3028176G

ATLAS OF COLONIAL WATERBIRDS NESTING ON THE CANADIAN GREAT LAKES, 1989-1991. PART 4. MARSH-NESTING TERNS ON LAKE HURON AND THE LOWER GREAT LAKES SYSTEM IN 1991

Madeline J. Austen
Hans Blokpoel
Gaston D. Tessier

SK
470
T42
No. 217

This series may be cited as :

Austen, M.J., H. Blokpoel and G.D. Tessier. 1996.
Atlas of colonial waterbirds nesting on the Canadian Great Lakes 1989-1991.
Part 4. Marsh-nesting terns on Lake Huron and the lower Great Lakes system in 1991.
Technical Report Series No. 217
Canadian Wildlife Service, Ontario Region

Published by Authority of the
Minister of Environment
Canadian Wildlife Service

©Minister of Supply and Services Canada 1996
Catalogue No. CW69-5/217E
ISBN 0-662-22743-3
ISSN 0831-6481

Copies may obtained from:

Hans Blokpoel
Canadian Wildlife Service
Ontario Region
49 Camelot Drive
Nepean, Ontario
K1A 0H3

NOTE

The Atlas is to consist of five parts as follows:

Part 1. Cormorants, gulls and island-nesting terns on Lake Superior in 1989. (Blokpoel and Tessier 1991).

Part 2. Cormorants, gulls and island-nesting terns on Lake Huron in 1989. (In preparation).

Part 3. Cormorants, gulls and island-nesting terns on the lower Great Lakes system in 1990. (Blokpoel and Tessier 1996).

Part 4. Marsh-nesting terns on Lake Huron and the lower Great Lakes system in 1991. (This report).

Part 5. Herons and egrets in the Great Lakes system during 1989-1991. (In preparation).

ABSTRACT

During the 1991 breeding season, a survey was conducted of marsh-nesting Forster's Terns (*Sterna forsteri*) and Black Terns (*Chlidonias niger*) in the Canadian Great Lakes. The survey area consisted of the shoreline marshes (i.e., marshes within 5 km of the shoreline) of the Canadian portions of Lake Huron (excluding the North Channel), St. Clair River, Lake St. Clair, Detroit River, Lake Erie, Niagara River, Lake Ontario, and the St. Lawrence River downstream to Cornwall. Two wetland areas (at Rondeau Provincial Park and in Presqu'ile Bay outside Presqu'ile Provincial Park) did not receive adequate coverage in 1991 and were surveyed again in 1992. The 1991 and 1992 data were combined to arrive at estimates for 1991/92.

The field work was a cooperative effort by the Canadian Wildlife Service, Long Point Bird Observatory (LPBO), and volunteers whose efforts were coordinated by LPBO. Areas were surveyed for terns by automobile, boat, canoe, and on foot. Nest numbers were estimated following a special protocol.

Forster's Terns were confirmed breeding in 1991/92 at 17 colonies with a total estimate of 568 nests. All Forster's Tern colonies with confirmed and probable breeding evidence were coastal. Forster's Terns were found breeding only along Lake St. Clair and Lake Erie. Probable breeding for Forster's Terns was reported at 3 colonies (10 nests) and possible breeding at 4 colonies (minimum of 10 pairs).

Black Terns were confirmed breeding in 1991/92 at 65 colonies with a total estimate of 545 nests. Of the 76 Black Tern colonies with confirmed and probable breeding evidence, 61 (80%) were coastal. Black Terns were confirmed breeding throughout the survey area, with estimated numbers of nests as follows: Lake St. Clair (153), Georgian Bay (143), Lake Ontario (99), Lake Erie (67), Lake Huron (46), and the St. Lawrence River (37). Probable breeding was reported for Black Terns at 11 colonies (31 nests) and possible breeding at 5 colonies (minimum of 8 pairs).

The 1991 survey results (together with those from 1992) are presented in detail in Appendix 2. The organization and layout of Appendix 2 are explained in Appendix 1. In addition to being listed, the 1991 colony sites (together with those from 1992) are also plotted in Appendices 4-14. The colony sites are plotted both on 1:250,000 maps (to provide overviews) and on 1:50,000 maps (to provide details of location). The organization of these maps is explained in Appendix 3.

RÉSUMÉ

Pendant la période de nidification de 1991, on a inventorié les nicheurs de marais, en particulier la Sterne de Forster (*Sterna fosteri*) et la Guifette Noire (*Chlidonias niger*) dans les grands lacs canadiens. L'aire couverte comprenait les marais riverains (jusqu'à cinq kilomètres à l'intérieur) de la partie canadienne du lac Huron (excluant le North Channel), la rivière St. Clair, le lac Erie, la rivière Niagara, le lac Ontario et la rivière St.Laurent jusqu'à Cornwall. Deux endroits marécageux (un au parc provincial Rondeau et l'autre à la baie de Presqu'île, à l'extérieur du parc provincial de Presqu'île) n'ont pas été complètement inventoriés en 1991 et ont reçu un examen plus approfondie en 1992. On a combiné les données de 1991 et 1992 afin de formuler un estimé pour 1991/92.

Le travail sur le terrain a été l'effort du Service canadien de la faune, du Long Point Bird Observatory (LPBO) et de volontaires entrainés par le LPBO. L'aire inventoriée pour les sternes a été examinée en automobile, en bateau, en canot et a pied. C'est à partir d'un protocol spécial que l'on a estimé le nombre de nids.

On a confirmé qu'en 1991/92, la Sterne de Forster nichait dans 17 colonies avec un total de 568 nids. Toutes les colonies avec évidence de reproduction "confirmée" ou "probable" étaient côtières. On a trouvé que la Sterne du Forster ne se reproduisait que sur le bord du lac St. Clair et du lac Erie. On a rapporté une reproduction "probable" de la Sterne de Forster à 3 colonies (10 nids) et une reproduction "possible" à 4 colonies (avec un minimum de 10 paires).

On a confirmé qu'en 1991/92, la Guifette Noire se reproduisait dans 65 colonies avec une estimation totale de 545 nids. Des 76 colonies nichantes de Guifette Noire "confirmées" ou "probables", 61 (80%) étaient côtières. On a confirmé que la Guifette Noire se reproduisait sur toute l'aire inventoriée avec une estimation de nids suivante: le lac St. Clair (153), la baie Georgienne (143), le lac Ontario (99), le lac Erie (67), le lac Huron (46) et la rivière St. Laurent (37). On a rapporté une reproduction "probable" pour la Guifette Noire à 11 colonies (31 nids) et une reproduction "possible" à 5 colonies (avec un minimum de 8 paires).

Les résultats du relevé de 1991 (avec ceux de 1992) sont présentés en détail à l'annexe 2. L'organisation et une explication détaillée de l'annexe 2 sont présentés à l'annexe 1. En plus d'être énumerées, les colonies de 1991 (de même que celles de 1992) sont aussi relevées graphiquement aux annexes 4 à 14. On peut retrouver la localité des colonies sur les cartes à l'échelle de 1:250,000 (lesquelles donnent un aperçu général) ainsi que sur les cartes à l'échelle de 1:50,000 (pour une localité plus précise). On explique à l'annexe 3 l'organisation de ces cartes.

TABLE OF CONTENTS

Page

ABSTRACT.....i

RÉSUMÉ.....ii

TABLE OF CONTENTS.....iii

1.INTRODUCTION.....1

2.STUDY AREA.....2

3.DEFINITIONS.....4

4.METHODS.....4
4.1. Main Study Area.....4
4.2. Northern Study Area.....10
4.3. Preparation of maps.....11

5.RESULTS AND DISCUSSION.....12
5.1. Overall numbers of colony sites.....12
5.2. Forster's Tern.....13
5.3. Black Tern.....16

6.ACKNOWLEDGEMENTS.....21

7.LITERATURE CITED.....21

8.APPENDICES.....24
8.1. App.1. Explanation of the listing of the colony sites in Appendix 2.....24
8.2. App.2. Colony sites and numbers of nesting pairs.....26
8.3. App.3. Explanation of the mapping of the colony sites in Appendices 4-14.....32
8.4. App.4-14. Maps of colony sites.....34

1 INTRODUCTION

Birds that breed in a colony and that breed or feed in association with water are referred to as colonial waterbirds (Maehr and Rodgers 1985). Colonial waterbirds are of special concern to the Canadian Wildlife Service (CWS) because during the nesting season they are concentrated on their colony sites and are then highly vulnerable to predation and disturbance. In addition, as top predators in the food web, they may bio-accumulate contaminants that are present in their environment, and, therefore, they can be used to monitor contaminant levels and their bio-effects. In the Great Lakes, contaminant levels in Herring Gull eggs have been monitored routinely since the early 1970s (Mineau *et al.* 1984, Bishop *et al.* 1992). Furthermore, when gulls nest at large colonies in urban or industrial sites they may cause various problems to people (Blokpoel and Tessier 1986). An additional concern is that nesting gulls may encroach on the nesting habitat of other species (Courtney and Blokpoel 1983, Blokpoel and Tessier 1986).

Large-scale inventories of colonial waterbirds nesting on the Great Lakes did not begin until 1976. In 1976, and again in 1977, the U.S. portions of the Great Lakes were surveyed under contract for the U.S. Fish and Wildlife Service (USFWS) (Scharf *et al.* 1978). The Canadian portions of the Great Lakes were surveyed and censused in a more gradual fashion: Lake Ontario and the upper St. Lawrence River in 1976 (Blokpoel 1977), Lake Erie and adjacent waterbodies in 1977 (Blokpoel and McKeating 1978), Lake Superior in 1978 (Blokpoel *et al.* 1980) and Lake Huron, including Georgian Bay and the North Channel, in 1980 (Weseloh *et al.* 1986). During 1981-1988 certain areas were re-inventoried during one or more years (e.g. Blokpoel and Harfenist 1986, Weseloh *et al.* 1988).

A lakes-wide inventory of all colonial waterbird species on both sides of the Canada/US border was carried out during 1989-1991. The inventory was done in close cooperation between CWS and USFWS. In Canada, the fieldwork was coordinated by CWS (Ontario Region) and was largely carried out by contractors with substantial assistance from the Ontario Ministry of Natural Resources and Parks Canada. Because of the large amount of work and cost involved in making an inventory of all the Great Lakes it was decided to attempt a 3-year effort with fieldwork as follows:

1989 - all "primary" species in the upper Great Lakes;
1990 - all "primary" species in the lower Great Lakes;
1991 - all "secondary" species in all Great Lakes.

For the purpose of the inventory, "primary" species are species that nest primarily (or originally) on sparsely vegetated islands and off-shore structures, i.e. Double-crested Cormorant (*Phalacrocorax auritus*), Ring-billed Gull (*Larus delawarensis*), Herring Gull (*L. argentatus*), Great Black-backed Gull (*L. marinus*), Common Tern (*Sterna hirundo*) and Caspian Tern (*S. caspia*). "Secondary" species are species that nest primarily in marshes and on densely vegetated islands, i.e. Great Blue Heron (*Ardea herodias*), Great Egret (*Casmerodius albus*), Cattle Egret (*Bubulcus ibis*), Little Blue Heron (*Egretta caerulea*), Snowy Egret (*E. thula*), Black-crowned Night Heron (*Nycticorax nycticorax*), Forster's Tern (*Sterna forsteri*), and Black Tern (*Chlidonias niger*).

During the inventories of the "primary" species in 1989 and 1990, any colony of "secondary" species which was encountered was noted but in most cases no effort was made to count the number of nests. In 1991, when the "secondary" species were surveyed, logistic and budgetary restraints made it impossible to survey Lake Superior (except for the coast of Pukaskwa National Park) and some parts of Lake Huron.

The data for the Canadian Great Lakes are presented in detailed reports with complete information on colony locations. These reports are published as CWS Technical Reports and the five Technical Reports listed on the page preceeding the Abstract will together constitute the "Atlas of Colonial Waterbirds nesting on the Canadian Great Lakes, 1989-1991."

This report constitutes Part 4 of the "Atlas of Colonial Waterbirds Nesting on the Canadian Great Lakes, 1989-1991." It has the following purposes:

(1) to present the results of the 1991 inventory of marsh-nesting terns (Forster's Terns and Black Terns) using the format that has been used by USFWS for several other atlases of colonial waterbirds,

(2 to present the results of follow-up work conducted in 1992 at two locations inadequately covered in 1991: Rondeau Provincial Park and Presqu'ile Bay, and

(3) to compare the results from 1991/92 with available historic data, where possible.

Our intended readership consists of managers, planners, developers, park naturalists, people responding to oil spills and various other "users" of the Great Lakes and their natural resources, as well as biologists and interested lay people. We tried to present a large amount of information in a concise format and we recommend that readers refer to the Methods section in order to access the information quickly.

2 STUDY AREA

Our study area, shown in Figure 1, was largely determined by previous knowledge about the breeding range of the two marsh-nesting tern species in Ontario.

Forster's Terns nest in southwestern Ontario (Godfrey 1986). More specifically, the Atlas of the Breeding Birds of Ontario (hereafter referred to as the ABBO; Cadman *et al.* 1987) showed that during 1981 to 1985 the breeding range of this species in southern Ontario was restricted to the Great Lakes coastlines (southern Lake Huron, Lake St. Clair, and Lake Erie), except for one possible inland nesting area (Lake Simcoe, north of Toronto).

Black Terns nest mostly in the southern portion of Ontario, but there are also scattered records for northern Ontario (Cadman *et al.* 1987). During 1981 to 1985, Black Terns were not confirmed nesting along the shore of Lake Superior. Nesting was confirmed in some areas along the St. Mary's River and on St. Joseph's Island and Manitoulin Island. During the ABBO years, volunteers surveyed 10-km squares and were not asked to provide specific locality information.

Therefore, the number and size of coastal colonies versus inland colonies cannot be determined from ABBO data. Many of the breeding colonies reported to the ABBO appear to be inland colonies, judging by the location of suitable habitat, with the exception of colonies along the edge of St. Joseph's Island, one colony along the north shore of the North Channel, and another colony along the east shore of Georgian Bay (Cadman *et al.* 1987). The latter breeding record has been questioned by a knowledgeable birder living in the area (A. Sinclair pers. comm. 1991).

Due to the breeding distributions of Forster's and Black Terns outlined above and our limited resources, we decided to define our survey area as the shorelines of Georgian Bay (except for Manitoulin Island), southern Lake Huron (from Tobermory to Sarnia), the St. Clair River, Lake St. Clair, the Detroit River, Lake Erie, the Niagara River, Lake Ontario, and the St. Lawrence River downstream to Cornwall (Fig. 1). We used two different approaches for the inventory:
(1) the Main Study Area was inventoried by volunteers. The Main Study Area encompasses the shorelines "downstream" of Matchedash Bay (Fig. 1), and
(2) the Northern Study Area, consisted of the shorelines from Matchedash Bay north to McGregor Bay near Little Current, Lake Huron (Fig. 1).

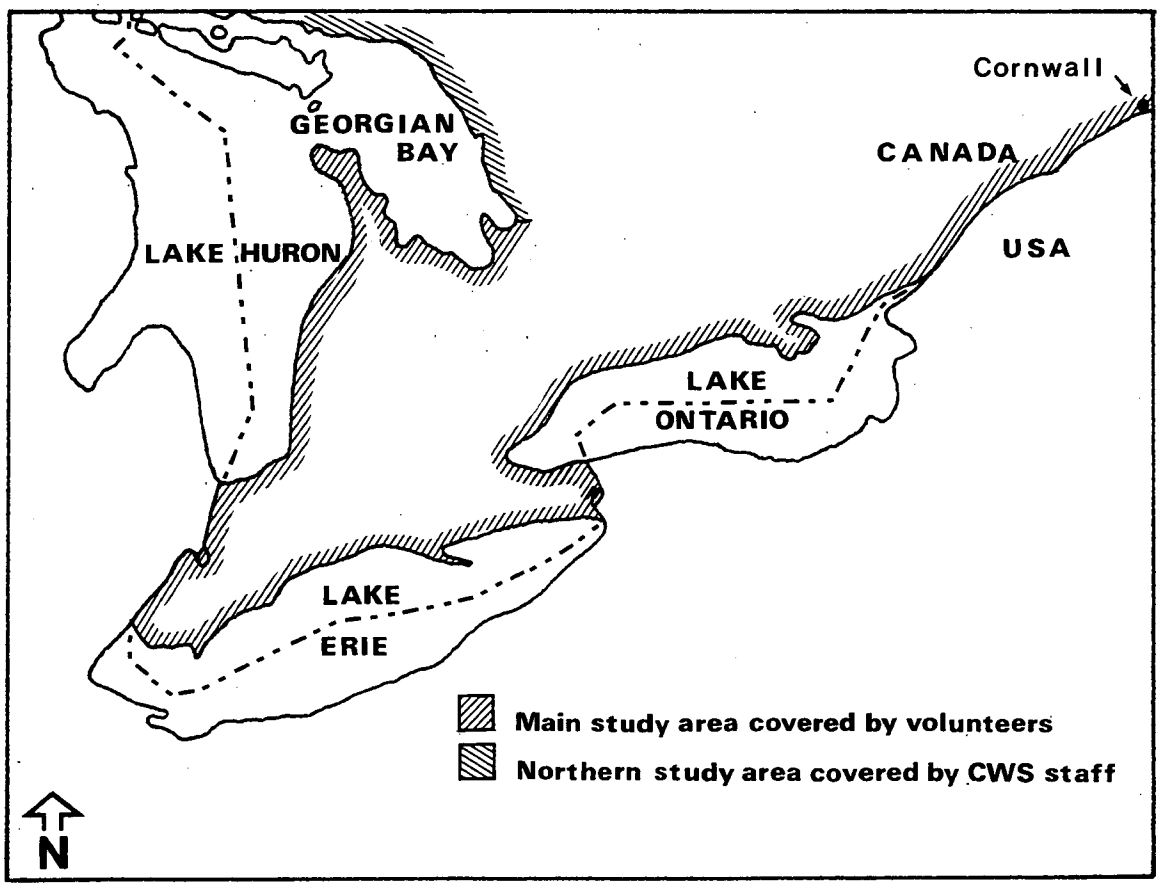


Figure 1. Map of part of the Great Lakes showing the study area.

3 DEFINITIONS

For the purpose of this report, a **colony** consists of one or more breeding pairs of a species that usually nests in groups. Thus we consider a single tern nest as a colony. We refer to the place where a colony is located as the **colony site**. It is often difficult to determine the extent of a colony and thus that of a colony site. For example, if two areas of floating vegetation, separated by only a few metres of water, are each supporting tern nests, one could argue that they form, biologically, one colony and that, therefore, the two areas constitute one colony site. In this report we generally present our findings for the smallest possible geographical unit or section of a marsh. In many cases, the exact location (latitude/longitude) of the colony site is regarded as the centre of the area circled on data maps completed by the volunteers, unless otherwise specified by survey participants.

4 METHODS

4.1 Main Study Area

All suitable habitat within a 5-km band along the Canadian Great Lakes shoreline starting from Matchedash Bay in Georgian Bay, and continuing around the Bruce Peninsula, Lake Huron, St. Clair River, Lake St. Clair, Detroit River, Lake Erie, Niagara River, Lake Ontario, and the St. Lawrence River east to Cornwall was surveyed for terns (Fig. 1). In addition to these mainland marshes, the Walpole Island marshes, Amherst Island (in eastern Lake Ontario), and Quinte Island (Prince Edward County, eastern Lake Ontario) were also surveyed.

A total of 315 10X10-km squares (based on the Universal Transverse Mercator (UTM) grid system) fell within the 5-km band along the Great Lakes shoreline. UTM squares are clearly defined on the Canadian National Topographic Series maps at the scales of 1:50,000 and 1:250,000 and were selected for use in the ABBO and the Ontario Rare Breeding Bird Program (ORBBP). In total, 144 squares (Fig. 2) and 301 sites with suitable habitat were surveyed in the study area.

4.1.1 Volunteer-network

In order to cover all marshes within the main study area during the 1991 breeding season, it was necessary to enlist the aid of volunteer birders in Ontario. Therefore, Long Point Bird Observatory (LPBO) was contracted to coordinate a volunteer-based program, "The 1991 Census of Marsh-nesting Colonial Waterbirds," to estimate the numbers of nesting terns, egrets and night-herons along the Great Lakes. Only the information on tern colonies is presented in this report; results on the other species are reported in Austen and Cadman (1991) and will be presented in Part 5 of the Atlas of Colonial Waterbirds Nesting on the Canadian Great Lakes, 1989-1991.

4.1.2 Ontario Rare Breeding Bird Program

Volunteers for the census were contacted through the Ontario Rare Breeding Bird Program

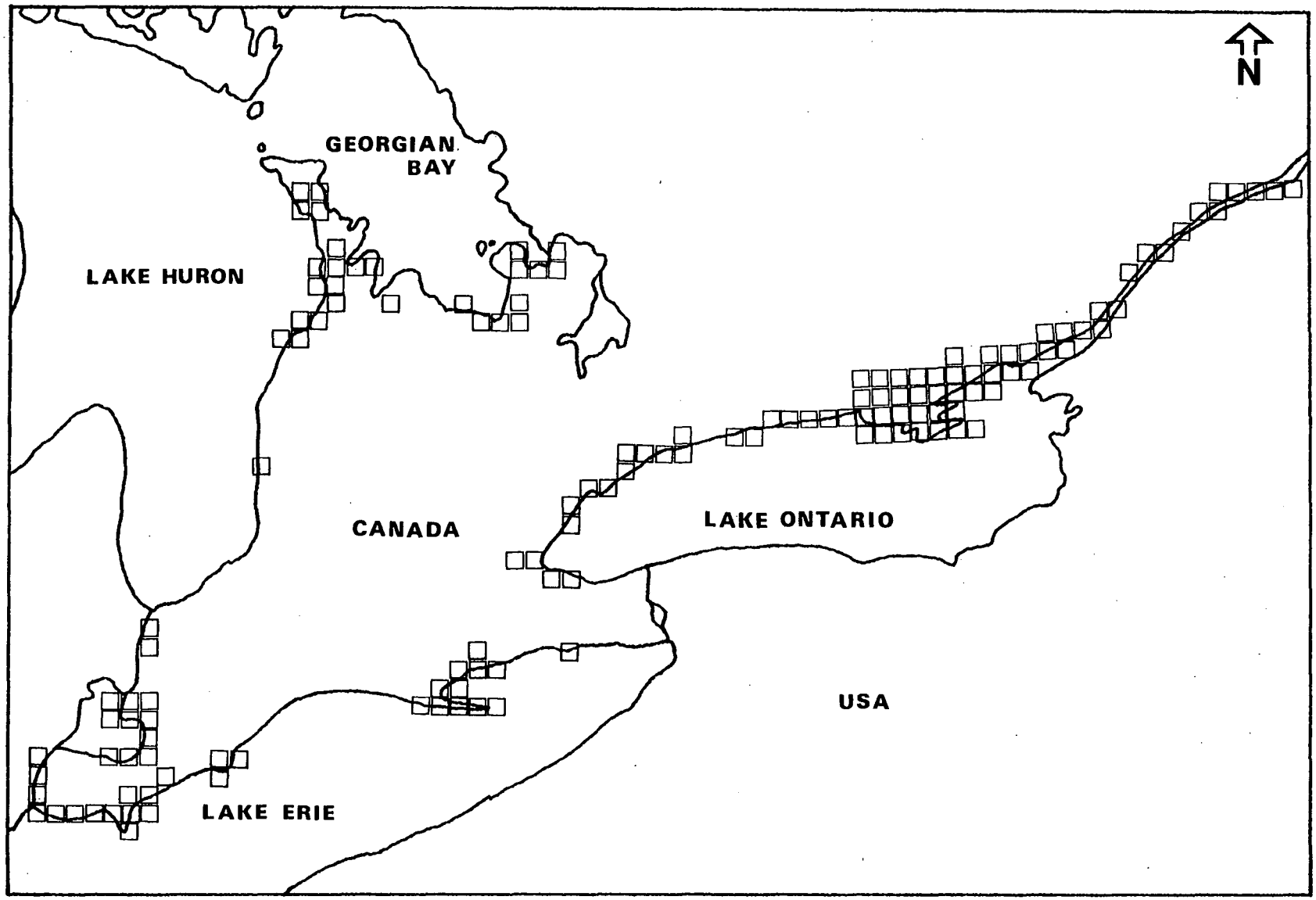


Figure 2. Squares that were surveyed during the 1991 census

(ORBBP) network. The ORBBP was a co-operative program sponsored by the Federation of Ontario Naturalists and co-sponsored by the LPBO, the Nature Conservancy of Canada, and the Ontario Field Ornithologists. It was a follow-up to the Atlas of the Breeding Birds of Ontario, which was a 5-year program that provided information on the distribution and relative abundance of Ontario's birds (Cadman *et al.* 1987). The ORBBP consisted of 3 years of field work (the bulk of which was performed at very low cost by a province-wide network of volunteer naturalists), followed by nearly 2 years of data summary and status report production. ORBBP staff had been compiling data on Forster's Terns and Black Terns (together with other marsh-nesting colonial waterbirds) since 1989.

4.1.3 Procedures for designating search areas

To facilitate field work for the ORBBP, the province was separated into regions based on counties or regional municipalities (Fig. 3), and a Regional Coordinator was chosen for each region. Regional Coordinators for the 24 ORBBP regions bordering the Great Lakes (excluding Lake Superior), together with the Project Coordinator (M. Austen), were responsible for organizing volunteer coverage of shoreline marshes for terns and other marsh-nesting colonial waterbirds in 1991.

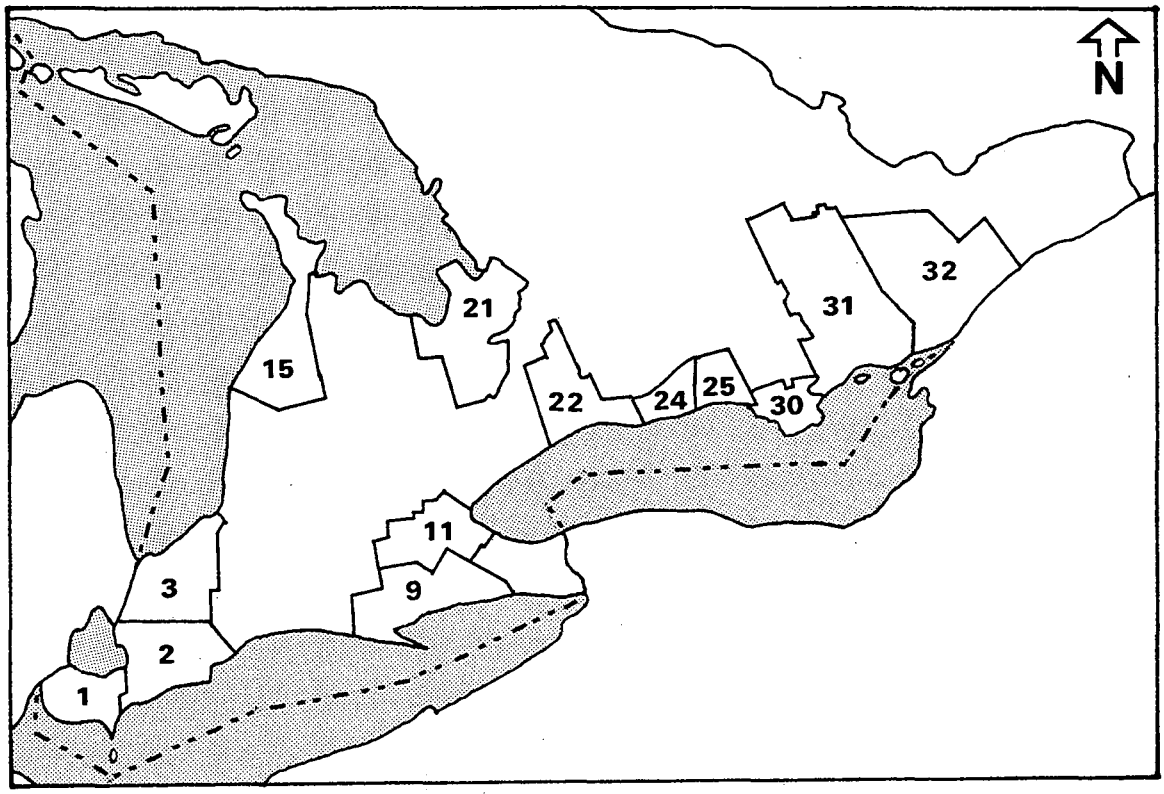
Sheets showing the 10X10-km squares (described below) were sent to the Regional Coordinators for distribution to volunteers in their regions. Regional Coordinators, using historical data and their knowledge of the region, delineated areas with suitable habitat for colonial marsh-nesting species on the sheets and assigned squares to volunteers. Volunteers were instructed to search all areas with suitable habitat for the target species in their allotted squares. Squares without suitable habitat were not covered.

4.1.4 Information and data sheets used by volunteers

The Project Coordinator prepared information sheets for volunteers and Regional Coordinators and a data form for use in the field. Packages containing this information were distributed well in advance of the breeding season to the 24 Regional Coordinators listed in the Acknowledgements.

Volunteers were asked to survey suitable habitat for terns (and other marsh-nesting waterbirds) in designated atlas squares from mid-May to mid- to late-June. Volunteers were provided with a data form (see Austen and Cadman 1991), similar to the ORBBP Survey Forms, which outlined known or potential sites (reported during the ABBO, ORBBP, or from the Ontario Nest Record Scheme (ONRS)) for terns. Volunteers were asked to outline the locations of additional areas with suitable habitat on their data forms, if they knew of any.

Volunteers surveyed areas within a 5-km strip along the Great Lakes by boat, canoe, automobile or on foot, depending on which method was the most appropriate for a given site. Volunteers recorded the following information regarding sites where terns were observed on their data forms: location, date of visit, number of hours spent at the site, percent of location covered, viewing distance (i.e., the distance they were from the birds or potential breeding habitat in metres), mode of transport (e.g., canoe, boat, etc.), breeding evidence (i.e., the highest breeding code obtained,



1 – ESSEX	22 – DURHAM
2 – KENT	24 – NORTHUMBERLAND - WEST
3 – LAMBTON	25 – NORTHUMBERLAND - EAST
9 – HALDIMAND / NORFOLK	30 – PRINCE EDWARD
11 – HAMILTON	31 – LENNOX - ADDINGTON / FRONTENAC
15 – BRUCE	32 – LANARK - SOUTH / LEEDS - GRENVILLE
21 – SIMCOE	

Figure 3. Sketch map showing the Ontario Rare Breeding Birds Program regions involved in the study.

similar to the ORBBP), species code, maximum number of adults counted after conducting several "sweeps" of the site with binoculars or a scope, and number of nests (number of adults divided by two, see Section 4.1.5 Nest counts and estimates). More details of these procedures can be found in Austen and Cadman (1991).

Volunteers were asked to record the highest level of breeding evidence obtained. Breeding evidence codes were as follows:

X -adults observed
SH -adults associated with suitable breeding habitat
CD -courtship display
AB -agitated behaviour
LF -adult landing with food
IB -incubating birds
NO - nest observed
NE -nest with eggs
NY -nest with young
FY - fledged young near the nest

These levels were later categorized as possible, probable or confirmed breeding by M. Austen, in a fashion similar to that outlined in Cadman *et al.* (1987).

4.1.5 Nest counts and estimates

The number of tern nests was estimated by halving the maximum number of adult terns counted during any one of a series of sweeps with a pair of binoculars and/or a spotting scope. If an odd number of terns were observed (e.g., 9 terns) then the nest estimate was rounded up (i.e., the nest estimate would be 5 nests). In large colonies where it was difficult to count each individual tern, the number of adult terns was estimated. This technique was used to keep disturbance of tern colonies to a minimum level. Further details regarding the methodology of the census are outlined in Austen and Cadman (1991). Volunteers, Ontario Ministry of Natural Resources (OMNR) staff, and the field crew surveyed areas to the best of their ability and with the minimum amount of disturbance to marsh-nesting birds.

4.1.6 Field work and survey dates

Field work commenced on 27 May and was completed by 15 July 1991. A total of 67 volunteers searched 144 squares and a minimum of 301 different sites for colonial marshbirds. A minimum of 485 field hours was spent by volunteers and field staff surveying the main study area. Volunteers who participated in the census are listed in the Acknowledgements.

The St. Clair National Wildlife Area and the shoreline marshes extending up to Mitchell's Bay were surveyed by canoe and boat, respectively, during 9 - 11 July 1991 by a two-person field crew. The Walpole Island marshes were surveyed by the field crew (by foot, automobile, boat, and canoe) over a period of two weeks (11 - 21 June). A 2-hour aerial survey was performed on 17 June to help locate tern colonies (Fig. 4). All the main channels and cuts through suitable nesting areas and adjacent to colonies observed from the air were surveyed (Austen and Cadman 1991). Seaway Island and St. Anne Island did not appear to have suitable habitat for terns (both from the air and by boat) and, therefore, were not surveyed.

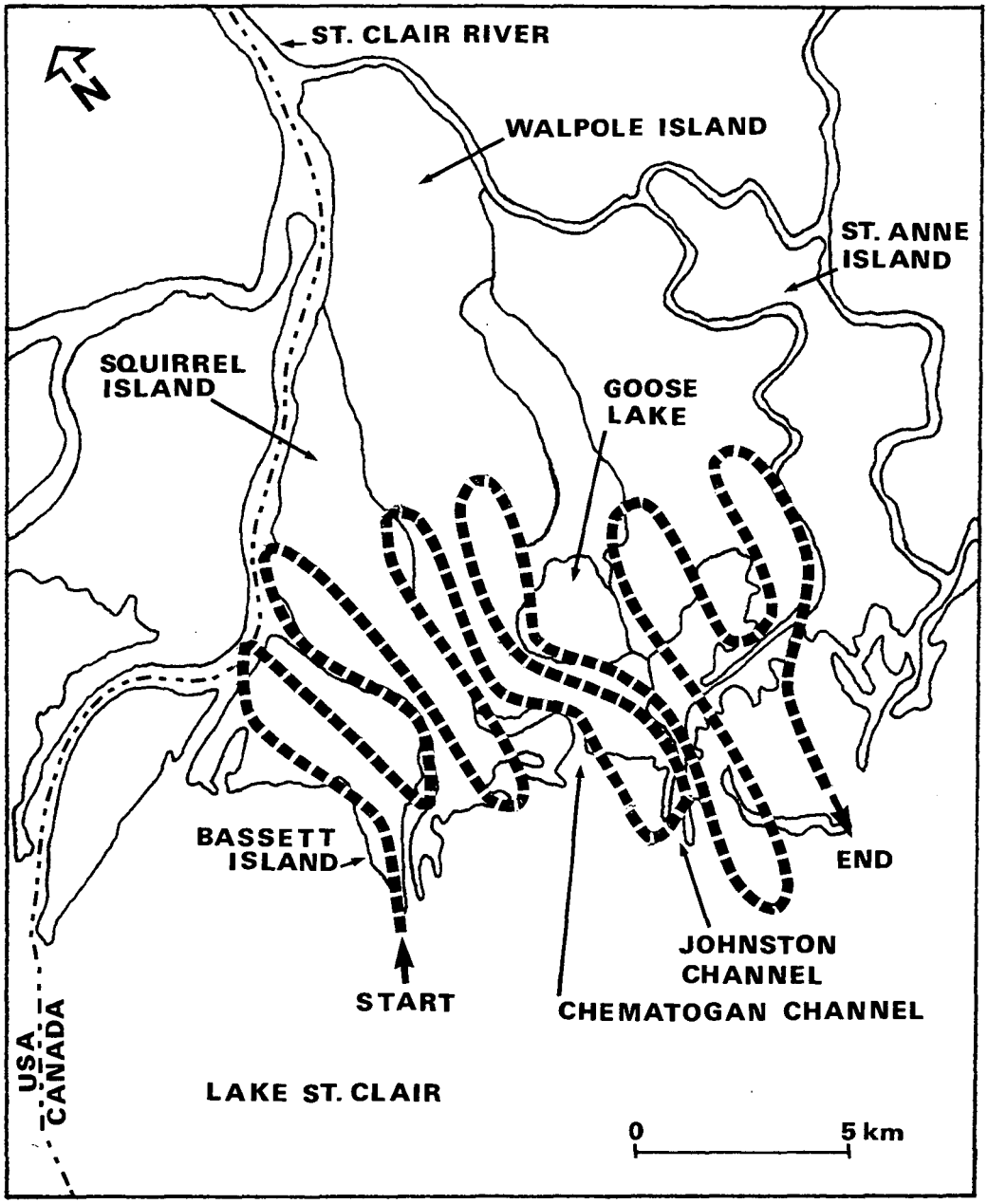


Figure 4. Route of aerial survey of the Walpole Island marshes.

All areas with suitable habitat in the Long Point-Turkey Point-Big Creek marshes were surveyed by foot, boat, canoe, and automobile by Jon McCracken (LPBO) over the period 9 June - 6 July.

In Simcoe region, Matchedash Bay was covered by Wayne LaFrance and other staff from the OMNR. The OMNR conducted a survey of colonial nesting species from 23 May to 7 June 1991 on waterbodies in the Huronia District. Their survey focused on locating and enumerating Black Tern colonies (LaFrance 1991). The areas surveyed within the study area bordering Georgian Bay included Sturgeon Bay, Mud Bay, and Matchedash Bay. All surveys were performed using a 16-foot boat.

A field crew, consisting of four summer students and the Project Coordinator, surveyed the 48 10x10-km squares that volunteers were unable to cover.

4.1.7 Areas with special problems

Lisgo (1991) surveyed marshes within Presqu'ile Provincial Park in 1991, but was unable to cover marshes outside the park boundary in Presqu'ile Bay due to time constraints. Black Terns nested near the Murray Canal in Presqu'ile Bay in previous years (S. Hadlington, pers. comm.) and were observed landing with food in 1991 in a marsh near the mouth of the Murray Canal (W.Lee pers.comm.).

Due to the inadequate coverage of Presqu'ile Bay and Rondeau Provincial Park by volunteers in 1991, M. Austen and M. Bradstreet from LPBO surveyed Presqu'ile Bay and Rondeau Provincial Park, respectively, for terns in 1992. Lisgo (pers. comm.) also conducted a survey of Black Terns in Presqu'ile Provincial Park in 1992.

Tern estimates from 1991 were revised using 1992 estimates from Presqu'ile Bay, Presqu'ile Provincial Park, and Rondeau Provincial Park. This did not greatly alter estimates of Black Tern numbers, but the revised 1991 estimate (using 1992 data) for Forster's Terns at Rondeau Provincial Park was significantly lower than the original estimate used in 1991.

Therefore, we decided to take a conservative approach and use the revised 1991 estimates rather than the original 1991 estimates.

4.2 Northern Study Area

During 4-6 June 1991, H.Blokpoel, together with J.Sullivan, surveyed the area from Matchedash Bay north to Twelve Mile Bay. During 1-9 June 1991, G.D. Tessier, together with W. Lee and D. Wesley, surveyed the area from Twelve Mile Bay north to McGregor Bay near Little Current, Lake Huron. All prospective areas (e.g., areas that were indicated on maps as having marshes) were visited by boat and viewed with binoculars. Occasionally shell crackers were used to determine whether terns were present in the marshes.

4.3 Preparation of maps

As mentioned in the Introduction, we present the tern data in a format that is similar to the one used by the USFWS for waterbird inventories in USA (e.g., Erwin 1979, Speich and Wahl 1989). The key elements of the format of USFWS atlases are: listing all colony sites by 1:250,000 map sheet, giving each colony site a unique identification number, plotting all colony sites on a 1:250,000 map (to provide overviews of colony distribution), and plotting colony sites on 1:24,000 USGS maps (to provide detailed colony locations). In the preparation of this report we used 1:250,000 and 1:50,000 maps prepared by the Geological Survey of Canada. The areas where Forster's Tern or Black Terns were found nesting were covered by the following 11 1:250,000 Map Sheets: 31D, 41A, 40O, 40J, 40G, 40I, 30L, 30M, 30N, 31C, and 31B (Fig. 5).

The unique identification numbers for the individual colony sites consist of a prefix (which is the number of the 1:250,000 topographical map that covers the area where the colony site is located) and a 3-digit number. For example, Johnston Bay is covered by the 1:250,000 map 40J (Detroit) and its identification number is 40J019 (see Appendix 2). Identification numbers were assigned, in increasing order, to colony sites along the shorelines of Georgian Bay; Lakes Huron, St. Clair, Erie, and Ontario; and the St. Lawrence River. All 1991 and 1992 colony sites, including colonies with possible, probable, and confirmed breeding evidence for terns, are listed in Appendix 2. Details on the organization of Appendix 2 are provided in Appendix 1.

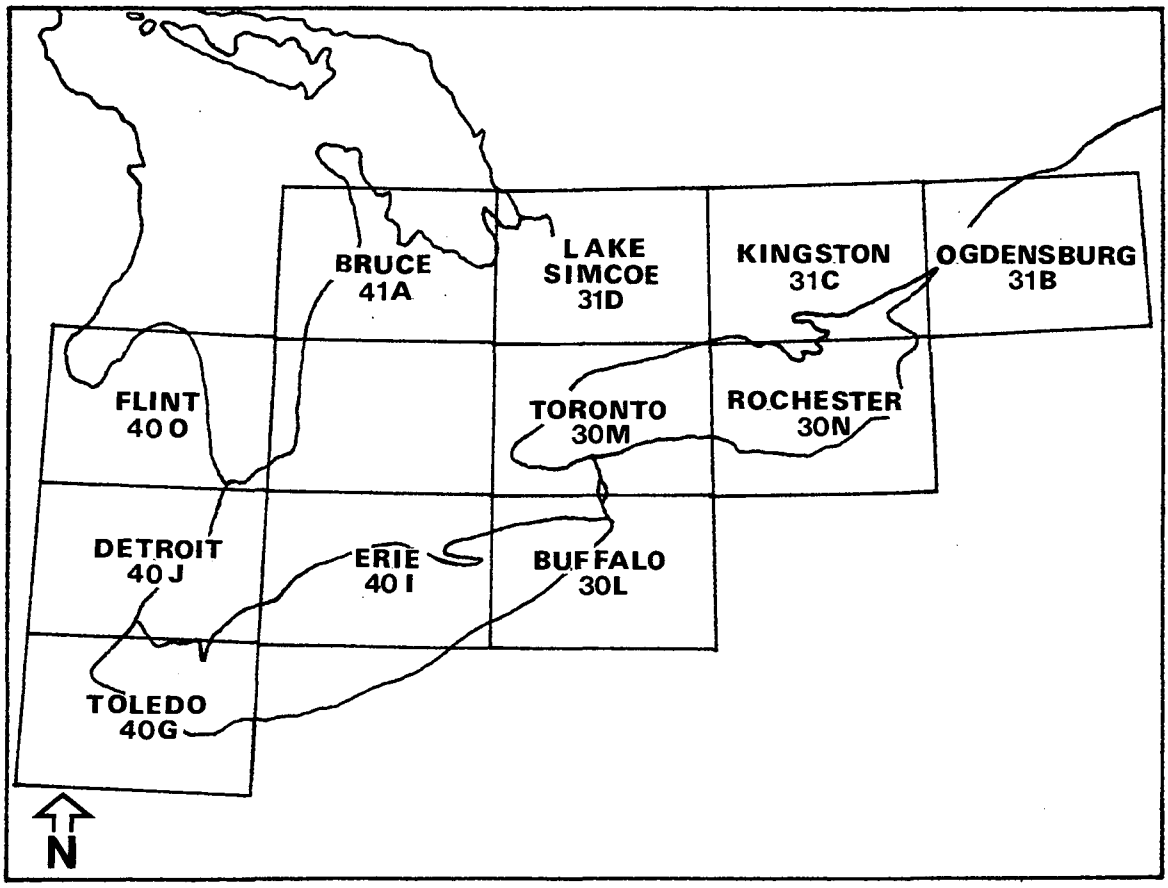


Figure 5. Map Sheets (1:250,000) that cover areas where Forster's Terns or Black Terns were found nesting in 1991/92.

5 RESULTS AND DISCUSSION

5.1 Overall Numbers of Colony Sites

All reported Black and Forster's Tern colony sites during 1991 and 1992 were located in the Main Study Area. No tern colonies were located by CWS staff or other individuals conducting field work in the Northern Study Area (B. Bowles, D. Fraser, R. Reid, and M. Sharp pers. comms.).

During 1991/92 the numbers of colony sites with confirmed, probable and possible breeding by Black and/or Forster's Terns in the Main Study Area were 82, 14, and 9 respectively (Table 1). Forster's Terns were confirmed breeding at 17 colony sites, Black Terns at 66 colony sites, and both species were nesting together at one colony site (Table 1).

Coverage in the majority of colony sites was sufficient to ensure that marsh-nesting terns, if present, would not have been overlooked. Sites where additional coverage or coverage earlier in the breeding season may have clarified the breeding status of target species are listed in Austen and Cadman (1991).

The 1991 survey results are presented in detail in Appendix 2. In Appendix 2 we use footnotes to indicate the colonies found in 1992 at Rondeau Provincial Park and Presqu'ile Bay (Sites 40I001, 40I004, 40I006, 40I007, 31C009, 31C010, 31C011, and 31C012).

In addition to being listed in Appendix 2, the 1991 colony sites, together with those for 1992, are plotted by the 11 1:250,000 Map Sheets in Appendices 4-14. The colony sites are plotted both on 1:250,000 maps (to provide overviews) and on 1:50,000 maps (to provide details of location). The organization of these maps is explained in Appendix 3.

In the following sections we present our findings in more detail by species.

Table 1. Numbers of colony sites with nesting by Forster's Tern and/or Black Tern in the study area in 1991/92.

	Number of colony sites		
Species	Confirmed Nesting	Probable Nesting	Possible Nesting
Forster's Tern	16	3	4
Black Tern	65	11	5
Forster's Tern and Black Tern	1		
Totals	82	14	9

5.2 Forster's Tern

5.2.1 Confirmed Breeding

At the 17 colony sites with confirmed breeding in 1991 there was an estimated total of 765 nests (Tables 1 and 2). Due to lack of time, Rondeau Provincial Park was not surveyed in 1991. The estimate for the number of Forster's Tern nests in 1991 (200 nests) was based on an estimate determined by A. Woodliffe in 1990. In Austen and Cadman (1991) this estimate was included in the total estimate because Forster's Terns had bred at Rondeau consistently since 1981 (ONRS) and S.Charbonneau believed that the numbers of Forster's Terns breeding at Rondeau in 1990 and 1991 were similar. However, in 1992, a much lower estimate of 3 nests was determined, reducing the total estimate of Forster's Terns nests at confirmed colonies to 568 nests in 1991/92. The reduction in the number of Forster's Terns from 1991 to 1992 may have been associated with the large number of Ring-billed Gulls (estimate of 300 to 400 pairs) and Herring Gulls (estimate of 25 pairs) nesting on Gull Island and the adjacent marshy island in Rondeau (Bradstreet 1992). All Forster's Tern data presented below are based on the revised 1991 estimate (i.e., 1991 data supplemented with data from Rondeau in 1992) of 17 confirmed colonies with a total of 568 nests (Tables 1 and 2).

The majority of nests in 1991/92 (98%) were found along Lake St. Clair with the remainder being found at Rondeau Provincial Park and the Long Point Company Marshes on Lake Erie (Table 2, Appendix 2). In the Walpole Island Marshes on Lake St. Clair, most Forster's Terns were breeding on the Grassy Bend Islands and around the Johnston Channel area (estimated total of 550 nests, 13 colonies) (Appendix 2). The largest colonies of Forster's Terns were found on the Grassy Bend Islands and in Johnston Channel (Walpole Island marshes) (Appendix 2). On one of the Grassy Bend Islands 267 nests were counted; this was the largest colony found in 1991 (Appendix 2). Forster's Terns were also located in 2 colonies (5 nests) at the St. Clair National Wildlife Area.

It is interesting to note that all Forster's Tern colonies with confirmed breeding are located within the Aylmer District of the OMNR (which covers Lake St. Clair and western Lake Erie, Fig.6).

5.2.2 Unconfirmed Breeding

Forster's Terns were considered as probable breeders at three sites: Tremblay Beach sewage lagoons (4 nests), a second site with 3 nests at Long Point Company Marsh (different from the confirmed site mentioned above) and at Kettle Point marshes (3 nests) (Appendix 2).

Forster's Terns were considered possible breeders at the following four sites: marshes near Jeanette's Creek and 6 km north of Mitchell's Bay and at Lake Pond and Girardin Pond, Point Pelee (Appendix 2). Probable and possible breeding of Forster's Terns is reported by waterbody in Table 2.

Table 2. Numbers of colonies and nests of Forster's Terns in the Main Study Area during 1991/92, by main waterbody.

Waterbody	Confirmed Nesting		Probable Nesting		Possible Nesting	
	colonies	nests	colonies	nests	colonies	nests
Georgian Bay	0	0	0	0	0	0
Lake Huron	0	0	1	3	0	0
Lake St.Clair	15[a]	555	1	4	2	?[b]
Lake Erie						
1991[c]	2	210	1	3	2	10
1992[d]	2	13				
Lake Ontario						
1991	0	0	0	0	0	0
1992	0	0	0	0	0	0
St. Lawrence R.	0	0	0	0	0	0
Main Study Area						
1991	17	765	3	10	4	≥10[b]
1992	17	568				

[a] Includes the colony site where Black Terns were also nesting.

[b] An estimate of the number of nests was not provided. Therefore, the total number of nests is a minimum estimate.

[c] Includes a 1990 estimate of 200 pairs for Rondeau Provincial Park which was not visited in 1991(1990 data from A. Woodliffe, pers. comm., as reported in Austen and Cadman 1991).

[d] Includes a 1992 estimate of 1 colony with 3 nests for Rondeau Provincial Park (Bradstreet 1992).

5.2.3 Comparison of 1991/92 data with historic information

Prior to the 1991 survey of the Great Lakes (Austen and Cadman 1991, this report), no systematic surveys of terns on the Canadian portion of the Great Lakes have been published. Therefore, it is not possible to compare 1991/92 data from this survey with earlier surveys. Despite this, many of the areas covered during the 1991 Colonial Marshbird Census were known to have colonies of the target species from the ABBO (1981-1985), the ORBBP (1989-1991), and/or the ONRS (1977 until present). Where possible, comparisons are made here between available historical data and the results of this survey. More details are provided in Austen and Cadman (1991).

Lake Huron During the ABBO years, the 10-km square (17MT18) which includes the Kettle Point marshes (Site 40O001) was estimated to have 2 - 10 breeding pairs. Numbers of Forster's Terns in this area are still low (3 pairs estimated in 1991, A. Rider pers. comm.) and this colony is still peripheral to the main breeding colonies in Ontario.

Lake St. Clair Forster's Terns nested at Mitchell's Bay in 1978 (8 nests) and Rondeau from 1981 - 1985 (maximum of 59 nests recorded in the ONRS). During the ABBO years, approximately 11 to 100 breeding pairs of Forster's Terns were estimated to be breeding at Rondeau, while in 1990, 200 breeding pairs were estimated. In 1992, only 3 pairs were confirmed breeding at Rondeau (Appendix 2). It appears that gulls nesting on Gull Island (where Forster's Terns nest) and an adjacent island may be at least partially responsible for the sharp decline in tern numbers from 1990 to 1992.

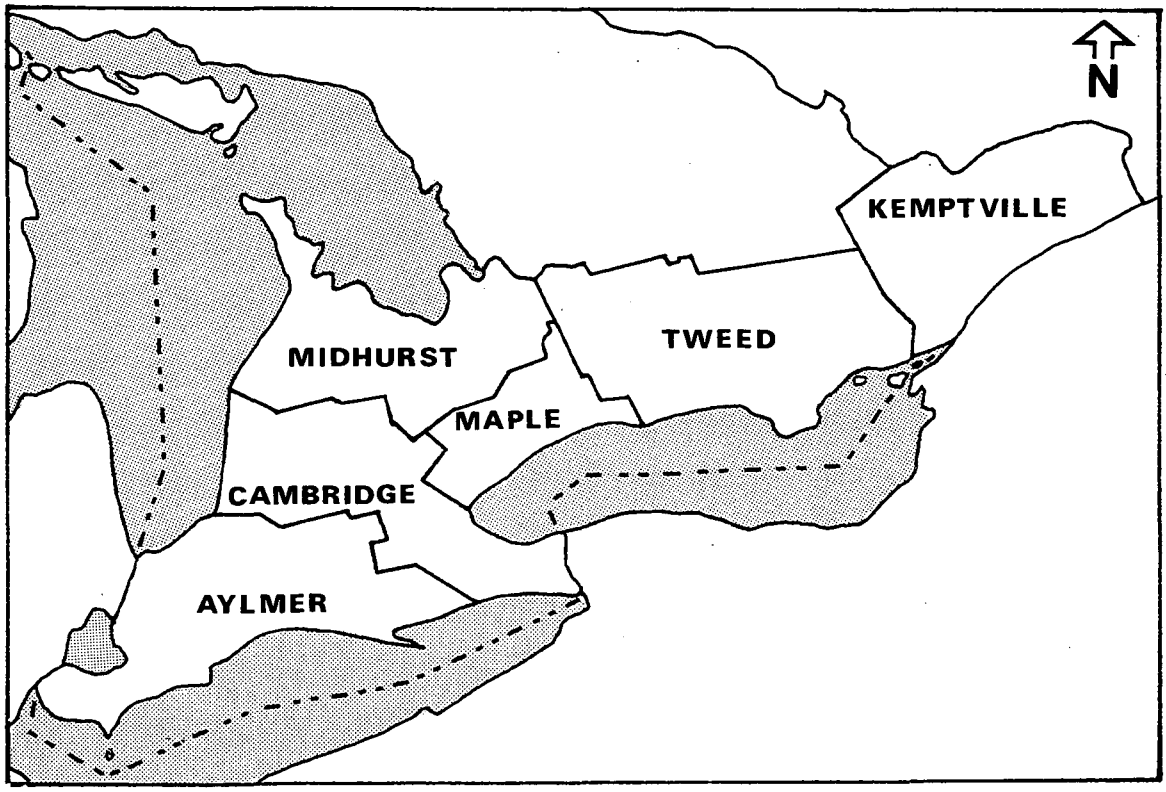


Figure 6. Sketch map showing the Ontario Ministry of Natural Resources Districts involved in the study.

Forster's Terns have nested in Bassett Channel (1977 - 26 nests), Bassett Island (one nest reported in both 1979 and 1983), Walpole Island (one nest reported in the southwest corner in 1979) and Goose Lake on Walpole Island (one nest in 1983) (ONRS). In the Walpole Island marshes, a total abundance estimate of 123 - 1200 breeding pairs was determined during the ABBO years (Austen and Cadman 1991). In 1991, 550 Forster's Terns were breeding in the Walpole Island marshes; colonies were concentrated largely in the Grassy Bend Islands and Johnston Channel area, with smaller colonies in Bassett Channel and Snooks Lake (Appendix 2). In 1990, 134 Forster's Tern nests were found on one of the Grassy Bend Islands (R. Tymstra pers. comm.) and, in 1991, the largest Forster's Tern colony (267 counted nests) was found on this same island. Numbers of Forster's Terns in the Walpole Island marshes in 1991 were within the abundance estimate range determined during the Atlas.

Lake Erie The possibility of Forster's Terns nesting at Long Point was first suggested by Baillie (1950). In 1976, a colony of about 50 pairs was found breeding in a section of cattail marsh in what is now part of the Long Point National Wildlife Area (McCracken *et al.* 1981). In 1978, fledged juveniles were observed west of Courtright Ridge. In 1979, 20 nests were located in the CWS marsh near Thoroughfare Point. In 1980, the birds moved to two sites within the Long Point Company Marsh; at least 60 adults were observed here (McCracken *et al.* 1981).

In 1991, only 10 pairs of Forster's Terns were confirmed breeding in the northern section of Long Point Company Marsh (Site 40I016), compared to an abundance estimate of 101 - 1,000 for one square at Long Point (17NT51) during the Atlas. This suggests a decline of at least 90% in breeding Forster's Terns at Long Point. This decline was also supported by J. McCracken (see Section 5.3.3).

Lake Ontario Forster's Terns are not known to breed in Lake Ontario, however, summer sightings have been recorded for this area. Two first-summer birds were reported at Cranberry Marsh (Durham Regional Municipality) on 10 June 1990, and at least one was still there on 17 June 1990 (Bain and Henshaw 1990). A Forster's Tern was reported at Sandbanks Provincial Park, West Lake Sector (Prince Edward County) on 4 August 1980 (Sprague and Weir 1984).

5.3 Black Tern

5.3.1 Confirmed breeding

In 1991/92, Black Terns were confirmed breeding at 66 colony sites with a total estimate of 545 nests: 510 nests in colonies outside of Rondeau and Presqu'ile, plus 11 nests at Rondeau and 24 nests at Presqu'ile, based on 1992 data (Tables 1 and 3). In 1992, numbers of Black Terns at Presqu'ile (24 nests) were down from incomplete census numbers in 1991 (34 nests) (Bradstreet 1992). In 1991, when Presqu'ile Bay and Rondeau Provincial Park were not surveyed by volunteers, a minimum total of 545 Black Tern nests was estimated at 61 confirmed colony sites within the study area (Table 3, Appendix 2).

In 1991/92, the Black Tern was widely distributed throughout the study area with an estimated 46 nests (4 colonies) along Lake Huron; 143 nests (8 colonies) along Georgian Bay; 153 nests (19 colonies) along Lake St. Clair, with 114 nests (75%) located in the Walpole Island marshes; 67

Table 3. Numbers of colonies and nests of Black Terns in the Main Study Area during 1991/92, by main waterbody.

Waterbody	Confirmed Nesting		Probable Nesting		Possible Nesting	
	colonies	nests	colonies	nests	colonies	nests
Georgian Bay	8	143	0	0	0	0
Lake Huron	4	46	0	0	0	0
Lake St. Clair	19[a]	153	0	0	1	?[d]
Lake Erie						
1991[b]	12	≥57	8	≥23[d]	0	0
1992[b]	14	67				
Lake Ontario						
1991[c]	14	109	3	8	4	8
1992[c]	16	99				
St. Lawrence R.	4	37	0	0	0	0
Main Study Area						
1991[e]	61	≥545	11	≥31[d]	5	≥8[d]
1992[e]	65	545				

[a] Includes the colony site where Forster's Terns were also nesting.

[b] In 1991, Rondeau Provincial Park was not surveyed by volunteers but Black Terns were known to be nesting. In the 1991 figures, Rondeau Provincial Park is represented here by one colony with ≥1 nest. In 1992, 3 colonies (with 11 nests) were found at Rondeau Provincial Park (Bradstreet 1992).

[c] The 1991 estimate includes 34 pairs at 2 colonies at Presqu'ile Provincial Park and Presqu'ile Bay (Murray Canal) (from Austen and Cadman 1991; App. 2). In 1992, during a more intensive survey of Presqu'ile Bay and of Presqu'ile Provincial Park (Lisgo 1992), 24 pairs of Black Terns in 4 colonies were located (Bradstreet 1992).

[d] An estimate of the number of nests at one colony was not provided. Therefore, the total number of nests is a minimum estimate.

[e] Black Terns were confirmed breeding at a total of 66 colony sites in 1991 and 1992 (Table 1), but not all of the colony sites in the Presqu'ile area were occupied in both years, so the totals for each year are lower than 66.

nests (14 colonies) along Lake Erie; 99 nests (16 colonies) along Lake Ontario; and 37 nests (4 colonies) located along the St. Lawrence River (Table 3). The number of nests along Lakes Erie and Ontario differ from those reported in Austen and Cadman (1991), because of results obtained at Rondeau Provincial Park and Presqu'ile Bay/Provincial Park in 1992.

Confirmed colonies of Black Terns were recorded in the following OMNR Districts: Aylmer - 33 colonies (220 nests), Cambridge - 1 colony (1 nest), Midhurst - 12 colonies (189 nests), Maple - 2 colonies (20 nests), Tweed - 15 colonies (103 nests), and Kemptville - 2 colonies (12 nests) (Table 4). Black Terns were not reported in 1991/92 in Parry Sound, Sault Ste. Marie, or Sudbury districts (Table 4). Figure 6 shows the OMNR Districts included in the study.

5.3.2 Unconfirmed breeding

The total number of Black Terns considered as probable breeders in the study area was 31 pairs in 11 colonies (Table 1). Probable breeding was recorded at eight sites (minimum of 23 nests) on Lake Erie and three sites on Lake Ontario (8 nests) (Appendix 2). Probable breeding evidence was recorded for the two colonies located in 1991 at Presqu'ile Provincial Park, for a total of five sites (42 nests) on Lake Ontario (Austen and Cadman 1991). In 1992, all colonies at Presqu'ile Provincial Park and Presqu'ile Bay were confirmed, hence the reduction to three sites with probable breeding evidence for Black Terns on Lake Ontario (8 nests). Black Terns were considered possible breeders (i.e. adults observed in suitable habitat) near Jeanette's Creek (Kent); at Winona sewage ponds (Hamilton-Wentworth-Brant); Beaver Meadow and East Lake (Prince Edward); and Cataraqui Conservation Area (Lennox-Addington/Frontenac) (Appendix 2). Birds at Cataraqui Conservation Area were believed to be foraging birds from known nesting areas further north on the same marsh (R. Weir pers. comm.). Possible breeding for Black Terns was recorded at a total of 5 colonies with a minimum of 8 nests (Table 3).

Unconfirmed breeding colonies of Black Terns (probable and possible breeding, respectively) are reported by waterbody in Table 3 and by OMNR District in Table 4.

5.3.3 Comparison of 1991/92 data with historical information

The 1991 tern census was the first survey to record abundance of nesting Black Terns at colonies along the Canadian Great Lakes in a single breeding season. Information on nesting Black Terns was collected during the years of field work for the ABBO and the ORBBP, but these projects focused on the presence/absence of terns in 10-km squares and on the location of breeding sites, respectively. Therefore, the 1991/92 tern data cannot be compared with historical data for many of the areas surveyed during this study. Austen and Cadman (1991) summarized changes in tern abundance, where possible, with available data from the ONRS, ABBO and ORBBP. The main trends are noted briefly below, but the reader should consult Austen and Cadman (1991) for further details.

A comparison of 1991/92 colony locations with nesting records on file with the ONRS, revealed that Black Terns are no longer nesting in many marshes along the Great Lakes shoreline (e.g., Bradley's Marsh, Coote's Paradise, Humber River, Shoal Point Marsh, Cranberry Marsh, Oshawa Second Marsh, Marl Lake, Pleasant Bay, Gananoque Lake, Rattray Marsh, and Port Credit

Table 4. Numbers of colonies and nests of Black Terns in the Main Study Area during 1991/92, by OMNR district.

OMNR District	Confirmed Nesting		Probable Nesting		Possible Nesting	
	colonies	nests	colonies	nests	colonies	nests
Aylmer - 1991[a]	31	≥210	8	≥23[c]	1	?[c]
1992[a]	33	220	0	0	0	0
Cambridge	1	1	0	0	1	1
Midhurst	12	189	0	0	0	0
Maple	2	20	1	1	0	0
Tweed 1991[b]	13	113	2	7	2	2
1992[b]	15	103	0	0	0	0
Kemptville	2	12	0	0	1	5
Parry Sound	0	0	0	0	0	0
Sault Ste. Marie	0	0	0	0	0	0
Sudbury	0	0	0	0	0	0
Main Study Area						
1991	61	≥545	11	≥31[c]	5	≥8[c]
1992	65	545				

[a] Rondeau Provincial Park was not surveyed by volunteers in 1991, but Black Terns were known to be nesting. Therefore, in the 1991 figures Rondeau Provincial Park is represented by one colony with ≥ 1 nest. In 1992, there were 3 colonies with 11 nests (Bradstreet 1992).

[b] The 1991 estimate includes 34 pairs at 2 colonies at Presqu'ile Provincial Park and Presqu'ile Bay (Murray Canal) (from Austen and Cadman 1991; App. 2). In 1992, during a more intensive survey of Presqu'ile Bay and of Presqu'ile Provincial Park (Lisgo 1992), 24 pairs of Black Terns in 4 colonies were located (Bradstreet 1992).

[c] No estimate of nest numbers was provided for one colony. Therefore, the total number of nests is a minimum estimate.

marsh) (Austen and Cadman 1991).

Some former nesting sites (e.g., Bradley's Marsh) no longer have suitable habitat for the species, while others are under increasing development pressures (e.g., Frenchman's Bay), at least partially explaining the abandonment of these areas for nesting by terns.

Reasons for the decline of Black Terns at sites such as the Long Point marshes, which still have large areas of suitable habitat, are less evident. Black Terns were common in the Long Point marshes in the early 1900s and as recently as the mid-1970s (McCracken *et al.* 1981). Twenty-three and 32 nests were counted in 1975 and 1976, respectively, within a 14-ha study area in the Crown Marsh at Long Point (Dunn 1979). Jon McCracken (pers. comm.) reported an 80 to 90 percent reduction in the numbers of both Black and Forster's Terns in the Long Point region from a decade ago (the last time a similar survey was performed by McCracken). Some factors that might partially explain this decline include a reduction in the amount of floating debris (i.e., nesting substrate), high lake levels, and a succession of mild winters which do not give the marshes their usual ice protection (McCracken pers. comm.). In 1992, fewer than 10 individual Black Terns (5 nests) were located during a survey of the Long Point Company marshes (Bradstreet 1992). Fewer than 10 Black Tern pairs nested west of the dyke in the Big Creek marshes and there was no confirmed nesting of Black Terns east of the Company marsh, despite surveys of several areas with suitable habitat (Bradstreet 1992). (1992 results from Long Point are not presented in Tables 1 to 4, because the 1991 survey was more systematic and thorough).

Black Tern numbers have also declined in marshes along Lake Ontario in Durham Regional Municipality and many former nesting sites appear to have been abandoned (e.g., Shoal Point Marsh, Oshawa Second Marsh, Bayly St. Wetland, Cranberry Marsh, Whitby Harbour, Lynde Creek Marsh, and Duffins Creek) (Connell and Norman 1989; Austen and Cadman 1991). Due to the decline of Black Terns nesting in the Durham region in 1990, the breeding status of Black Terns was changed from uncommon (i.e., 51 - 100 pairs) to scarce (i.e., 11 - 50 pairs) (Bain and Henshaw 1990). In 1991, only 20 pairs were confirmed breeding in Durham (within the 1991 Main Study Area) compared to a minimum of 145 pairs during the ABBO years, supporting the decline in Black Tern numbers reported by Bain and Henshaw (1990).

In a few areas, such as Tiny Marsh near Georgian Bay, Black Tern numbers appear to have increased since the ABBO. In 1991, 60, possibly 66, pairs of terns were confirmed breeding at Tiny Marsh (Sites 31D050-31D052) compared to 2 to 10 breeding pairs estimated during the ABBO years.

In order to monitor Black Tern numbers, regular surveys (every 5-10 years) need to be conducted along the Great Lakes. The 1991 data will provide baseline data for comparison with future surveys. It would also be worthwhile expanding the survey to include all areas in southern Ontario, so that both inland and coastal colonies are monitored (see Austen *et al.*1994 for most recent data on distribution in Ontario). This would help determine whether declines noted at some coastal colonies are reflective of declines in the southern Ontario breeding population.

6. ACKNOWLEDGEMENTS

The authors would like to thank the following volunteers who participated in the 1991 Colonial Marshbird Survey: M. Bain, D. and L. Bennett, R. Bilinsky, R. Bobson, C. Boekema, C. Buck, M. Cadman, B. Charlton, J. Dempsey, J. Haggeman, C. Hebert, K. Hennige, J. Jalava, R. Jones, C. and B. Jose, R. Knapton, B. Lukasic, N. Mahony, M. Malone, W. McIlveen, K. McLaughlin, L. Mitchell, R. Munroe, F. Pointner, C. Potter, P. Prior , J. Raven, A. Rider, G. Riley, G. Sadowski, R. Simms, K. and M. Speedie, J. Sprague, J. Spruce, M. Spruce, R. Tymstra, H. Watson, R. Westerhoff, J. Williams, B. Wyatt, and B. Wylie.

A special thanks is extended to all Regional Coordinators for the survey: J. Barker, A. Boisvert, N. Carleton, S. Connop, R. Dobos, L. Fazio, F. Hindmarsh, T. Hoffman, S. LaForest, H. Lancaster, J. McCracken, T. McDonald, P. Middleton, M. Pickup, P. Read, A. Sinclair, W.Thompson, M. and H. van der Zweep, P. VanDijken, C. Watson, R. Weir, and A. Woodliffe. We also thank J. Arndt, A. Page, R. Guthrie, and V. Wyatt who provided valuable assistance during the inventory, while working for the Ontario Rare Breeding Bird Program.

We are also grateful to W.Lee, J. Sullivan, and D.Wesley , all with the CWS, for providing boat transportation and field assistance.

W. LaFrance (Huronia District) and K. Lisgo (Presqu'ile Provincial Park) of the OMNR also provided information on marsh-nesting colonial waterbirds in their regions. B. Bowles, R. Reid, D. Fraser, and M. Sharp also provided information relevant to the study from field work on the Muskoka Heritage Study.

Funding for this inventory was provided to LPBO by CWS, Ontario Region. We thank R.Pratt, CWS, Ontario Region, for his comments on the draft report.

7. LITERATURE CITED

Austen, M.J.W. and M.D. Cadman. 1991. Distribution and abundance of marsh-nesting colonial waterbirds in the Canadian portions of the Great Lakes study area in 1991 (from Twelve Mile Bay, Georgian Bay to Cornwall, St. Lawrence River). Report prepared for Canadian Wildlife Service, Ontario Region, Nepean. 120 pp.

Austen, M.J.W., M.D.Cadman and R.D.James. 1994. Ontario birds at risk: status and conservation needs. Federation of Ontario Naturalists and Long Point Bird Observatory, 165 pp.

Baillie, J.L. 1950. Region reports. Nesting season - June 1 to August 15, 1950. Ontario -- western New York region. Audubon Field Notes 4: 272 - 274.

Bain, M. and B. Henshaw. 1990. Annual Bird Report - Durham Region, Ontario 1990. Durham Region Field Naturalists and Pickering Naturalists.

Bishop, C.A., D.V. Weseloh, N.M. Burgess, J. Struger, R.J. Norstrom, R. Turtle, and

K.A. Logan. 1992. An atlas of contaminants in eggs of fish-eating colonial birds of the Great Lakes (1970-1988). Vols. 1 and 2. Canadian Wildlife Service Technical Report Series 152 and 153.

Blokpoel, H. 1977. Gulls and terns nesting in northern Lake Ontario and the upper St. Lawrence River. Canadian Wildlife Service Progress Notes 75. 12 pp.

Blokpoel, H. and A. Harfenist. 1986. Comparisons of 1980 and 1984 inventories of Common Tern, Caspian Tern and Double-crested Cormorant colonies in the eastern North Channel, Lake Huron, Ontario. Colonial Waterbirds 9: 61-67.

Blokpoel, H. and G.B. McKeating. 1978. Fish-eating birds nesting in Canadian Lake Erie and adjacent waters. Canadian Wildlife Service Progress Notes 87. 12 pp.

Blokpoel, H., J.P. Ryder, I. Seddon, and W.R. Carswell. 1980. Colonial waterbirds nesting in Canadian Lake Superior in 1978. Canadian Wildlife Service Progress Notes 118. 13 pp.

Blokpoel, H. and G.D. Tessier. 1986. The Ring-billed Gull in Ontario: a review of a new problem species. Canadian Wildlife Service Occasional Paper 57. 32pp.

Blokpoel, H. and G.D. Tessier. 1991. Atlas of Colonial Waterbirds nesting on the Canadian Great Lakes, 1989-1991. Part 1. Cormorants, gulls and island-nesting terns on Lake Superior in 1989. Canadian Wildlife Service Technical Report 181. 74 pp.

Blokpoel, H. and G.D. Tessier. 1996. Atlas of Colonial Waterbirds nesting on the Canadian Great Lakes, 1989-1991. Part 3. Cormorants, gulls and island-nesting terns on the lower Great Lakes system in 1990. Canadian Wildlife Service Technical Report 225. 74 pp.

Bradstreet, M.S.W. 1992. Distribution and abundance of marsh-nesting colonial waterbirds at Presqu'ile and Rondeau, Ontario in 1992. Report prepared by Long Point Bird Observatory for Canadian Wildlife Service, Ontario Region, Nepean.

Cadman, M.D., P.F.J. Eagles, and F.M. Helleiner. 1987. Atlas of the Breeding Birds of Ontario. Federation of Ontario Naturalists and the Long Point Bird Observatory, University of Waterloo Press. 617 pp.

Connell, S.R. and A.J. Norman. 1989. Survey of Colonial Nesting Birds in Maple District 1989. Ontario Ministry of Natural Resources.

Courtney, P.A. and H. Blokpoel. 1983. Distribution and numbers of Common Terns on the lower Great Lakes during 1900-1980: a review. Colonial Waterbirds 6: 107-120.

Dunn, E.H. 1979. Nesting biology and development of young in Ontario Black Terns. Can. Field Nat. 93: 276-281.

Erwin, R.M. 1979. Coastal waterbird colonies: Cape Elizabeth, Maine to Virginia. U.S. Fish and Wildlife Service, Biological Services Program, FWS/OBS-79/10. 212 pp.

Godfrey, W.E. 1986. The Birds of Canada, rev. ed. National Museums of Canada, Ottawa. 595 pp.

LaFrance, W. 1991. Colonial Bird Nesting Survey. Huronia District - Spring 1991. Ontario Ministry of Natural Resources, Huronia District.

Lisgo, K. 1991. Black Tern population study 1991 - Presqu'ile Provincial Park.

Maehr, D.S. and J.A. Rogers. 1985. Colonial waterbirds: an elusive definition. Colonial Waterbirds 8: 186-187.

McCracken, J.D., M.S. Bradstreet, and G.L. Holroyd. 1981. Breeding Birds of Long Point, Lake Erie. Canadian Wildlife Service Report Series Number 44.

Mineau, P., G.A. Fox, R.J. Norstrom, D.V. Weseloh, D.J. Hallett and J.A. Ellenton. 1984. Using the Herring Gull to monitor levels and effects of organochlorine contamination in the Canadian Great Lakes. Pp. 425-452 *in* Nriagu, J.O., and M.S. Simmons (Eds.), Toxic Contaminants in the Great Lakes. Wiley and Sons, New York, USA.

Scharf, W.C., G.W. Shugart, and M.L. Chamberlin. 1978. Colonial birds nesting on man-made and natural sites in the U.S. Great Lakes. Report TR-D-78-10, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, USA. 140 pp.

Speich, S.M. and T.R. Wahl. 1989. Catalog of Washington seabird colonies. U.S. Fish and Wildlife Service Biological Report 88(6). 510 pp.

Sprague, T. and R.D. Weir. 1984. The Birds of Prince Edward County. Kingston Field Naturalists, Kingston, Ontario. 190 pp.

Weseloh, D.V., P. Mineau, S.M. Teeple, H. Blokpoel, and B. Ratcliff. 1986. Colonial waterbirds nesting in Canadian Lake Huron in 1980. Canadian Wildlife Service Progress Notes 165. 28 pp.

Weseloh, D.V., S.M. Teeple, and H. Blokpoel. 1988. The distribution and status of colonial waterbirds nesting in western Lake Erie. Pp. 134-144 *in* J.E. Downhower (Ed.). The Biogeography of the Island Region of Western Lake Erie. Ohio State University Press, Colombus, Ohio, USA

Appendix 1. Explanation of the listing of the colony sites in Appendix 2.

There are 11 1:250,000 Topographical Maps that cover the main study area. Starting from Georgian Bay and working "downstream" to Cornwall on the St. Lawrence River these maps are 31D, 41A, 40O, 40J, 40G, 40I, 30L, 30M, 30N, 31C, and 31B. The results of the 1991/92 survey are plotted by Topographical Map. Information on all colony sites found within the Main Study Area is presented in Appendix 2. Appendix 2 runs across two opposite pages and to help the reader we have repeated the colony site identification number on the right hand page. All colony identification numbers are listed in Appendix 2 for the first time because there were no previous systematic surveys published with which to compare the 1991/92 results. Therefore, the 1991/92 census was used as the basis for allocating colony site identification numbers. Some colony site identification numbers begin at numbers greater than 001 because these numbers had already been used for other parts of this Atlas.

Regarding the naming of colony sites, we have used the 1:50,000 Topographic Map Sheets as the basis for names. For some smaller marshes, we have used the names provided by volunteers knowledgeable with the area. Regarding bird names, we use the following abbreviations: FOTE - Forster's Tern and BLTE - Black Tern.

Because a large proportion of the 1991 census was conducted by volunteers, and terns are known to be particularly vulnerable to nest disturbance, emphasis was placed on counting adults to obtain nest estimates and <u>not</u> confirming breeding by finding nests. Volunteers were encouraged to watch the behaviour of the birds and list the highest breeding code possible (see Section 4.1.4). For example, if a courtship display or a nest was observed, breeding was confirmed for the species. However, if the bird was only seen flying around in suitable habitat but did not appear to be landing in the marsh or feeding young, a level of possible breeding evidence was assigned by M. Austen. At the majority of colonies listed in Appendix 2 breeding was confirmed. For those cases where breeding was unconfirmed, a code of "Po", representing possible evidence of breeding or "Pr", representing probable evidence of breeding is listed beside the value under the "Estimated # of Nests" column. The "Estimated # of Nests" column contains the 1991 estimate of the number of tern nests based on adult counts (see Section 4.1.5). A "?" under this column indicates that the estimate of the number of nests was not provided by volunteers.

Appendix 2. Colony sites and estimated numbers of nesting pairs of Black Terns and Forster's Terns found during the 1991 Colonial Marshbird Census. See App. 1 for explanations.

Colony Site Ident. Number	Name of Colony Size	Dist. From Lake (km)	Latitude	Longitude
31D045	Sturgeon Bay	0	44 43 50	79 44 30
31D046	Matchedash Bay (north)	0	44 45 49	79 41 00
31D047	Matchedash Bay (northeast)	0	44 45 42	79 40 33
31D048	Matchedash Bay (south)	0	44 44 18	79 40 21
31D049	Wye Marsh (= Mud Lake)	0	44 43 08	79 51 24
31D050	Tiny Marsh (north)	3	44 36 18	79 57 00
31D051	Tiny Marsh (middle)	3	44 36 10	79 56 46
31D052	Tiny Marsh (south)	3	44 35 54	79 56 36
41A057	Sky Lake	2	44 48 48	81 15 00
41A058	Isaac Lake (north)	3	44 46 36	81 14 12
41A059	Isaac Lake (south)	3	44 46 00	81 13 42
41A060	Boat Lake	3	44 43 48	81 13 36
40O001	Kettle Point marshes	0	43 13 15	82 01 00
40J003	Squirrel Island bridge	0	42 35 18	82 32 06
40J004	North Bassett Channel-A	0	42 32 42	82 34 54
40J005	North Bassett Channel-B	0	42 32 42	82 34 54
40J006	Squirrel Island	0	42 32 12	82 33 50
40J007	Bassett Channel (north)	0	42 30 55	82 34 06
40J008	Bassett Island	0	42 30 00	82 35 36
40J009	Bassett Channel (south)	0	42 29 54	82 35 18
40J010	Bassett Channel (middle)A	0	42 30 08	82 35 06
40J011	Bassett Channel (middle)B	0	42 30 08	82 35 06
40J012	Marsh Northwest of Bass Bay	0	42 30 12	82 33 48
40J013	Snooks Lake-A	0	42 30 36	82 33 36
40J014	Snooks Lake-B	0	42 30 36	82 33 36
40J015	Johnston Channel - southwest	0	42 29 00	82 31 30
40J016	Johnston Channel - southeast	0	42 29 00	82 31 12
40J017	Johnston Channel - mid-north-A	0	42 29 06	82 31 06
40J018	Johnston Channel - mid-north-B	0	42 29 06	82 31 06
40J019	Johnston Channel - north-A	0	42 29 18	82 30 54
40J020	Johnston Channel - north-B	0	42 29 18	82 30 54
40J021	Johnston Bay	0	42 29 54	82 30 18
40J022	Grassy Bend Islands - west	0	42 27 48	82 29 48
40J023	Grassy Bend Islands - middle	0	42 27 42	82 29 42
40J024	Grassy Bend Islands - east	0	42 27 36	82 29 36
40J025	Johnston Channel - northwest	0	42 30 00	82 28 48
40J026	Johnston Channel - northeast	0	42 30 06	82 28 18
40J027	Mud Bay	0	42 29 12	82 28 06
40J028	Marsh North of Mitchell's Bay	3-4	42 31 48	82 24 00
0J029	Bass Haven	0	42 29 30	82 25 12

Colony Site Ident. Number	ORBBP Square	ORBBP Region	OMNR District	Nearest lake/river	Estimated # of Nests	
					BLTE	FOTE
31D045	17NV95	Simcoe	Midhurst	Georgian Bay	7[a]	0[a]
31D046	17PV05	Simcoe	Midhurst	Georgian Bay	3[a]	0[a]
31D047	17PV05	Simcoe	Midhurst	Georgian Bay	3[a]	0[a]
31D048	17PV05	Simcoe	Midhurst	Georgian Bay	9[a]	0[a]
31D049	17NV85/95	Simcoe	Midhurst	Georgian Bay	61	0
31D050	17NV83	Simcoe	Midhurst	Georgian Bay	22	0
31D051	17NV83	Simcoe	Midhurst	Georgian Bay	22	0
31D052	17NV83	Simcoe	Midhurst	Georgian Bay	16	0
41A057	17MV86	Bruce	Midhurst	Lake Huron	3	0
41A058	17MV85	Bruce	Midhurst	Lake Huron	12	0
41A059	17MV85	Bruce	Midhurst	Lake Huron	12	0
41A060	17MV85	Bruce	Midhurst	Lake Huron	19	0
41O001	17MT18	Lambton	Aylmer	Lake Huron	0	3Pr
40J003	17LT71	Lambton	Aylmer	Lake St. Clair	8	0
40J004	17LT71	Lambton	Aylmer	Lake St. Clair	0	9
40J005	17LT71	Lambton	Aylmer	Lake St. Clair	2	0
40J006	17LT71	Lambton	Aylmer	Lake St. Clair	8	0
40J007	17LT70	Lambton	Aylmer	Lake St. Clair	0	21
40J008	17LT60	Lambton	Aylmer	Lake St. Clair	18	0
40J009	17LT60	Lambton	Aylmer	Lake St. Clair	0	12
40J010	17LT60	Lambton	Aylmer	Lake St. Clair	0	5
40J011	17LT60	Lambton	Aylmer	Lake St. Clair	2	0
40J012	17LT70	Lambton	Aylmer	Lake St. Clair	15	0
40J013	17LT70	Lambton	Aylmer	Lake St. Clair	0	8
40J014	17LT70	Lambton	Aylmer	Lake St. Clair	31	0
40J015	17LT70	Lambton	Aylmer	Lake St. Clair	0	75
40J016	17LT70	Lambton	Aylmer	Lake St. Clair	0	60
40J017	17LT70	Lambton	Aylmer	Lake St. Clair	0	10
40J018	17LT70	Lambton	Aylmer	Lake St. Clair	2	0
40J019	17LT70	Lambton	Aylmer	Lake St. Clair	0	1
40J020	17LT70	Lambton	Aylmer	Lake St. Clair	12	0
40J021	17LT70	Lambton	Aylmer	Lake St. Clair	2	15
40J022	17LT70	Lambton	Aylmer	Lake St. Clair	0	17
40J023	17LT70	Lambton	Aylmer	Lake St. Clair	0	50
49J024	17LT70	Lambton	Aylmer	Lake St. Clair	0	267
40J025	17LT70	Lambton	Aylmer	Lake St. Clair	3	0
40J026	17LT70	Lambton	Aylmer	Lake St. Clair	4	0
40J027	17LT70	Lambton	Aylmer	Lake St. Clair	7	0
40J028	17LT80	Kent/Lamb	Aylmer	Lake St. Clair	0	?Po
40J029	17LT80	Kent	Aylmer	Lake St. Clair	7	0

Data from Ontario Ministry of Natural Resources, Huronia District (LaFrance 1991)

Appendix 2. (continued)

Colony Site Ident. Number	Name of Colony Size	Dist. From Lake (km)	Latitude	Longitude
40J030	Marsh South of St. Anne Island	0	42 29 00	82 26 30
40J031	Mitchell's Bay	0	42 27 12	82 25 06
40J032	Mitchell's Point	0	42 26 42	82 25 48
40J033	St. Clair NWA (west)-A	0	42 22 12	82 24 12
40J034	St. Clair NWA (west)-B	0	42 22 12	82 24 12
40J035	St. Clair NWA (east)-A	0	42 22 00	82 23 36
40J036	St. Clair NWA (east)-B	0	42 22 00	82 23 36
40J037	Jeanette's Creek - north	1.5	42 19 00	82 26 00
40J038	Jeanette's Creek - south	3	42 17 45	82 25 40
40J039	Tremblay Beach Lagoons	0	42 18 12	82 30 00
40G009	Pt. Pelee - Marsh Boardwalk	0	41 58 12	82 31 48
40G010	Girardin Pond-A	0	41 57 30	82 31 12
40G011	Girardin Pond-B	0	41 57 30	82 31 12
40G012	Pt. Pelee - Lake Pond-A	0	41 58 00	82 31 18
40G013	Pt. Pelee - Lake Pond-B	0	41 58 00	82 31 18
40I001	Rondeau P.P. - Gull I. area	0	42 15 50	81 53 30
40I004	Rondeau Prov. Park -A	0	42 17 10	81 52 12
40I005	Bates Marsh, Rondeau	0.5	42 19 54	81 50 42
40I006	Rondeau Prov. Park -B	0	42 16 12	81 52 20
40I007	Rondeau Prov. Park -C	0	42 15 32	81 52 30
40I008	Big Creek Marsh	0	42 35 18	80 27 36
40I009	Big Creek Canal, Long Point	0	42 36 00	80 27 30
40I010	Thoroughfare Point - south	0	42 34 36	80 21 42
40I011	Rice Bays	0	42 35 00	80 21 00
40I012	Thoroughfare Point - north	0	42 35 54	80 20 24
40I013	The Cottages, Long Point	0	42 35 30	80 19 30
40I014	Long Point Co. Marsh - south-A	0	42 34 30	80 19 00
40I015	Long Point Co. Marsh - south-B	0	42 34 30	80 19 00
40I016	Long Point Co. Marsh - north-A	0	42 35 30	80 17 30
40I017	Long Point Co. Marsh - north-B	0	42 35 30	80 17 30
40I018	Courtright Ridge, Long Point	0	42 33 42	80 14 36
40I019	Bluff Pond, Long Point	0	42 33 36	80 08 24
40I020	Edge of Turkey Point-west	0	42 39 12	80 21 30
40I021	Interior of Turkey Point	0	42 40 06	80 21 30
40I022	Edge of Turkey Point-east	0	42 39 30	80 20 18
40I023	Nanticoke Marsh	0	42 47 54	80 04 24
30L004	Dunnville, Grand River Marsh	1	42 53 00	79 35 00
30M021	Winona sewage pond	0.5	43 13 00	79 36 50
30M022	Red Hill Creek Marsh	0	43 15 15	79 46 00
30M023	Northeast Frenchman's Bay	0	43 50 00	79 05 00

Colony Site Ident. Number	ORBBP Square	ORBBP Region	OMNR District	Nearest lake/river	Estimated # of Nests	
					BLTE	FOTE
40J030	17LT80	Kent	Aylmer	Lake St. Clair	1	0
40J031	17LT80	Kent	Aylmer	Lake St. Clair	7	0
40J032	17LT80	Kent	Aylmer	Lake St. Clair	18	0
40J033	17LS89	Kent	Aylmer	Lake St. Clair	0	2
40J034	17LS89	Kent	Aylmer	Lake St. Clair	3[a]	0
40J035	17LS89	Kent	Aylmer	Lake St. Clair	0	3
40J036	17LS89	Kent	Aylmer	Lake St. Clair	3	0
40J037	17LS88	Kent	Aylmer	Lake St. Clair	0	?Po
40J038	17LS88	Kent	Aylmer	Lake St. Clair	?Po	0
40J039	17LS78	Essex	Aylmer	Lake St. Clair	0	4Pr
40G009	17LS74	Essex	Aylmer	Lake Erie	2	0
40G010	17LS74	Essex	Aylmer	Lake Erie	0	2Po
40G011	17LS74	Essex	Aylmer	Lake Erie	3Pr	0
40G012	17LS74	Essex	Aylmer	Lake Erie	0	8Po
40G013	17LS74	Essex	Aylmer	Lake Erie	7	0
40I001	17MS27	Kent	Aylmer	Lake Erie	0[b]	3[b]
40I004	17MS28	Kent	Aylmer	Lake Erie	2[b]	0[b]
40I005	17MS38	Kent	Aylmer	Lake Erie	?Pr	0
40I006	17MS27/28	Kent	Aylmer	Lake Erie	3[b]	0[b]
40I007	17MS27	Kent	Aylmer	Lake Erie	6[b]	0[b]
40I008	17NT41	Hald-Norf	Aylmer	Lake Erie	12	0
40I009	17NT41	Hald-Norf	Aylme	Lake Erie	1Pr	0
40I010	17NT51	Hald-Norf	Aylmer	Lake Erie	6	0
40I011	17NT51	Hald-Norf	Aylmer	Lake Erie	4	0
40I012	17NT51	Hald-Norf	Aylmer	Lake Erie	1	0
40I013	17NT51	Hald-Norf	Aylmer	Lake Erie	1Pr	0
40I014	17NT51	Hald-Norf	Aylmer	Lake Erie	0	3Pr
40I015	17NT51	Hald-Norf	Aylmer	Lake Erie	6	0
40I016	17NT51	Hald-Norf	Aylmer	Lake Erie	0	10
40I017	17NT51	Hald-Norf	Aylmer	Lake Erie	4	0
40I018	17NT61	Hald-Norf	Aylmer	Lake Erie	2Pr	0
40I019	17NT71	Hald-Norf	Aylmer	Lake Erie	2Pr	0
40I020	17NT52	Hald-Norf	Aylmer	Lake Erie	1	0
40I021	17NT52	Hald-Norf	Aylmer	Lake Erie	7	0
40I022	17NT52	Hald-Norf	Aylmer	Lake Erie	6	0
40I023	17NT73	Hald-Norf	Aylmer	Lake Erie	2Pr	0
30L004	17PT14	Hald-Norf	Aylmer	Lake Erie	12Pr	0
30M021	17PT18	Hamilton	Cambridge	Lake Ontario	1Po	0
30M022	17PT08	Hamilton	Cambridge	Lake Ontario	1	0
30M023	17PU55	Durham	Maple	Lake Ontario	1Pr	0

[a] Estimate includes one nest from a colony referred to as "North of the National Wildlife Area" in Austen and Cadman (1991)

[b] Data for 1992 from Bradstreet (1992)

Appendix 2 (continued)

Colony Site Ident. Number	Name of Colony Size	Dist. From Lake (km)	Latitude	Longitude
30M024	Hydro Park Marsh	0	43 49 30	79 04 00
30M025	Pumphouse Marsh	0	43 51 24	78 50 36
30N005	East Lake	0	43 53 43	77 12 52
30N006	Beaver Meadow, East Lake	1	43 57 40	77 11 02
30N007	Big Sand Bay - west	0	43 55 24	76 56 24
30N008	Big Sand Bay - east	0	43 55 30	76 56 06
31C009	Presqu'ile Provincial Park	0	44 00 36	77 44 00
31C010	Presqu'ile Bay - west	0	44 00 45	77 44 30
31C011	Presqu'ile Bay - Gosport	0	44 01 30	77 43 00
31C012	Presqu'ile Bay - east	0	44 01 38	77 42 22
31C013	Presqu'ile Bay - Murray Canal	0	44 01 48	77 40 40
31C014	Dead Creek	2	44 03 00	77 36 42
31C015	Big Island Marsh	2	44 06 30	77 13 40
31C016	Hungry Bay	0	44 10 10	77 12 06
31C017	Cressy Marsh	0.5	44 04 12	76 53 36
31C018	North Gull Point, Amherst I.	0	44 06 42	76 45 42
31C019	Long Point Bay Msh,Amherst I.	0	44 07 24	76 42 26
31C020	Amherst Island - Northeast	0	44 08 06	76 40 54
31C021	Amherst Island - East	0	44 11 00	76 37 18
31C022	Hydro Property, West of Bath	1	44 09 30	76 50 48
31C023	Cataraqui Conservation Area	0	44 13 20	76 32 30
31C024	Little Cataraqui River Marsh	4	44 15 40	76 31 45
31C025	Cataraqui River Marshes	4	44 16 24	76 27 48
31C026	Southeast Lansdowne	3.5	44 24 00	76 00 24
31B012	East Mitchellville	4	44 25 40	75 57 10

Colony Site Ident. Number	ORBBP Square	ORBBP Region	OMNR District	Nearest lake/river	Estimated # of Nests	
					BLTE	FOTE
30M024	17PU55	Durham	Maple	Lake Ontario	5	0
30M025	17PU75	Durham	Maple	Lake Ontario	15	0
30N005	18UD26	Pr.Edward	Tweed	Lake Ontario	1Po	0
30N006	18UD26	Pr.Edward	Tweed	Lake Ontario	1Po	0
30N007	18UD46	Pr.Edward	Tweed	Lake Ontario	1	0
30N008	18UD46	Pr.Edward	Tweed	Lake Ontario	13	0
31C009	18TD87	Northumb	Tweed	Lake Ontario	30,12[a]	0
31C010	18TD87	Northumb	Tweed	Lake Ontario	6[a]	0[a]
31C011	18TD87	Northumb	Tweed	Lake Ontario	3[a]	0[a]
31C012	18TD87	Northumb	Tweed	Lake Ontario	3[a]	0[a]
31C013	18TD87	Northumb	Tweed	Lake Ontario	4	0
31C014	18TD98	Northumb	Tweed	Lake Ontario	3	0
31C015	18UD28	Pr.Edward	Tweed	Bay of Quinte	1	0
31C016	18UD29	Pr.Edward	Tweed	Lake Ontario	3	0
31C017	18UD48	Pr.Edward	Tweed	Lake Ontario	12	0
31C018	18UD58	L-A/Front	Tweed	Lake Ontario	6	0
31C019	18UD68	L-A/Front	Tweed	Lake Ontario	5Pr	0
31C020	18UD68	L-A/Front	Tweed	Lake Ontario	5	0
31C021	18UD69	L-A/Front	Tweed	Lake Ontario	10	0
31C022	18UD59	L-A/Front	Tweed	Lake Ontario	2Pr	0
31C023	18UD79	L-A/Front	Kemptv.	Lake Ontario	5Po	0
31C024	18UE70	L-A/Front	Tweed	St.Lawr.R.	15	0
31C025	18UE80	L-A/Front	Tweed	St.Lawr.R.	10	0
31C026	18VE11	L-S/L-G	Kemptv.	St.Lawr.R.	6	0
31B012	18VE21	L-S/L-G	Kemptv.	St.Lawr.R.	6	0

[a] Data for 1992 from Bradstreet (1992) and Lisgo (pers. comm.)

Appendix 3. Explanation of the mapping of the colony sites in Appendices 4-14.

Starting from Georgian Bay and working "downstream" to Cornwall on the St. Lawrence River the following 11 1:250,000 Maps cover the Main Study Area: 31D, 41A, 40O, 40J, 40G, 40I, 30L, 30M, 30N, 31C, and 31B.

All colony sites active in 1991/92 are plotted by 1:250,000 Map. Thus the colony sites in the area covered by Map 31D (i.e., sites 31D045 - 31D052, listed in App. 2) are plotted on a number of maps, which together form Appendix 4. Similarly, colony sites in the area covered by Map 41A (i.e., sites 41A057 - 41A060) are plotted on the maps of Appendix 5, and so on.

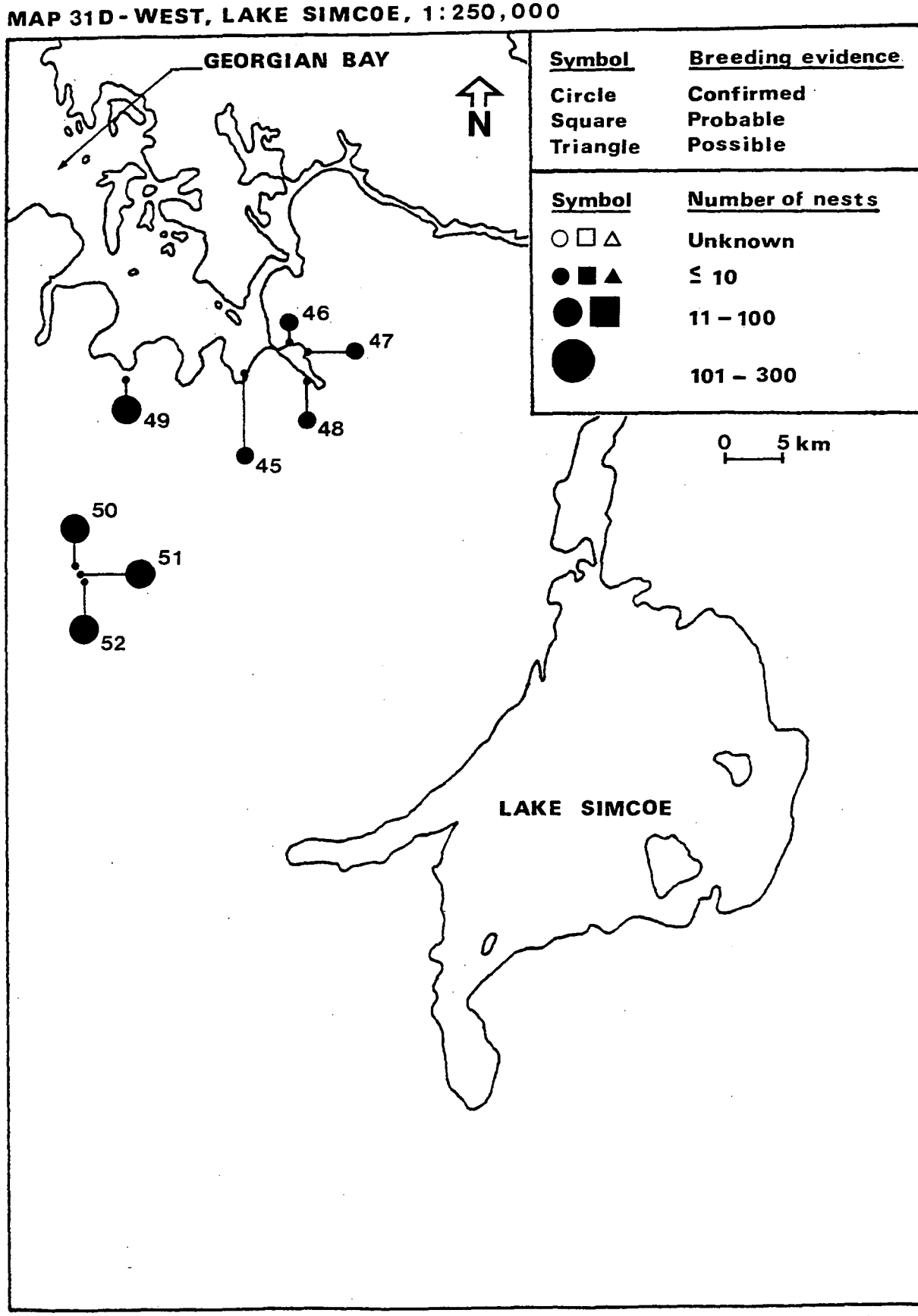
All colony sites are plotted both on 1:250,000 maps and on 1:50,000 maps. For example, Appendix 4 first shows an overview of the locations of all colony sites in the area covered by Map 31D and then continues to show their detailed locations.

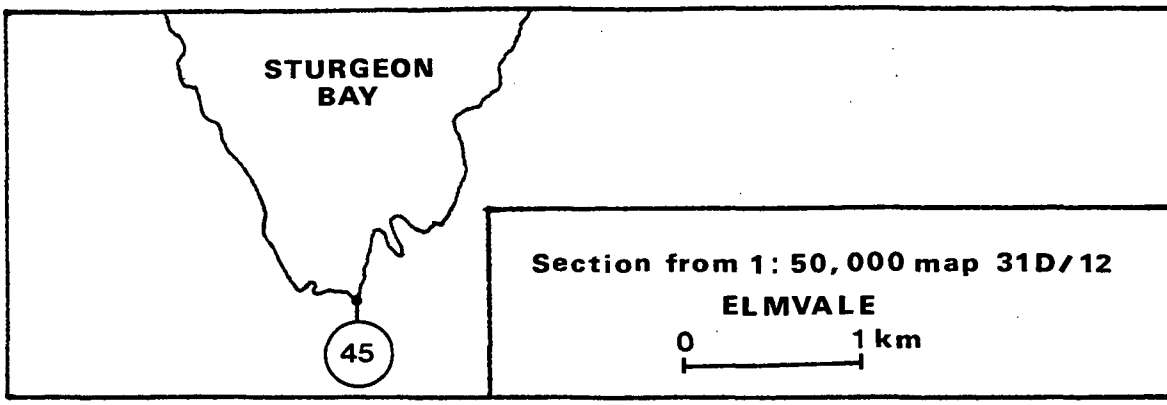
To find the colony site identification number of a certain plotted colony, combine the Map number (given at the top of the page in the case of 1:250,000 maps and in the boxes for the 1:50,000 maps) and the number in the circle associated with that colony. For example, the colony identification number of the marsh marked with a circle containing the number 49 on the map of App.4 is 31D049 and in Appendix 2 the name of colony site 31D049 is given as Wye Marsh. Similarly, the colony site marked by the circle containing the number 60 on the maps of App. 5 is 41A060 and App.2 shows its name as Boat Lake.

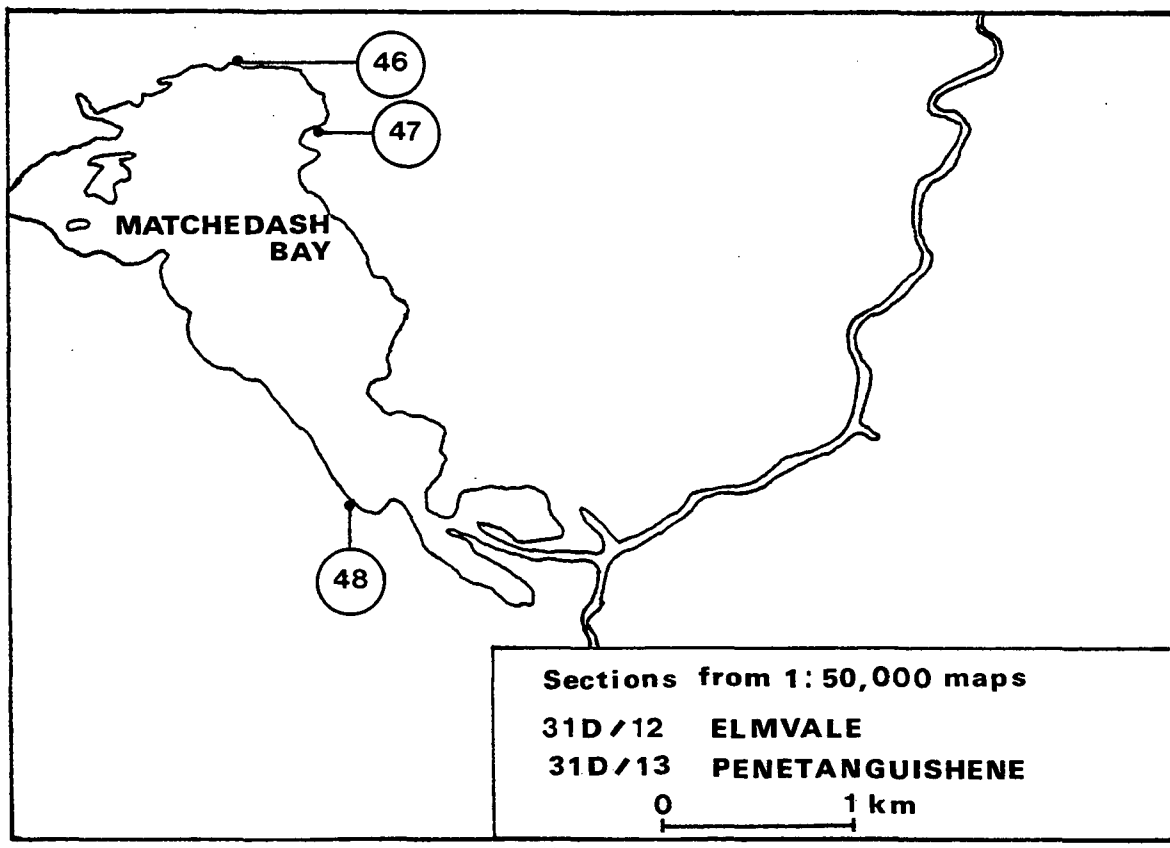
When plotting the colony sites on the 1:250,000 maps we used three different-sized symbols to indicate three size classes of the tern colonies. These symbols are based on the total of nests of all terns nesting at a colony site. In addition, on both the 1:250,000 and 1:50,000 maps, three different shapes (circle, square, and triangle) were used to indicate the highest level of breeding evidence obtained for terns at each colony site. A circle indicates confirmed breeding, a square indicated probable breeding, and a triangle indicates possible breeding (see Section 4.1.4).

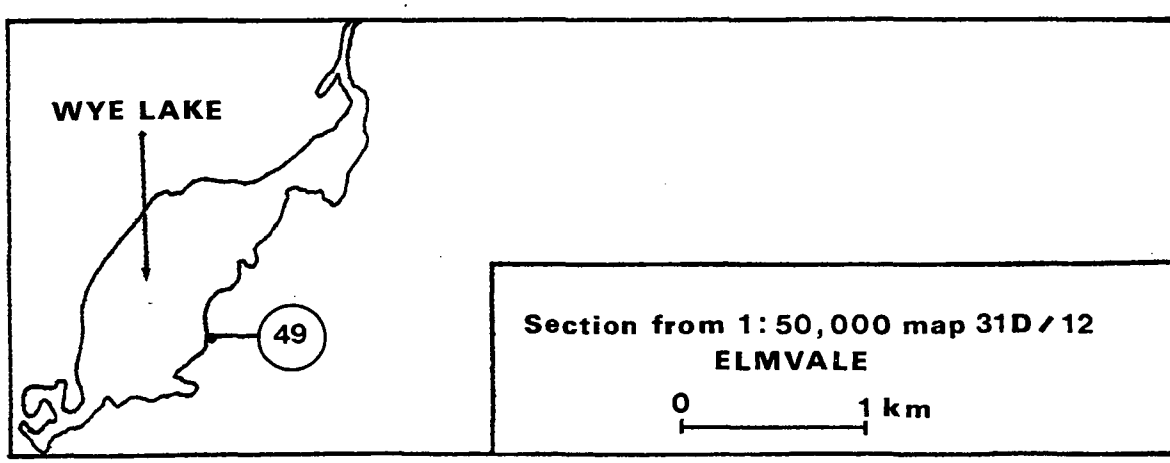
Appendix 4

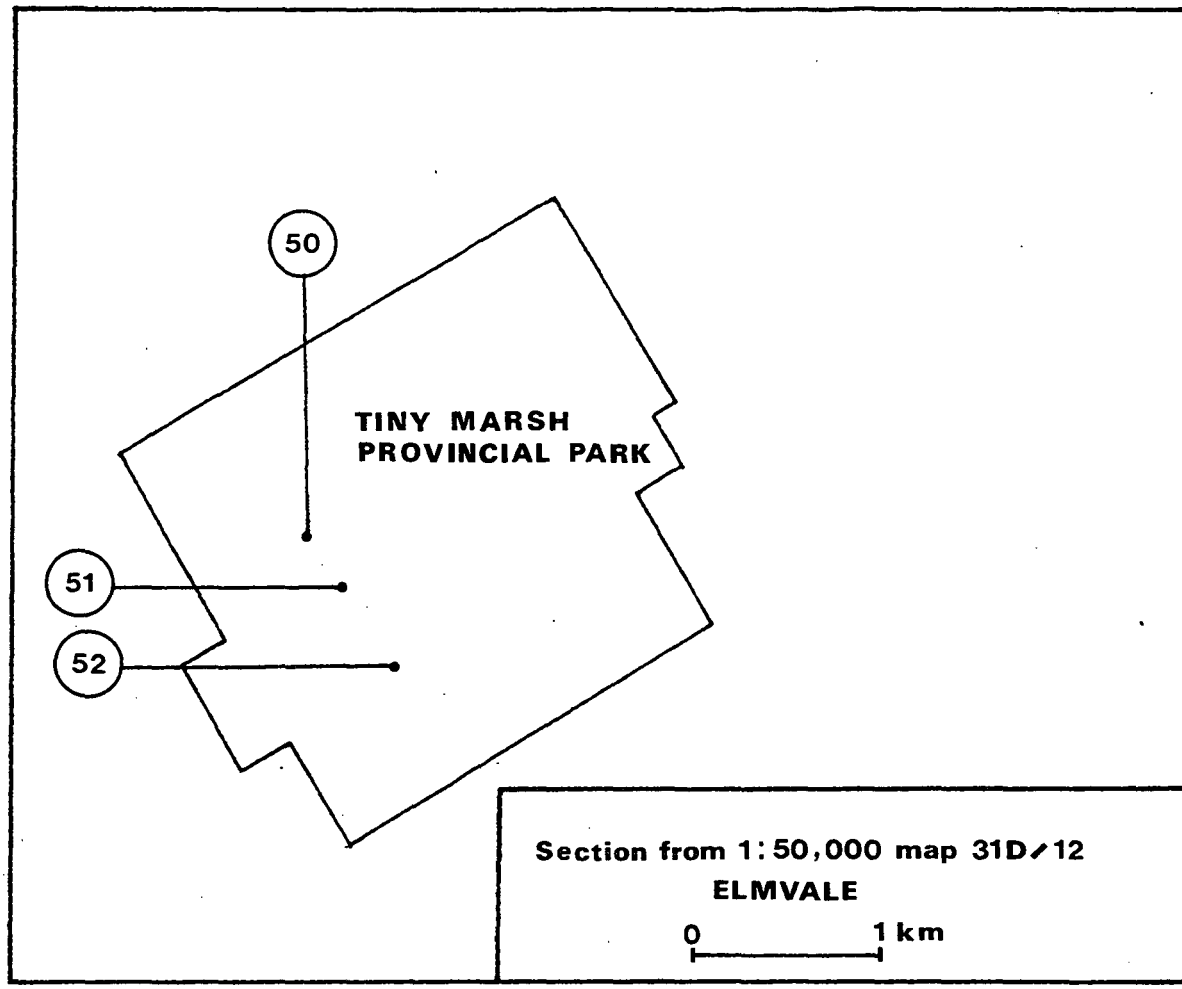
MAP 31D-WEST, LAKE SIMCOE, 1:250,000




STURGEON BAY
45
Section from 1: 50,000 map 31D/12
ELMVALE
0
1 km

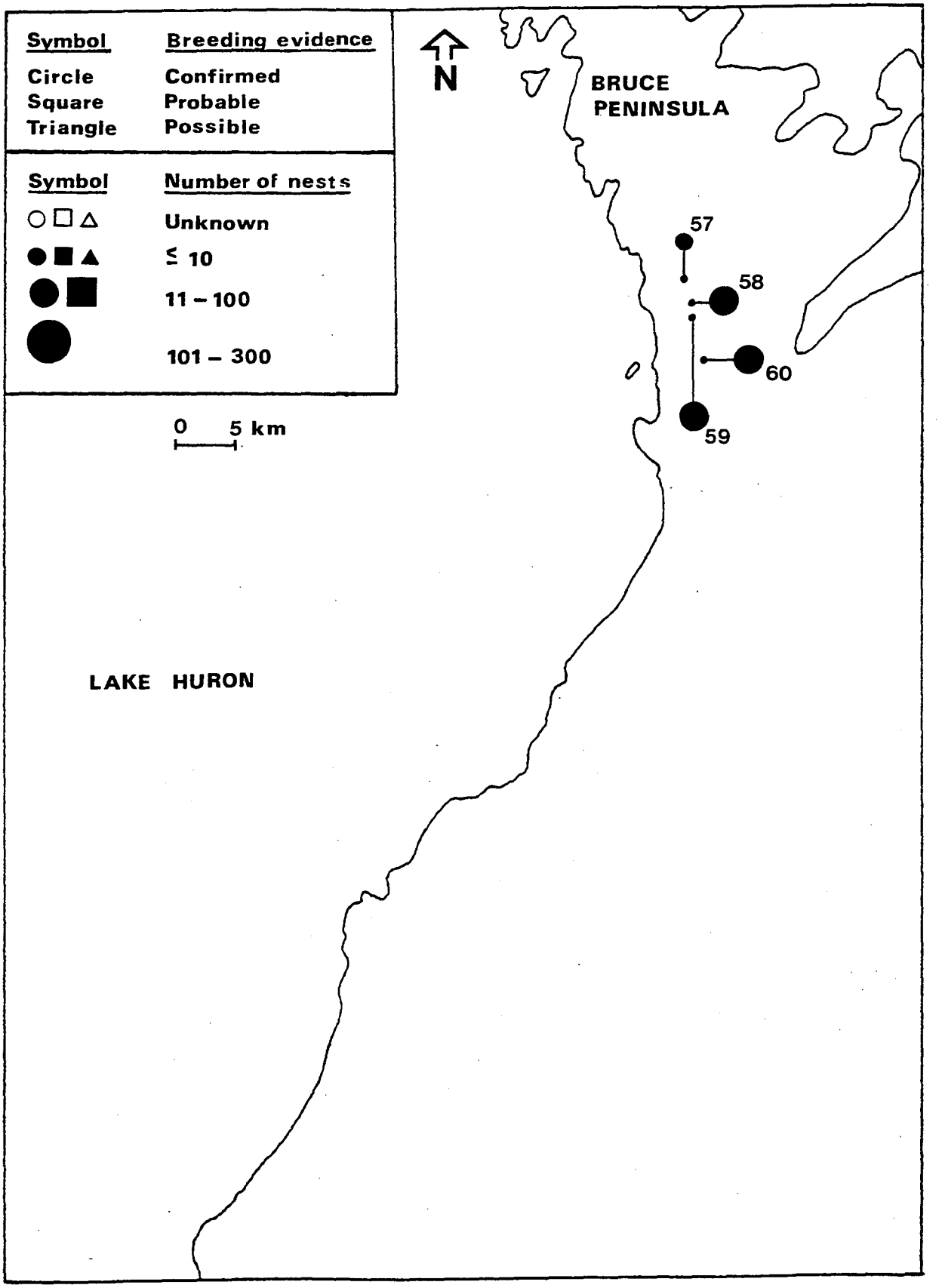

46
47
MATCHEDASH BAY
48
Sections from 1: 50,000 maps
31D/12 ELMVALE
31D/13 PENETANGUISHENE
0
1 km

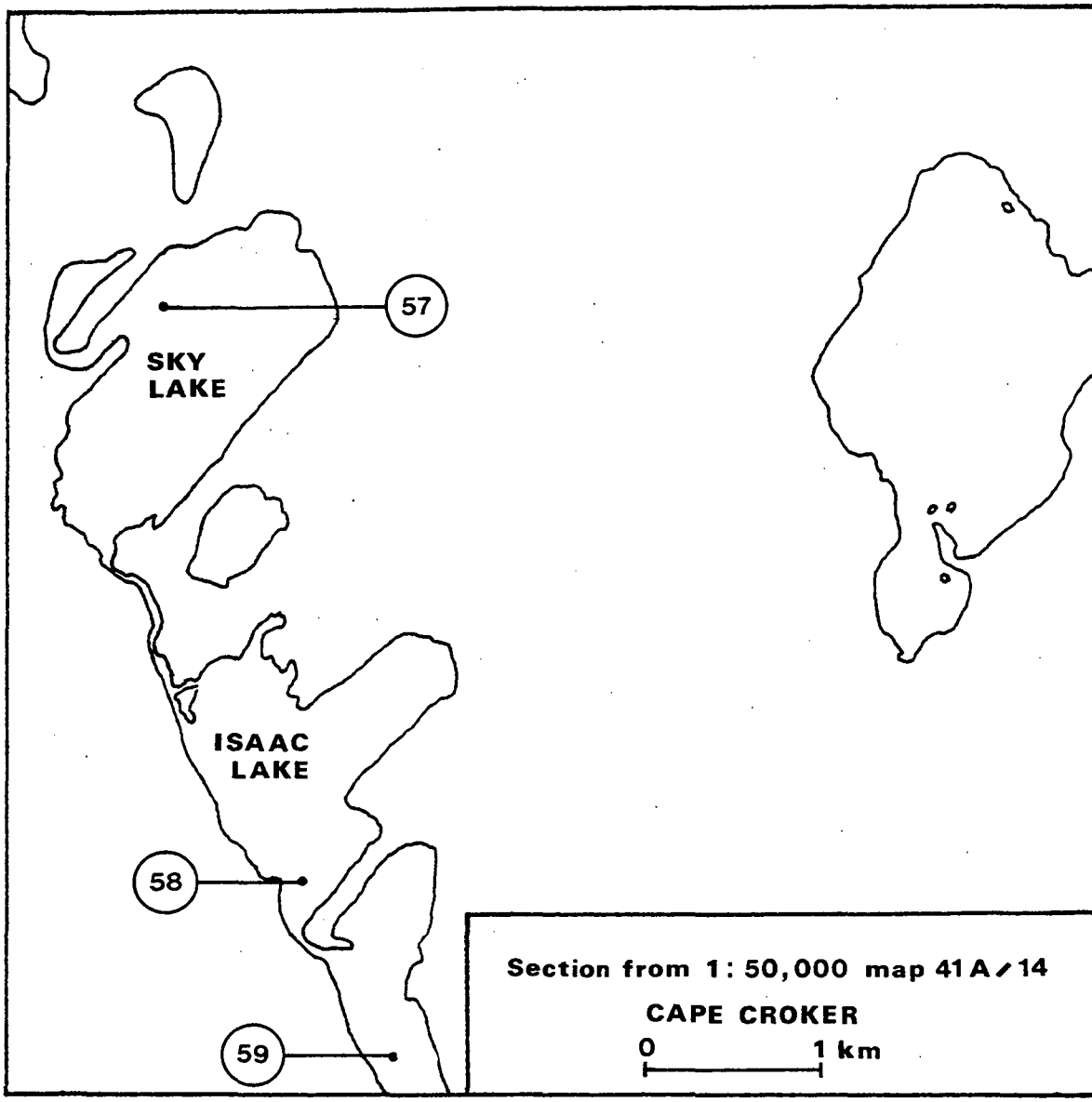

WYE LAKE
49
Section from 1: 50,000 map 31D/12
ELMVALE
0
1 km

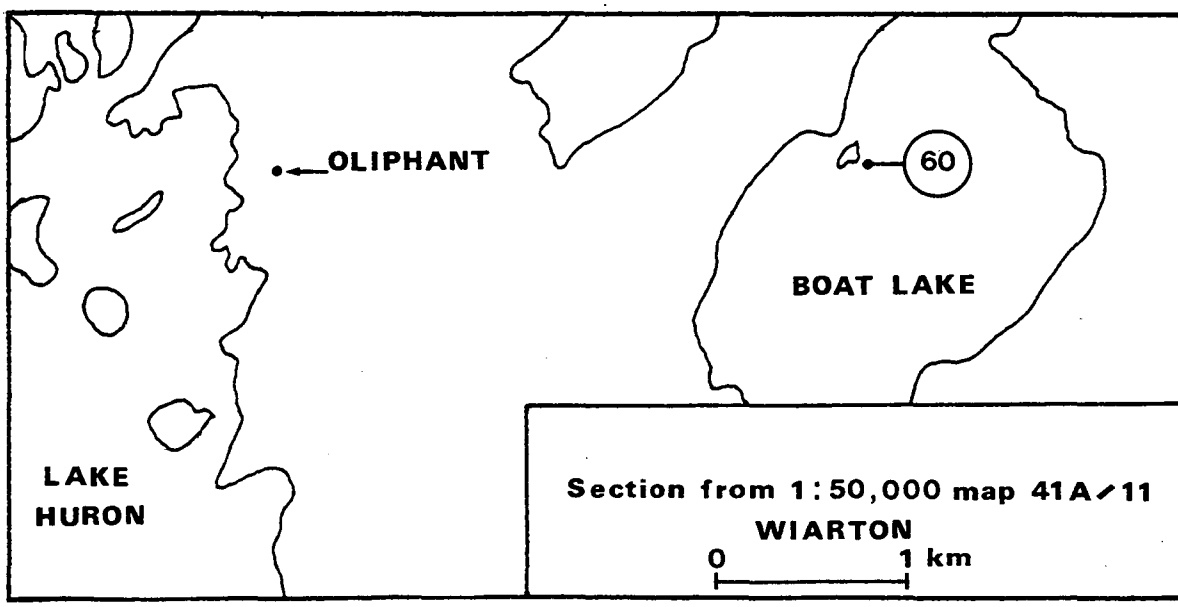

50
TINY MARSH
PROVINCIAL PARK
51
52
Section from 1:50,000 map 31D/12
ELMVALE
0
1 km

Appendix 5

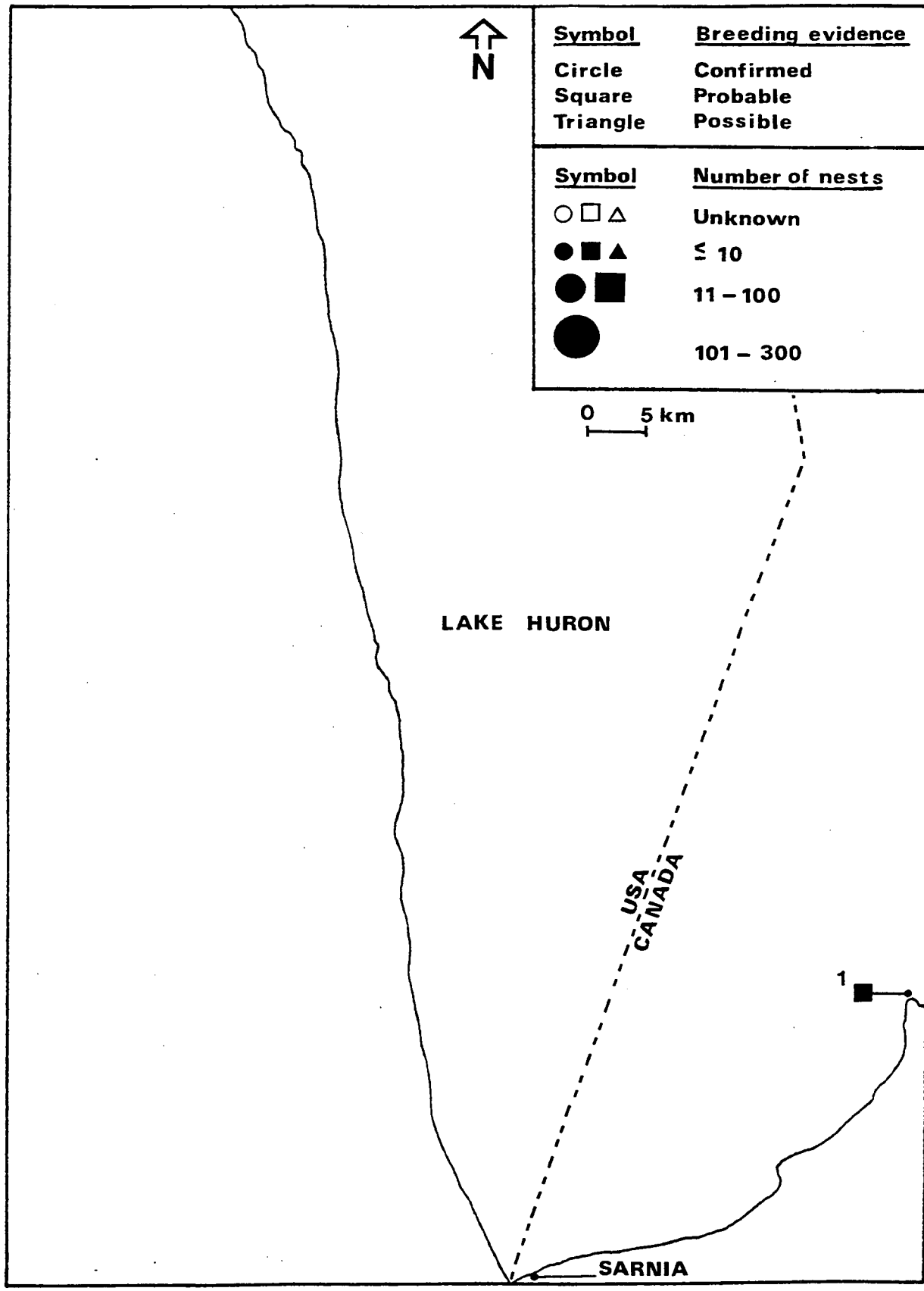
MAP 41A - WEST, BRUCE, 1:250,000

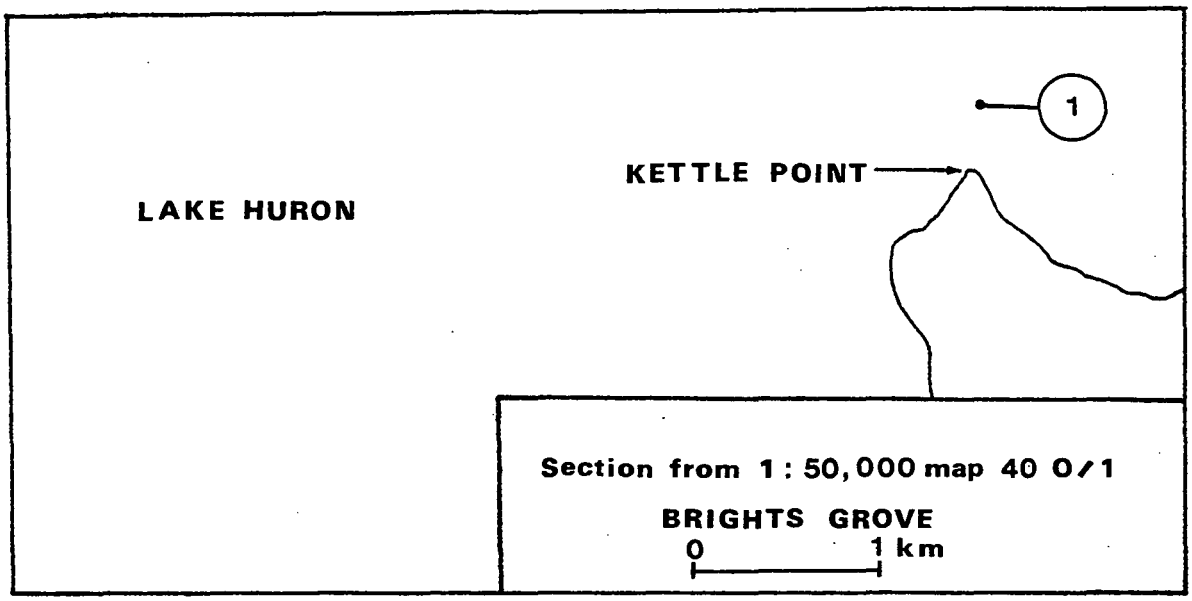



57
SKY
LAKE
ISAAC
LAKE
58
59
Section from 1: 50,000 map 41A/14
CAPE CROKER
0
1 km

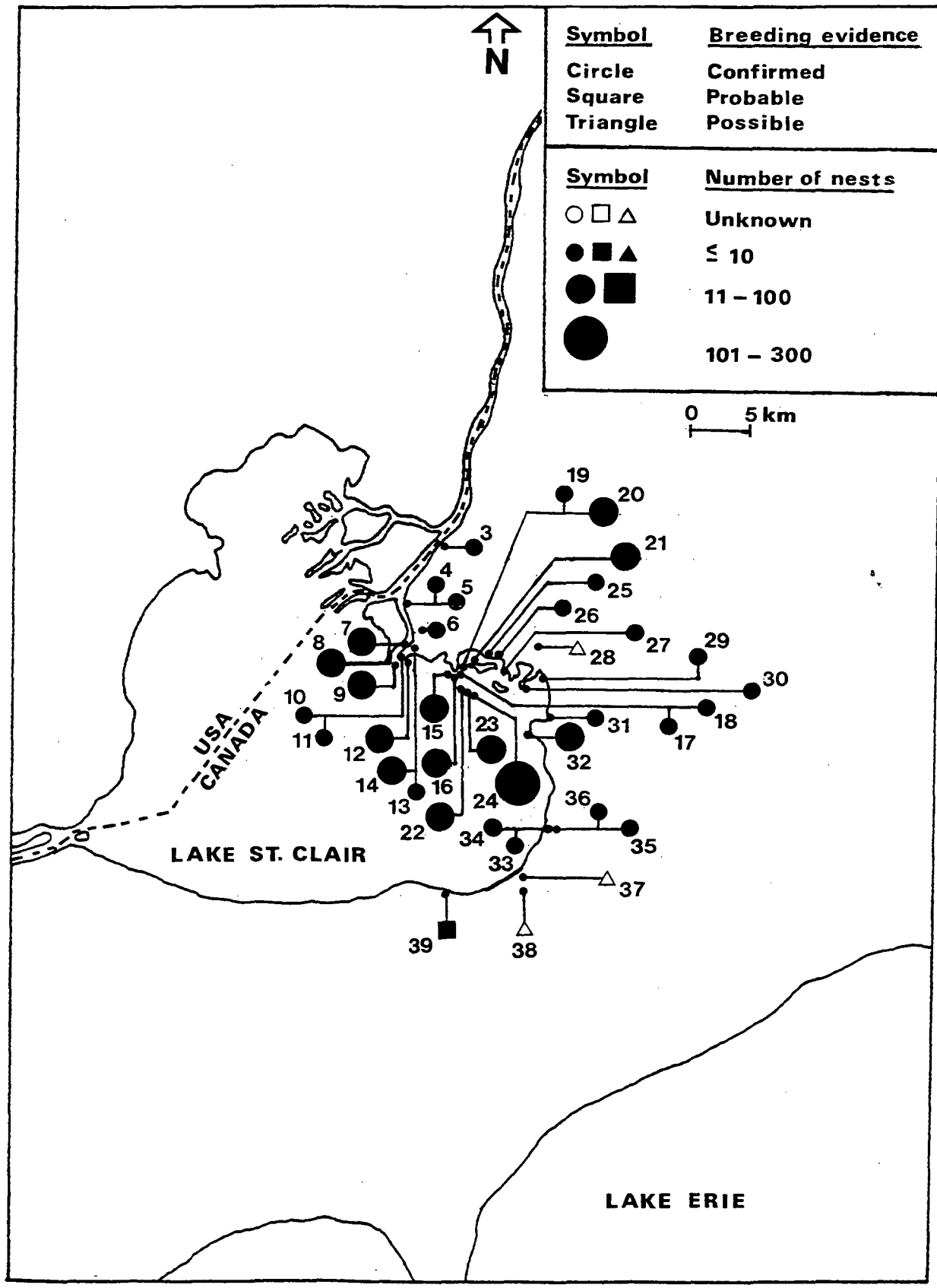

OLIPHANT
60
BOAT LAKE
LAKE
HURON
Section from 1: 50,000 map 41A/11
WIARTON
0
1 km

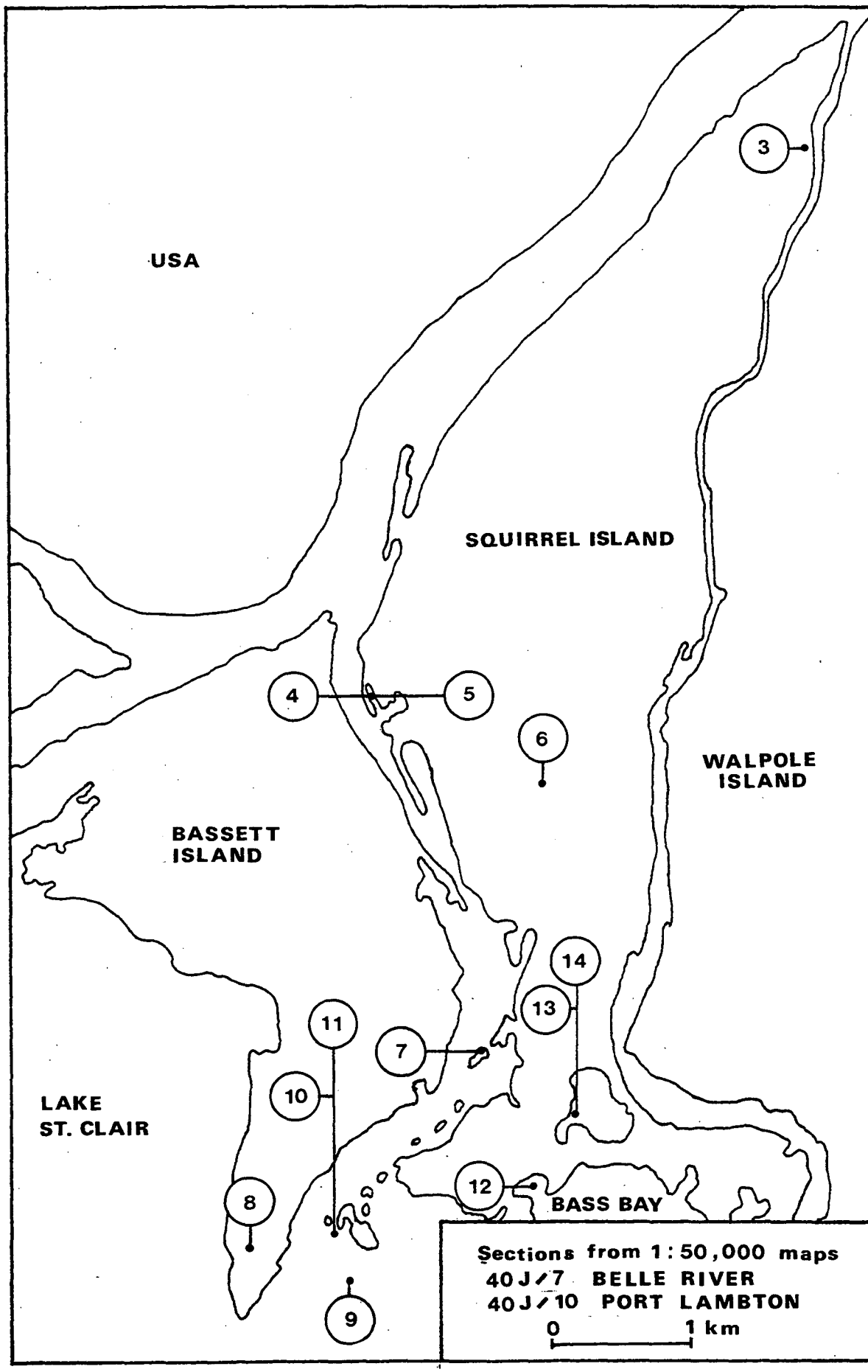
MAP 400 - EAST, FLINT, 1:250,000

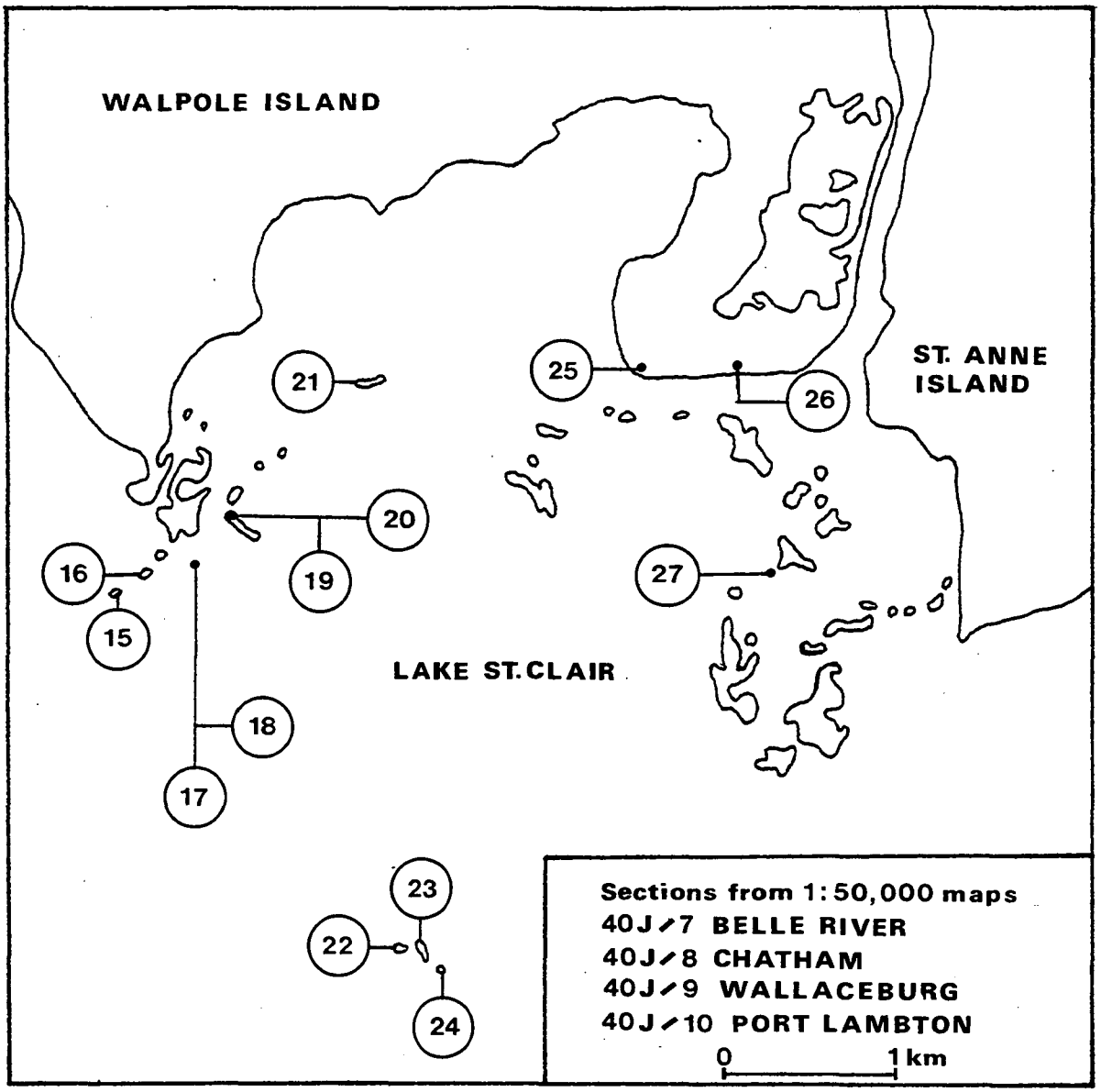



1
KETTLE POINT
LAKE HURON
Section from 1 : 50,000 map 40 O/1
BRIGHTS GROVE
0
1 km

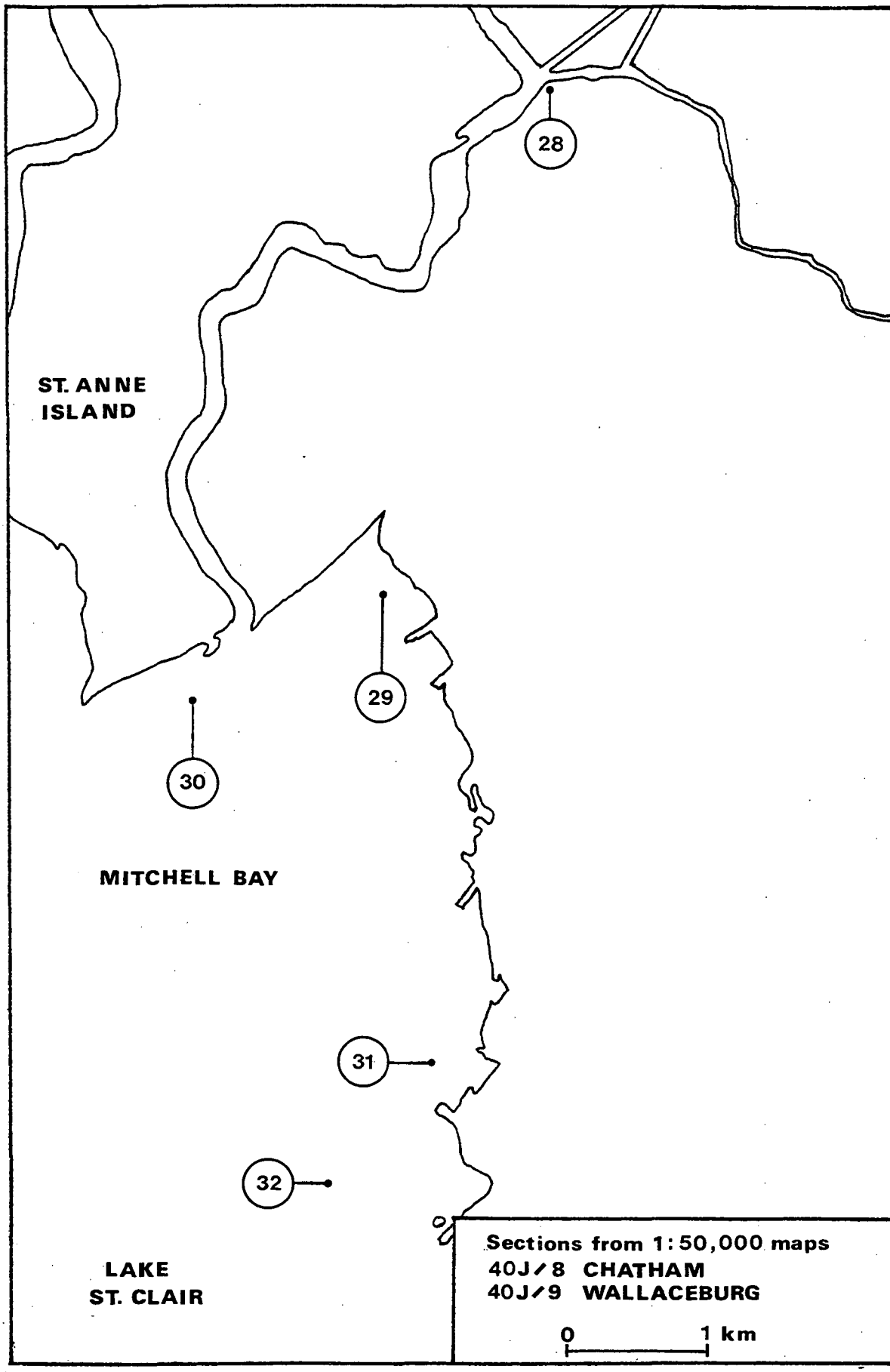
MAP 40J-EAST, DETROIT, 1 : 250,000

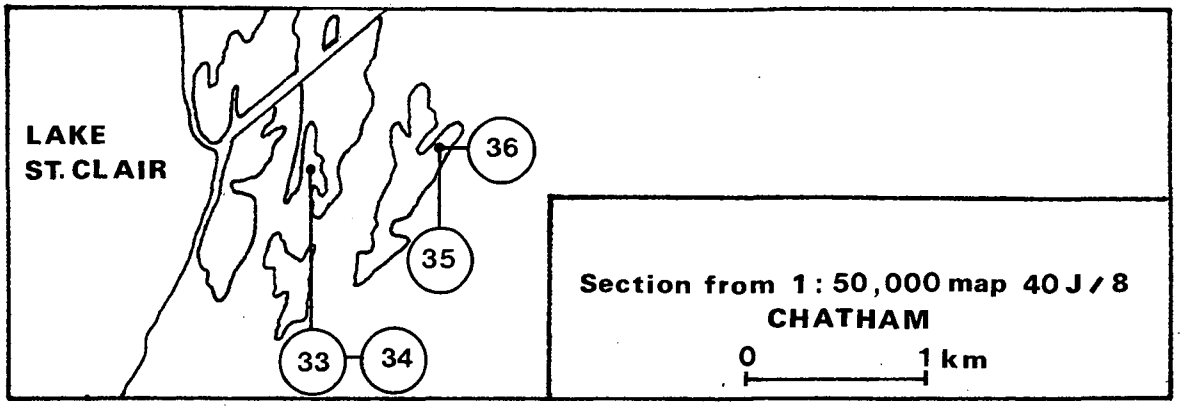


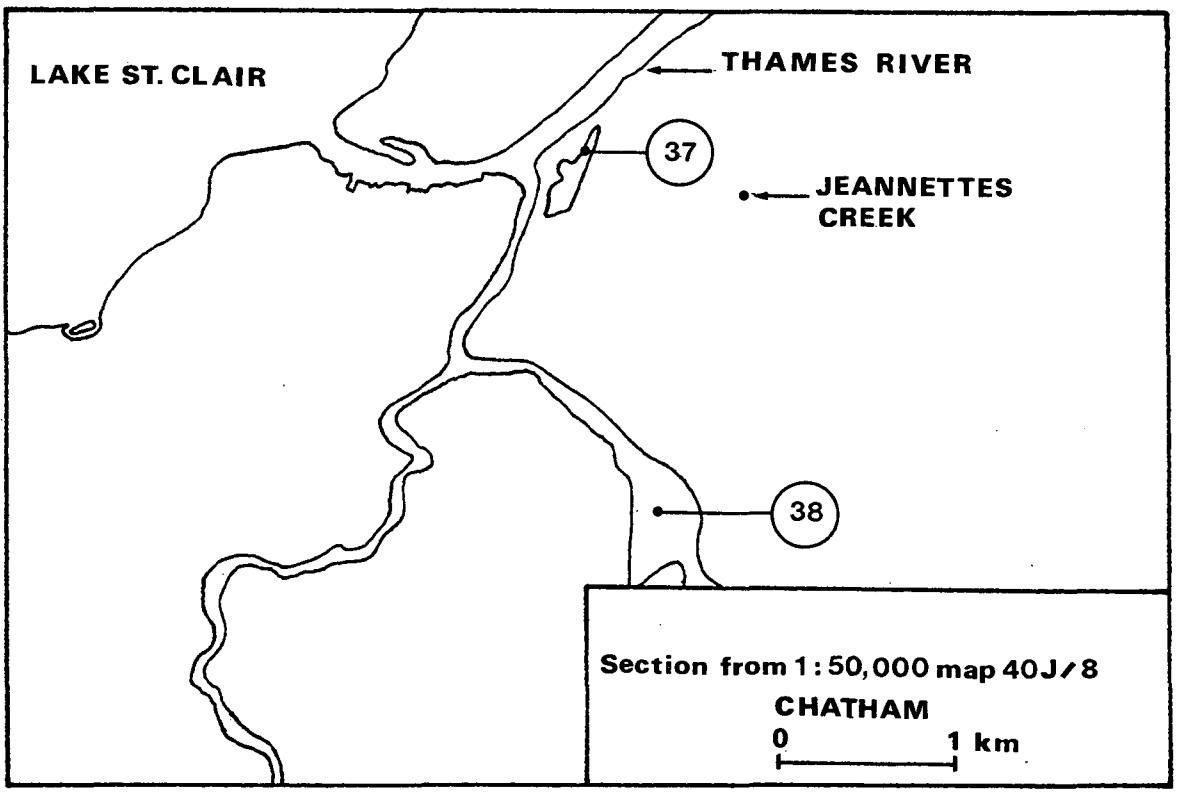

USA
SQUIRREL ISLAND
WALPOLE ISLAND
BASSETT ISLAND
LAKE ST. CLAIR
BASS BAY
3
4
5
6
7
8
9
10
11
12
13
14
Sections from 1:50,000 maps
40J/7 BELLE RIVER
40J/10 PORT LAMBTON
0
1 km

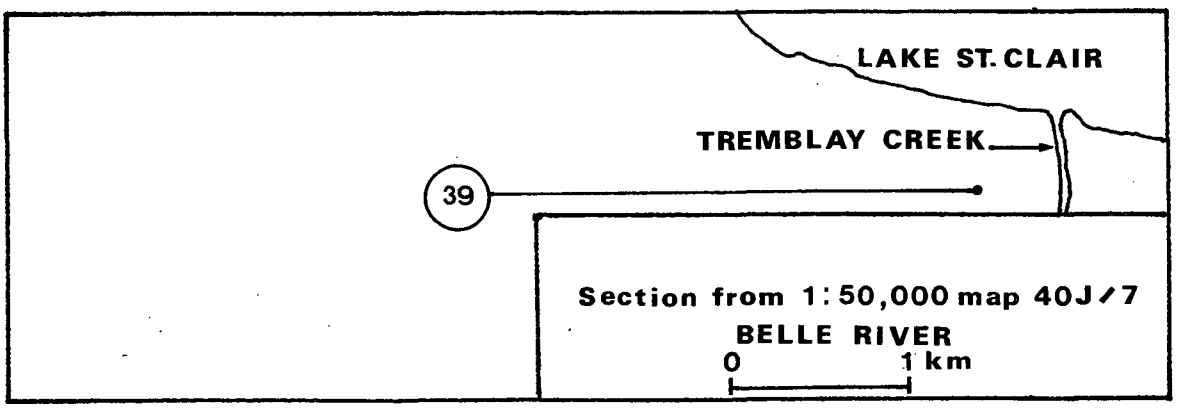

WALPOLE ISLAND
ST. ANNE ISLAND
LAKE ST. CLAIR
15
16
17
18
19
20
21
22
23
24
25
26
27
Sections from 1:50,000 maps
40J/7 BELLE RIVER
40J/8 CHATHAM
40J/9 WALLACEBURG
40J/10 PORT LAMBTON
0
1 km

App. 7 (cont'd)


28
ST. ANNE
ISLAND
29
30
MITCHELL BAY
31
32
LAKE
ST. CLAIR
Sections from 1:50,000 maps
40J/8 CHATHAM
40J/9 WALLACEBURG
0
1 km

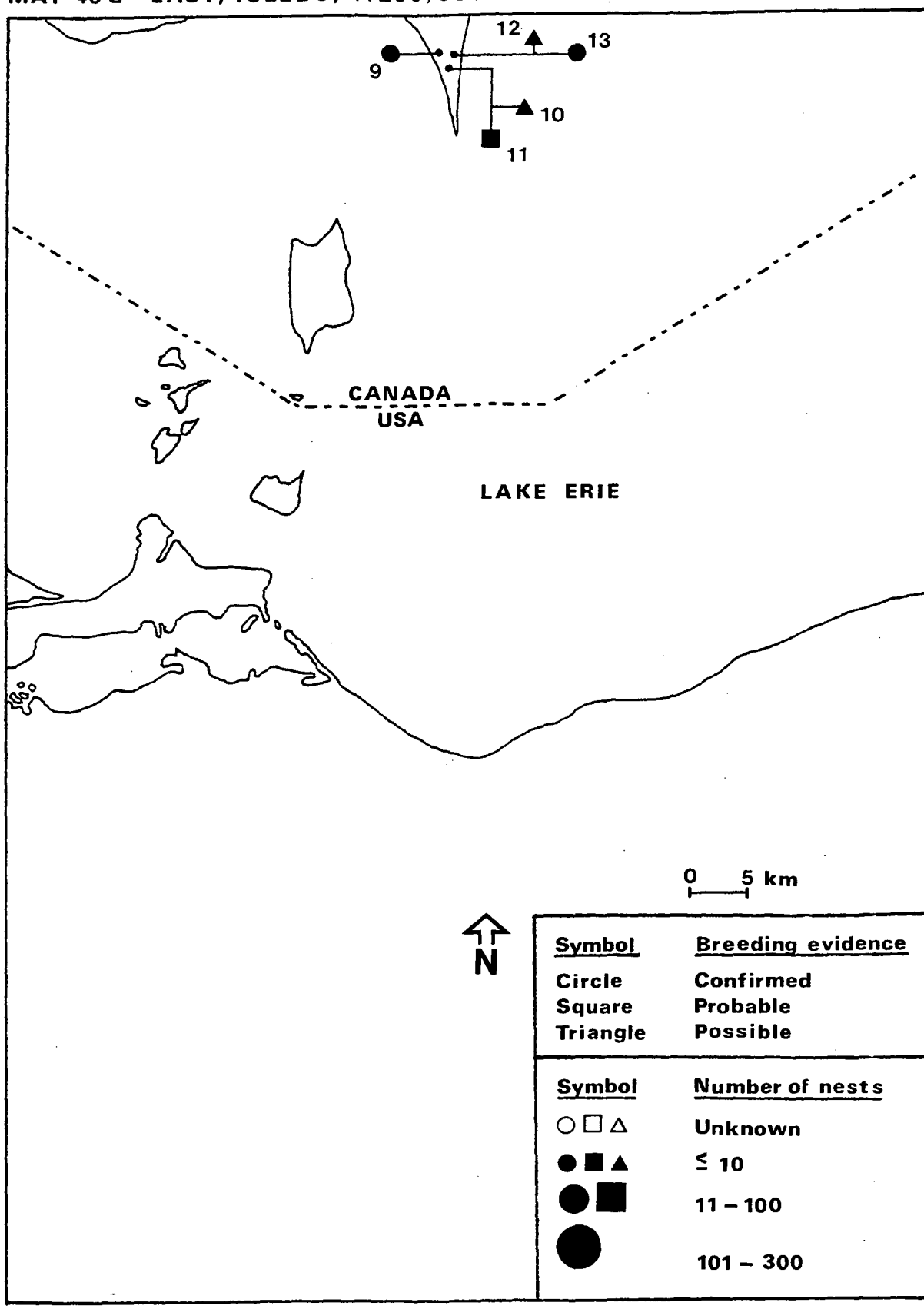

LAKE
ST. CLAIR
36
35
33
34
Section from 1 : 50,000 map 40 J / 8
CHATHAM
0
1 km

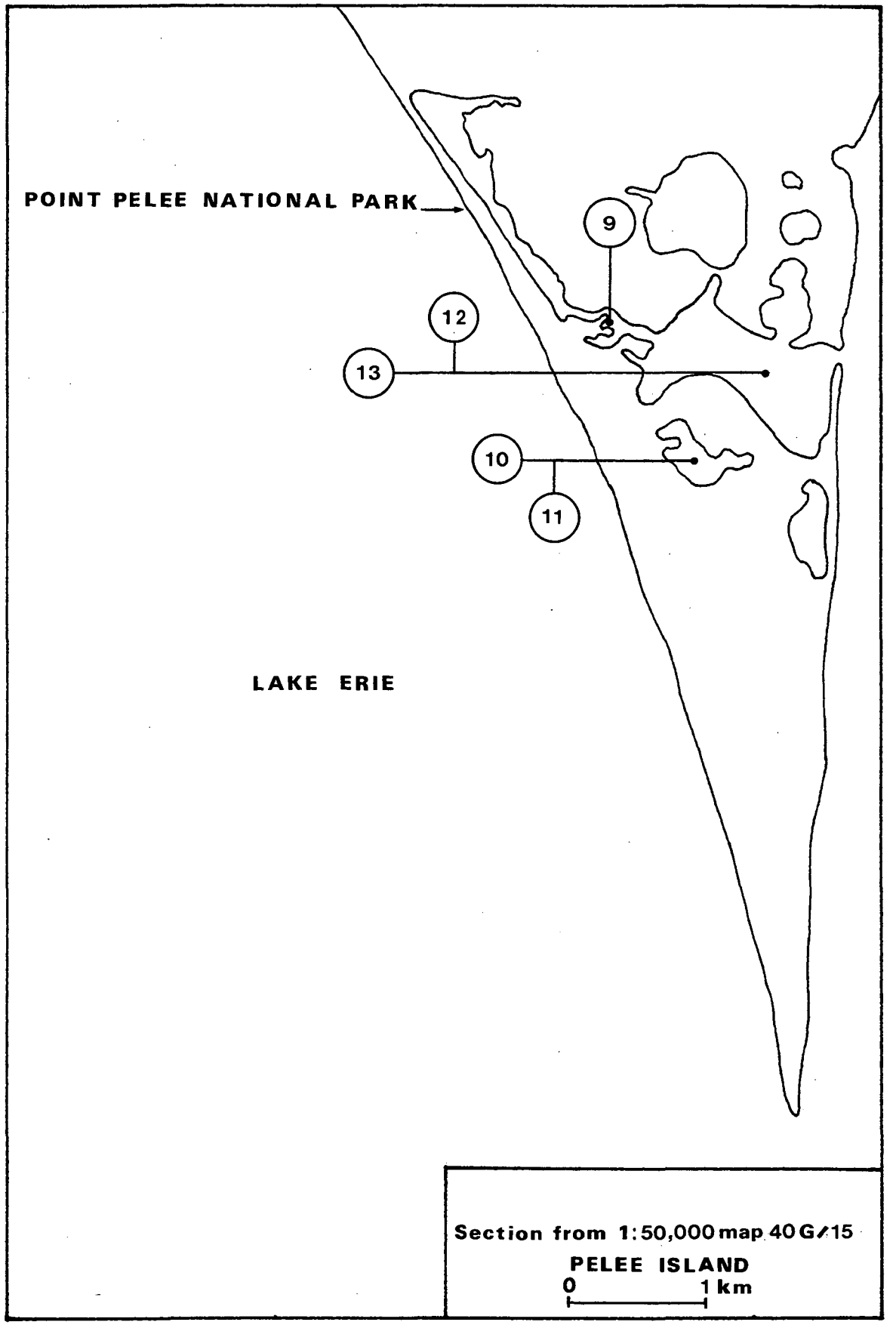

LAKE ST. CLAIR
THAMES RIVER
37
JEANNETTES
CREEK
38
Section from 1 : 50,000 map 40J / 8
CHATHAM
0
1 km


LAKE ST. CLAIR
TREMBLAY CREEK
39
Section from 1 : 50,000 map 40J / 7
BELLE RIVER
0
1 km

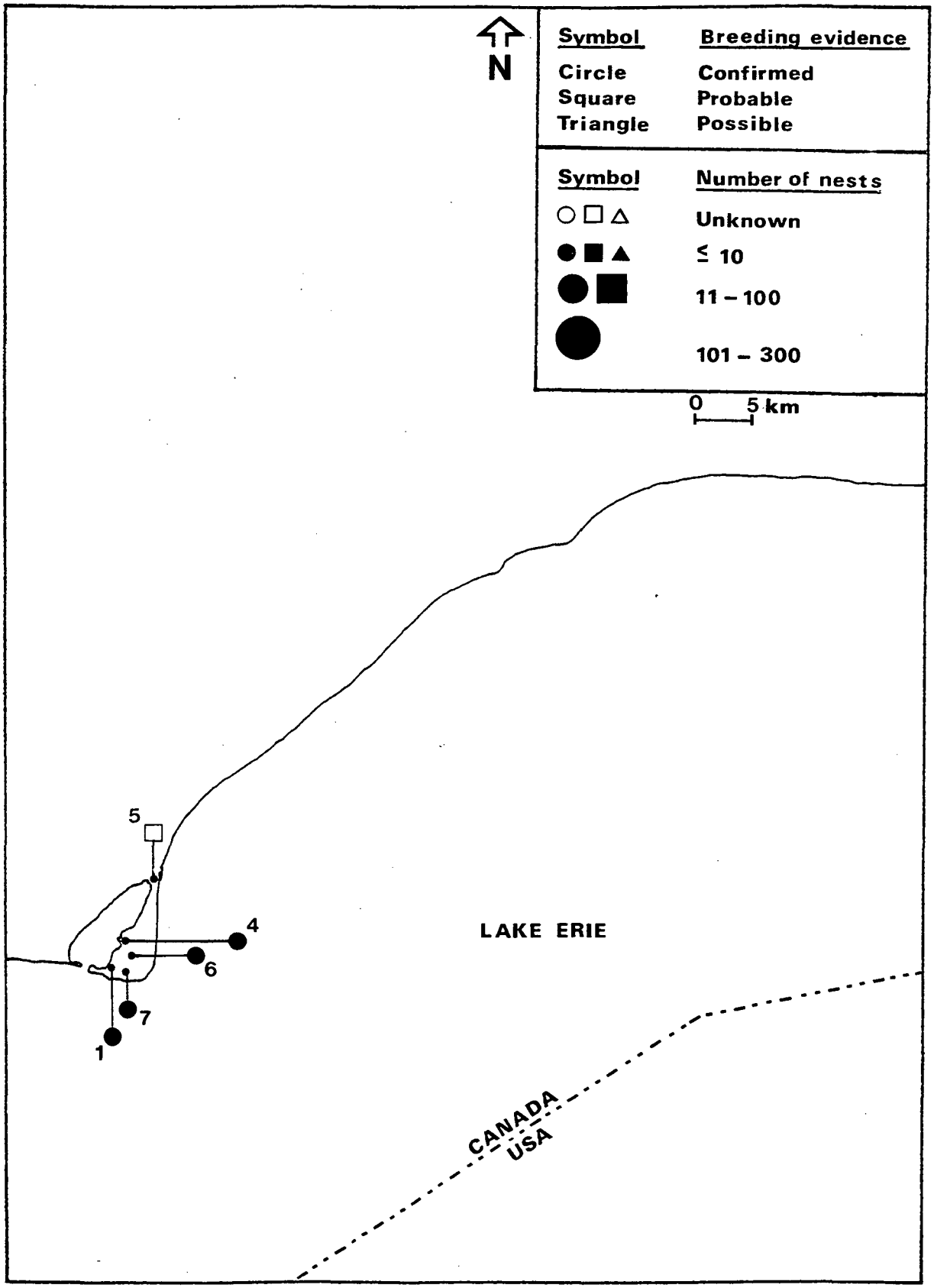
Appendix 8

MAP 40 G - EAST, TOLEDO, 1:250,000



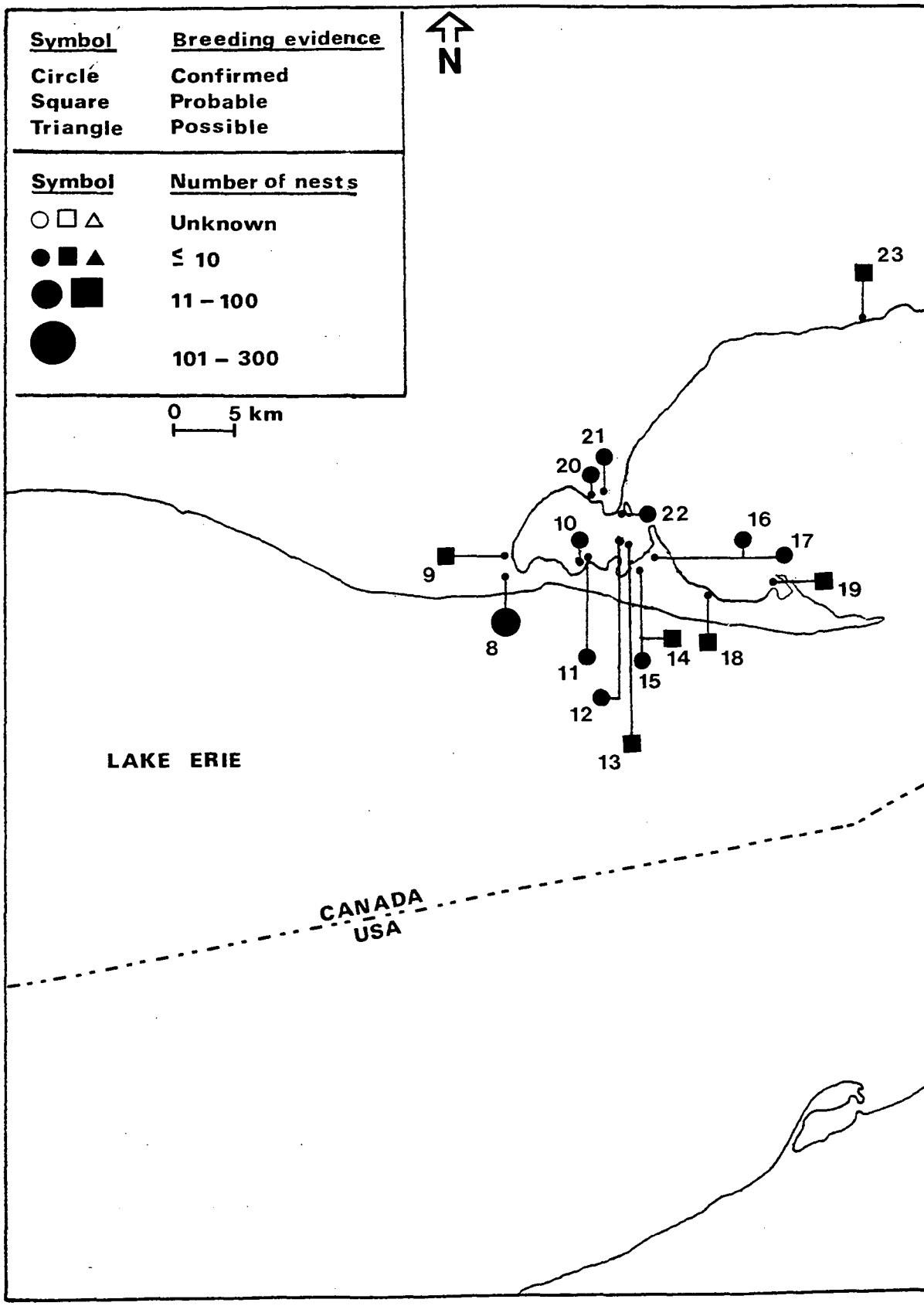

POINT PELEE NATIONAL PARK
9
12
13
10
11
LAKE ERIE
Section from 1:50,000 map 40G/15
PELEE ISLAND
0
1 km

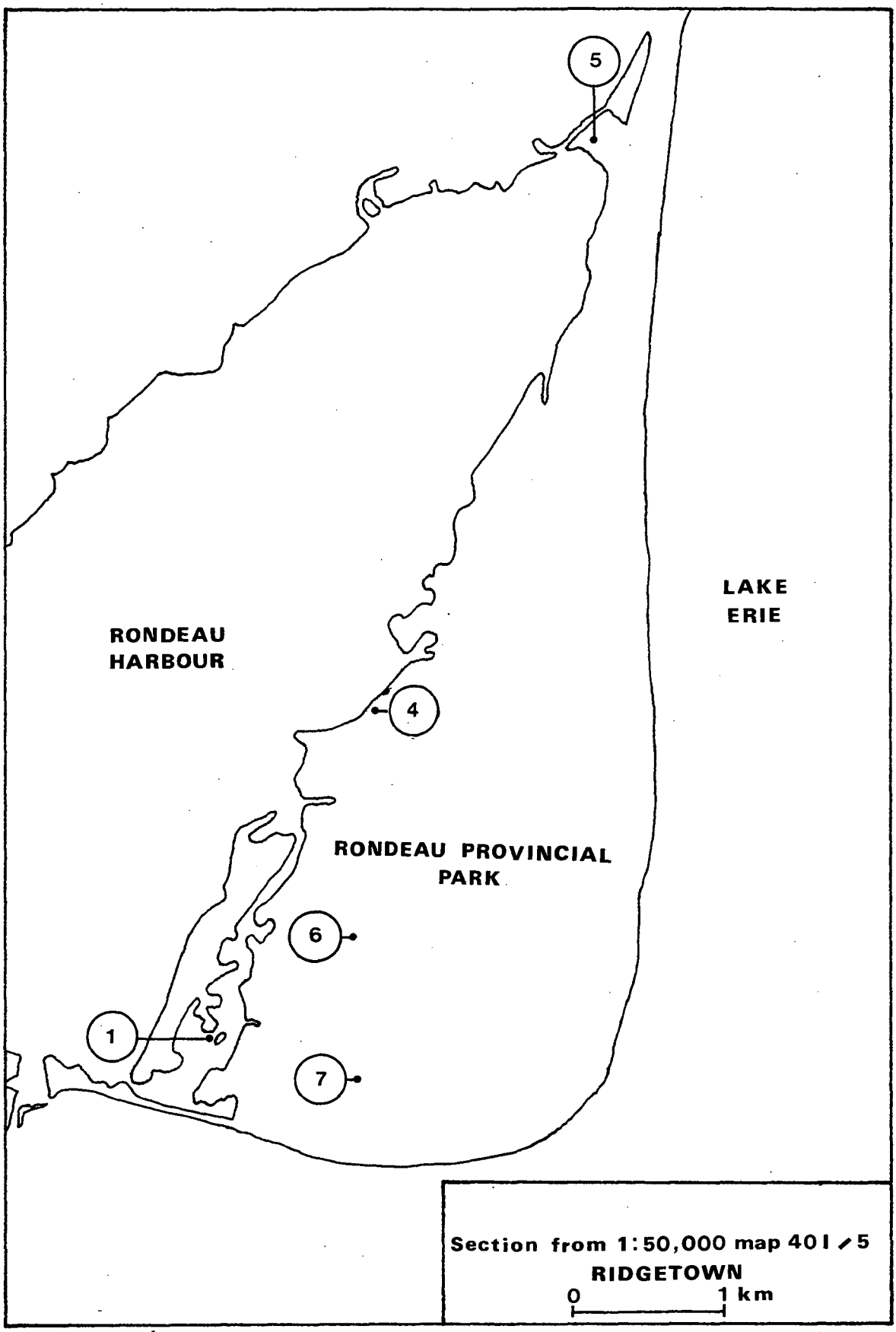
MAP 40 I - WEST, ERIE, 1:250,000

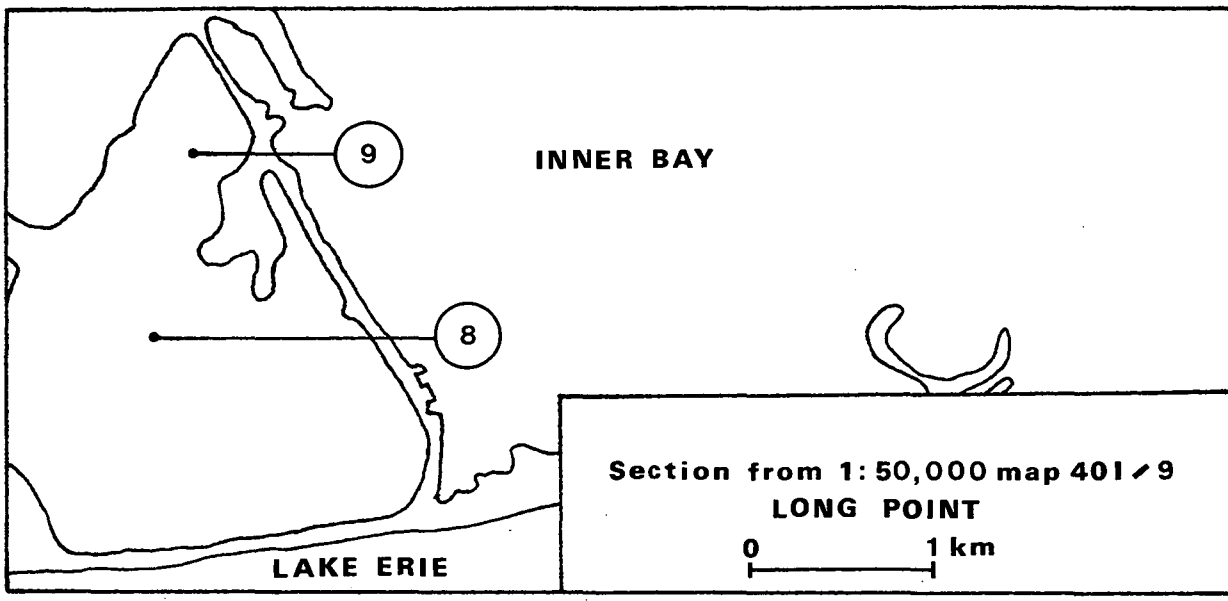


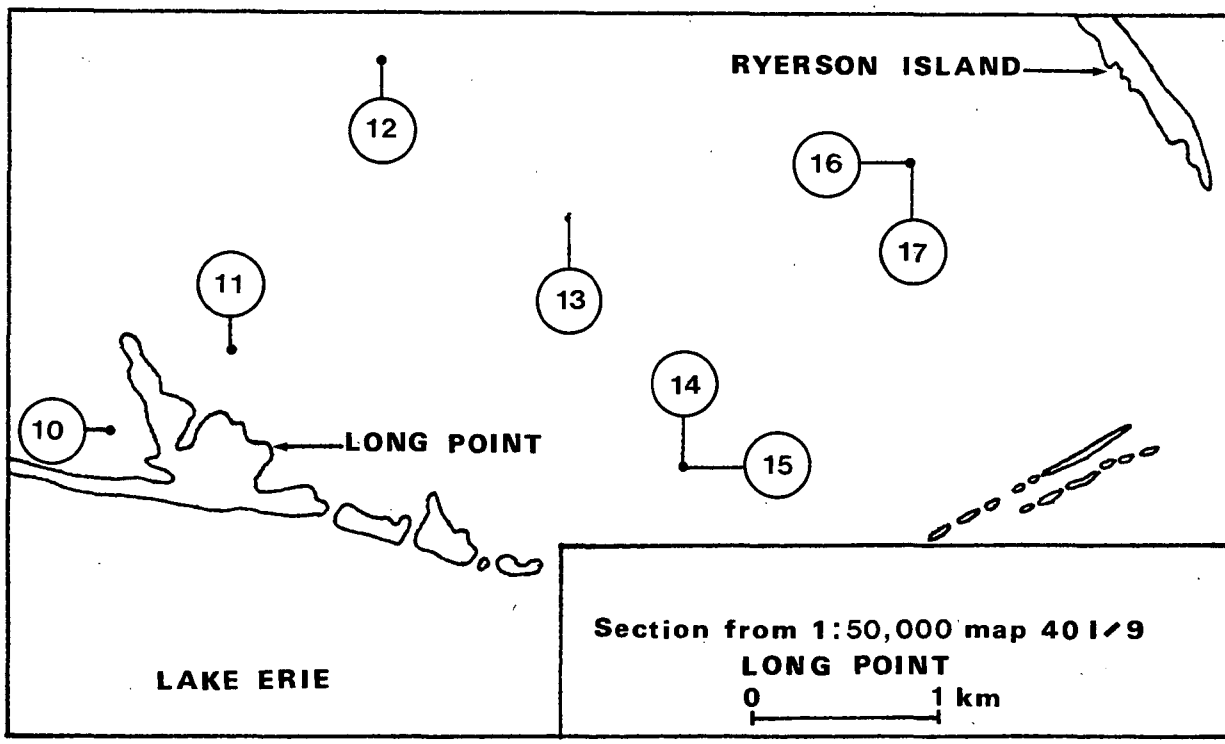
MAP 40 I - EAST, ERIE, 1:250,000

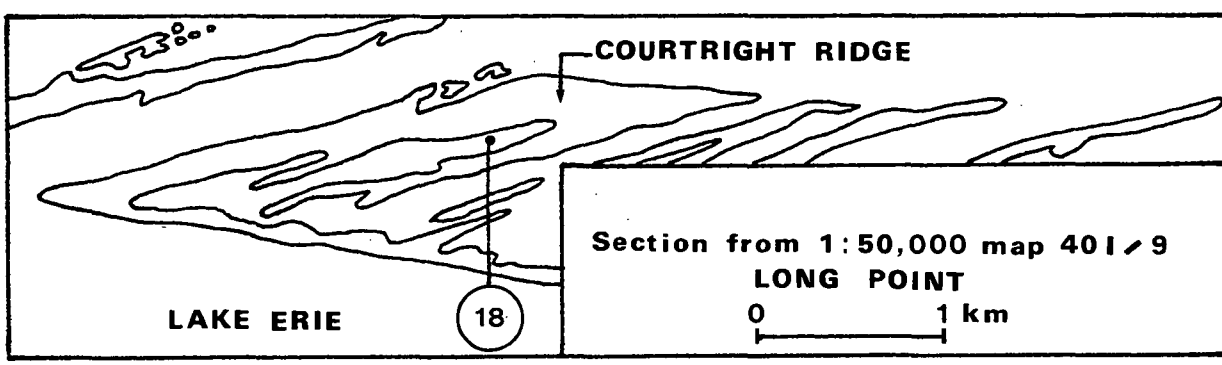
App. 9 (cont'd)

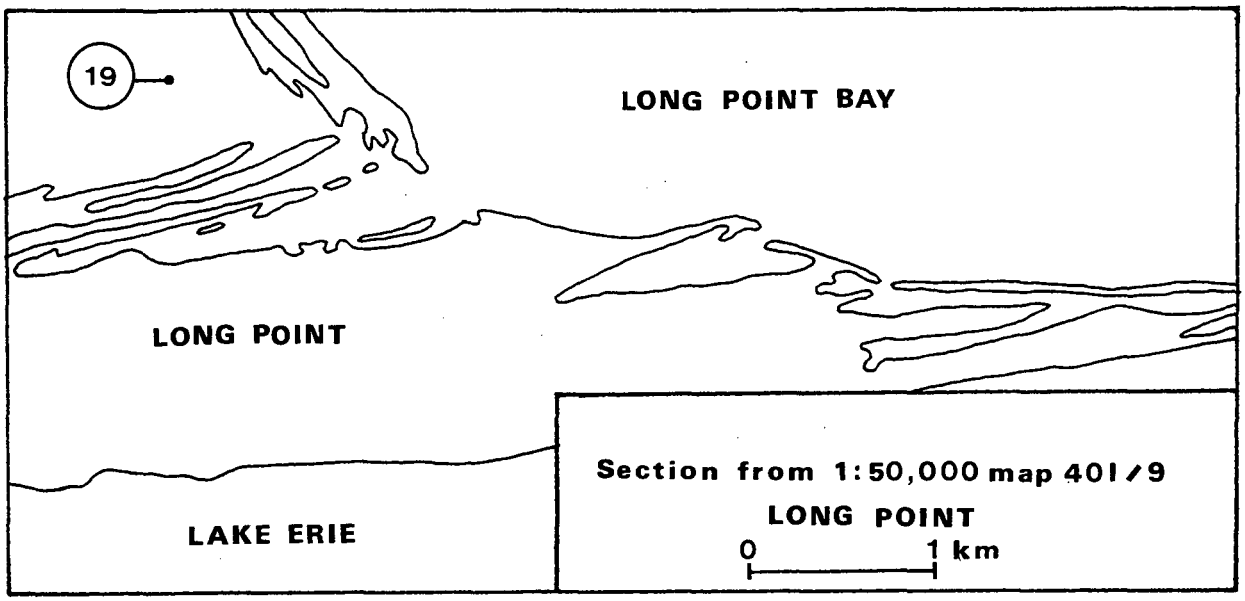


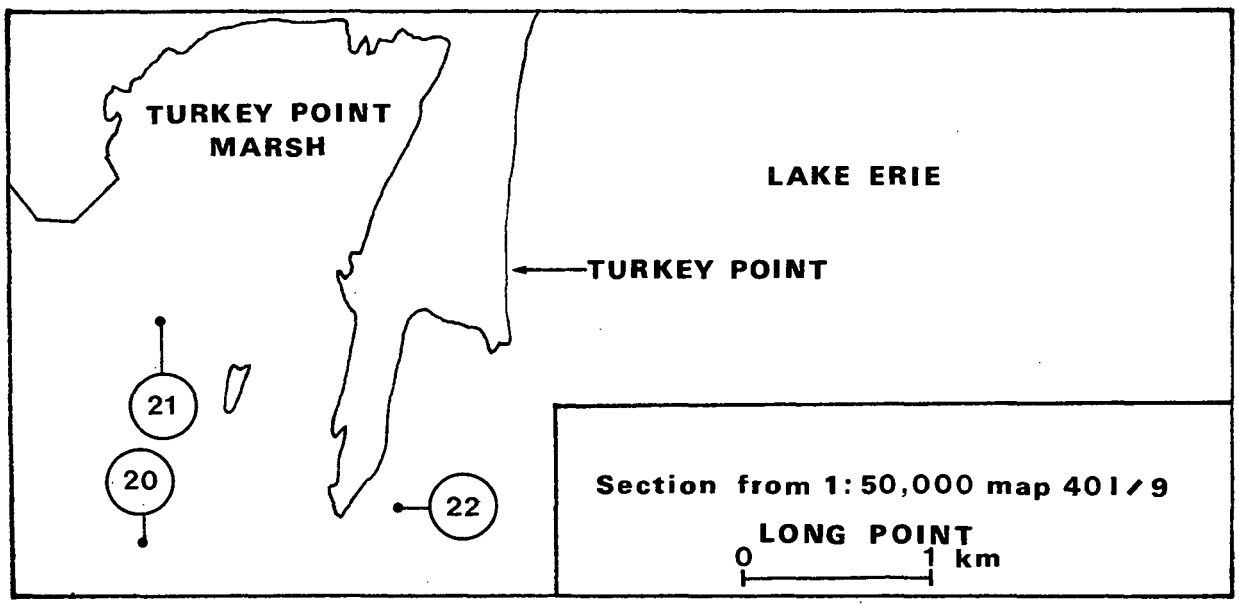

5
LAKE
ERIE
RONDEAU
HARBOUR
4
RONDEAU PROVINCIAL
PARK
6
1
7
Section from 1:50,000 map 40I/5
RIDGETOWN
0
1 km

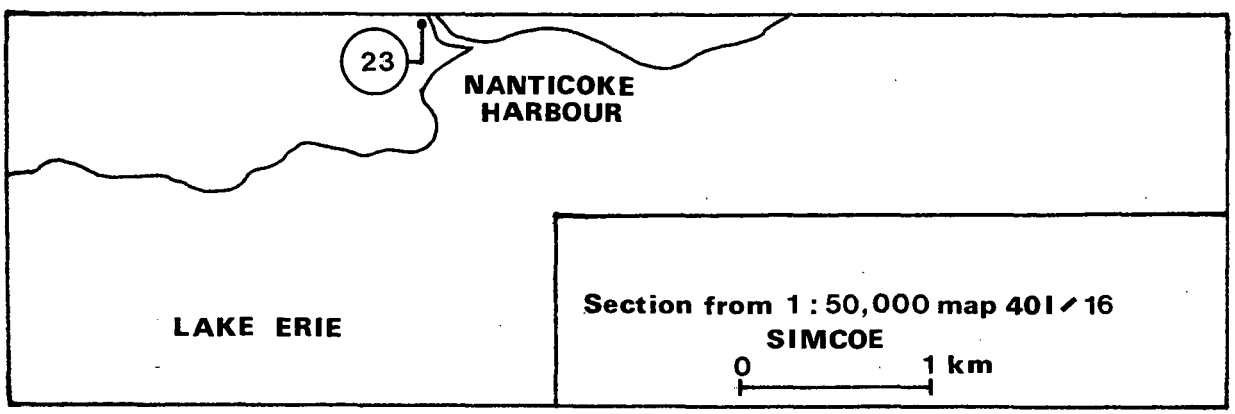

9
INNER BAY
8
LAKE ERIE
Section from 1:50,000 map 40I/9
LONG POINT
0
1 km


RYERSON ISLAND
12
16
17
11
13
14
10
LONG POINT
15
LAKE ERIE
Section from 1:50,000 map 40I/9
LONG POINT
0
1 km

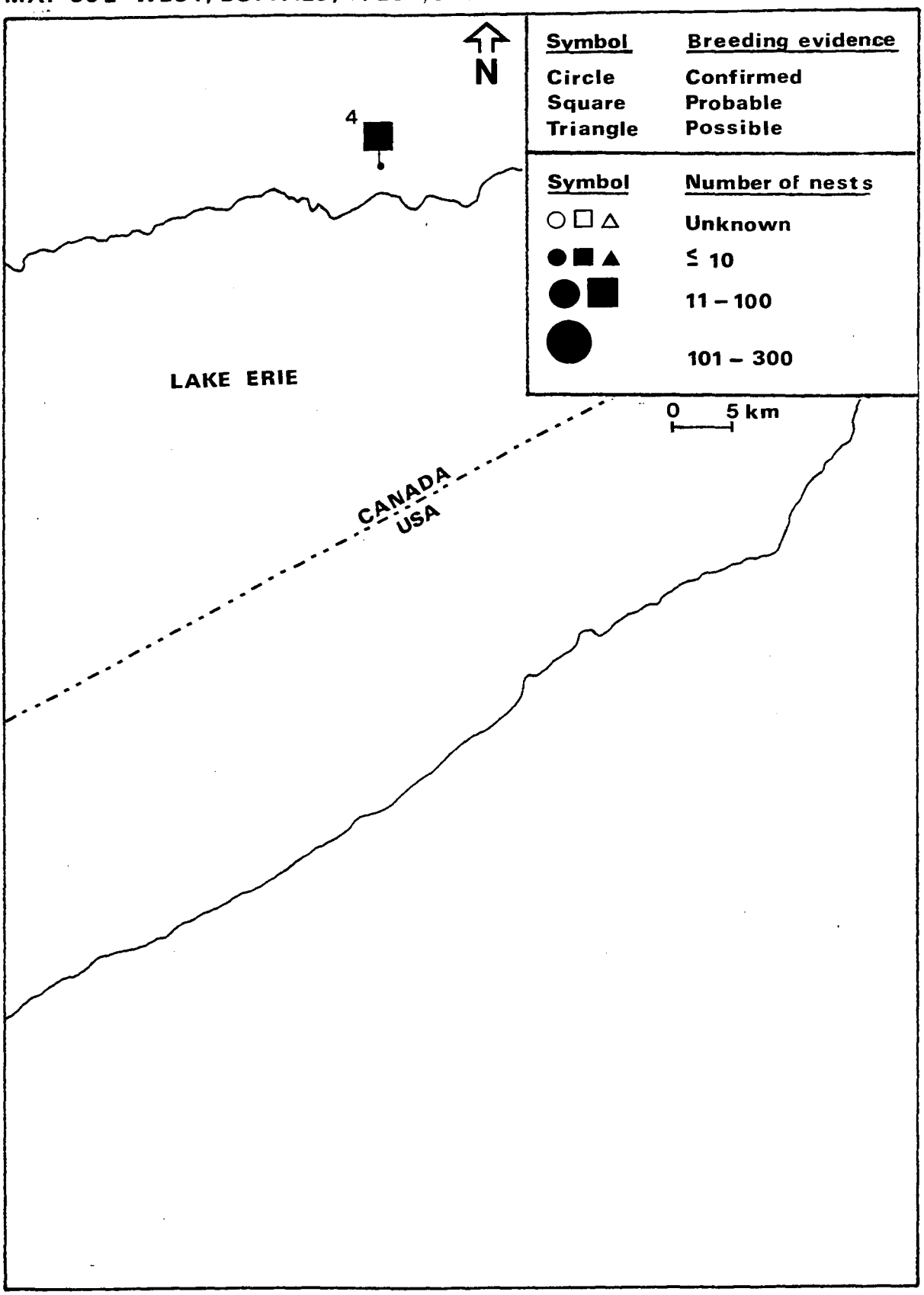

COURTRIGHT RIDGE
LAKE ERIE
18
Section from 1:50,000 map 40I/9
LONG POINT
0
1 km

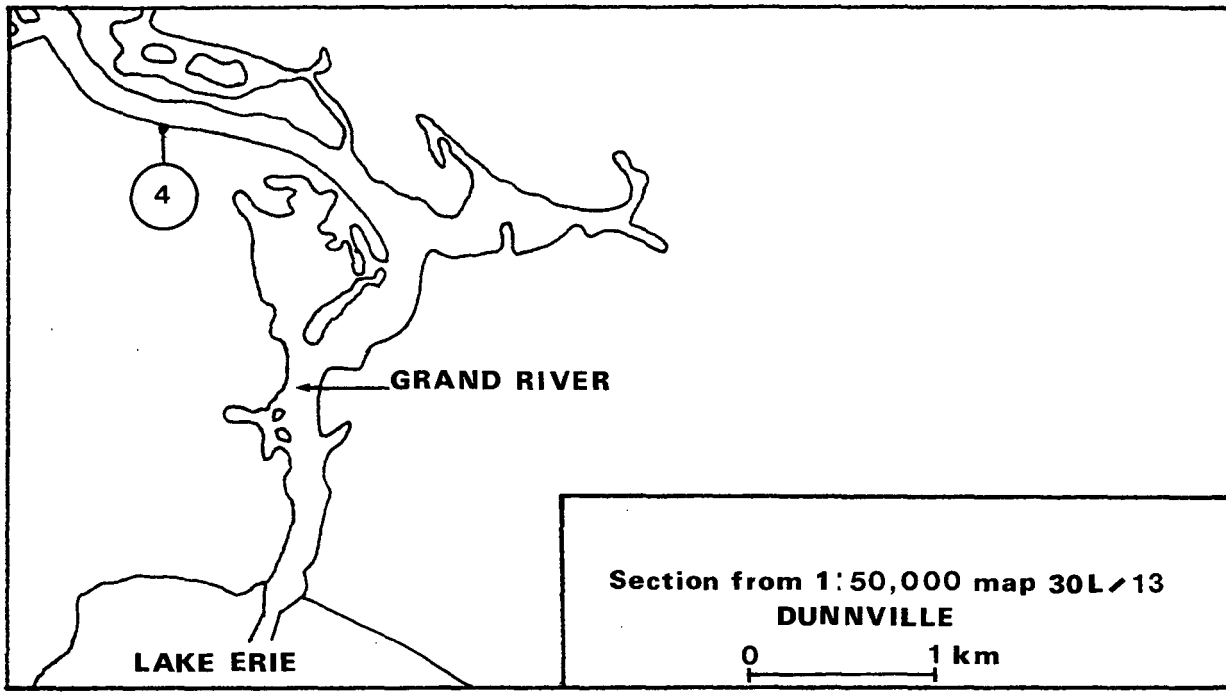

19
LONG POINT BAY
LONG POINT
LAKE ERIE
Section from 1:50,000 map 401/9
LONG POINT
0
1 km


TURKEY POINT
MARSH
LAKE ERIE
TURKEY POINT
21
20
22
Section from 1:50,000 map 401/9
LONG POINT
0
1 km

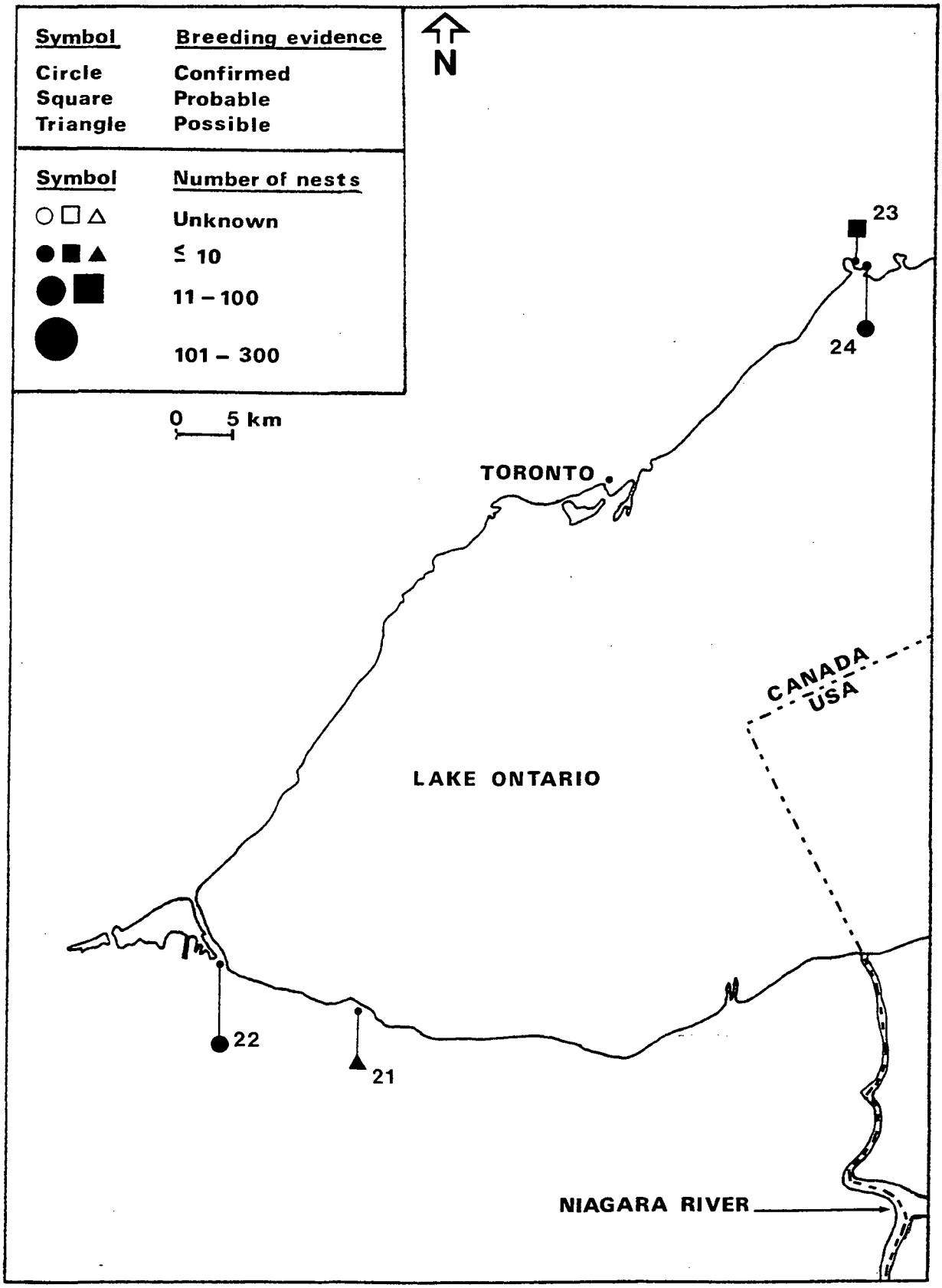

23
NANTICOKE
HARBOUR
LAKE ERIE
Section from 1:50,000 map 401/16
SIMCOE
0
1 km

MAP 30L-WEST, BUFFALO, 1:250,000



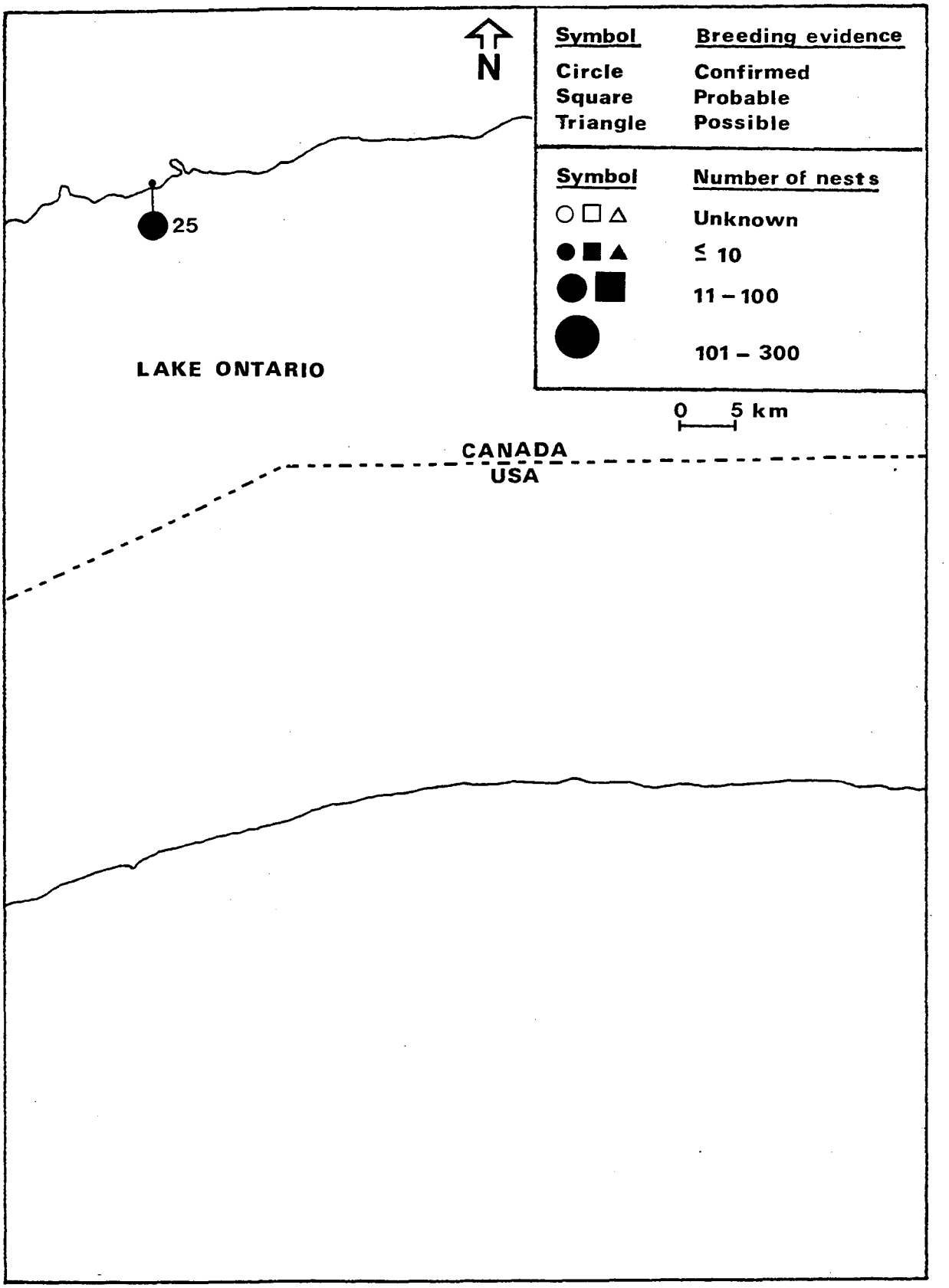

4
GRAND RIVER
LAKE ERIE
Section from 1:50,000 map 30L/13
DUNNVILLE
0
1 km

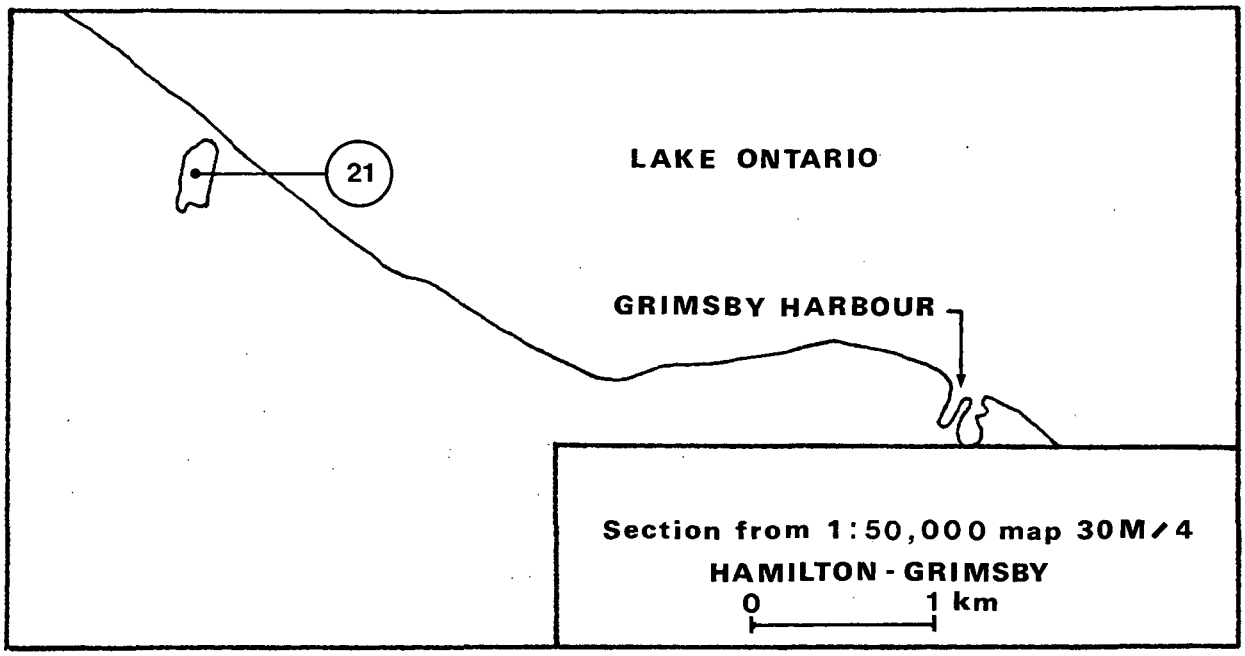
MAP 30M - WEST, TORONTO, 1 : 250,000

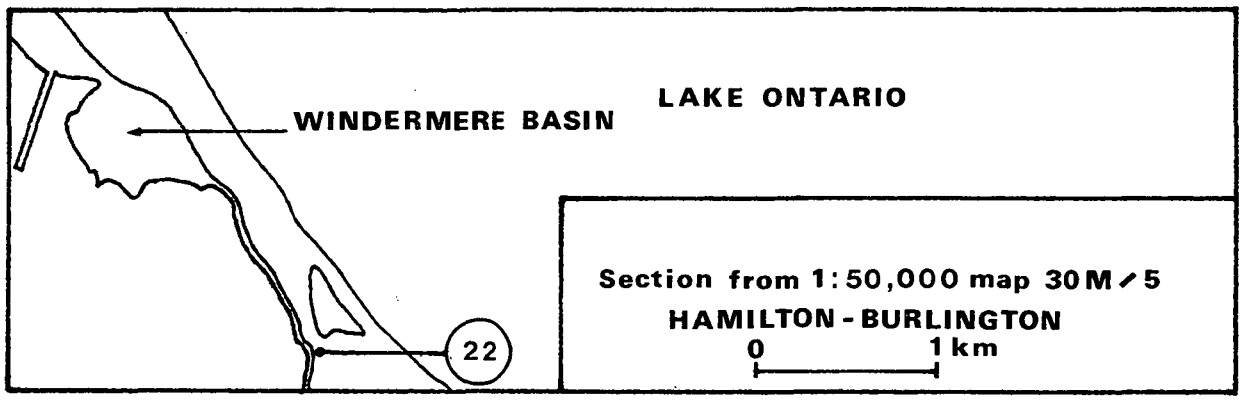


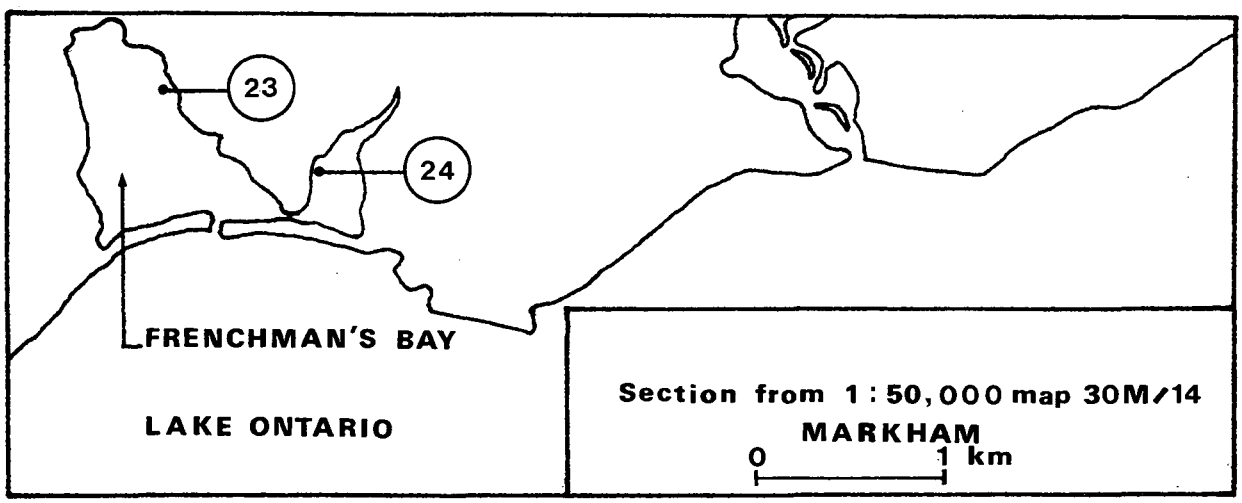
App. 11 (cont'd)

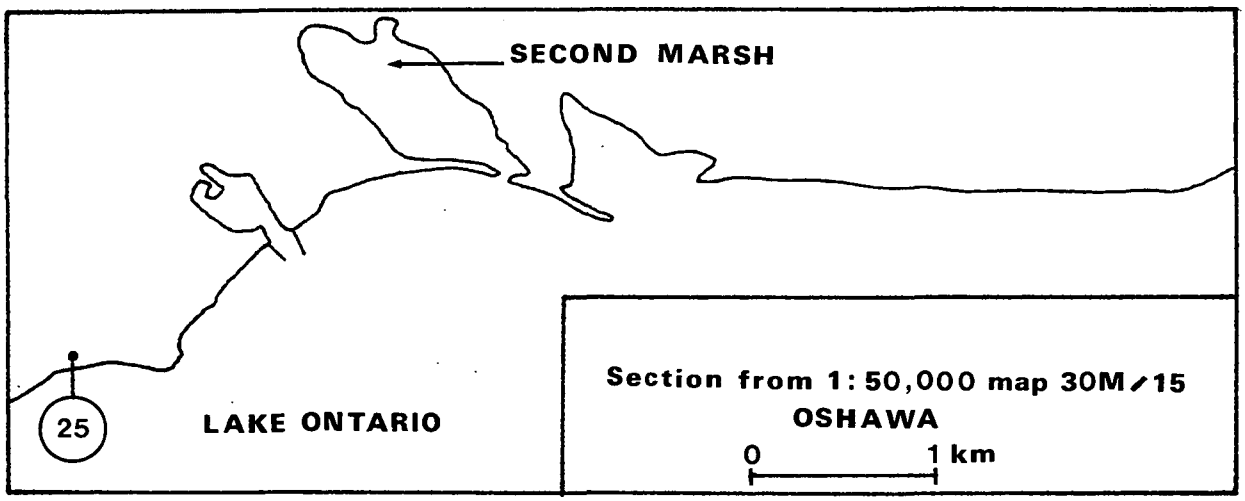
MAP 30M - EAST, TORONTO, 1:250,000



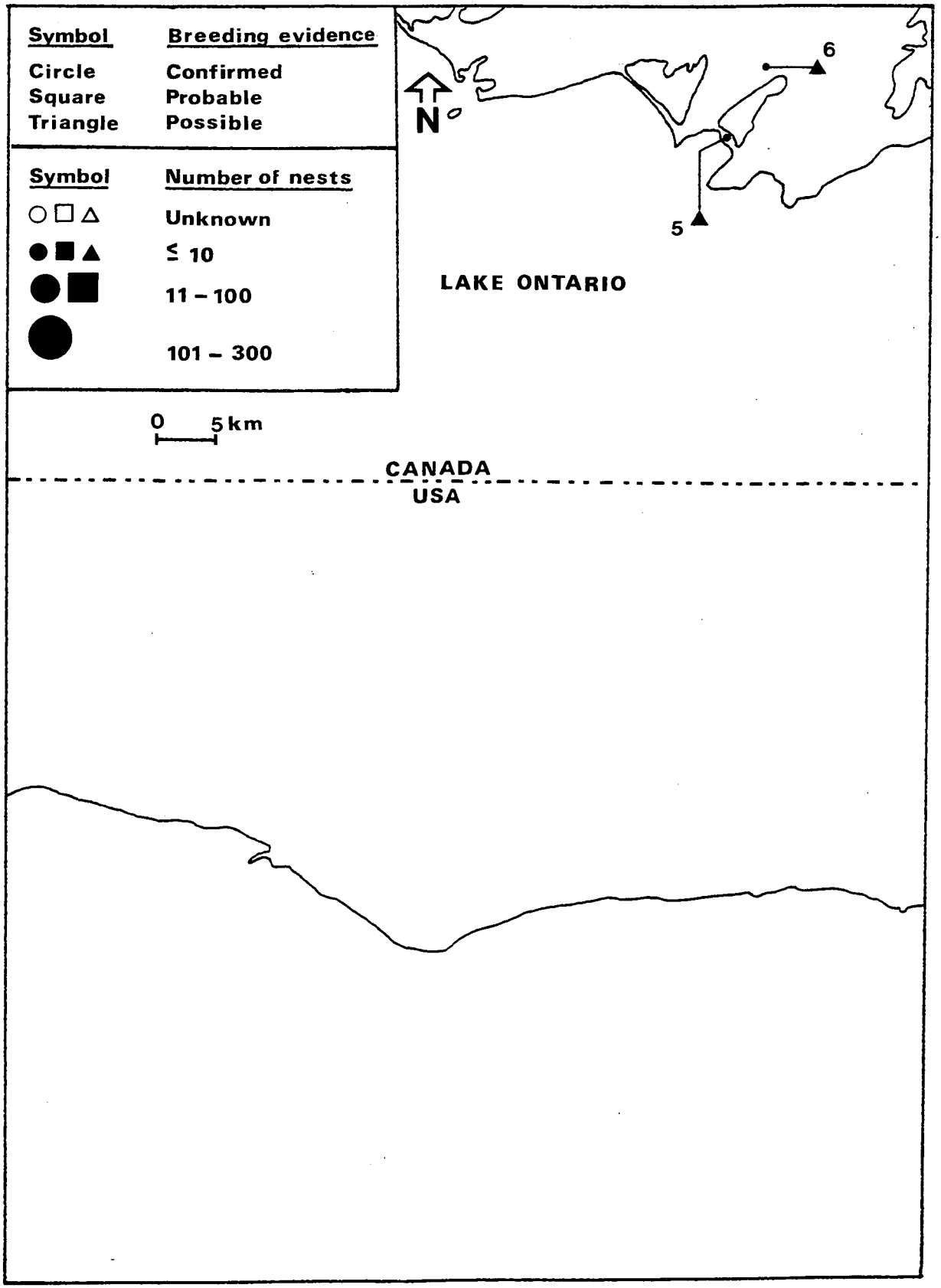

21
LAKE ONTARIO
GRIMSBY HARBOUR
Section from 1:50,000 map 30M/4
HAMILTON - GRIMSBY
0
1 km


WINDERMERE BASIN
LAKE ONTARIO
22
Section from 1:50,000 map 30M/5
HAMILTON - BURLINGTON
0
1 km


23
24
FRENCHMAN'S BAY
LAKE ONTARIO
Section from 1:50,000 map 30M/14
MARKHAM
0
1 km

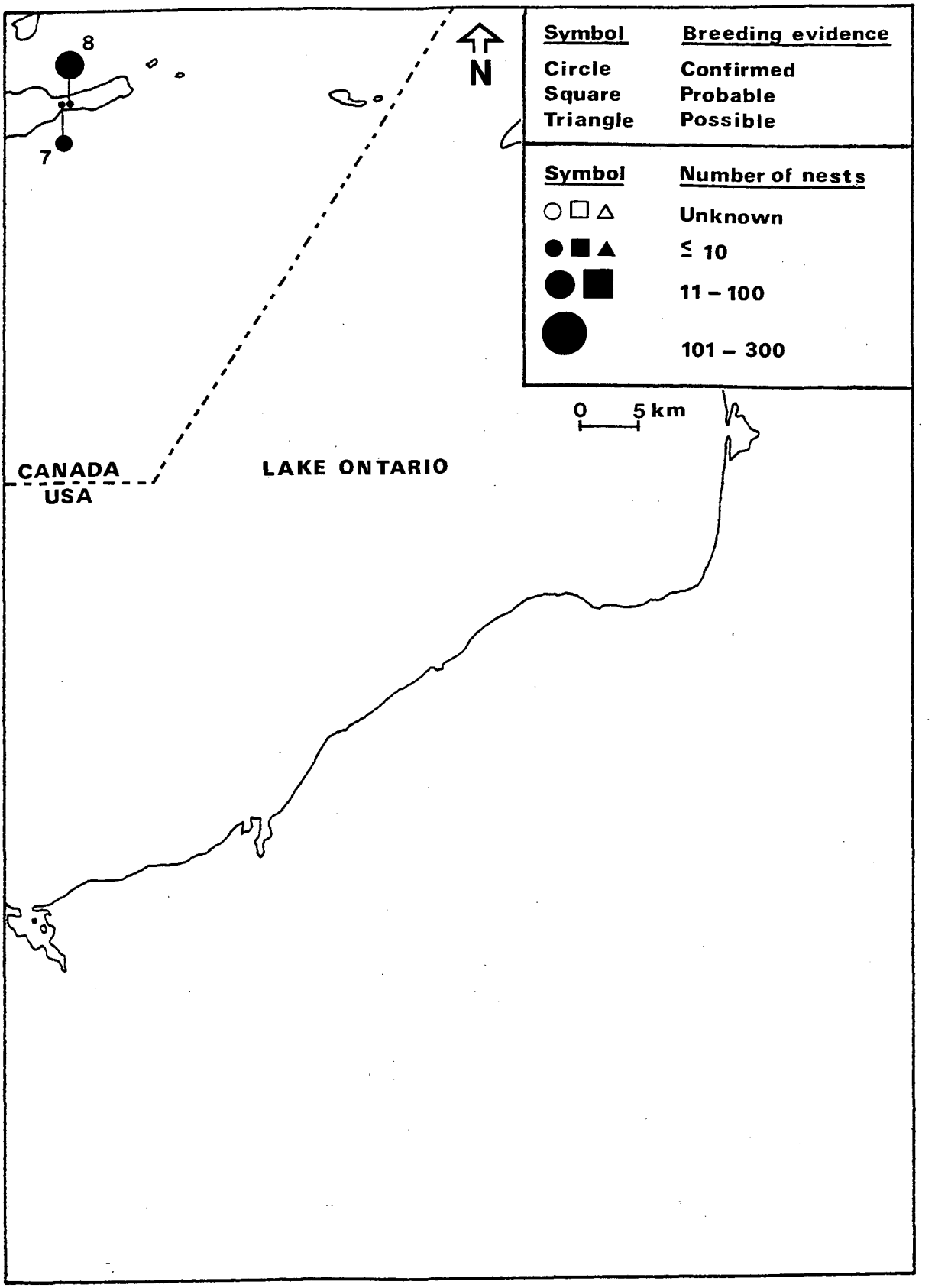

SECOND MARSH
25
LAKE ONTARIO
Section from 1: 50,000 map 30M/15
OSHAWA
0
1 km

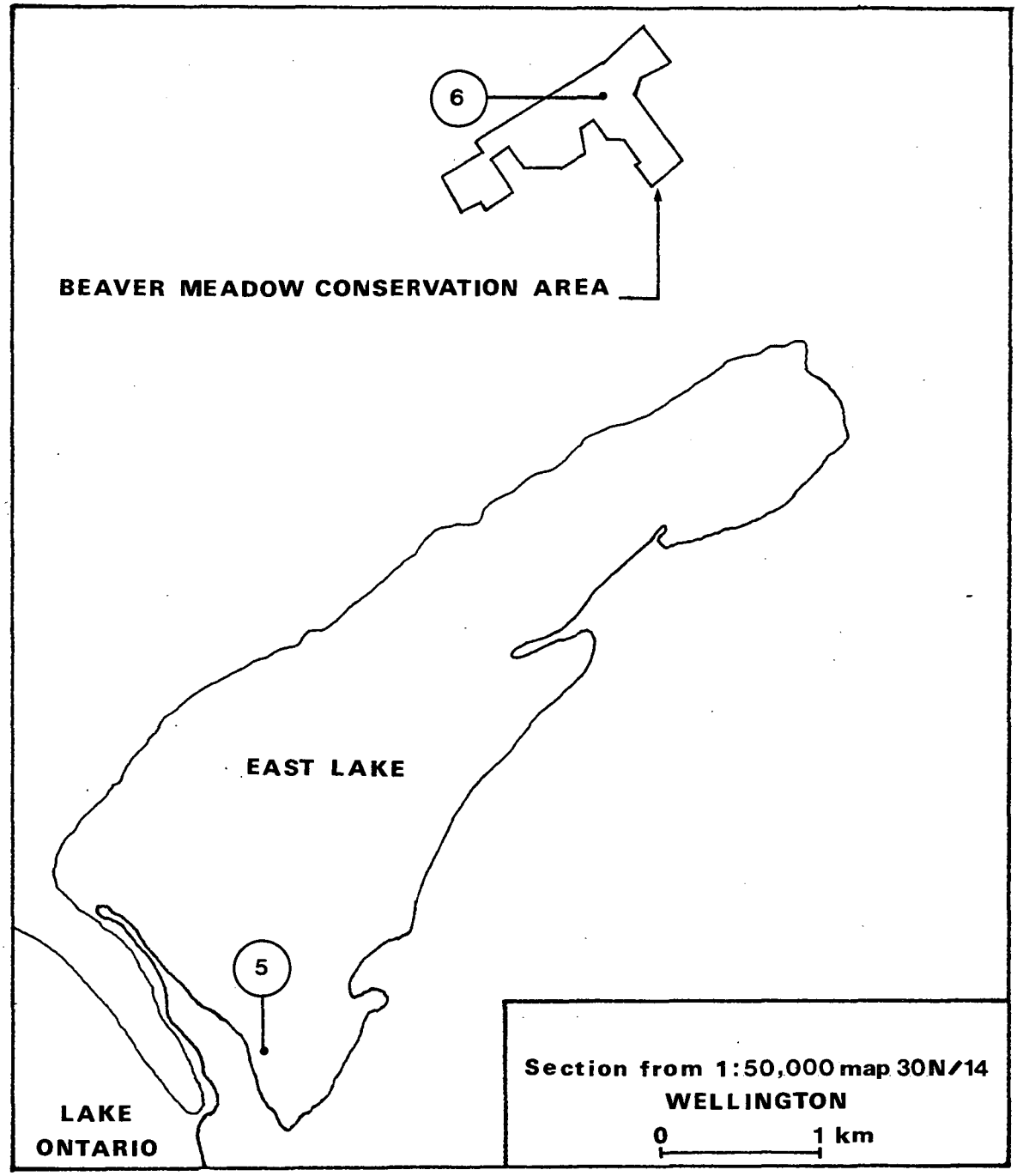
MAP 30 N-WEST, ROCHESTER, 1:250,000

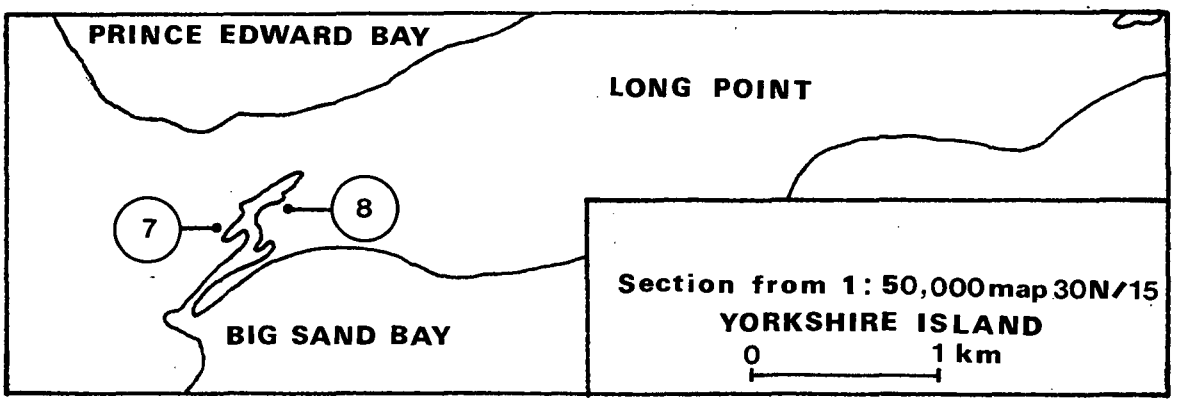


App. 12 (cont'd)

MAP 30N - EAST, ROCHESTER, 1 : 250,000

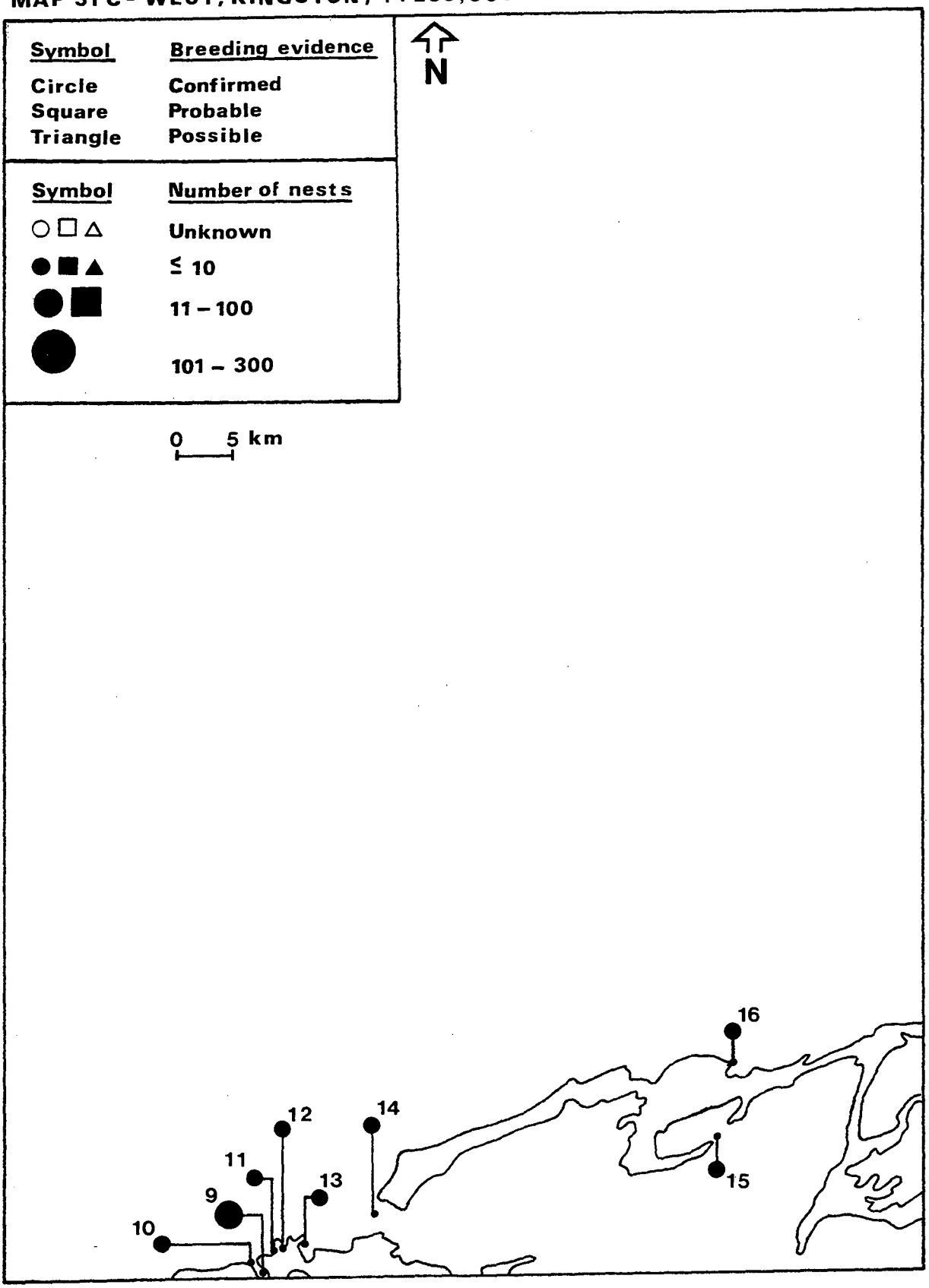



6
BEAVER MEADOW CONSERVATION AREA
EAST LAKE
5
LAKE
ONTARIO
Section from 1:50,000 map 30N/14
WELLINGTON
0
1 km


PRINCE EDWARD BAY
LONG POINT
7
8
BIG SAND BAY
Section from 1: 50,000 map 30N/15
YORKSHIRE ISLAND
0
1 km

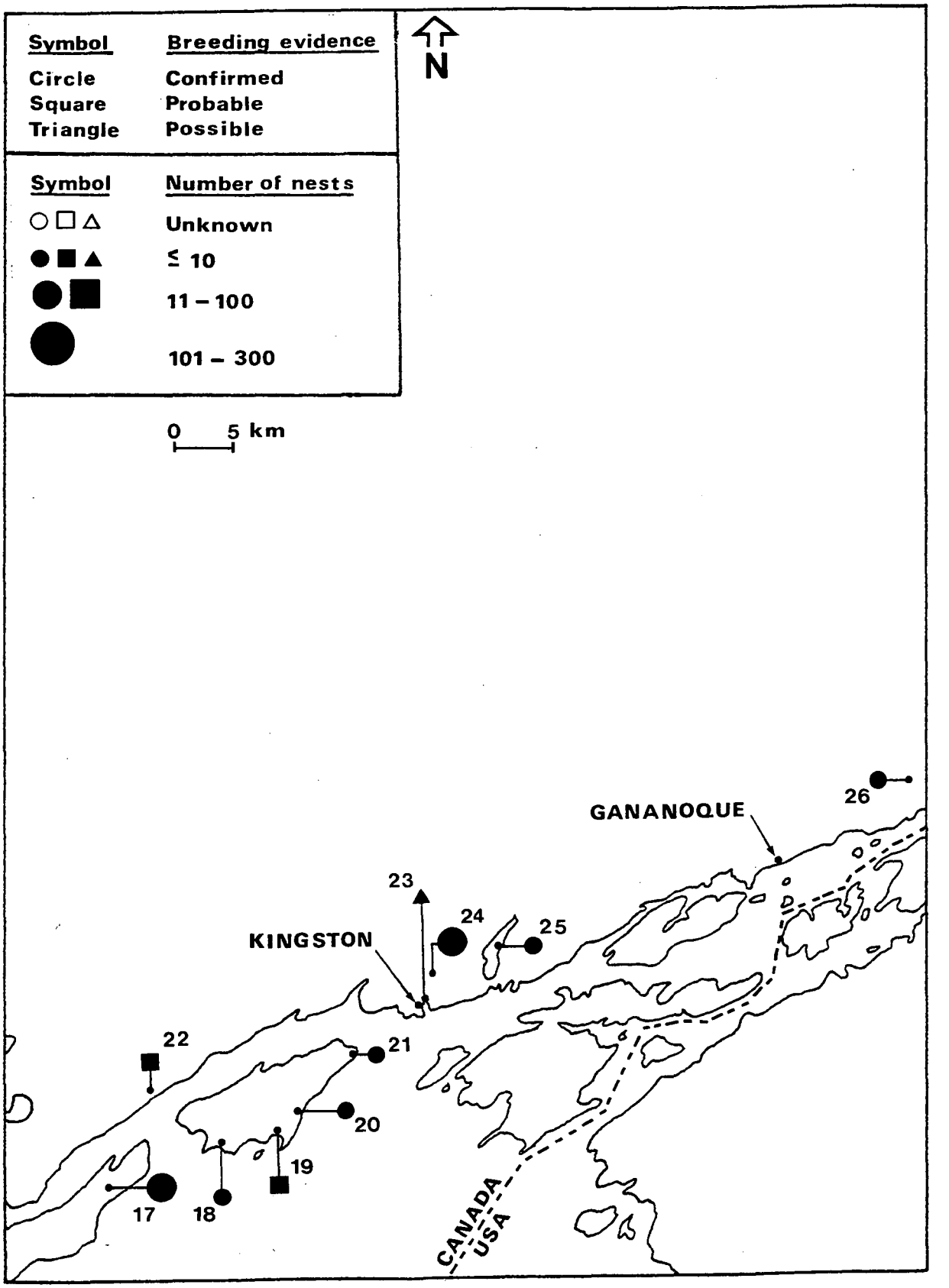
Appendix 13

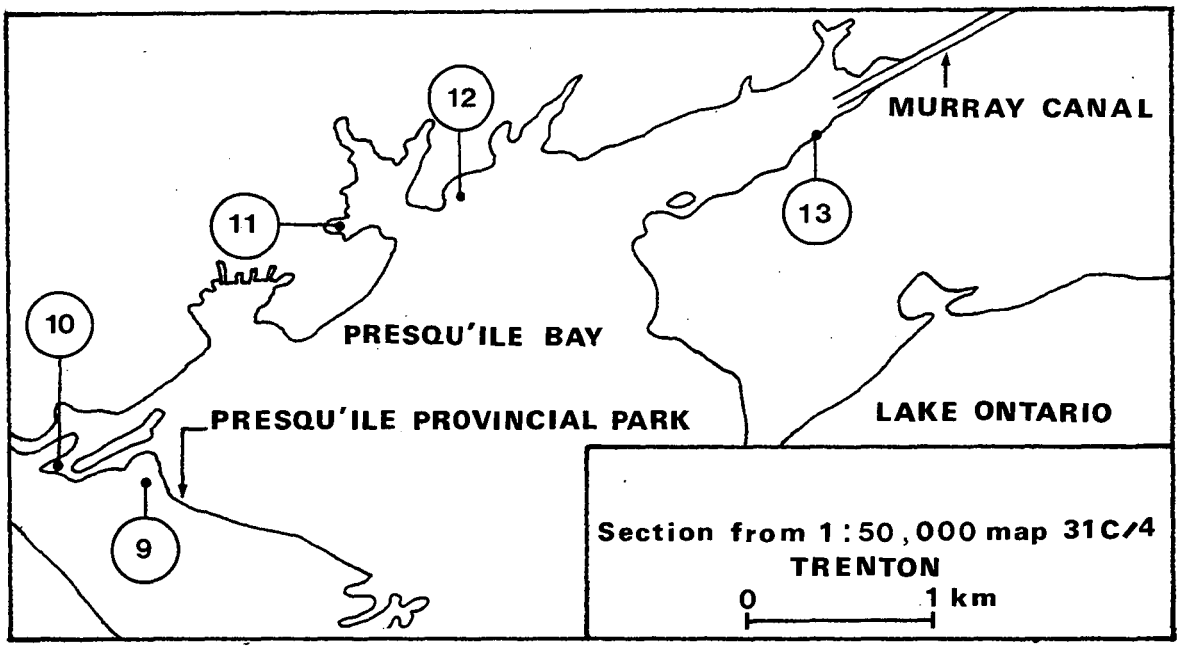
MAP 31 C - WEST, KINGSTON, 1 : 250,000

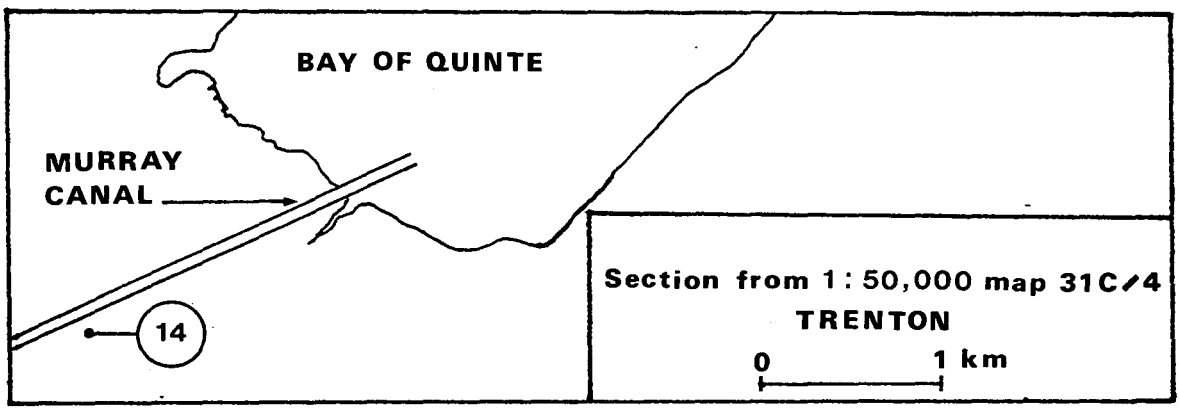


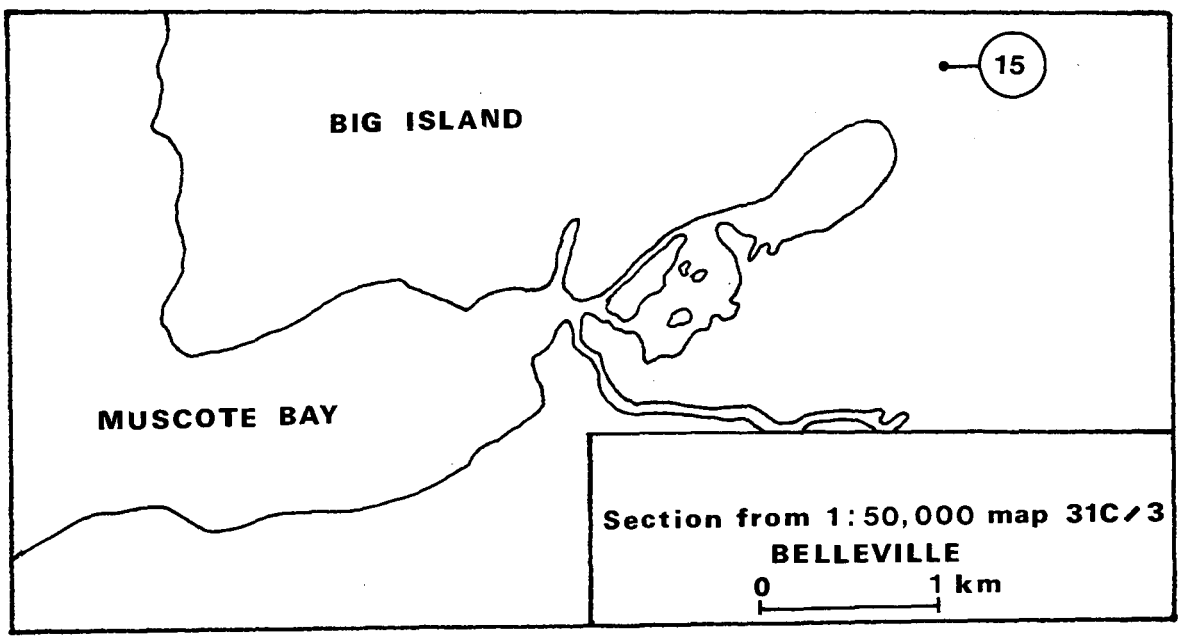
App. 13 (cont'd)

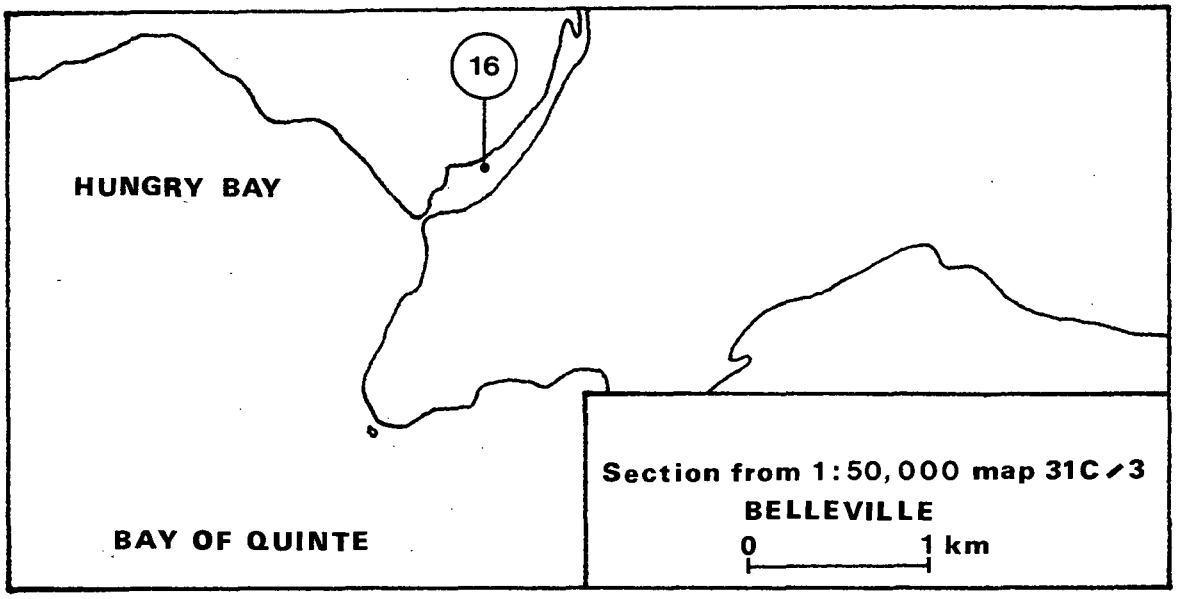
MAP 31C - EAST, KINGSTON, 1:250,000

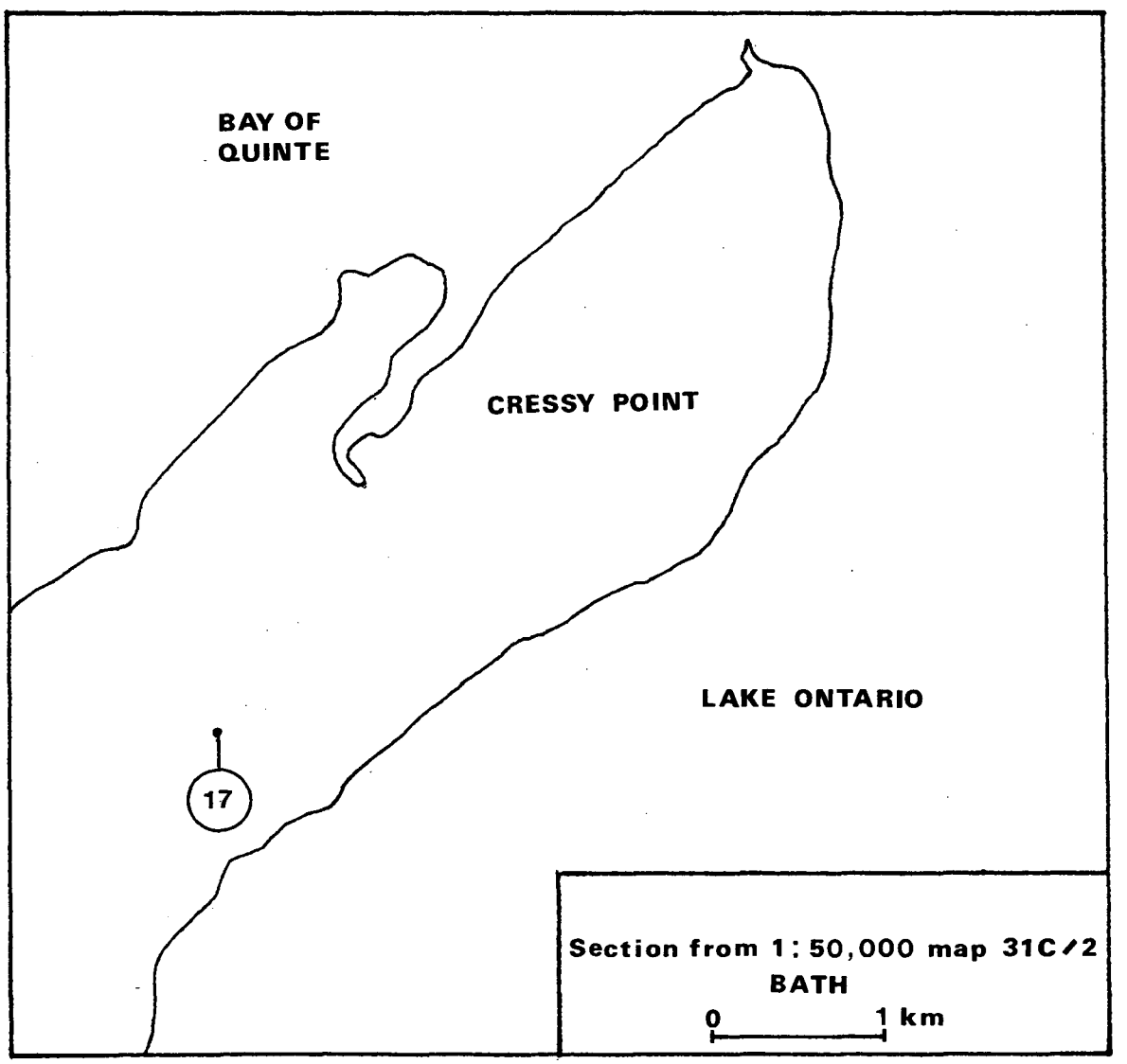


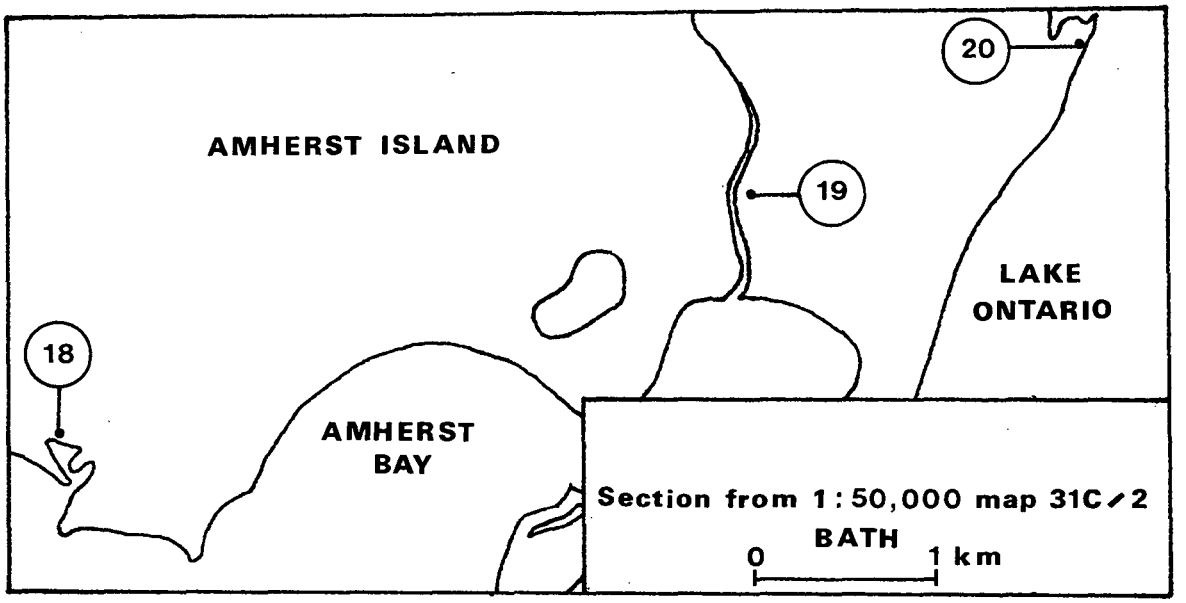

12
MURRAY CANAL
11
13
10
PRESQU'ILE BAY
PRESQU'ILE PROVINCIAL PARK
LAKE ONTARIO
9
Section from 1:50,000 map 31C/4
TRENTON
0
1 km

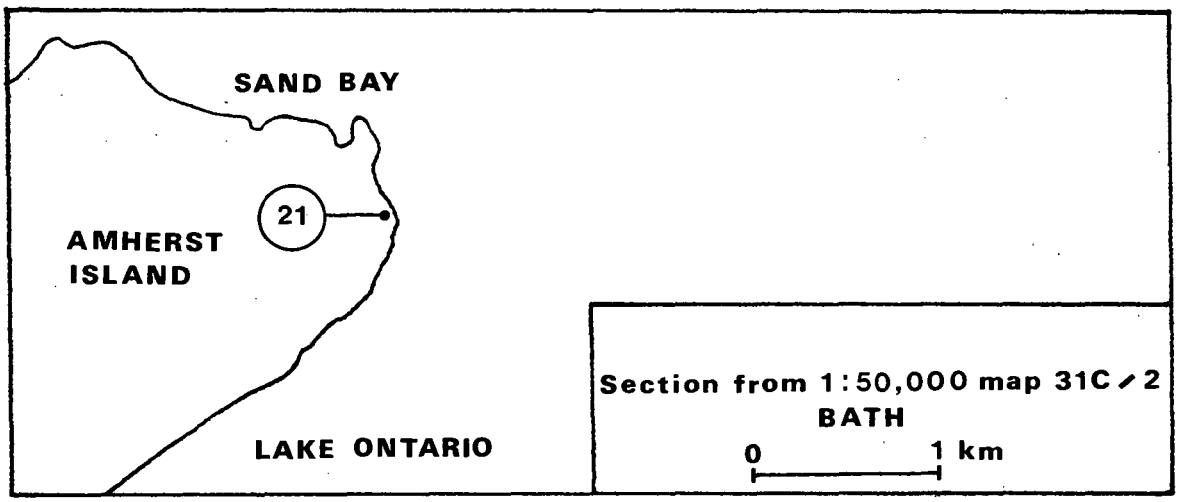

BAY OF QUINTE
MURRAY
CANAL
14
Section from 1:50,000 map 31C/4
TRENTON
0
1 km

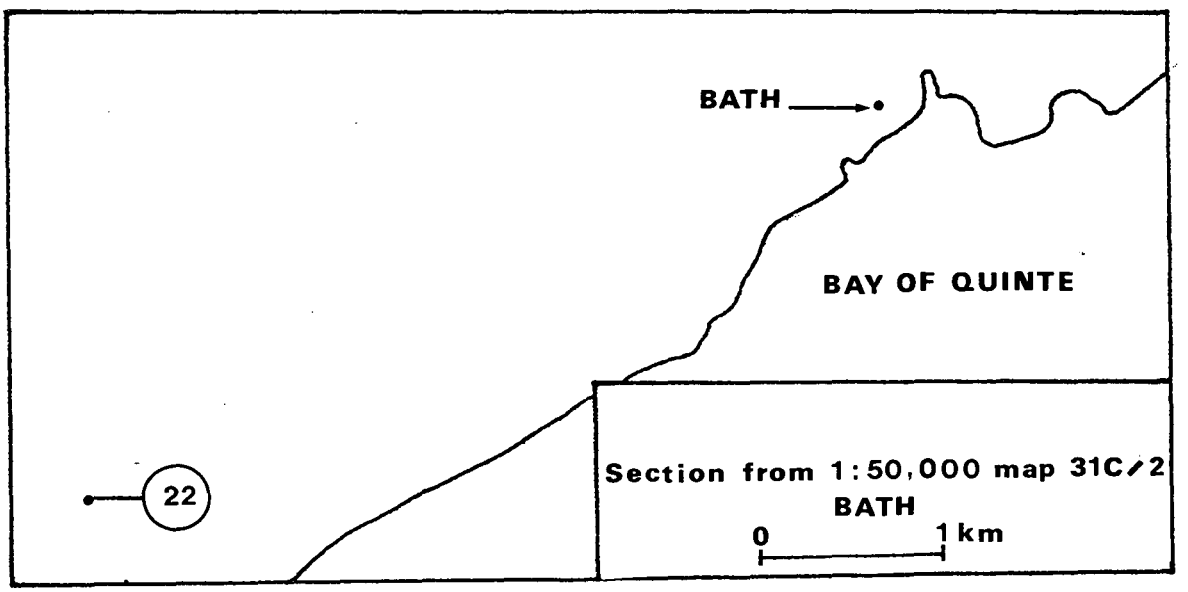

15
BIG ISLAND
MUSCOTE BAY
Section from 1:50,000 map 31C/3
BELLEVILLE
0
1 km

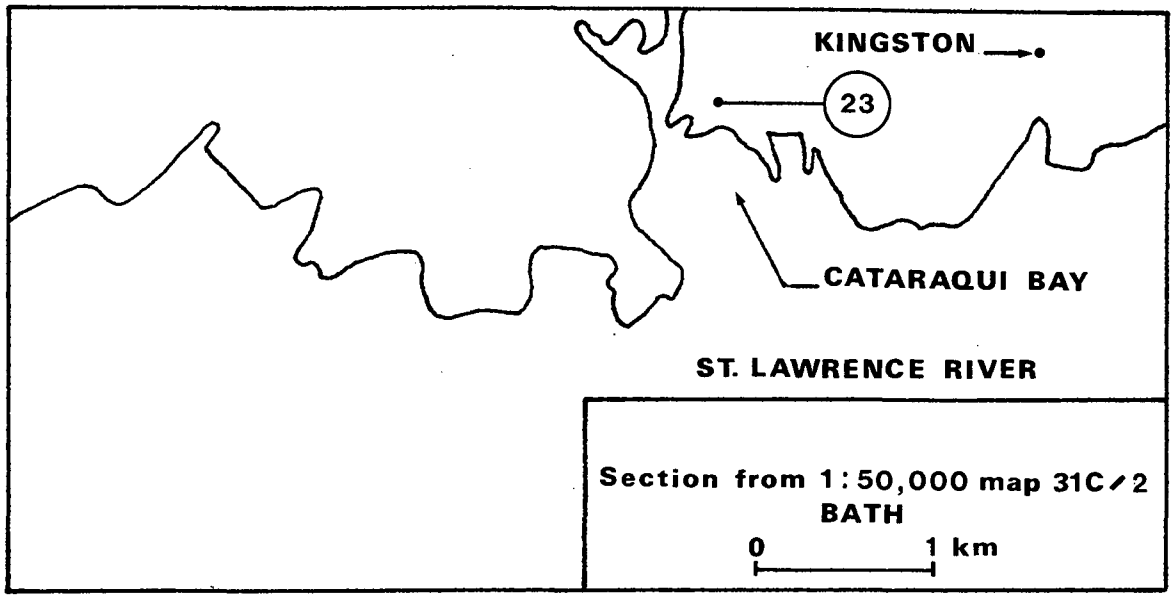

16
HUNGRY BAY
BAY OF QUINTE
Section from 1:50,000 map 31C/3
BELLEVILLE
0
1 km

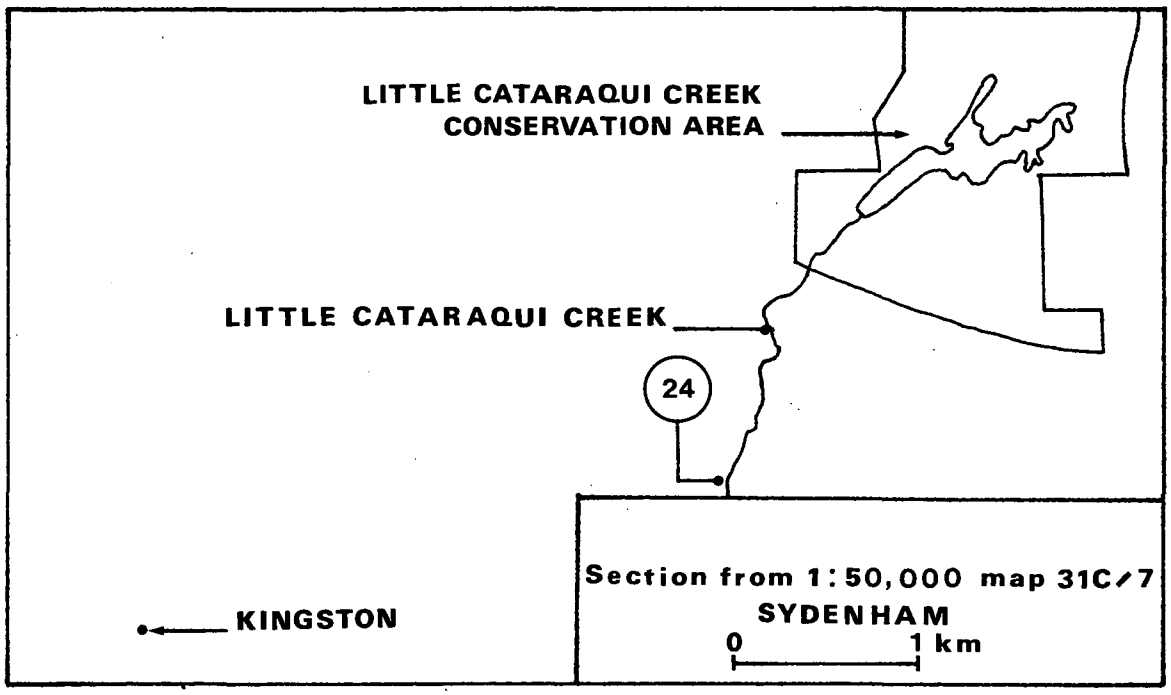

BAY OF QUINTE
CRESSY POINT
LAKE ONTARIO
17
Section from 1:50,000 map 31C/2
BATH
0
1 km

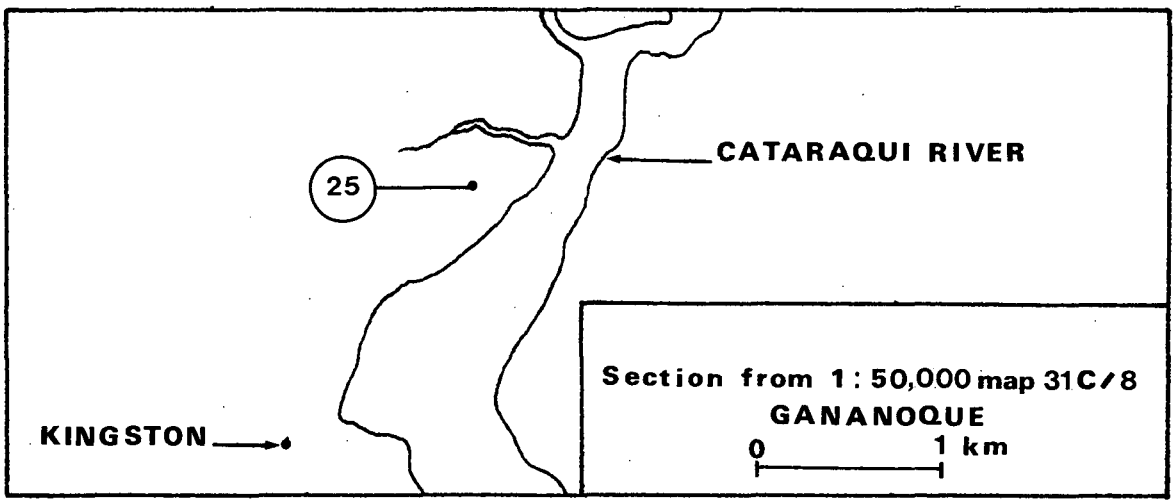

AMHERST ISLAND
20
19
LAKE ONTARIO
18
AMHERST BAY
Section from 1:50,000 map 31C/2
BATH
0
1 km

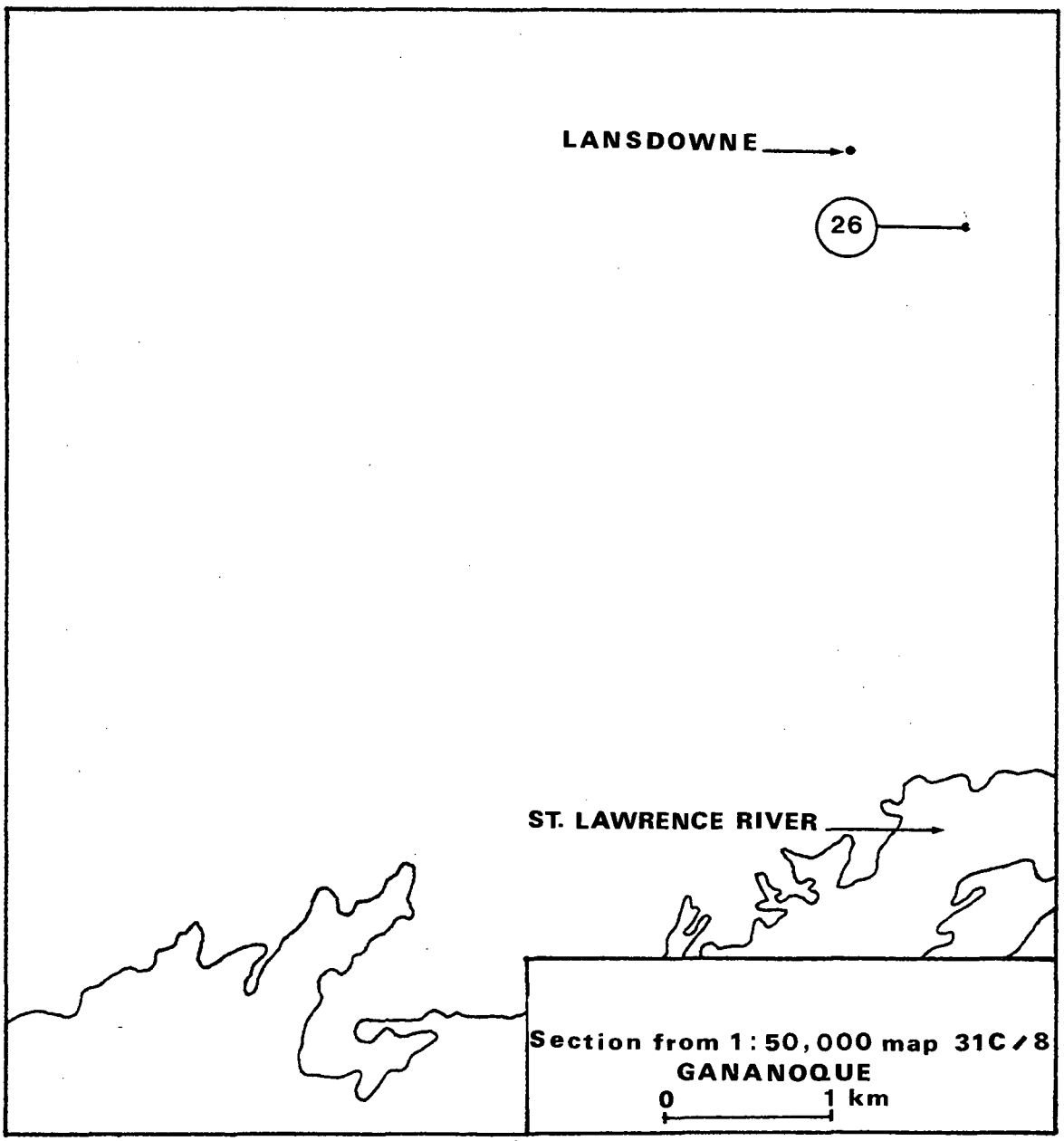

SAND BAY
21
AMHERST ISLAND
LAKE ONTARIO
Section from 1:50,000 map 31C/2
BATH
0
1 km


BATH
BAY OF QUINTE
22
Section from 1:50,000 map 31C/2
BATH
0
1 km


KINGSTON
23
CATARAQUI BAY
ST. LAWRENCE RIVER
Section from 1:50,000 map 31C/2
BATH
0
1 km

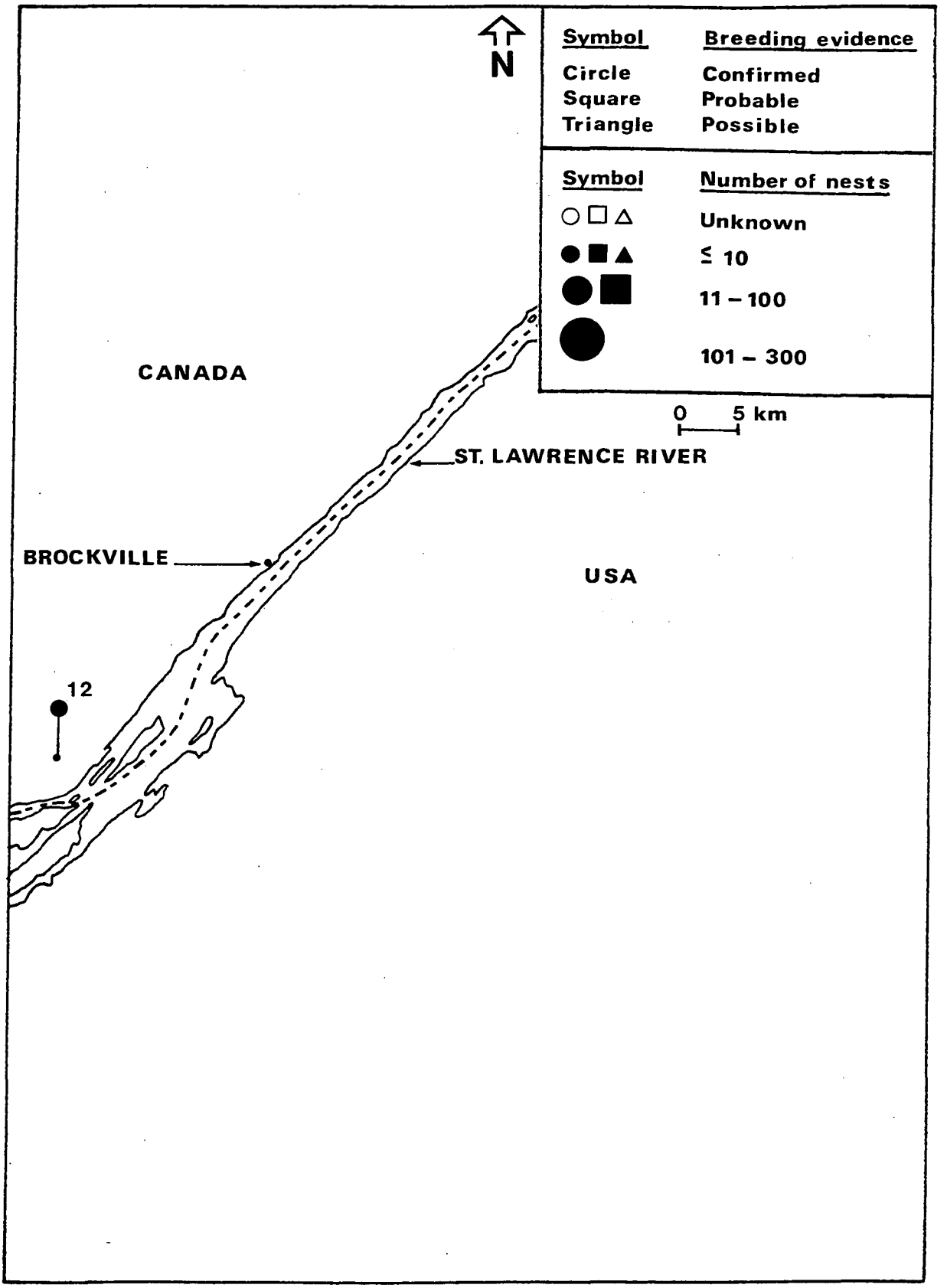

LITTLE CATARAQUI CREEK
CONSERVATION AREA
LITTLE CATARAQUI CREEK
24
KINGSTON
Section from 1:50,000 map 31C/7
SYDENHAM
0
1 km

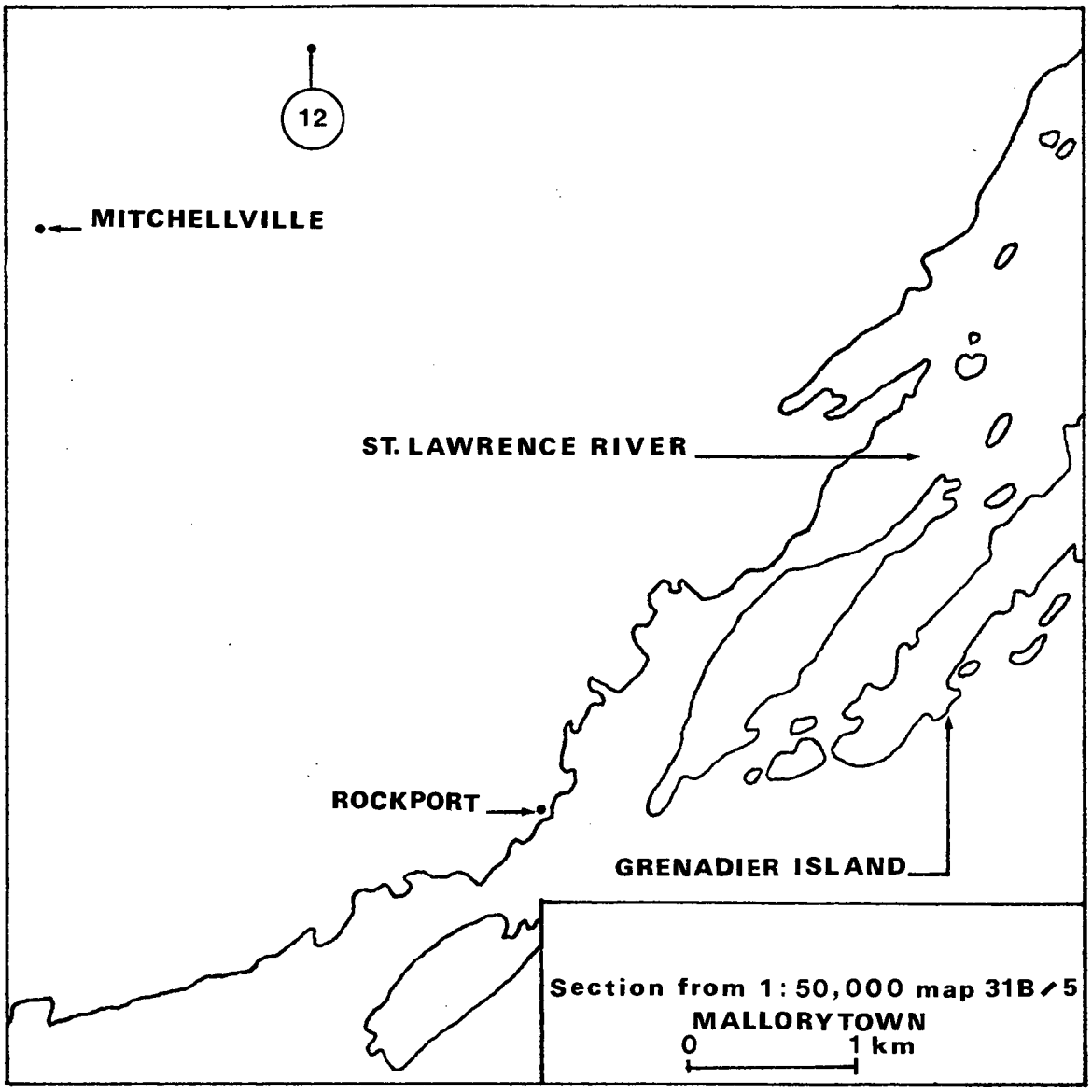

CATARAQUI RIVER
25
KINGSTON
Section from 1 : 50,000 map 31C/8
GANANOQUE
0
1 km


LANSDOWNE
26
ST. LAWRENCE RIVER
Section from 1 : 50,000 map 31C/8
GANANOQUE
0
1 km

Appendix 14

MAP 31 B - WEST, OGDENSBURG, 1 : 250,000




12
MITCHELLVILLE
ST. LAWRENCE RIVER
ROCKPORT
GRENADIER ISLAND
Section from 1:50,000 map 31B/5
MALLORYTOWN
0
1 km