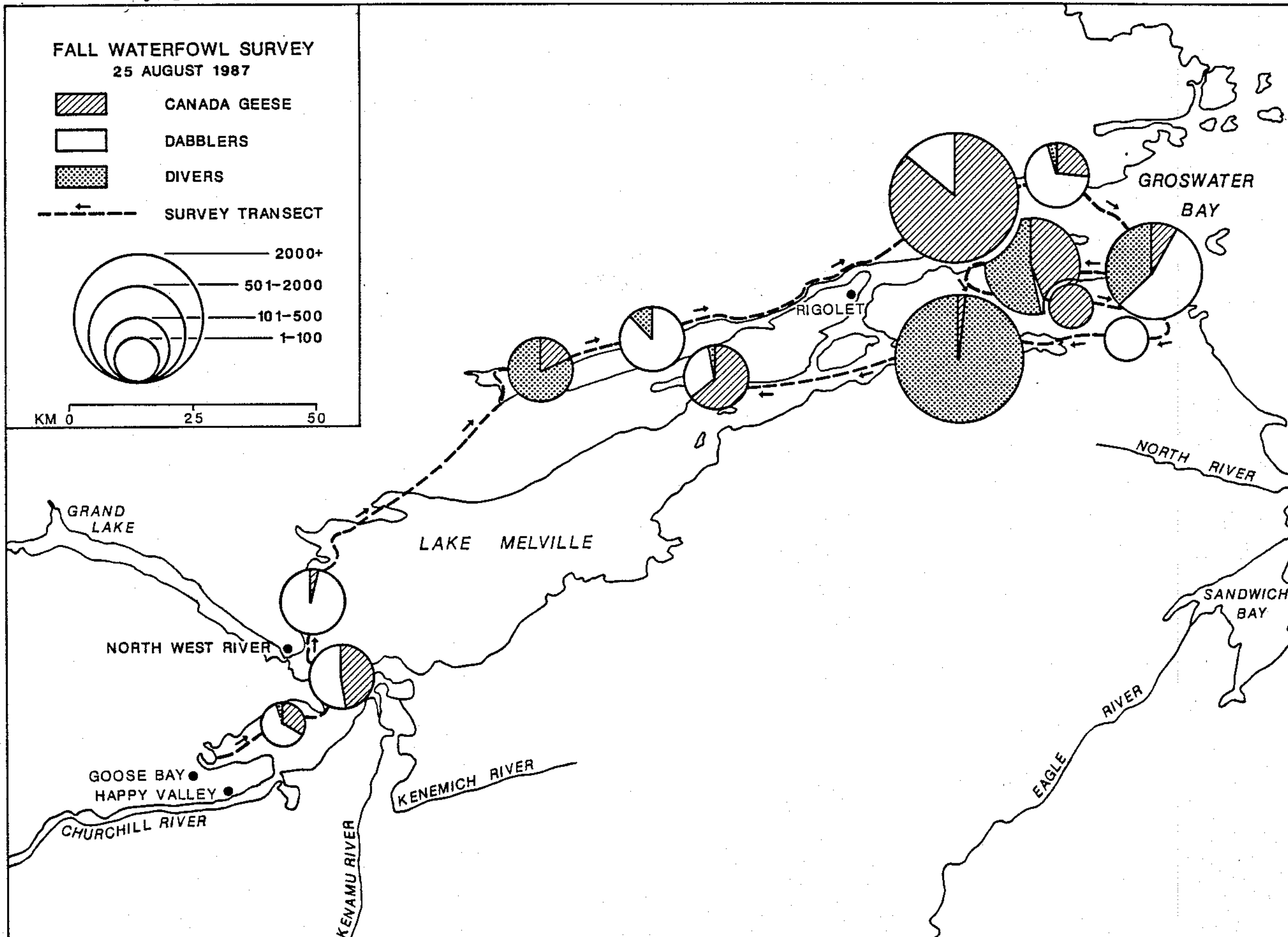

FALL WATERFOWL SURVEY
25 AUGUST 1987
CANADA GEESE
DABBLERS
DIVERS
SURVEY TRANSECT
2000+
501-2000
101-500
1-100
KM 0
25
50
GROSWATER
BAY
RIGOLET
NORTH RIVER
SANDWICH BAY
EAGLE RIVER
LAKE MELVILLE
GRAND LAKE
NORTH WEST RIVER
GOOSE BAY
HAPPY VALLEY
CHURCHILL RIVER
KENAMU RIVER
KENEMICH RIVER

Figure 4.18

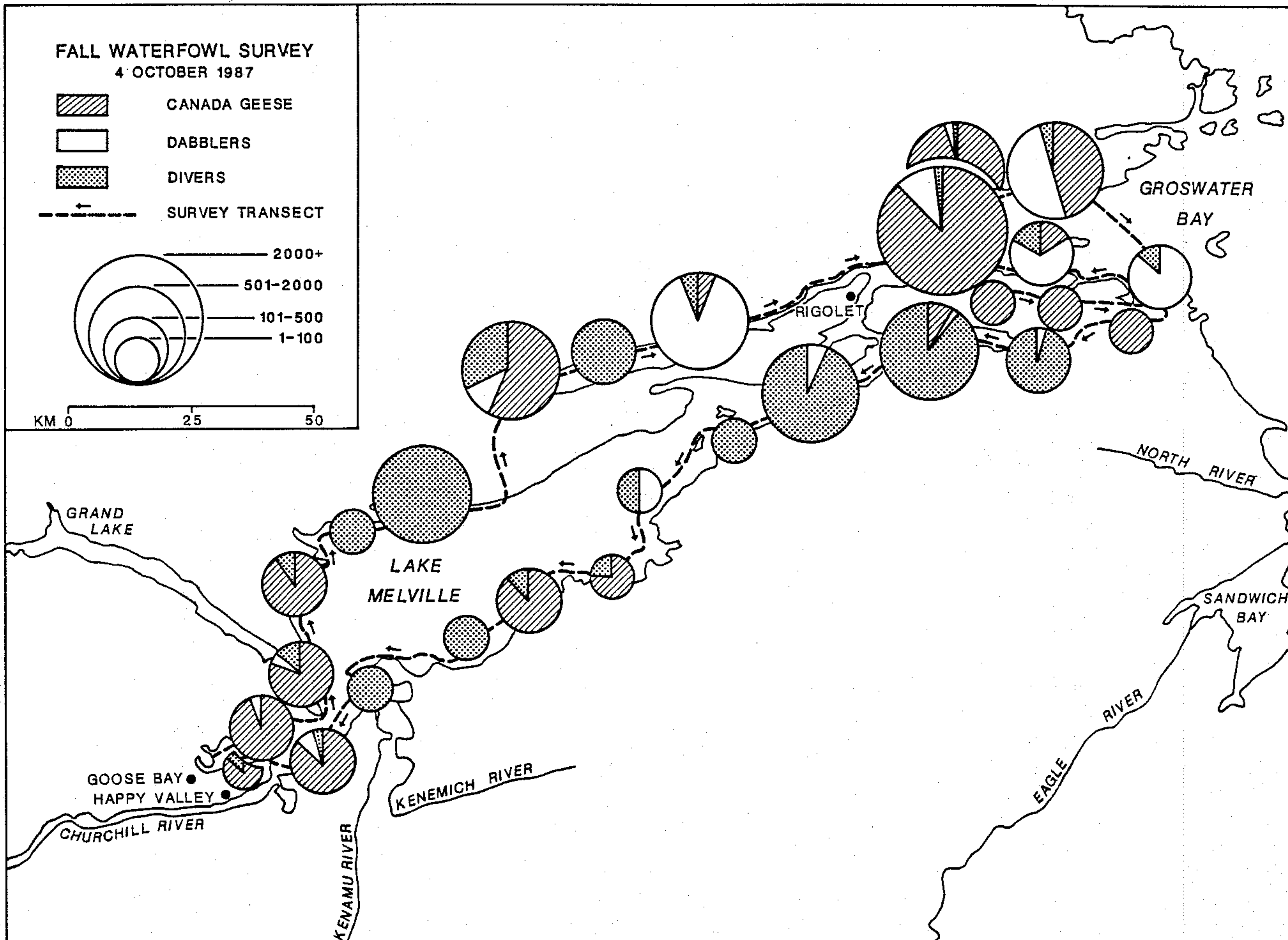

FALL WATERFOWL SURVEY
4 OCTOBER 1987
CANADA GEESE
DABBLERS
DIVERS
SURVEY TRANSECT
2000+
501-2000
101-500
1-100
KM 0
25
50
GROSWATER BAY
RIGOLET
NORTH RIVER
SANDWICH BAY
EAGLE RIVER
LAKE MELVILLE
GRAND LAKE
GOOSE BAY
HAPPY VALLEY
CHURCHILL RIVER
KENAMU RIVER
KENEMICH RIVER

Figure 4.19

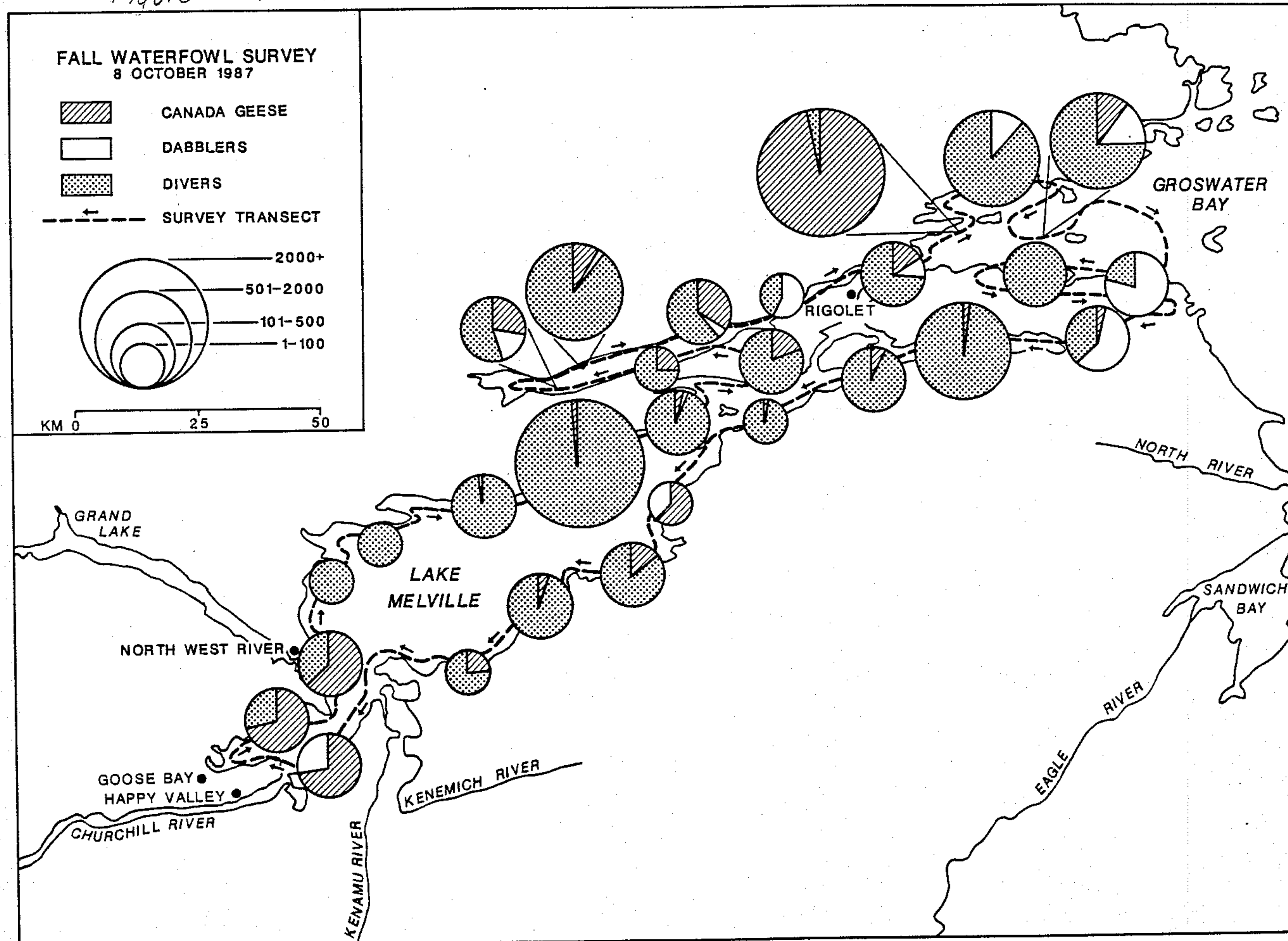

FALL WATERFOWL SURVEY
8 OCTOBER 1987
CANADA GEESE
DABBLERS
DIVERS
SURVEY TRANSECT
2000+
501-2000
101-500
1-100
KM 0
25
50
GROSWATER BAY
RIGOLET
NORTH RIVER
SANDWICH BAY
EAGLE RIVER
LAKE MELVILLE
GRAND LAKE
NORTH WEST RIVER
GOOSE BAY
HAPPY VALLEY
CHURCHILL RIVER
KENAMU RIVER
KENEMICH RIVER

Figure 4.20

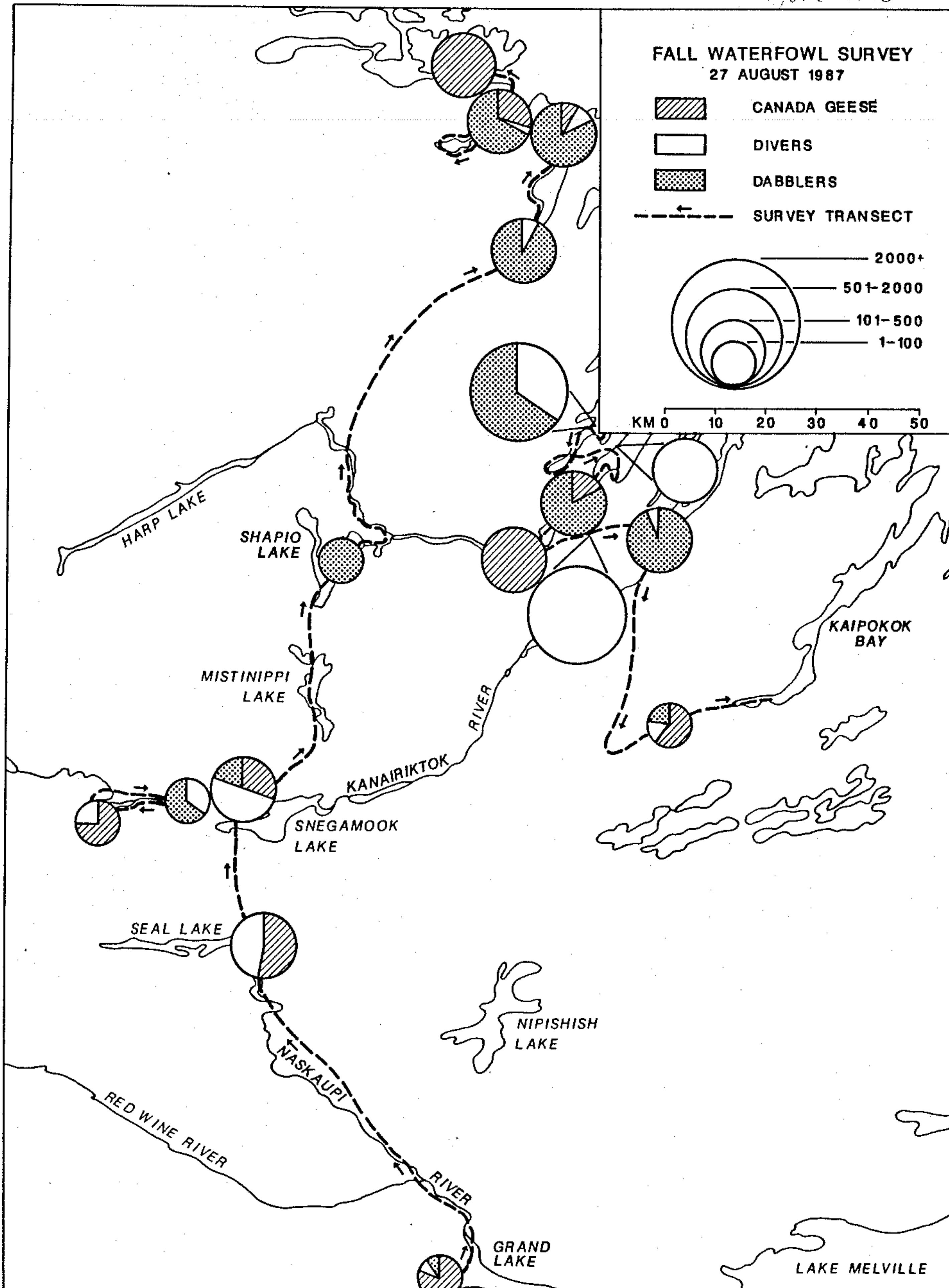

FALL WATERFOWL SURVEY
27 AUGUST 1987
CANADA GEESE
DIVERS
DABBLERS
SURVEY TRANSECT
2000+
501-2000
101-500
1-100
KM 0 10 20 30 40 50
HARP LAKE
SHAPIO LAKE
MISTINIPPI LAKE
KANAIRIKTOK RIVER
KAIPOKOK BAY
SNEGAMOOK LAKE
SEAL LAKE
NIPISHISH LAKE
NASKAUPI RIVER
RED WINE RIVER
GRAND LAKE
LAKE MELVILLE

Figure 4.21

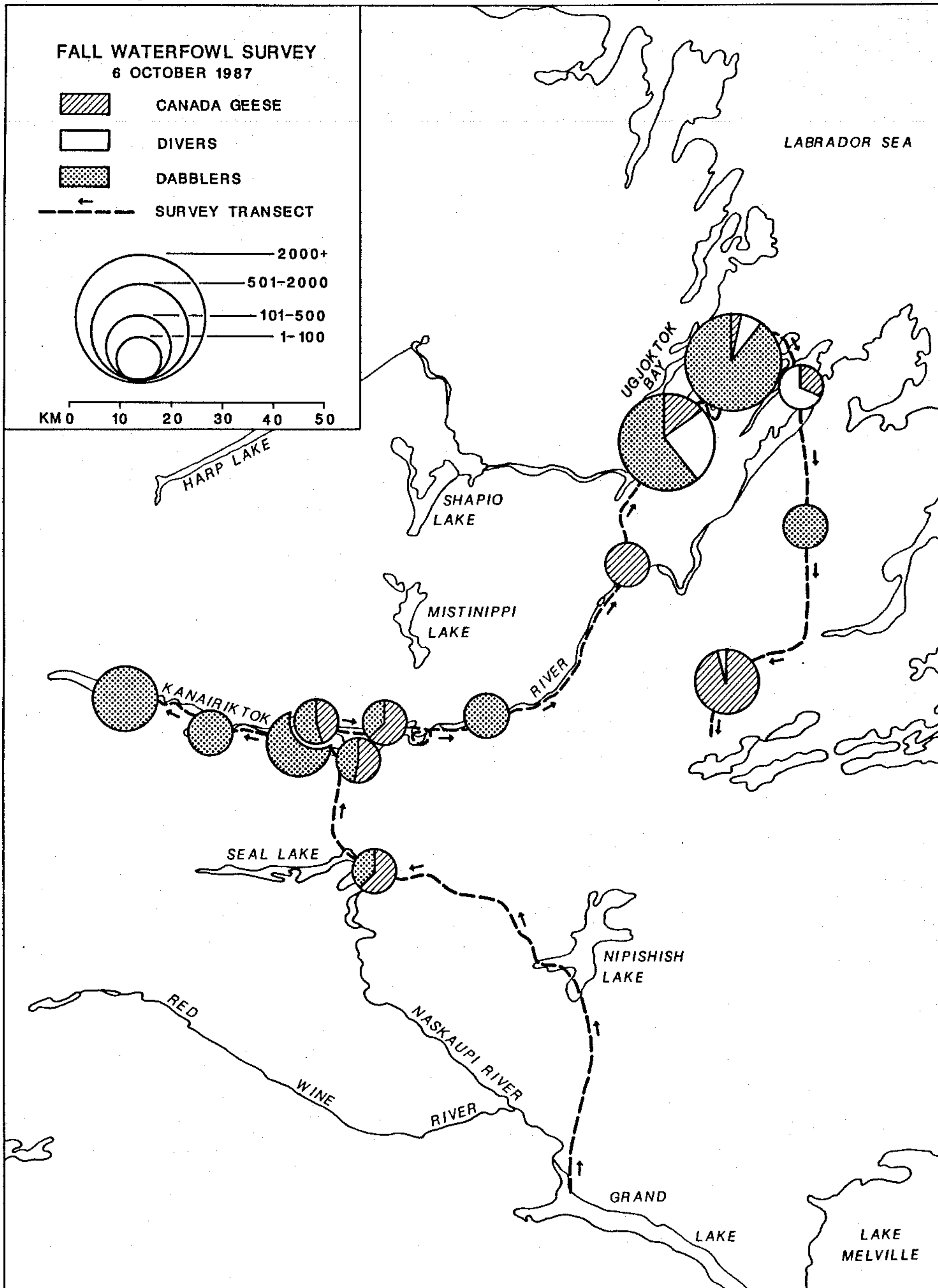

FALL WATERFOWL SURVEY
6 OCTOBER 1987
CANADA GEESE
DIVERS
DABBLERS
SURVEY TRANSECT
2000+
501-2000
101-500
1-100
KM 0 10 20 30 40 50
LABRADOR SEA
UGJOKTOK BAY
HARP LAKE
SHAPIO LAKE
MISTINIPPI LAKE
KANAIRIKTOK
RIVER
SEAL LAKE
NIPISHISH LAKE
RED
WINE
RIVER
NASKAUPI RIVER
GRAND
LAKE
LAKE MELVILLE

Figure 4.22

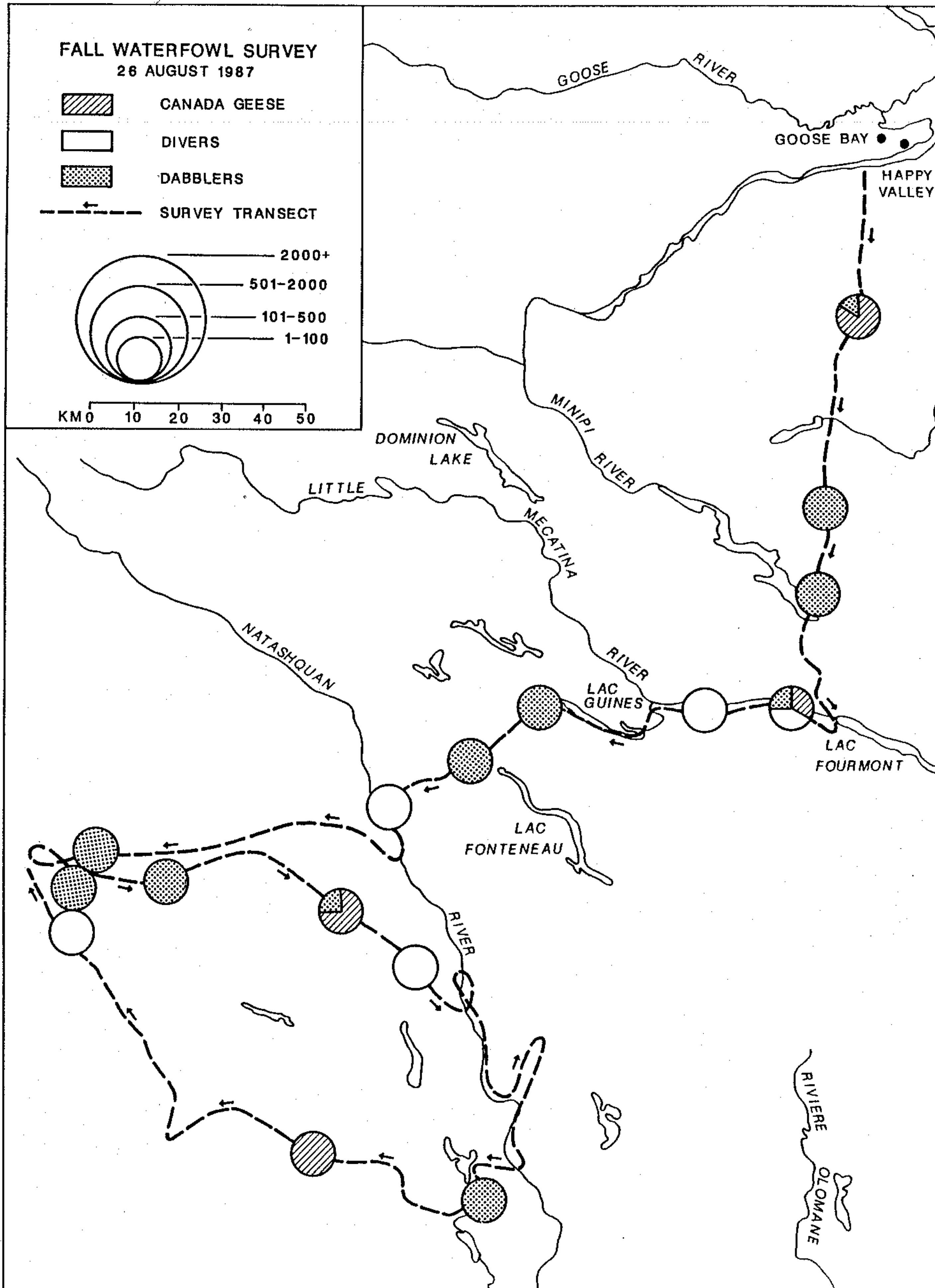

FALL WATERFOWL SURVEY
26 AUGUST 1987
CANADA GEESE
DIVERS
DABBLERS
SURVEY TRANSECT
2000+
501-2000
101-500
1-100
KM 0 10 20 30 40 50
GOOSE RIVER
GOOSE BAY
HAPPY VALLEY
MINIPI RIVER
DOMINION LAKE
LITTLE MECATINA RIVER
NATASHQUAN RIVER
LAC GUINES
LAC FOURMONT
LAC FONTENEAU
RIVIERE OLOMANE

Figure 4.23

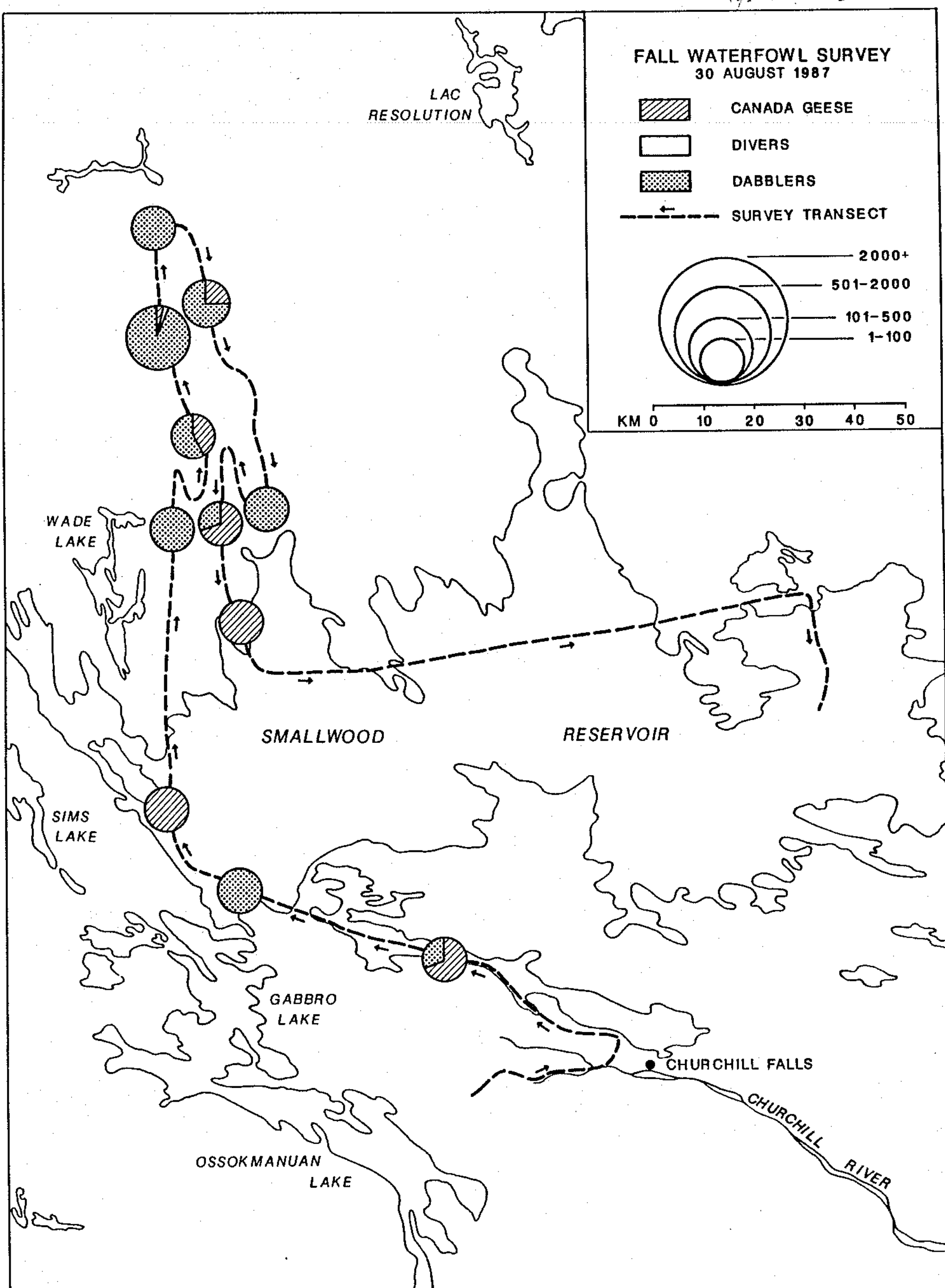

FALL WATERFOWL SURVEY
30 AUGUST 1987
CANADA GEESE
DIVERS
DABBLERS
SURVEY TRANSECT
2000+
501-2000
101-500
1-100
KM 0 10 20 30 40 50
LAC RESOLUTION
WADE LAKE
SMALLWOOD
RESERVOIR
SIMS LAKE
GABBRO LAKE
OSSOKMANUAN LAKE
CHURCHILL FALLS
CHURCHILL RIVER

Figure 4.24

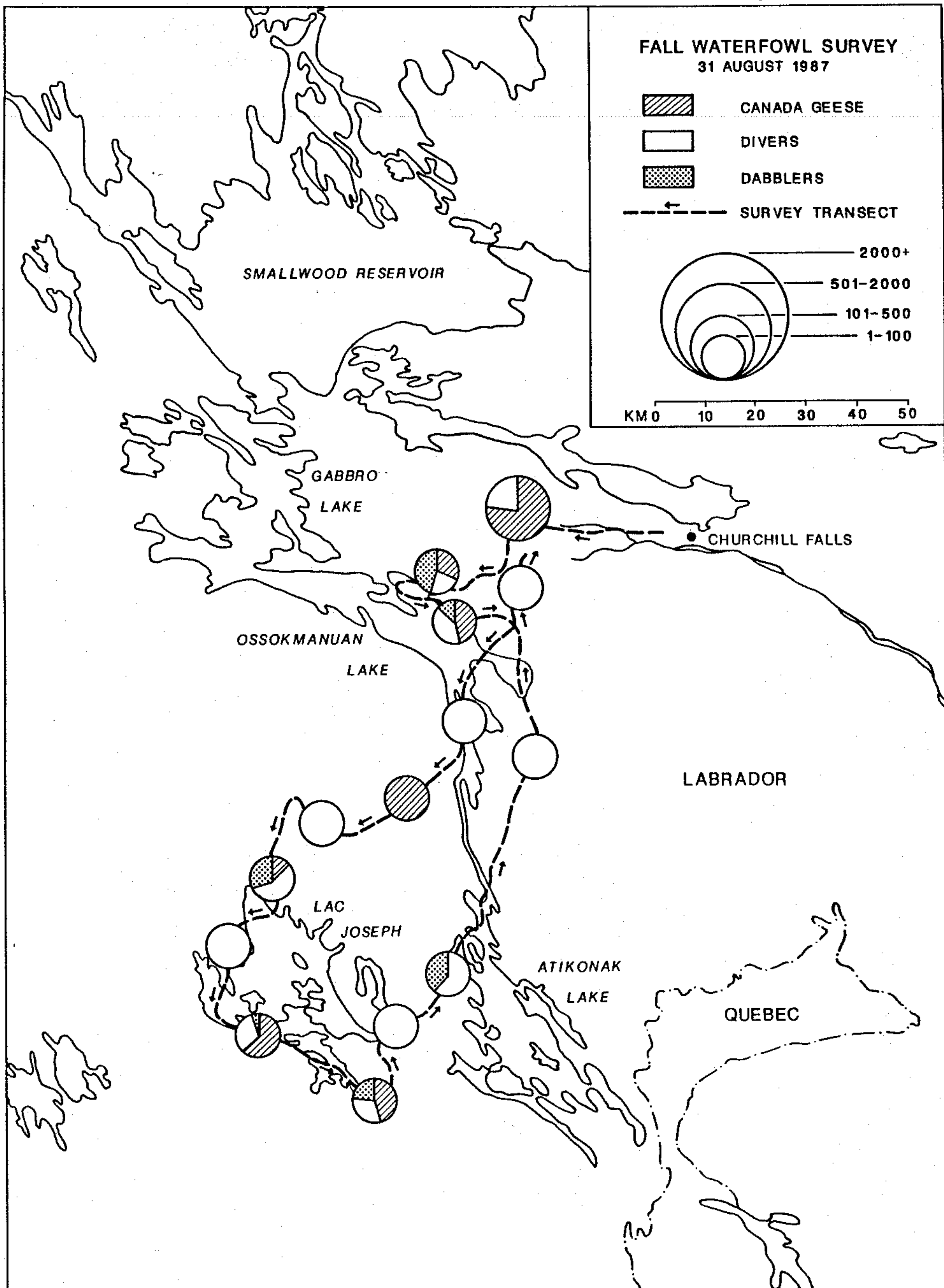
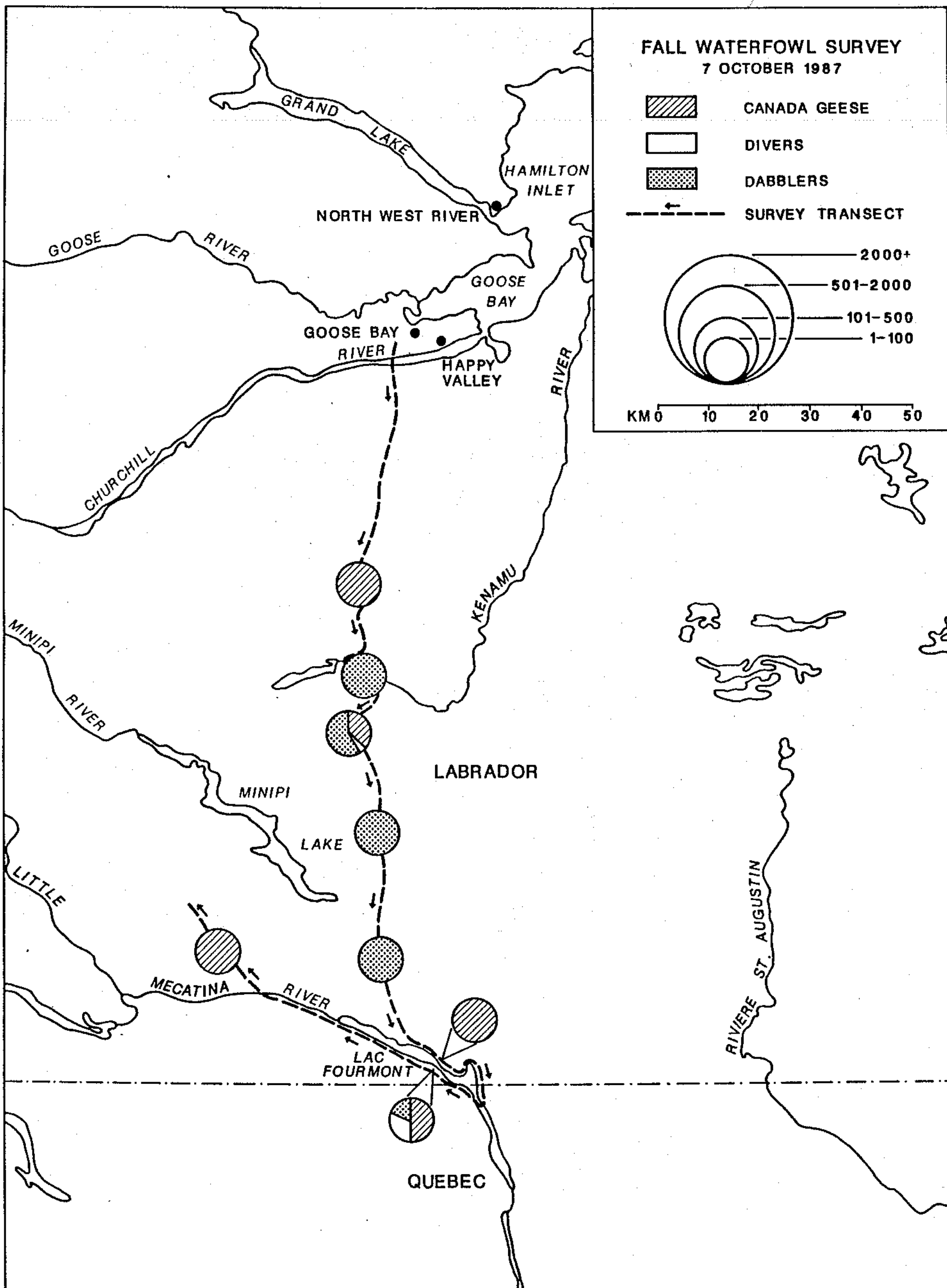

FALL WATERFOWL SURVEY
31 AUGUST 1987
CANADA GEESE
DIVERS
DABBLERS
SURVEY TRANSECT
2000+
501-2000
101-500
1-100
KM 0 10 20 30 40 50
SMALLWOOD RESERVOIR
GABBRO LAKE
CHURCHILL FALLS
OSSOKMANUAN LAKE
LABRADOR
LAC JOSEPH
ATIKONAK LAKE
QUEBEC

Figure 4.25


FALL WATERFOWL SURVEY
7 OCTOBER 1987
CANADA GEESE
DIVERS
DABBLERS
SURVEY TRANSECT
2000+
501-2000
101-500
1-100
KM 0 10 20 30 40 50
GRAND LAKE
HAMILTON INLET
NORTH WEST RIVER
GOOSE RIVER
GOOSE BAY
GOOSE BAY
RIVER
HAPPY VALLEY
CHURCHILL
RIVER
KENAMU
MINIPI RIVER
MINIPI LAKE
LABRADOR
LITTLE
MECATINA RIVER
LAC FOURMONT
QUEBEC
RIVIERE ST. AUGUSTIN

August was repeated on 6 October (Figure 4.21). Total waterfowl on Snegamook Lake remained relatively low with less than 1000 birds observed. Moderate concentrations of diving ducks in particular were located along Ugjotok Bay.

During surveys flown in late August in the interior of Labrador, no large concentrations of waterfowl were observed (Figures 4.22 - 4.24). Similarly, no large concentrations were seen on interior lakes or rivers during the 7 October survey (Figure 4.25).

4.2.2. Spring Staging Surveys

For the purpose of the spring survey, a concentration was defined as more than 50 waterfowl observed in a 10 km X 10 km block. The locations and descriptions of spring waterfowl staging sites and the species composition at these sites are summarized below and are illustrated in Figures 4.26 - 4.31.

Goose River, Lake Melville, Double Mer, Groswater Bay, Sandwich Bay 13 and 19 May 1988
(Figures 4.26, 4.27, 4.28)

Goose River is a slow moving brook that flows through a broad flat peatland and empties into a very extensive area of tidal mud flats (Figures 4.26 and 4.27). This area was identified as an important post-breeding area for Canada geese in the fall surveys. On both spring surveys, the majority of waterfowl were Canada Geese.

Double Mer is a 40 km narrow finger of saltwater. There are shallows and tidal mud flats along its north shore which offer feeding sites for waterfowl. On the 13 May survey Canada geese were most abundant (Figure 4.27), whereas on 19 May, black ducks and Canada geese comprised most of the flocks (Figure 4.28).

On 13 May, the head of Lake Melville from Mulligan Bay south to Epinette Peninsula then west to and including Goose Bay was surveyed. This 175 km stretch of coastline contains many sections of shallow water, tidal mud flats and grassy shorelines which provide good habitat for feeding waterfowl (Figure 4.27). Canada geese were present in large flocks and black duck, scaup and merganser made up most of the remainder of the birds observed.

The southside of Groswater Bay south along the coast to Cartwright contains muddy tidal flats which provide good feeding habitat for Canada Geese and dabbling ducks in the autumn, however, these areas were partly ice covered at the time of the survey. Rocky islets provide good feeding habitat for seas ducks (Figure 4.27). Large flocks ~~with~~ in which common eider and oldsquaw occurred in approximately equal numbers were present along this coast.

<u>Makkovik, Cape Harrison, North Shore of Groswater Bay</u>
19 May 1988 (Figure 4.28)

Figure 4.26

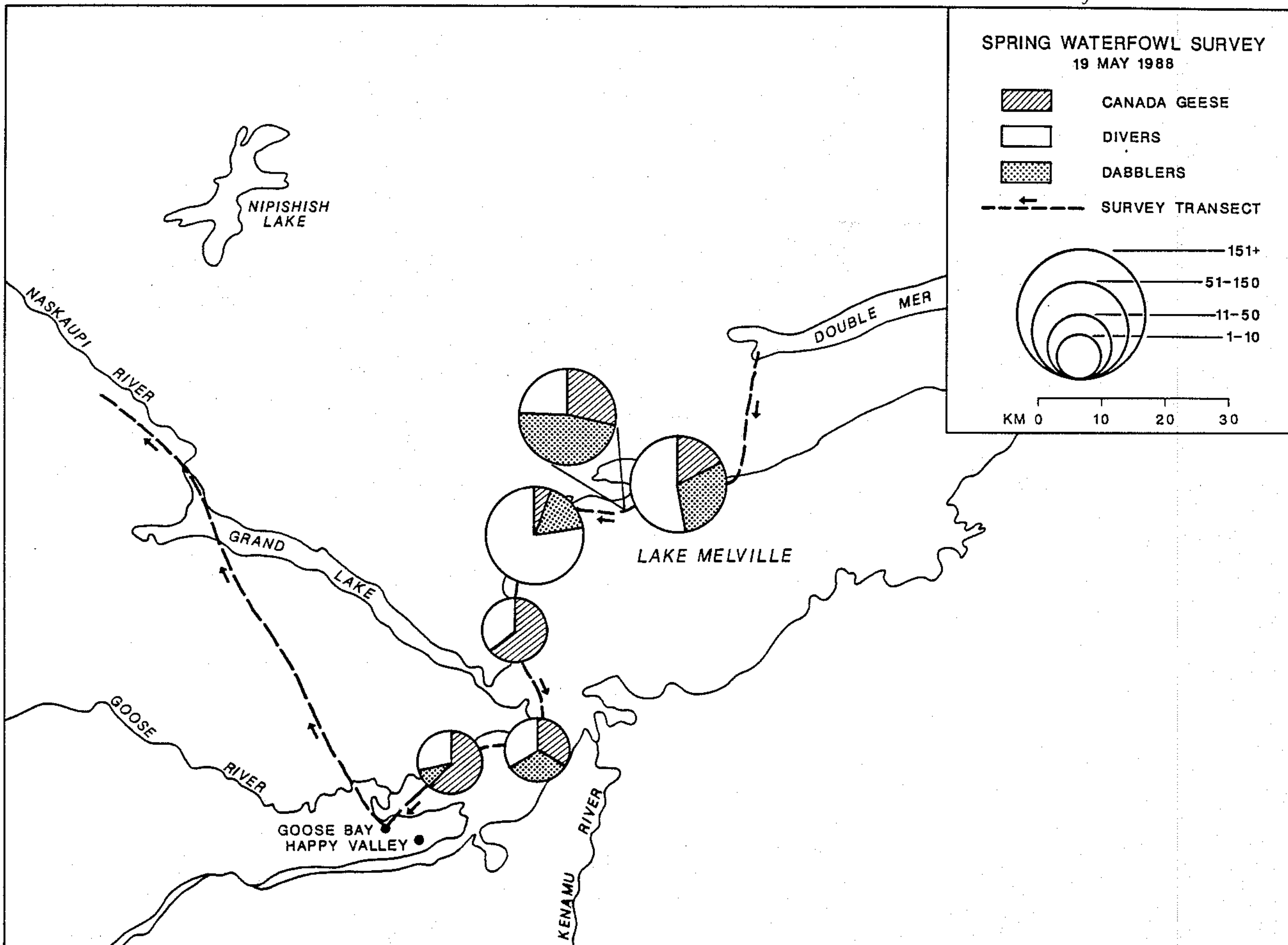

SPRING WATERFOWL SURVEY
19 MAY 1988
CANADA GEESE
DIVERS
DABBLERS
SURVEY TRANSECT
151+
51-150
11-50
1-10
KM 0
10
20
30
NIPISHISH LAKE
NASKAUPI RIVER
GRAND LAKE
GOOSE RIVER
GOOSE BAY
HAPPY VALLEY
KENAMU RIVER
LAKE MELVILLE
DOUBLE MER

Figure 4.27

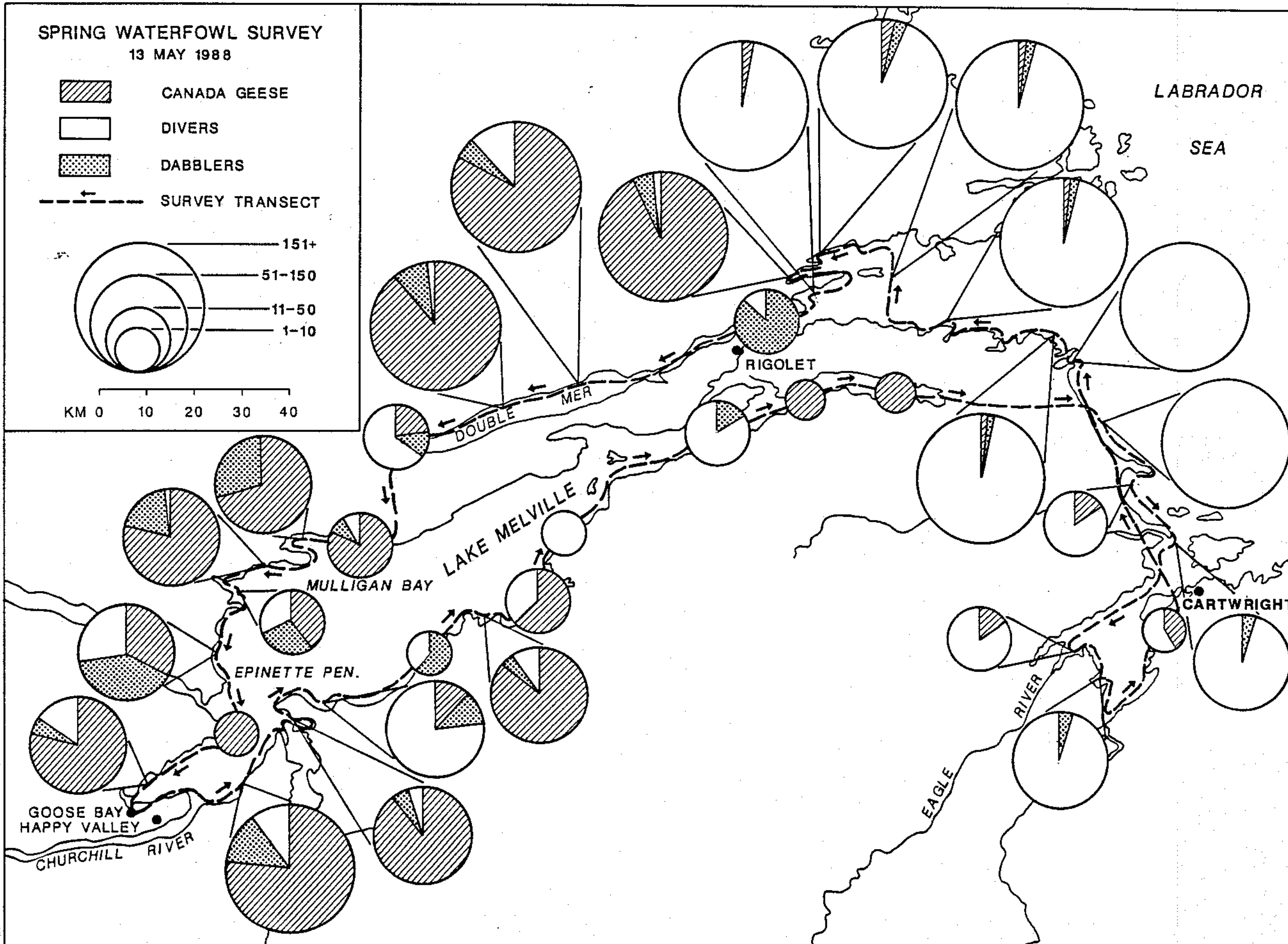
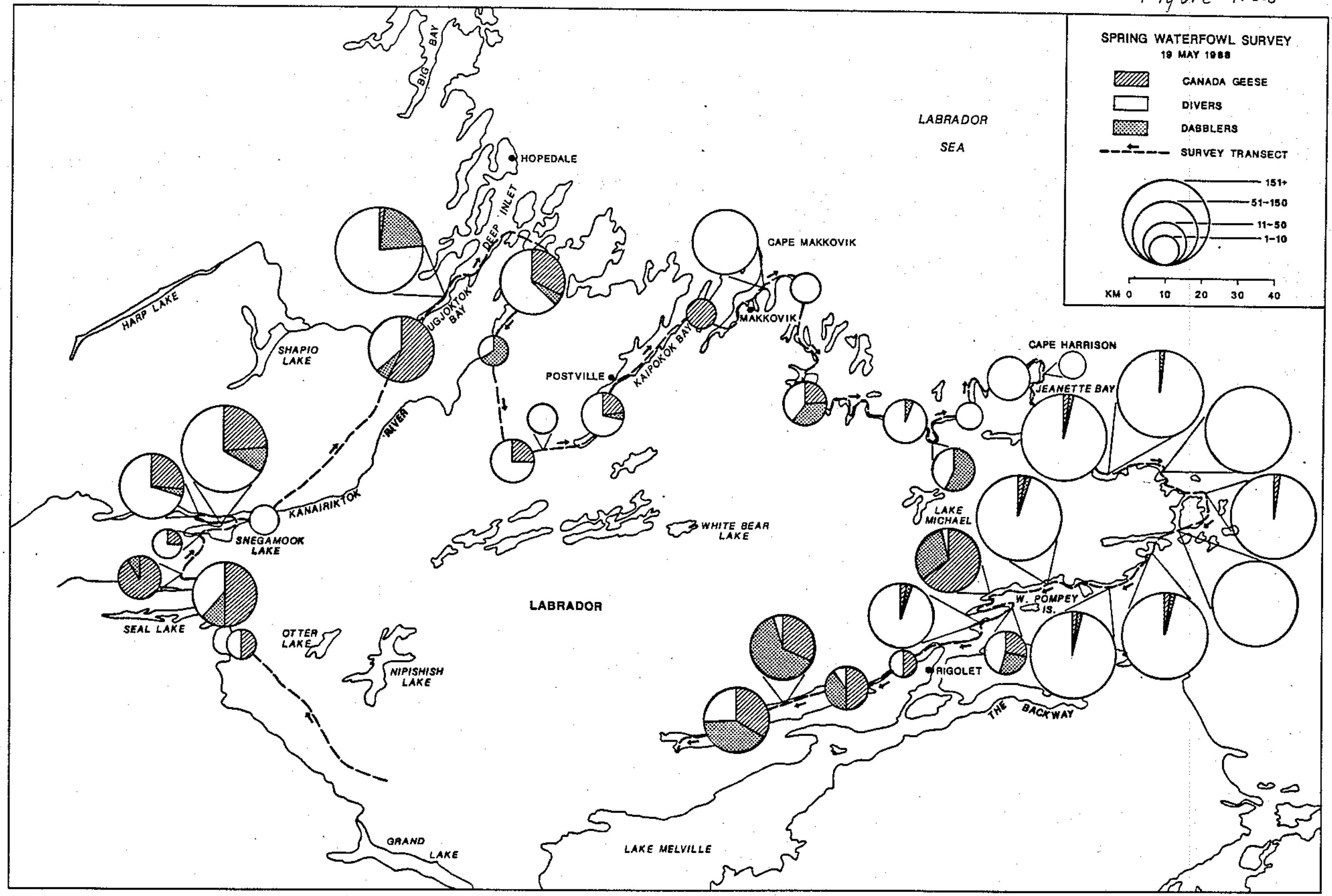

SPRING WATERFOWL SURVEY
13 MAY 1988
CANADA GEESE
DIVERS
DABBLERS
SURVEY TRANSECT
151+
51-150
11-50
1-10
KM 0
10
20
30
40
LABRADOR
SEA
RIGOLET
CARTWRIGHT
DOUBLE
MER
LAKE MELVILLE
MULLIGAN BAY
EPINETTE PEN.
GOOSE BAY
HAPPY VALLEY
CHURCHILL
RIVER
EAGLE
RIVER

Figure 4.28


SPRING WATERFOWL SURVEY
19 MAY 1988
CANADA GEESE
DIVERS
DABBLERS
SURVEY TRANSECT
151+
51-150
11-50
1-10
KM 0 10 20 30 40
LABRADOR SEA
HOPEDALE
BIG BAY
DEEP INLET
UGJOKTOK BAY
HARP LAKE
SHAPIO LAKE
CAPE MAKKOVIK
MAKKOVIK
KAIPOKOK BAY
POSTVILLE
CAPE HARRISON
JEANETTE BAY
KANAIRIKTOK
RIVER
SNEGAMOOK LAKE
WHITE BEAR LAKE
LAKE MICHAEL
W. POMPEY IS.
LABRADOR
SEAL LAKE
OTTER LAKE
NIPISHISH LAKE
RIGOLET
THE BACKWAY
GRAND LAKE
LAKE MELVILLE

Jeanette Bay south along the coast to West Pompey Island. The rocky shoreline, many rocky islets and shoals provide excellent feeding for seaducks especially common eider. There were numerous flocks evenly distributed along this 120 km stretch of shoreline.

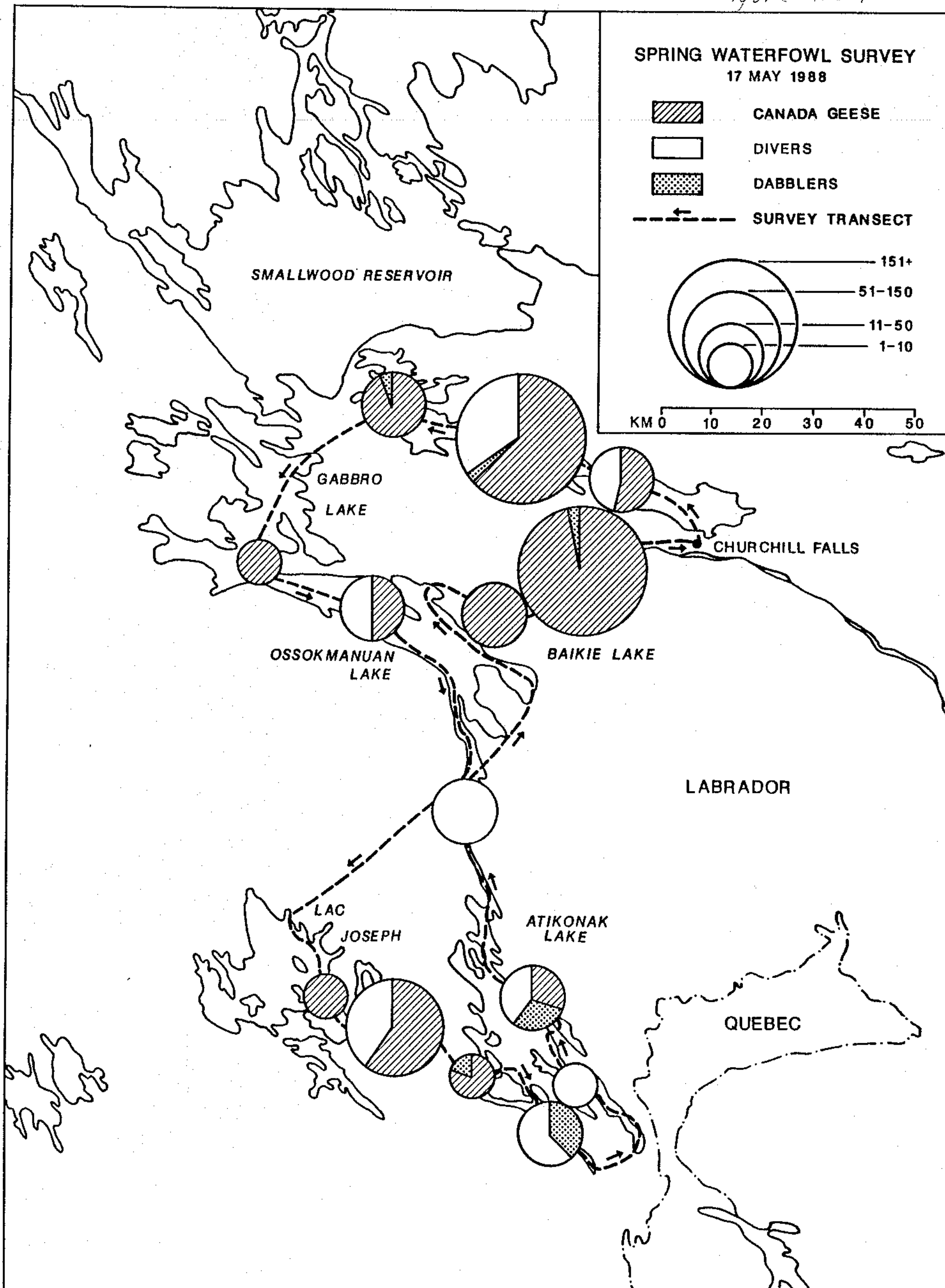
Ugjoktok Bay and Kanairiktok Bay
19 May 1988 (Figure 4.28)

Ugjoktok Bay, at the head of Deep Inlet, is a narrow bay with extensive tidal mudflats and some low lying grassy shores. This area was identified as a productive area for waterfowl during the autumn surveys. Diving ducks were especially numerous there in the spring. Kanairiktok Bay is similar to Ugjoktok Bay in that it is long and narrow with fairly extensive mudflats. However, unlike at Ugjoktok Bay, most of the waterfowl were concentrated at the head of the bay. Diving ducks and Canada geese were present here in approximately equal numbers.

Gabbro Structure, Ossokmanuan Lake, Lac Joseph, Baikie Lake 17 May 1988 (Figure 4.29)

Baikie Lake is a shallow lake with many sand flats, situated between Churchill Falls and Ossakmanuan Lake. On the 17 May survey this lake contained mainly Canada Geese. The outflow of Lac Joseph is an area of moving water that thaws out earlier than the

Figure 4.29



SPRING WATERFOWL SURVEY
17 MAY 1988
CANADA GEESE
DIVERS
DABBLERS
SURVEY TRANSECT
151+
51-150
11-50
1-10
KM 0 10 20 30 40 50
SMALLWOOD RESERVOIR
GABBRO LAKE
CHURCHILL FALLS
OSSOKMANUAN LAKE
BAIKIE LAKE
LABRADOR
LAC JOSEPH
ATIKONAK LAKE
QUEBEC

surrounding areas. Atikonak River at the outflow of Atikonak Lake is also an area of moving water that thaws out earlier than the surrounding area. Both areas were attractive to diving ducks and Canada geese.

<u>North of Smallwood Reservoir, Lobstick and Grabbo Structures</u> 17 May 1988 (Figure 4.30)

The Lac Elson area is in the peatland north of the Smallwood Reservoir which has been described by Goudie and Whitman (1987) as one of the most important waterfowl breeding habitats in Labrador. The area consisted of shallow lakes and ponds with wide slow moving streams. Canada Geese were present in flocks of up to 50 sitting on the ice by open water or in the water.

The area 40 km southwest of Lac Elson provides habitat similar to that of Lac Elson. These two areas are separated by a range of rocky hills. On the 17 May survey there were mainly Canada Geese and scaup.

The portion of the Churchill River between Lobstick control structure and Flour Lake has a substantial flow of water. This flow caused large areas of open water to be present while surrounding areas such as Smallwood resevoir were frozen. Canada Geese and scaup were the most common species observed there.

<u>Naskaupi River, Seal Lake, Snegamook Lake, West Micmac Lake, Upper Kanairiktok River and Northeast</u>

Figure 4.30

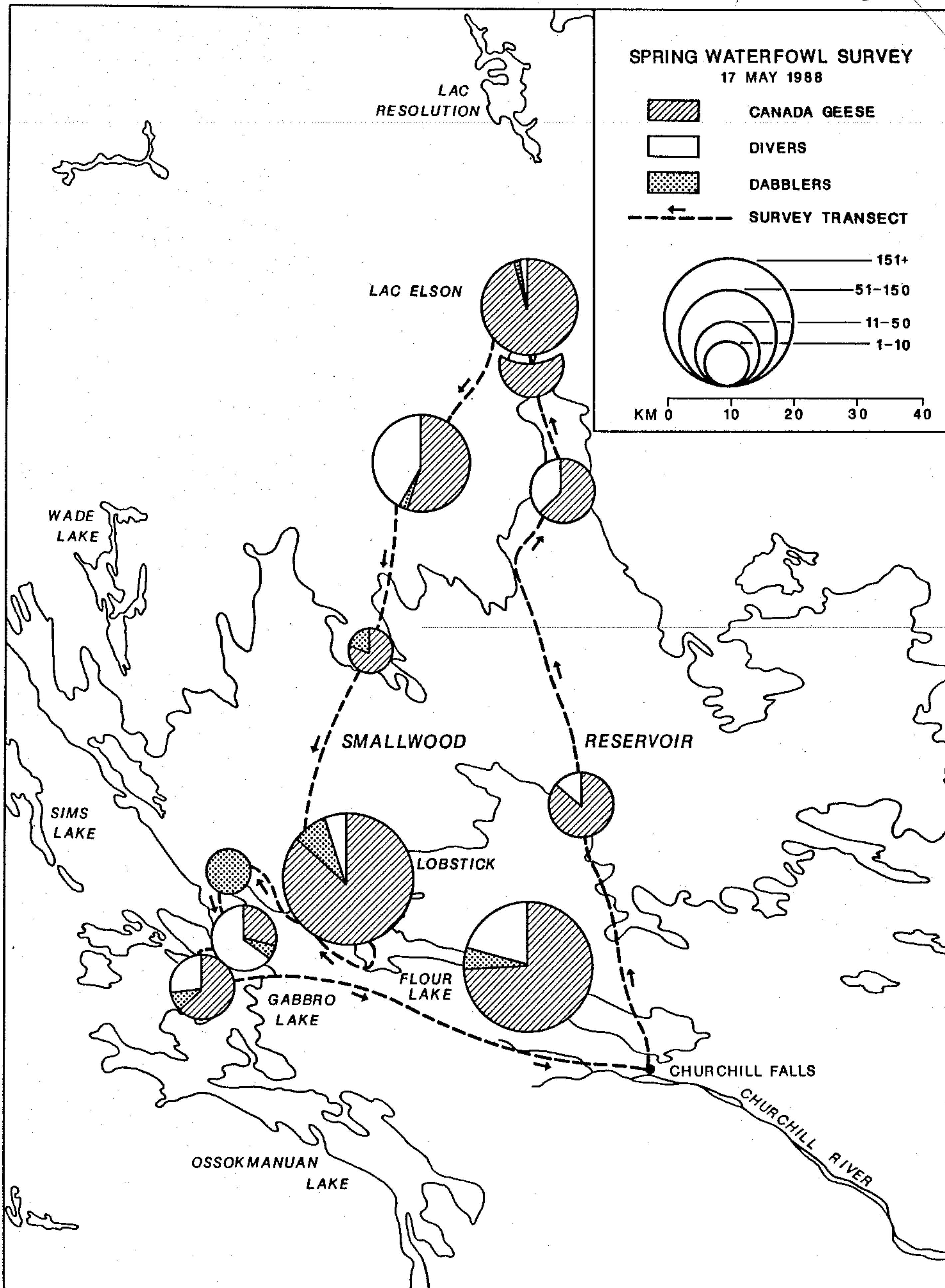
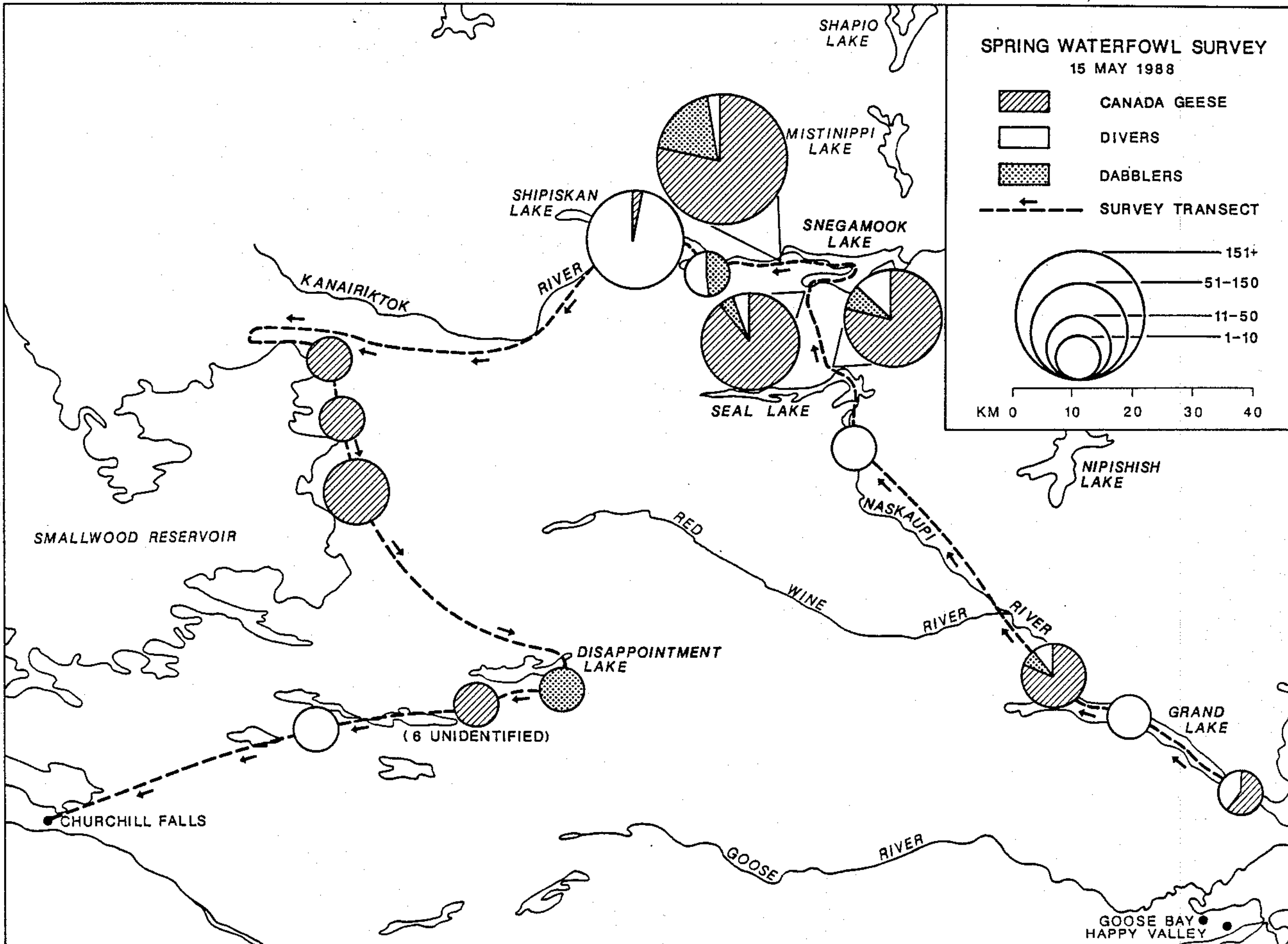

SPRING WATERFOWL SURVEY
17 MAY 1988
CANADA GEESE
DIVERS
DABBLERS
SURVEY TRANSECT
151+
51-150
11-50
1-10
KM 0 10 20 30 40
LAC RESOLUTION
LAC ELSON
WADE LAKE
SMALLWOOD
RESERVOIR
SIMS LAKE
LOBSTICK
FLOUR LAKE
GABBRO LAKE
CHURCHILL FALLS
CHURCHILL RIVER
OSSOKMANUAN LAKE

Figure 4.31


SPRING WATERFOWL SURVEY
15 MAY 1988
CANADA GEESE
DIVERS
DABBLERS
SURVEY TRANSECT
151+
51–150
11–50
1–10
KM 0 10 20 30 40
SHAPIO LAKE
MISTINIPPI LAKE
SHIPISKAN LAKE
SNEGAMOOK LAKE
SEAL LAKE
NIPISHISH LAKE
KANAIRIKTOK RIVER
NASKAUPI RIVER
RED WINE RIVER
GOOSE RIVER
SMALLWOOD RESERVOIR
DISAPPOINTMENT LAKE
(6 UNIDENTIFIED)
GRAND LAKE
CHURCHILL FALLS
GOOSE BAY
HAPPY VALLEY

Smallwood Reservoir 15 May 1988 (Figure 4.31) and 19 May 1988 (Figure 4.28).

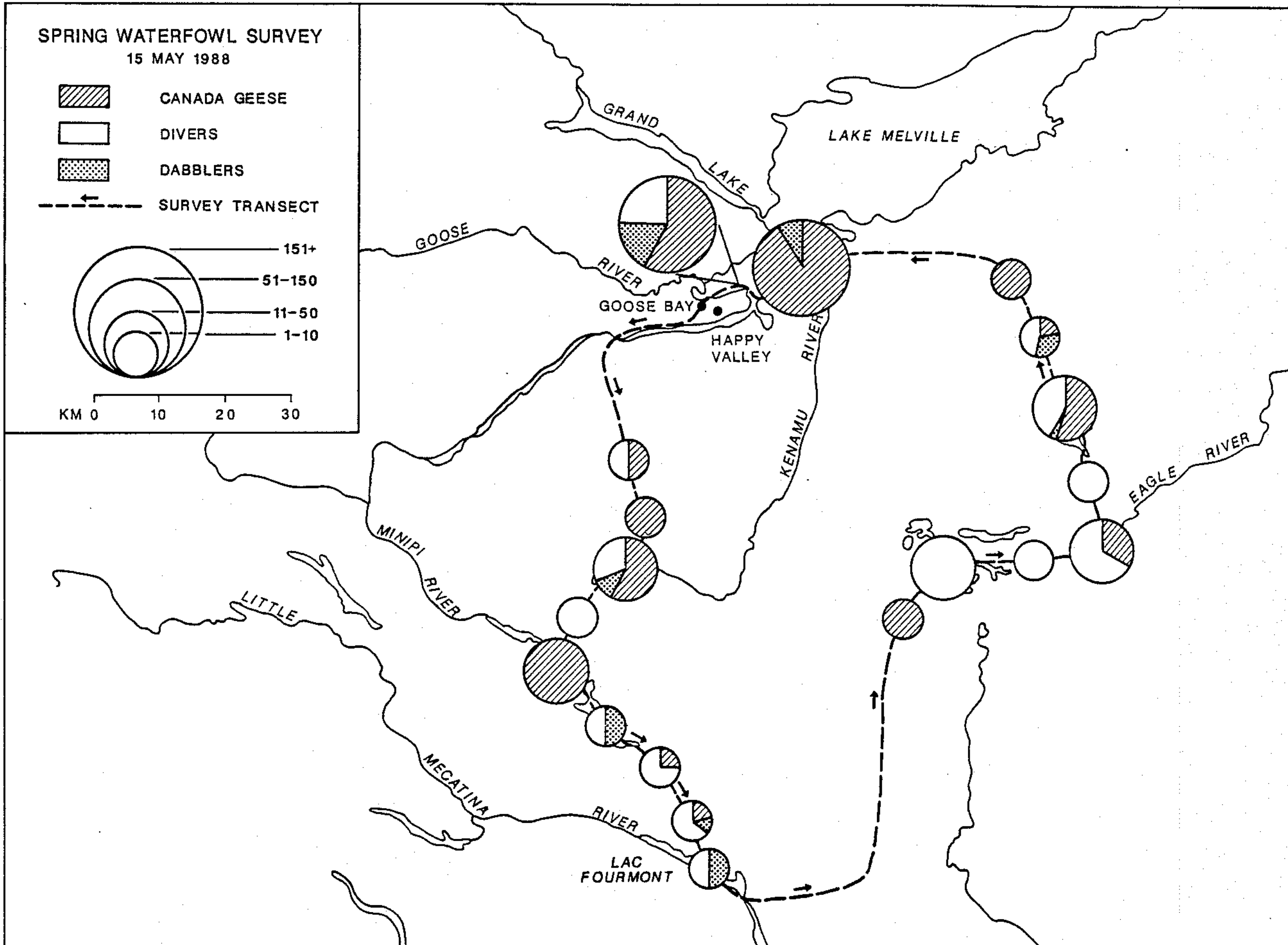
Seal Lake is a unique lake in this region. At the east end it is very shallow and sandy with broad, flat muddy shorelines. It was found to be a relatively important post breeding concentration site in late August 1987. Canada geese and dabbling ducks were in the majority on both surveys, with lesser numbers of goldeneye.

The western end of Snegamook Lake is one of the richest single inland locations for waterfowl in Labrador. It is an important site for breeding and summer moulting (Gillespie and Wetmore 1974, Goudie and Whitman 1987). Here the general sandy nature of the terrain and a large delta formed by the Kanairiktok River have resulted in several shallow sandy ponds and coves and a relatively large grassy marsh with shallow ponds, slow meandering streams and oxbows. Canada geese, scaup, black duck and goldeneye made up most of the flocks observed there during May.

The Kanairiktok River, from Shipiskan Lake to 5 km down river, is an area of swiftly flowing water with light rapids. As in the October 1987 survey, this area was favoured by goldeneye.

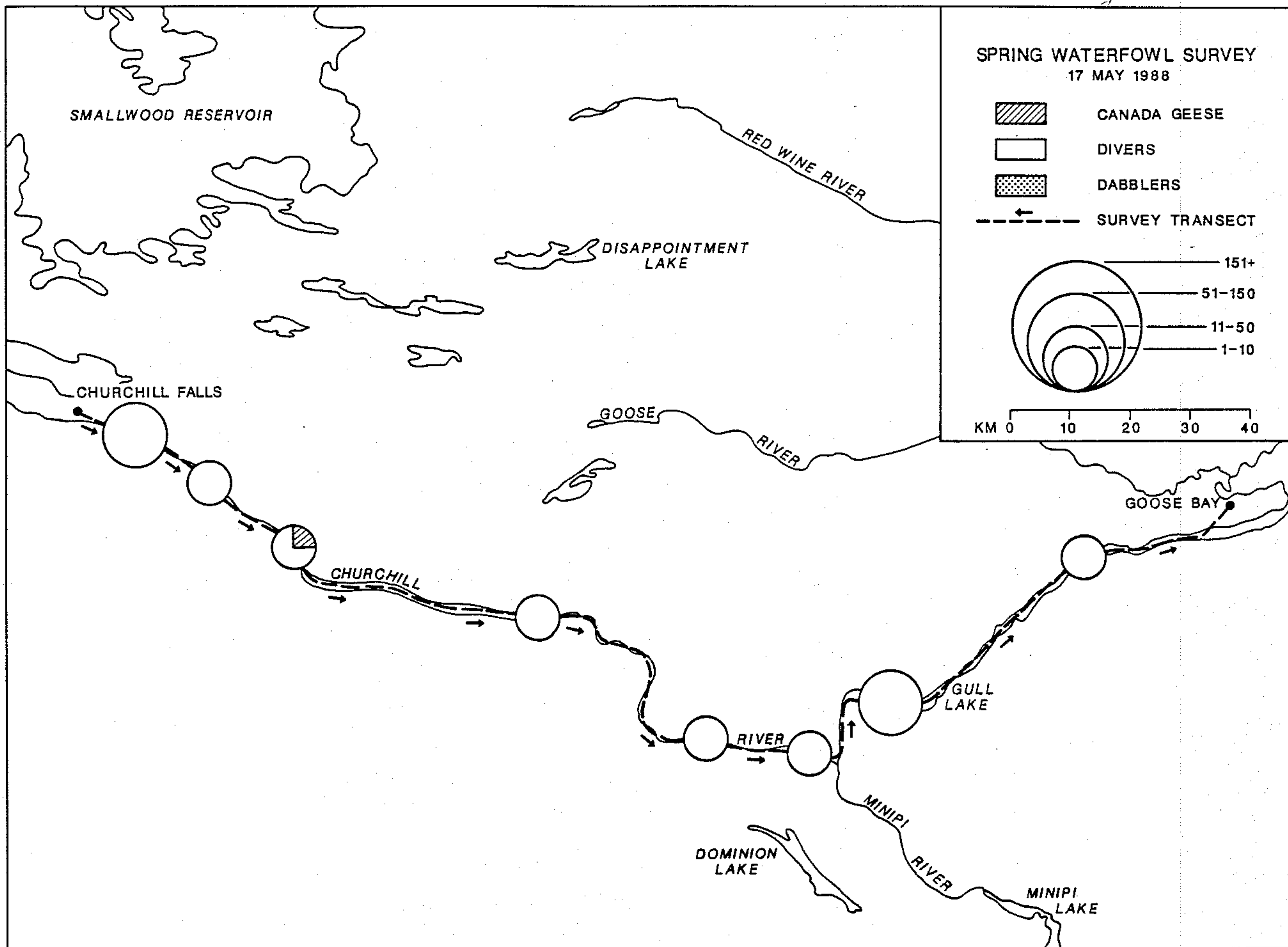
Surveys of the Churchill River (Figure 4.32) and smaller river and lake systems south of Goose Bay (Figure 4.33) found only small and isolated flocks composed mainly of divers and Canada geese.

Figure 4.32



SPRING WATERFOWL SURVEY
15 MAY 1988
CANADA GEESE
DIVERS
DABBLERS
SURVEY TRANSECT
151+
51–150
11–50
1–10
KM 0
10
20
30
GRAND
LAKE
LAKE MELVILLE
GOOSE
RIVER
GOOSE BAY
HAPPY
VALLEY
RIVER
KENAMU
EAGLE
RIVER
MINIPI
RIVER
LITTLE
MECATINA
RIVER
LAC
FOURMONT

Figure 4. 33


SPRING WATERFOWL SURVEY
17 MAY 1988
CANADA GEESE
DIVERS
DABBLERS
SURVEY TRANSECT
151+
51-150
11-50
1-10
KM 0 10 20 30 40
SMALLWOOD RESERVOIR
RED WINE RIVER
DISAPPOINTMENT LAKE
GOOSE RIVER
CHURCHILL FALLS
CHURCHILL RIVER
GOOSE BAY
GULL LAKE
MINIPI RIVER
MINIPI LAKE
DOMINION LAKE

5.0 DISCUSSION

The total waterfowl breeding population of the Labrador interior during 1980-82 was estimated to be 573,500 pairs, made up of 152,900 ± 60,300 pairs of Canada geese, 165,300 ± 67,900 pairs of dabbling ducks, and 254,900 ± 85,800 pairs of diving ducks (Goudie and Whitman 1987). There is no current population estimate of waterfowl for the north shore of Quebec (J. Bedard, pers. comm.); however, a number of surveys have identified areas of importance to waterfowl. The coast of the north shore and the Gulf of St. Lawrence contain bays and estuaries that provide staging grounds for sea ducks, mainly common eider, goldeneye and oldsquaw (Lehoux et al. 1985). The Romaine-Mecatina drainage basin is considered to have great potential for breeding waterfowl (Hydro-Quebec 1978, 1979).

The lake systems between Schefferville and the George River drainage in northeastern Quebec have been identified as important waterfowl breeding area (DesGranges and Houde in press).

Overall, there was considerable variability in the results of the 1987 breeding pairs survey. There were few consistent trends, in terms of the magnitude and direction of changes, among species, ecoregions or between survey methods (Table 5.1 and 5.2). This is due in part to the small sample sizes from which these results were obtained. However, a detailed examination of the results and other factors that will be discussed below is needed to explain some of the variation.

No scoters were observed in the transect or plot surveys for the control ecoregion in 1987 (Eagle Plateau), although they were present in 1980-82. Scoters were unusual in that they occurred sporadically in the samples. They were relatively abundant in the Smallwood Resevoir, but were absent, or expected to be absent, in five of the ten transects (Figure 4.11). Similarly, scoters were abundant in the Smallwood Reservoir plot in 1981 and 1987, but were absent, or expected to be absent, from Snegamook and West Micmac plots. The summary tables give the impression that there are dramatic changes in the abundance of scoters when in fact it was typical that no pairs were expected, or that only one or two pairs were observed. A change from zero to one pair per 100 km^2 would still constitute a 100% net difference. All other waterfowl species occurred in greater densities, thus expected and observed values were mostly greater than one, making comparisons of net change more valid.

Transect results for Canada geese were inconclusive, with three of the five ecoregions showing a higher than expected density within the LLTA. The plot results, however, all show lower than expected

Table 5.1 Relative difference in pair abundance of observed waterfowl within the LLTA compared to expected values (Transect Data).

	ECOREGION					
	Mistastin Lake	St. Paul	Smallwood Res.	Churchill Falls	Postville	Net Differences
Canada goose	↓↓↓	↑↑↑↑	↑↑↑↑	↑↑↑↑	↓↓↓↓	↑
green-winged teal	↓↓↓↓	↓↓↓↓	↓↓↓↓	↓↓↓↓	↓↓↓↓	↓↓↓↓
black duck	↑↑↑↑	—	↓↓↓↓	↑↑↑↑	↓↓↓↓	—
scaup	—	↓↓↓↓	↑↑↑↑	↑↑	↓↓	—
scoter	↑↑↑↑	↑↑↑↑	↑↑↑↑	↓↓↓↓	—	↑↑
goldeneye	↓↓	↓↓↓↓	↓↓↓↓	↓↓↓↓	↓↓↓↓	↓↓↓↓
merganser	—	↑↑↑↑	↑↑↑↑	↑↑	↓↓	↑↑

Net difference: $\frac{\# \uparrow - \# \downarrow}{N \text{ ecoregions}}$ = # of arrows up or down

$\left[\frac{observed}{expected} - 1\right] \times 100\%$

— No difference in expected and observed values.
↓/↑ observed value up to 25% less/greater than expected value
↓↓/↑↑ observed value 26-50% less/greater than expected value
↓↓↓/↑↑↑ observed value 51-75% less/greater than expected value
↓↓↓↓/↑↑↑↑ observed value more than 76% less/greater than expected value

Table 5.2 Relative difference in pair abundance of observed waterfowl within LLTA compared to expected values (Plot Data).

	ECOREGION			
	Postville 1987	Snegamook	Smallwood Reservoir	Net Differences
Canada goose	↓↓↓↓	↓↓↓	↓↓↓↓	↓↓↓↓
green-winged teal	↓↓	↑↑↑↑	↓↓↓↓	↓
black duck	↑↑↑↑	↓	↓↓↓↓	—
scaup spp.	↑↑↑↑	↓↓↓↓	↓↓↓↓	↓
scoter spp.	—	—	↑↑↑↑	↑
goldeneye	↑↑↑↑	↓↓↓↓	↓↓↓↓	↓
merganser	↓↓	↓↓	↑↑↑↑	↑

Net difference: $\frac{\# \uparrow - \# \downarrow}{N \text{ ecoregions}}$ = # of arrows up or down

$\left[\frac{\text{observed}}{\text{expected}} - 1\right] \times 100\%$

— No difference in expected and observed values.
↓/↑ observed value up to 25% less/greater than expected value
↓↓/↑↑ observed value 26-50% less/greater than expected value
↓↓↓/↑↑↑ observed value 51-75% less/greater than expected value
↓↓↓↓/↑↑↑↑ observed value more than 76% less/greater than expected value

densities within the LLTAs. Green-winged teal densities were more than 75% lower than expected in transect results for all ecoregions. Results from the plot surveys were inconclusive. Goldeneye densities were less than expected in all ecoregions from transect results and were more than 75% lower than expected for four of the five ecoregions examined. Results of the plot surveys were inconclusive.

Results for black duck and scaup were inconclusive from both the plot and transect surveys, but overall little change was noted. Merganser densities were higher than expected in three of the five ecoregions based on transect results, while plot results were similar.

There was also considerable variation in the breeding densities among the ecoregions. However, the Postville ecoregion transect results showed a significant decline, with all species occurring in lower than expected densities within the LLTA. Since this ecoregion was the most intensively sampled of the five test ecoregions and therefore yielded the most reliable results, and because this area is also the most heavily overflown of the five ecoregions, there is reason to suspect that low-level flying may have had an impact on the quality of habitat for breeding waterfowl. However, on the basis of the overall survey results, the existing low-level flying activities are apparently not having dramatic, uniform effects on these waterfowl groups.

A review of relevant literature and personal communications has shown that waterfowl are susceptible (some species more so than others) to disturbance by aircraft, and that birds have been observed to flush or be otherwise disturbed by low-level flying activities in Labrador (see Technical Report __ - Effects of Aircraft Noise on Wildlife). Whether or not these disturbances result in long term changes in population densities has not been determined. As Schweinsberg et al. (1974) suggest, the effects may not show up until one or more years after disturbance, and then only be manifested as a gradual disappearance of waterfowl from the area. Conclusive evidence of an impact from low-level flying on waterfowl awaits a more intensive investigation.

Virtually all of the freshwater in Labrador freezes over during the winter months. This forces waterfowl that breed in the study area to migrate to warmer climes in fall and then return again in the spring to breed. To take advantage of the full length of the relatively short breeding season in Labrador, waterfowl arrive at breeding sites as soon as the sites are available, i.e. free of ice and snow. Waterfowl typically arrive at staging sites in the general area of the breeding grounds, and wait there for the breeding areas to become ice free. It was apparent from the spring surveys that are relatively few areas in the interior of Labrador where waterfowl concentrate in the spring, but that many coastal areas have concentrations of waterfowl.

The approximate chronology for Labrador waterfowl is presented in Appendix C. Precise dates are largely influenced by the timing of the spring thaw which varies from year to year depending on weather conditions from the previous winter and during the spring. At Terrington Basin, Goose Bay the first totally ice free day varies from 6 May to 6 June (Appendix D). The first migrating waterfowl probably arrive in the study area during the last half of April with peak numbers occurring around mid May. Ice conditions before mid April appear to be too severe for waterfowl.

Diving ducks probably arrive in the study area in late April, since rivers, which are their prefered habitats become ice free earliest. Canada geese probably arrive in large numbers during early May, followed in mid to late May by dabbling ducks. By late May only resident breeding waterfowl and some non-breeding waterfowl are likely to be present at spring staging areas.

Little is known regarding the paths of inward spring migration, but this information is needed because when waterfowl are concentrated there is a greater potential for aircraft/bird collisions to occur. Once the birds have arrived on the breeding grounds they are widely distributed and occur at low densities, except for a small number of identified breeding concentrations such as Snegamook Lake and Woods Lake.

The breeding period is a sensitive time for waterfowl. A female common eider, for example, is known to lose 32% of her postlaying weight during incubation (Welty 1982). Commencement of incubation varies with species and location from 2 May to 2 June (except merganser 11 June and wigeon 18 June) for southern Labrador.

During July most waterfowl become flightless for 3-5 weeks during moulting. The flightless interval for black ducks has been estimated to be 27 -30 days, peaking in mid-July in Labrador (Bowman 1987). This period is found to be synchronous between years and birds generally return to the same moulting areas each year. This is a time of high stress because birds are not feeding, rely on fat reserves and remain sedentary to conserve energy. Disturbances during this period could result in unnecessary expenditure of energy, and ultimately, increased mortality. Although the fidelity of black ducks to moulting areas is documented, Goudie (pers. comm.) noted that no birds returned to Snegamook Lake to moult after the first season of low-level flying. Apparently, after a decrease in low-level flying activity, the black duck population in the area partially recovered.

Surveys to locate moulting areas were not conducted as a part of this study. These areas are very difficult to locate because little is known about habitat preferences for moulting, there are comparatively few areas (although supposedly large numbers of birds may use these areas), and moulting birds are difficult to find during this time as they are often concealed by vegetation. At present, three major areas have been identified as important moulting locations: Snegamook Lake, Nutak/Okak and Flatwater Brook (M. Bateman pers. comm.). Other moulting sites undoubtedly exist in the study region.

Goslings and ducklings fledge between 15 July - 31 August and thereafter prepare for the fall migration. Birds are believed to be moderately sensitive during this period since they must feed heavily to build up sufficient reserves for fall migration. Disturbances that reduce the amount of time spent foraging or that cause high energy expenditures may be detrimental to waterfowl.

Prior to the fall staging surveys, a number of interior lakes and rivers were identified as having the capacity to support large concentrations of waterfowl during the autumn. However, no large concentrations of waterfowl were observed in the Labrador interior during surveys flown in late August 1987. Coastal areas appear to be more heavily used in the fall. Observations made by people living along coastal and the interior Labrador indicated that waterfowl, particularly Canada geese, migrated approximately two to three weeks earlier than normal. A probable explanation for low waterfowl use of apparently good staging habitat in the interior is the phenological advance of events associated with a particularly mild northern winter in 1986-87. Northern nesting birds (particularly Canada geese) may have been able to begin nesting upon arrival in the area instead of waiting for the snow cover to dissipate. Consequently, breeding, moulting and staging may have occurred earlier in the summer as well. The pulse of the greater snow goose migration through Quebec was also observed to be earlier than is typical for the region (G. Rochette pers. comm.). The final survey south of Goose Bay on 7 October revealed low numbers of waterfowl, which supports the idea that birds had either moved to the coast or had already flown south.

As the birds stage for fall migration during August and September they again concentrate in large flocks which increases the likelihood of collisions between birds and low-flying aircraft. Although the fall staging areas that were identified in the Labrador interior during 1987 were not in heavy use at that time, it is likely that these areas would contain larger numbers of waterfowl during the peak staging period which normally occurs in September. It follows that a reduction in the volume of low-level overlights of known staging areas during this period will reduce the probability of bird strikes and lessen any disturbance to waterfowl.

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7.0 PERSONAL COMMUNICATIONS

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B. Mactavish	S. Fudge and Associates, St. Johns, Newfoundland
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APPENDIX A

ASSUMPTIONS OF THE ANALYSIS AND CALCULATION OF EXPECTED DENSITY VALUES

ASSUMPTIONS OF THE ANALYSIS AND CALCULATION OF EXPECTED DENSITY VALUES

Assumptions:

1) A change in the density of a species in the control ecoregion (Plateau) between 1980-81 and 1987 will be indicative of the expected change for all ecoregions during the same time period.

   For example, if we find that there are twice as many Canada geese on the Plateau ecoregion (control) in 1987 compared to 1980-81, then we expect to see twice as many Canada geese in other ecoregions of the study area regardless of the comparative densities between ecoregions.

2) Because the methodology was similar in 1980-81 and 1987, survey errors will also be similar. Comparisons or transect data were made using densities which were not corrected for air/round differences. This is acceptable since we are only examining relative differences, so that this source of error cancels out:

A) $$\frac{\text{Density}_{\text{control}}\ 1987_{\text{uncorrected}}}{\text{Density}_{\text{control}}\ 1980_{\text{uncorrected}}} = \frac{\text{Density}_{x\,(\text{expected})}\ 1987_{\text{uncorrected}}}{\text{Density}_{x}\ 1980_{\text{uncorrected}}}$$

B) $$\frac{\text{Density}_{\text{control}}\ 1987 \times a}{\text{Density}_{\text{control}}\ 1980 \times a} = \frac{\text{Density}_{x\,(\text{expected})}\ 1987 \times a}{\text{Density}_{x}\ 1980 \times a}$$

(a = air/ground correction factor)

Calculation of expected density:

Re-arranging formula B we have:

C) $\text{Density}_{X\,(expected)}\ 1987_{uncorrected} =$

$$\frac{\text{Density}_{X}\ 1980_{uncorrected} \times \text{Density}_{control}\ 1987_{uncorrected}}{\text{Density}_{control}\ 1980_{uncorrected}}$$

The 1987 expected density for ecoregion x represents the uncorrected density we would observe if there had been no change in the productivity of this habitat between 1980 and 1987. We compare this to the observed uncorrected density for ecoregion X in 1987.

A difference in the observed and expected values represents a change in the productivity of ecoregion X for a particular species betweeen 1980 and 1987.

APPENDIX B

RESULTS OF BREEDING PAIR SURVEYS FOR WATERFOWL BY S. FUDGE AND ASSOCIATES LTD. IN THE UNGAVA PENINSULA

Results of the Plateau breeding pair survey, total for all ecoregions[1] 9 June 1987.

Species	Total Individuals	Equivalent Pairs
Canada goose	13	3
green-winged teal	2	1
black duck	59	4
mallard	--	--
northern pintail	16	--
blue-winged teal	2	1
dabblers	80[2]	7
scaup	4	2
scoter	7	--
common goldeneye	17	5
merganser	10	3
oldsquaw	--	--
ring-neck duck	--	--
Total divers	38	10
Unidentified	6	4
Total Waterfowl	136	23

1 Ecoregions examined by this survey were Eagle Plateau and Paradise river.

2 Includes unidentified dabblers

Results of the Fontineau breeding pair survey, total for all ecoregions[1], 10 June 1987.

Species	Total Individuals	Equivalent Pairs
Canada goose	19	8
green-winged teal	0	0
black duck	7	3
mallard	0	0
northern pintail	1	1
blue-winged teal	0	0
dabblers	8	4
scaup	5	1
scoter	3	2
common goldeneye	48	5
merganser	11	7
oldsquaw	0	0
ring-neck duck	0	0
Total divers	70[2]	18[2]
Unidentified	6	1
Total Waterfowl	103	31

1 Ecoregions examined by this survey were Churchill Falls, St. Paul and North Shore.

2 Includes three units of unidentified divers.

Results of the Reservoir breeding pair survey, total for all ecoregions[1], 14 June 1987.

Species	Total Individuals	Equivalent Pairs
Canada goose	30	6
green-winged teal	3	0
black duck	6	2
mallard	0	0
northern pintail	0	0
blue-winged teal	0	0
dabblers	9	2
scaup	5	3
scoter	9	5
common goldeneye	5	4
merganser	25	13
oldsquaw	2	1
ring-neck duck	0	0
Total divers	46	26
Unidentified	0	0
Total Waterfowl	85	34

1 Ecoregions examined by this survey were Western Plateau, Mistastin Lake and Smallwood Reservoir.

Results of the Snegamook breeding pair survey, total for all ecoregions[1], 17 June 1987.

Species	Total Individuals	Equivalent Pairs
Canada goose	32	0
green-winged teal	0	0
black duck	40	0
mallard	0	0
northern pintail	0	0
blue-winged teal	0	0
dabblers	40	0
scaup	26	0
scoter	1	1
common goldeneye	4	1
merganser	5	4
oldsquaw	0	0
ring-neck duck	0	0
Total divers	36	8
Unidentified	21	1
Total Waterfowl	129	9

1 Ecoregions examined by this survey were Postville and Nipishish Lake.

Results of the Snegamook 36 km^2 breeding pair survey, in the Postville ecoregion, 13 June 1987.

Species	Total Individuals	Equivalent Pairs
Canada goose	287	19
green-winged teal	194	46
black duck	1352	74
mallard	0	0
northern pintail	0	0
blue-winged teal	0	0
dabblers	1546	120
scaup	583	56
scoter	0	0
common goldeneye	352	65
merganser	19	9
ring-neck duck	0	0
Total divers	954	130
Unidentified	0	0
Total Waterfowl	2787	269

Results of the Woods Lake 36 km^2 breeding pair survey, 14 June 1987.

Species	Total Individuals	Equivalent Pairs
Canada goose	41	7
green-winged teal	14	4
black duck	21	3
mallard	1	1
northern pintail	9	1
blue-winged teal	0	0
dabblers	45	9
scaup	22	1
scoter	6	3
common goldeneye	0	0
merganser	7	3
ring-neck duck	0	0
Total divers	35	7
Unidentified	0	0
Total Waterfowl	121	23

Results of the Lake 1155 36 km^2 breeding pair survey, 15 June 1987.

Species	Total Individuals	Equivalent Pairs
Canada goose	17	2
green-winged teal	7	3
black duck	22	5
mallard	0	0
northern pintail	0	0
blue-winged teal	0	0
dabblers	29	8
scaup	7	5
scoter	0	0
common goldeneye	14	1
merganser	2	1
ring-neck duck	14	4
Total divers	37	11
Unidentified	0	0
Total Waterfowl	83	21

APPENDIX C

APPROXIMATE CHRONOLOGY OF WATERFOWL BREEDING IN LABRADOR

(GOUDIE AND WHITMAN 1987)

Species	Area (sample size)	Mean start of Incubation	Mean date of fledging (range)
Canada goose	SW (Labrador City) -- Natashquan River (5)	16 May	8 Aug.(22 July, 11-16 Aug.)
	West (Woods Lake) (3)	22 April	15 July (12-20 July)
	Central (Snegamook Lake -- Goose River) (17)	25 May	17 Aug. (10-26 Aug.)
	East Central (Micmac Lake -- Groswater Bay) (13)	19 May	17 Aug. (10-26 Aug.)
	North (Nain) (2)	2 June	25 Aug. (23-27 Aug.)
green-winged teal	all areas (7)	14 June	10 Aug. (3-14 Aug.)
black duck	West (Woods Lake) (5)	2 May	21 July (14-28 July)
	Southeast (Eagle Plateau) (5)	21 May	9 Aug. (5-14 Aug.)
	East-Central (Groswater Bay) (1)	12 May	31 July
	Central (Snegamook Lake) (8)	24 May	12 Aug. (21-25 July, 15-22 Aug.)
	North (Nain) (2)	8 June	27 Aug. (19 Aug.-3 Sept.)
mallard	Central (Snegamook Lake) (1)	12 May	31 July
northern pintail	all areas (7) (SE., EC., and C)	23 May	30 July (23 July-12 Aug.)
American wigeon	Central (Snegamook Lake) (1)	18 June	29 Aug.
black scoter	all areas (1)	12 May[1]	8 Aug.[1]
common goldeneye	all areas (10)	1 June	26 Aug. (14 Aug.-1 Sept.)
red-breasted merganser	all areas (8) (EC and N)	11 June	11 Sept. (28 Aug.-22 Sept.)

[1] Seems improbably early for that species (cf. Palmer 1976): might perhaps have been a brood of another duck seen with a female scoter.

APPENDIX D

FREEZE-UP DATA - GOOSE BAY LABRADOR

Freeze-up Data - Goose Bay, Labrador

(Terrington Basin)

Year	First Ice	Complete Freeze Over	Ice Deterioration	Ice Free
80-81	Nov. 6	Nov. 11	Apr. 29	May 26
81-82	Nov. 4	Nov. 28	May 18	June 5
85-86	Nov. 12	Nov. 20	Apr. 25	May 16
86-87	Oct. 31	Nov. 13	Mar. 27	June 1
Normal (1946-1969)	Nov. 3	Nov. 15	May 9	May 24

Data source: Atmospheric Environment Service,
Pleasantville, Newfoundland