# Management of Colonial Waterbirds Nesting in Hamilton Harbour: The First Two Years of Colonization of Artificial Islands and Population Trends

C. Pekarik, A. N. Nicassio, H. Blokpoel, D.V. Weseloh, J. Hall, S. Fink, C. Anderson and J. S. Quinn

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# MANAGEMENT OF COLONIAL WATERBIRDS NESTING IN HAMILTON HARBOUR: THE FIRST TWO YEARS OF COLONIZATION OF ARTIFICIAL ISLANDS AND POPULATION TRENDS

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# ABSTRACT

Three islands were constructed during the winter of 1995-1996 in the northeast corner of Hamilton Harbour, Lake Ontario, Canada. One of the purposes of the islands was to provide secure nesting habitat in Hamilton Harbour for six species of colonial waterbirds: Double-crested Cormorants, Black-crowned Night-Herons, Herring Gulls, Ring-billed Gulls, Caspian Terns and Common Terns. This paper discusses:

- 1.) The results of the first two nesting seasons on the new wildlife islands.
- 2.) Nesting habitats occupied by the six species elsewhere in Hamilton Harbour (in 1996 and 1997).
- 3.) The temporal trends of nest numbers in all of Hamilton Harbour.

Of the six target species, five nested on the new wildlife islands in 1996 and 1997. Double-crested Cormorants did not nest on the new islands. Caspian Terns and Ring-billed Gulls occupied sub-areas and substrates designated for them. Black-crowned Night-Herons, Herring Gulls and Common Terns nested on the wildlife islands but not on the substrates that were prepared for them. In both 1996 and 1997, all six species continued to occupy additional nesting sites elsewhere in Hamilton Harbour.

Temporal trends on the total number of nests in Hamilton Harbour were determined for each species. The analyses used the most recent ten years of quantitative data collected during the peak nesting period. They indicated that from 1987 to 1996 number of Double-crested Cormorant nests increased significantly and the number of Black-crowned Night-Heron nests declined significantly. From 1988 to 1997 the number of Herring Gull nests declined non-significantly and the number of Caspian Tern and Common Tern nests increased non-significantly. Although Ring-billed Gulls nested in great abundance during 1987-1997, quantitative data have not been collected, therefore temporal trends could not be determined for this species.

# RÉSUMÉ

Durant l'hiver de 1995-1996, on a construit trois îlots dans la partie nord-est du port de Hamilton, sur le lac Ontario (Canada). Ce projet visait notamment à créer un habitat de nidification dans un lieu sûr du port de Hamilton pour six espèces d'oiseaux aquatiques vivant en colonies, soit le cormoran à aigrettes, le bihoreau à couronne noire, le goéland argenté, le goéland à bec cerclé, la sterne caspienne et la sterne pierregarin. Cette publication étudie :

- 1. Les résultats des deux premières saisons de nidification sur les nouveaux îlots fauniques.
- 2. Les habitats de nidification occupés par les six espèces dans d'autres parties du port de Hamilton (en 1996 et en 1997).
- 3. Les tendances temporelles du nombre de nids dans tout le port de Hamilton.

En 1996 et 1997, cinq des six espèces cibles ont niché sur les nouveaux îlots fauniques. Seul le cormoran à aigrettes n'y a pas niché. La sterne caspienne et le goéland à bec cerclé ont occupé des sous-secteurs et des terrains inférieurs qui leur étaient réservés. Le bihoreau à couronne noire, le goéland argenté et la sterne pierregarin ont niché sur les îlots, mais pas dans les terrains inférieurs aménagés à leur intention. Tant en 1996 qu'en 1997, les six espèces ont toutes continué d'occuper des emplacements de nidification additionnels dans d'autres endroits du port de Hamilton.

On a établi, pour chaque espèce, les tendances temporelles du nombre total de nids au port de Hamilton. Les analyses ont utilisé les dix années les plus récentes de données quantitatives recueillies pendant la période de nidification de pointe. Elles ont révélé que de 1987 à 1996 le nombre de nids du cormoran à aigrettes a beaucoup augmenté et que celui des nids du bihoreau à couronne noire a beaucoup baissé. De 1988 à 1997, le nombre de nids du goéland argenté a un peu baissé et celui des nids de la sterne caspienne et de la sterne pierregarin a un peu augmenté. Même si le goéland à bec cerclé nichait en grand nombre de 1987 à 1997, aucune donnée quantitative n'a été relevée. Il a donc été impossible de déterminer une tendance temporelle pour cette espèce.

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# **1. INTRODUCTION**

Colonial waterbirds began breeding intermittently in Hamilton Harbour during the 1970s (Dobos *et al.* 1988). Since then, breeding populations have grown, such that during the 1990s Hamilton Harbour has become one of the most important nesting areas on the Great Lakes for colonial waterbirds (Blokpoel and Tessier 1996, Moore *et al.* 1995). Local areas, including the Eastport Development Area, Windermere Basin, Farr Island and Neare Island, have provided nesting habitat for six species of colonial waterbirds: Double-crested Cormorants (*Phalacrocorax auritus*), Black-crowned Night-Herons (*Nycticorax nycticorax*), Herring Gulls (*Larus argentatus*), Ring-billed Gulls (*Larus delawarensis*), Caspian Terns (*Sterna caspia*) and Common Terns (*Sterna hirundo*) (Figure 1).

The populations of three species of colonial waterbirds nesting in Hamilton Harbour warrant concern. Common Tern populations on the Great Lakes have been experiencing long-term declines. They are listed as endangered, threatened or of special concern in most states bordering the Great Lakes (Courtney and Blokpoel 1983, Kress et al. 1983, Blokpoel and Scharf 1991). Caspian Terns have been designated as a vulnerable species in Canada (COSEWIC 1992), an endangered species in Wisconsin and a threatened species in Michigan (Blokpoel and Scharf 1991). In Ontario they have been identified by the Ontario Ministry of Natural Resources (OMNR) as a "rare" species due to the small number of breeding sites they have in the Canadian Great Lakes basin (Neuman and Blokpoel 1997). Austen et al. (1994) evaluated the status of bird species breeding in low numbers in Ontario. Thev recommended placing Black-crowned Night-Herons on the list of "rare" species because they occupy relatively few nesting sites, have a small population and are at the northern edge of their North American range.

Changes are planned for the Eastport Development Area to increase port facilities for Hamilton Harbour. As a result, the colonial waterbirds breeding there would be displaced. The Fish and Wildlife Habitat Restoration Project of the Hamilton Harbour Remedial Action Plan (RAP) implemented the construction of three wildlife islands to accommodate the displacement of these species should it become necessary (Hamilton Harbour RAP 1992).



Figure 1. Map of Hamilton Harbour. The locations of colonial waterbird nesting colonies, mentioned in the text, are marked by an asterisk. Shaded areas represent water. Inset shows Hamilton Harbour in relation to Lake Ontario.

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Quinn *et al.* (1996) described the ecological parameters and conservation issues of the six species of colonial waterbirds in Hamilton Harbour. They also provided the initial framework and plans for the species-specific habitats created on the islands.

The islands were designed to:

- 1.) provide secure, long-term nesting habitat for the six species of colonial waterbirds which have been nesting at the Eastport Development Area and at Windermere Basin (Hall 1991);
- 2.) provide protected habitat for amphibians and reptiles (Hall 1991);
- 3.) provide an area with calm water on the lee side of the islands. This would allow the growth of submerged vegetation and provide fish spawning habitat, resulting in an increase in the number of fish species and population sizes breeding in Hamilton Harbour (Hall 1991).

The purposes of this report are:

- 1.) To present and discuss the results of the management activities for colonial waterbirds on the three new wildlife islands in 1996 and 1997.
- 2.) To present field data from 1996 and 1997 as well as historical information on the numbers and species of colonial waterbirds nesting in Hamilton Harbour. These historical data provide a wider context for discussing the management efforts on the three new wildlife islands.

# 2. STUDY AREA

Hamilton Harbour (43°16'24"N, 79°46'46"W) is located at the extreme west end of Lake Ontario, Ontario, Canada (Figure 1). The harbour has a surface area of 2,150 hectares and a mean depth of 13 metres (Hamilton Harbour RAP 1989). It is separated on the east from Lake Ontario by a large sandbar, the Burlington Beachstrip. Water exchange with Lake Ontario occurs via the Burlington Canal (Figure 1). At the west end, the harbour is divided by the Desjardins Canal, from a shallow (mean depth 0.7 metres) marsh called Cootes Paradise (Figure 1). The southern shore of Hamilton Harbour is used primarily for steel manufacturing and shipping related industries (Figure 1) (Moore *et al.* 1995). In the last century, the beachstrip on the eastern shore of Hamilton Harbour was widened and marshes and wetlands in the northeast corner of the harbour were filled. The area now accommodates the Skyway Bridge of the Queen Elizabeth Way Highway (QEW) (Figure 2) (Gebauer *et al.* 1993).

The northern shore of the harbour is primarily residential (Moore *et al.* 1995). The northwest shoreline of the harbour and the shoreline surrounding Cootes Paradise consist mostly of deciduous forest.

#### 2.1 THREE WILDLIFE ISLANDS

Three wildlife islands were built in the northeast corner of Hamilton Harbour, north of the Canada Centre for Inland Waters (Figures 1 and 2). East of the new islands is Eastport Drive, a city street with moderate traffic (Figure 1). Also located east of the islands is the Skyway Bridge of the QEW (Figure 2). To the north of the three new islands are two small islands (Farr Island and Neare Island) formerly used to support hydro-electric towers and which now support nesting colonies of colonial waterbirds. To the west of the new islands are the open waters of Hamilton Harbour (Figure 1).



Figure 2. Detail of eastern shore of Hamilton Harbour (shaded areas represent water). Numbers marked by an asterisk indicate observation points for shoreline surveys.

#### 2.2 EASTPORT

The area known as the Eastport Development Area (or Eastport) is comprised of three Piers: 25, 26 and 27 (Figure 2). These were created during the past 35 years by filling operations conducted by the Hamilton Harbour Commissioners (Dobos *et al.* 1988). Piers 26 and 27 contain confined disposal facilities (CDFs) used to store contaminated sediments dredged from Hamilton Harbour (Figures 1 and 2). On the western edge of Pier 27 there are approximately 150 Eastern cottonwood trees (*Populus deltoides*, most > 10 metres tall) and three willows (*Salix* spp., 3-5 metres tall) (Moore *et al.* 1995). The Cottonwoods have been used as nesting sites by Double-crested Cormorants. Probably due to the acidic feces of this species, all the Cottonwoods have died and by the spring of 1996 approximately 100 had fallen over. There are also several groups of Sandbar willows (*Salix exigua*, with stems < 2.5 centimetres wide) on Pier 27. On Pier 26 there are four Cottonwoods and one Manitoba maple (*Acer negundo*, all  $\leq$  5 metres tall) (Moore *et al.* 1995).

The land at Eastport is primarily flat with an occasional elevated mound (< 2 metres in height). The substrate is silt or clay (Moore *et al.* 1995). Most of the area is vegetated with small Celandine (*Chelidonium majus*) plants (~0.2 metres tall) and in certain locations densely covered with Stinging Nettle (*Urtica dioica*) (1-1.5 metres tall) and Black Mustard (*Brassica nigra*) (M. Taylor, W. McMartin, pers. comm.) (Moore *et al.* 1995).

In 1993, an artificial nesting raft (3.6 metres X 9.8 metres) was anchored in the southwest corner of the CDF on Pier 26 (Figure 2) (Lampman *et al.* 1996, McMartin 1996a). The raft was intended to encourage Caspian Terns to nest at a new "transition" location before attempting to move them to the new wildlife islands.

#### 2.3 WINDERMERE BASIN

Windermere Basin is located at the extreme southeast end of Hamilton Harbour (Figures 1 and 2). It has a surface area of 20 hectares and an average depth of less than 2 metres (Hamilton Harbour RAP 1989). Historically, Windermere Basin was a cattail (*Typha* spp.) marsh. It was altered by filling activities between 1957 and 1972 and the dredging of contaminated sediments in 1989 (Gebauer *et al.* 1993). In 1990 a submerged spur dyke was built to reduce water velocity and precipitate heavy matter into the sediments (Moore *et al.* 1995). Material was added to a portion of this dyke to create an island (Spur Dyke Island). This would provide safe insular nesting habitat for Common Terns. The substrate around Windermere Basin is flat, clay or gravel, covered sparsely with

low-lying vegetation (< 0.5 metres tall). Early successional species, such as Stinging Nettle and Quaking Aspen (*Populus deltoides*) are growing in the area (Moore *et al.* 1995).

#### 2.4 FARR ISLAND AND NEARE ISLAND

These two small artificial islands (approximately 30 metres x 35 metres) are located in the extreme northeast corner of the harbour (Figures 1 and 2). They were built in 1923 and supported tall steel hydro towers until 1983 (R. Edwards, Hamilton Harbour Commissioners, pers. comm.). Both islands have substrates composed of coarse rocks (approximately 0.3 metres in diameter). There is sparse vegetation on both islands, consisting primarily of an unidentified mustard species. On Farr Island there are two Manitoba maple trees, one approximately 2.5 metres tall and one approximately 0.75 metres tall.

#### 2.5 STELCO ROD MILL No. 2

This site is west of the Eastport Development Area, separated by approximately 300 metres of open water (Figure 2). There are two types of substrate found there. A dyke which runs along three sides of a rectangular pond is covered with crushed slag. Parts of this dyke are heavily vegetated. The other substrate found on the southwest end of the pond is clay which is graded yearly, resulting in little vegetation (Moore *et al.* 1995).

#### 2.6 COOTES PARADISE

Cootes Paradise is a large marsh at the western end of Hamilton Harbour (Figure 1). The open-water surface area is 250 hectares and the mean depth is 0.7 metres (Hamilton Harbour RAP 1992). It is joined with Hamilton Harbour by the Desjardins Canal. There are three islands in Cootes Paradise. In 1995, Double-crested Cormorants began nesting on Hickory Island, in the eastern section of the marsh.

#### 2.7 NORTH SHORE OF HAMILTON HARBOUR

The eastern portion of the north shore of Hamilton Harbour is primarily residential, with lawns extending to the shoreline. To the west, at Carroll's Point, the shoreline consists primarily of deciduous forest which is part of the Royal Botanical Gardens nature sanctuary (Gebauer *et al.* 1993). Double-crested Cormorants began nesting at Carroll's Point in 1996.

# 3. METHODS

#### **3.1 ISLAND CONSTRUCTION**

Three islands (approximately 100 metres x 30 metres) were constructed during the winter of 1995-96. North Island, Centre Island and South Island were placed 125 metres, 55 metres and 95 metres, respectively, from the shoreline. North Island and South Island were designed to withstand 50 year flood periods and Centre Island was designed to withstand a 25 year flood period. Elevated knolls and vegetation provide additional storm protection for birds nesting on the knolls and on the lee sides of the islands. Coarse rock (approximately 0.3 metres in diameter) was used to build the base of the islands, with the largest rocks placed on the windward (west) side. A layer, approximately 15 centimetres deep, of crushed stone (approximately 5 centimetres in diameter) was placed on the coarse rock base.

## 3.2 HABITAT CREATION AND MANAGEMENT TECHNIQUES ON THE THREE WILDLIFE ISLANDS AND EVENTS AT OTHER NESTING COLONIES IN HAMILTON HARBOUR, 1996 AND 1997

Before the 1996 breeding season parts of the new wildlife islands were conceptually divided into different sub-areas. Each sub-area was designated as a potential nesting site for one of the intended species and received special treatment to attract them to the site (Figure 3).



Figure 3. Three new wildlife islands showing the designated sub-areas and substrates for colonial waterbirds at the beginning of the breeding season, 1996. All sub-areas, except those designated for Black-crowned Night Herons were ready for use at the beginning of the 1996 breeding season.

### 3.2.1 Double-crested Cormorants

Cormorants are known to nest both in trees and on the ground (Peck and James 1983). One sub-area (250 square metres) in the middle of Centre Island was designated for nesting by Double-crested Cormorants (Figure 3).

Five nesting platforms were erected on each of five poles (6 metres above the island's surface) (Figure 4) (Meier 1981, Quinn *et al.* 1996). The nesting platforms were intended to attract cormorants to their designated sub-area. In the early spring of 1996 previously used nests and brush were placed on the gravel sub-area beneath the platforms; these were also intended to attract cormorants to the sub-area.

Cormorants have been nesting in trees on Hickory Island in Cootes Paradise since 1995 and their acidic feces has caused the death of those trees. In an effort to keep cormorant activity centred in the area of the new wildlife islands, the colony on Hickory Island was disturbed by the use of a flare gun. The gun was shot from the mainland (approximately 15 metres away), or from a canoe (approximately 4 metres from the island), or from the island itself on most nights between 23 April and 11 June 1996.



Figure 4. Double-crested Cormorant nesting platforms.

At Eastport, the availability of cormorant nesting habitat has been reduced. All of the Cottonwood trees traditionally used as nesting sites have died. By 1996 approximately 100 (out of approximately 150) of the dead trees had fallen over.

#### 3.2.2 Black-crowned Night-Herons

Black-crowned Night-Herons usually nest in trees or shrubs (Peck and James. 1983). Two sub-areas, the southern portion of Centre Island and all of South Island, were covered with topsoil and leaf mulch in preparation for the planting of native shrubs in autumn 1996 (Figure 3). Not all of the sub-areas originally intended for Black-crowned Night-Herons were planted because of the results of the 1996 nesting season (see section 4.1.2). In fall 1996 shrubs and trees were planted on the west side of South Island. The species planted were Eastern redcedar (Juniperus virginiana), Sandbar willow (Salix exigua), Manitoba maple, Cranberry (Vacccinium macrocarpon), Purple-flowering raspberry (Rubus odoratus) and Red-osier dogwood (Cornus stolonifera). The species of native shrubs were chosen such that the branches would be small, able to sustain Black-crowned Night-Herons and their nests, but not the weight of Doublecrested Cormorants (Quinn et al. 1996). In the future, a 5 metre buffer zone is planned between the Night-Heron and cormorant colonies on Centre Island. It is hoped that this will ensure that cormorants do not take over the nesting areas of Night-Herons.

#### 3.2.3 Herring Gulls

An elongated gravel ridge (100 metres x 1 metre) was constructed on Centre Island for nesting by Herring Gulls (Figure 3). Sub-areas not specifically designated for other species were also available for nesting by Herring Gulls and Ring-billed Gulls.

#### 3.2.4 Ring-billed Gulls

On all three wildlife islands, sub-areas not specifically designated for the five other colonial waterbird species were left unaltered for colonization by Ringbilled Gulls.

From 1991 to 1997 Ring-billed Gulls nesting in portions of the Eastport Development Area have been disturbed during the nesting season by the shooting of a loud noise-making gun approximately 200 times per day during daylight hours (W. Fitzgerald, Hamilton Harbour Commissioners, pers. comm.). In 1997 additional activities were undertaken to try to deter Ring-billed Gulls from nesting at Eastport. Most of the activities took place at Pier 26, once or twice they were used at Pier 25. Falconers used eight raptors to discourage Ring-billed Gulls from nesting in the area where they had been doing so in recent years. Most often, the falconers flew two Saker Falcons (*Falco scherrug*) and three Harris Hawks (*Parabuteo unicinctus*), occasionally they flew a

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Ferruginous Hawk (*Buteo regalis*), a Golden Eagle (*Aquila chrysaetos*) and a hybird Saker x Gyrfalcon (*Falco rusticolus*). The raptors were flown as needed to deter Ring-billed Gulls from loafing or nesting in the area, this was done at least eight times per day. Ring-billed Gull eggs were collected and destroyed under Canadian Wildlife Service permit. When dead Ring-billed Gulls were found, the carcasses were attached to a string and spun around to further discourage the gulls from loafing in the area.

#### 3.2.5 Caspian Terns

An elevated mound (200 square metres) was constructed on the north end of North Island. It was covered with a substrate composed of sand and pea gravel (Figure 3) (Quinn *et al.* 1996, Quinn and Sidervan in press). Ring-billed Gulls arrive from migration and establish nesting colonies earlier in the season than do terns. To keep the Caspian Tern sub-area available, it was covered with plastic sheeting from 15 March to 2 May 1996 and from 13 March to 29 April 1997. In 1996 gull nests constructed on the plastic sheeting were destroyed under Canadian Wildlife Service permit. In 1997 the plastic covering was not surveyed for gull nests.

In 1996 decoys of Caspian Terns (n=15) were installed on the Caspian Tern sub-area (during 3-16 May 1996). The decoys were intended to attract Caspian Terns to the top of the mound constructed for their use. They were installed even though colonization had already begun at the edge of the mound (two nests with eggs and 38 nest scrapes).

Red foxes (*Vulpes vulpes*) denning at Eastport caused disruptions to the Caspian Terns nesting there in 1995 (Lampman *et al.* 1996). Although three foxes were trapped both in 1995 and in 1996, foxes were still present at Eastport during the 1996 and 1997 breeding seasons.

#### 3.2.6 Common Terns

Two sub-areas (250 square metres each) were designated for Common Terns, one on the south end of North Island and one on the north end of Centre Island (Figure 3). A mixture of sand and gravel was used as substrate for both sub-areas (Quinn *et al.* 1996). Both sub-areas were covered with plastic sheeting from 16 March to 8 May 1996 and from 13 March to 29 April 1997. This was done to discourage nesting by Ring-billed Gulls and to keep the sub-areas available for Common Terns. In 1996 gull nests constructed on the plastic were destroyed under Canadian Wildlife Service permit. In 1997 the plastic covering was not surveyed for gull nests.

In 1996 decoys of Common Terns (n=12) were placed on the Common Tern subarea on North Island (during 8 May-12 June 1996). The decoys were intended to attract Common Terns to the sub-area.

Common Terns nesting on the mainland surrounding Windermere Basin have been subject to disturbance that could be be attributed to scattered, low density nesting (Moore *et al.* 1995). In 1994, Moore *et al.* (1995) found that the mainland colonies surrounding the basin had a 48 percent hatch rate for eggs while the colony on Spur Dyke Island, had a 90 percent hatch rate.

#### **3.3 SHORELINE SURVEYS**

In 1996, 48 surveys of the northeast corner of Hamilton Harbour were conducted from shore between 27 March and 30 September 1996. The purpose was to determine the number of colonial waterbirds of each species in that area of Hamilton Harbour. The areas surveyed included: Farr Island, Neare Island, North Island, Centre Island, South Island, and both the water and shoreline east of these areas. The surveys were conducted from four observation points along Eastport Drive (Figure 2). The stations were chosen such that they would allow the surveyor to observe as much of each island as possible. It was impossible to observe the west side of all islands. The surveys were conducted between 12:30 and 14:30 daily, during April and May and weekly thereafter. A 15-45x spotting scope was used. Individuals were classified by species and into three age categories: unfledged chicks, fledged chicks (juveniles) and adults. No shoreline surveys were conducted in 1997.

#### 3.4 NEST SURVEYS ON ISLANDS

In 1996 surveys were conducted early in the nesting season on each of the three new wildlife islands and on the adjacent Farr Island and Neare Island. In 1997 nest surveys were conducted early in the nesting season on the three new wildlife islands.

During each island visit the following information was collected:

- The number of nests, eggs and chicks of each species.
- The designated sub-area and substrate where nest(s) were located.

During visits by researchers wire-mesh domes were placed over tern nests to protect the eggs from increased predation by gulls. To protect chicks, wooden shelters were distributed throughout the tern colonies (Burness and Morris 1992). The shelters were left on the tern colonies throughout the nesting season. Mobile chicks, when disturbed by researchers, ran the risk of injury from attacks by conspecific adults and gulls, as well as the risk of drowning. When this was thought to pose a problem, visits to the island were discontinued. In 1996 visits to North Island and South Island were terminated on 20 June, visits to Centre Island were terminated on 24 June. In 1997 visits to North Island, South Island and Centre Island were terminated on 10 June, 13 June and 19 June, respectively.

#### 3.4.1 North Island

In 1996 surveys were conducted twice per week, between 28 March and 20 June. Since Caspian Tern nests were found on 2 May, visits were discontinued from 3 May to 16 May to increase the likelihood of successful colonization of the designated sub-area. In 1997 surveys were conducted twice per week between 5 May and 10 June.

#### 3.4.2 Centre Island

In 1996 and 1997 surveys were conducted twice per week from 3 April to 24 June and from 5 May to 19 June, respectively. In both years Common Tern nests were numbered and staked with tongue depressors (Quinn and Sidervan in press). In 1996 the nest contents of previously staked nests were checked on subsequent visits. In 1997 researchers did not check the nest contents of previously staked nests. They only staked the new nests they found on each visit.

#### 3.4.3 South Island

In 1996 and 1997 surveys were conducted twice per week from 3 April to 20 June and from 5 May to 13 June, respectively. In both years Common Tern nests were numbered and staked with tongue depressors (Quinn and Sidervan in press). In 1996 and 1997 nests checks were conducted as per Centre Island.

#### 3.4.4 Farr Island

In 1996 surveys were conducted twice per week between 28 March and 20 August. After 27 June 1996 cormorant chicks were mobile and did not stay in their respective nests, making it impossible to determine specific nest contents. From then on, only the total number of chicks on the island was counted. In 1997 a nest survey was conducted on 11 June. It was determined which species were nesting on the island though only cormorant nests were counted.

#### 3.4.5 Neare Island

Surveys were conducted twice per week between 28 March and 20 June 1996. Four additional surveys were conducted between 12 July and 7 August 1996 because shoreline surveys had revealed late nesting Black-crowned Night-Herons. In 1997 researchers from McMaster University visited the island to collect data for their study. They counted the number of Herring Gull nests (on 19 June). The researchers also determined what other species were nesting on the island, though they did not census those nests.

#### 3.5 NEST SURVEYS IN OTHER AREAS OF HAMILTON HARBOUR

#### 3.5.1 Eastport, Windermere Basin and Stelco Rod Mill No. 2

Data for 1987 were taken from Dobos et al. (1988), data from 1988-1994 were taken from Moore et al. (1995), data for 1995, 1996 and 1997 were compiled from unpublished sources. The number of breeding pairs of each species of colonial waterbird was determined by the number of active nests (attended nest scrapes and nests with eggs) counted during the last week of May or the first three weeks of June, corresponding to the "peak" nesting period for each species. In 1997 cormorant nests at Eastport were censused on 24 September. Counting nests later in the nesting season or in the fall may underestimate the size of the colony because nests are not maintained once young have fledged. Since censuses were conducted at Hickory Island on 14 July and on 24 September 1997 a correction factor was calculated that would estimate the number of tree nests that would no longer be visible on 24 September 1997. This correction factor was applied to the number of tree nests counted at Eastport. It was assumed that the number of ground nests would not be altered in the same way as the number of tree nests. In 1997 the total number of cormorant nests at Eastport in July was estimated by adding the calculated number of tree nests to the actual number of ground nests counted on 24 September.

#### 3.5.2 Hickory Island

In 1996 Double-crested Cormorant nests on Hickory Island were counted from shore, approximately 15 metres north of the island, on 18 May. In 1997 nests were counted on two dates: 24 September and 14 July. The counts were used to calculated the percentage of lost tree nests from July to September. This percentage of loss was used to estimate the number of cormorant nests at Eastport (see section 3.5.1) and Carroll's Point (see section 3.5.3) in July, since counts were only obtained at those sites on 24 September 1997.

#### 3.5.3 Carroll's Point

In 1996 Double-crested Cormorant nests on Carroll's Point were counted from a motor boat (25 HP) approximately 6 metres from shore on 12 June. The point of land was surveyed from both the north and the south sides. In 1997 a late season nest count was conducted from the shore on 24 September 1997. The correction factor obtained from tree counts at Hickory Island on 14 July and 24 September 1997 was used to estimate the total number of nests there would have been in July (see section 3.5.2).

#### 3.5.4 Hamilton Harbour Shoreline

In 1996 the shoreline of Hamilton Harbour was surveyed for Black-crowned Night-Heron nests. Surveys were conducted by two or three people from a motor boat (25-75 HP) traveling at slow speed. One person drove the boat while the other person(s) scanned the shoreline using binoculars. When Black-crowned Night-Herons were sighted, the location was surveyed by disembarking and walking the area. The south shoreline, from Canada Centre for Inland Waters to Desjardins Canal, was surveyed on 13 May 1996. The northern shoreline was surveyed on 8 July and 10 July 1996. In 1997 the shoreline of Hamilton Harbour was not surveyed for Black-crowned Night-Heron nests.

#### **3.6 Statistical Analysis**

For each species, except Ring-billed Gulls, population trends in Hamilton Harbour were determined using the last ten years of quantitative data that were collected during the peak nesting period. Data from 1987-1996 were used to determine trends for Double-crested Cormorants and Black-crowned Night-Herons. Data from 1988-1997 were used to determine trends for Herring Gulls, Caspian Terns and Common Terns. The Shapiro-Wilk statistic indicated that the errors were normally distributed; the Box-Cox method determined that no transformation of the dependent variable was necessary (Draper and Smith 1981, SAS Institute Inc. 1988). The intercept of the regression model was set to one year prior to the first year of data used in the equation. That is, 1986 for cormorants and Night-Herons and 1987 for Herring Gulls, Caspian Terns and Common Terns. The linear regression model fit to the data was the following:

#### Number of Nests = Intercept + Year.

All statistical analysis was conducted with the statistical program SAS, version 6.12 for Windows95. Results were determined at a 5% level of significance ( $\alpha$ =0.05).

# 4. RESULTS

#### **4.1 THE THREE WILDLIFE ISLANDS**

# 4.1.1 Double-crested Cormorants

Double-crested Cormorants did not nest on the designated platforms, on the ground beneath or anywhere else on the wildlife islands in 1996 and 1997 (Figures 5 and 6, Table 1). Shoreline surveys indicated that in 1996 they fished in the vicinity of the three wildlife islands and loafed on North Island.

#### 4.1.2 Black-crowned Night-Herons

During the summers of 1996 and 1997, Black-crowned Night-Herons nested among the large rocks on the west side of North Island (Figures 5 and 6). They established nine nests in 1996 and 19 in 1997 (Table 1). The native shrubs and trees intended as nesting habitat for Black-crowned Night-Herons were not planted until fall 1996. Night-Herons were not expected to nest on the new wildlife islands until the shrubs and trees had reached an adequate size to support the adults and their nests.

The planned planting of native vegetation for Night-Heron nesting habitat was altered. In 1996 Common Terns nested on some of the sub-areas originally intended for the plantings. These areas, on the southern portion of Centre Island and the northern portion of South Island (Figures 5), were left unplanted in 1997 to allow Common Terns to renest there. Shrubs and trees were planted only on the west side of South Island (Figure 6).



Figure 5. Sketch of the colonial waterbird habitat on the three new wildlife islands showing the actual breeding distribution during the 1996 breeding season. Areas of multiple nests are demarcated by dashed lines, single nests are indicated by triangles.



Figure 6. Sketch of the colonial waterbird habitat on the three wildlife islands showing the actual breeding distribution during the 1997 breeding season. Areas of multiple nests are demarcated by dashed lines, there were no single nests.

		LOCATION		
SPECIES	SOUTH ISLAND	CENTRE ISLAND	NORTH ISLAND	
	1996/97	1996/97	1996/97	
DCCO <sup>a</sup>	0/0	0/0	0/0	
BCNH <sup>a</sup>	0/0	0/0	9/19	
HERG <sup>a</sup>	0/0	3/3	40/59	
RBGU <sup>a</sup>	0/110	0/5	25/69	
CATE <sup>a</sup>	0/0	0/55	221/309	
COTEª	85/33	286/531 0/0		

TABLE 1. Number of nests of the six species of colonial waterbirds on the three new wildlife islands in 1996 and 1997.

<sup>a</sup> DCCO (Double-crested Cormorant), BCNH (Black-crowned Night-Heron), HERG (Herring Gull), RBGU (Ring-billed Gull), CATE (Caspian Tern), COTE (Common Tern).

#### 4.1.3 Herring Gulls

In 1996 Herring Gulls established 40 nests on North Island: 37 on the west side (on coarse rock and gravel substrate) and three on the mound intended for Common Terns (Figure 5, Table 1). A peak number of six Herring Gull fledglings was recorded (from shore) on 14 June 1996 on North Island. There was no apparent reason for the low number of fledglings (relative to the number of nests) that were observed, though shore-based surveys are not considered an accurate means of surveying for young Herring Gulls. In 1997 Herring Gulls established a total of 59 nests on North Island (Table 1). Most were on the gravel substrate in the centre of the island and some were on the mound at the south end of the island (Figure 6).

Herring Gulls did not occupy the elevated ridge constructed for their use on Centre Island (Figures 5 and 6). In 1996 they established two nests on gravel substrate near coarse rocks and one on the gravel substrate beneath the cormorant platforms (Figure 5, Table 1). In 1997 they established 3 nests beneath the cormorant platforms (Figure 6, Table 1). The substrate under the platforms was gravel in 1996. By 1997 vegetation had grown such that the substrate was gravel with some small (approximately 0.2 m tall) vegetation distributed sparsely throughout.

#### 4.1.4 Ring-billed Gulis

In 1996 Ring-billed Gulls established 25 nests on North Island, all were on coarse rocks on the east side of the island (Figure 5, Table 1). Shoreline surveys showed a peak number of two fledglings on North Island, 35 on Centre Island (22 July 1996), and five on South Island (25 July 1996).

In 1996 Ring-billed Gulls initiated nests on the plastic that covered the tern subareas on North Island. There were nine nests destroyed on the Caspian Tern sub-area and two on the Common Tern sub-area before the sheeting was removed.

In 1997 Ring-billed Gulls established 50 nests on the northeast end of North Island (Figure 6). Most were among the large rocks and at the interface between the gravel substrate and the large rocks. Three nests were among the colony of Caspian Terns (on the mound at the north end of the island). Two of these nests were seen being incubated by Herring Gulls (S. Fink, pers. comm.). Ring-billed Gulls also established 19 nests among the large rocks on the southeast end of North Island (Figure 6, Table 1).

Also in 1997 Ring-billed Gulls began nesting on South Island (n=110 nests) and Centre Island (n=5 nests) (Figures 5 and 6, Table 1). On South Island most of the nests were among the vegetation in the centre of the island, a few (approximately six) were among the large rocks at the north end of the island (Figure 6). On Centre Island the nests were beneath the cormorant platforms on gravel substrate that was sparsely vegetated.

#### 4.1.5 Caspian Terns

In 1996 a maximum count of 221 nests was obtained on 20 June (Table 1). The nests were established on North Island, on the sub-area intended for use by the Caspian Terns (Figure 5). A peak number of 113 fledglings on North Island and 36 on Centre Island was observed from shore on 30 July.

In 1997 Caspian Terns established 309 nests on the mound intended for their use on North Island (Figure 6, Table1). In 1997 Caspian Terns also began nesting on Centre Island (Figure 6, Table1). A maximum count of 55 nests was obtained on 19 June. The Caspian Terns nested on the knoll at the north end of the island; this knoll was intended as a Common Tern sub-area.

#### 4.1.6 Common Terns

Common Terns nested on the new wildlife islands in both 1996 and 1997 (Figures 5 and 6). During both years they did not nest on the sub-areas specified for their use (Figures 5 and 6). In 1996 the substrate chosen by the Common Terns was topsoil and leaf mulch, rather than the sand and gravel intended for their use (Figure 5). The colony on Centre Island had 286 nests and the colony on South Island had 85 nests (Table 1). The total number of Common Tern nests on the three wildlife islands in 1996 was 371. The peak number of fledglings observed from shore was 118 on Centre Island (12 July 1996) and 152 on South Island (16 July 1996).

In 1997 Common Terns nested again on Centre Island and on South Island (Figure 6, Table1). On Centre Island nests were observed and censused on six dates between 21 May and 19 June. The total cumulative number of nests found on those dates was 635. This number may overestimate the actual number of nests, since previously staked nests were not checked to see if they had been abandoned. Of the 635 nests, 104 were first observed under the artificial trees (for cormorants) on 19 June. The substrate beneath the artificial trees was gravel with sparse vegetation growing throughout. It is thought that these (104) nests were those of terns that were renesting, subsequent to having abandoned their nests at the south end of the island once that habitat was overgrown with thick vegetation. Based on this assumption the total number of Common Tern nests on Centre Island in 1997 was roughly estimated at 531 (635 minus 104).

In 1997 Common Terns nested on the north end of South Island (n=33 nests) (Figure 6, Table1). The colony was further north than the year before (Figures 5 and 6). The substrate they utilized was the interface where the gravel meets the large rocks at the edge of the island.

In 1996 and 1997, Common Terns did not attempt to nest on their designated sub-areas (Figures 5 and 6). In 1996 they were not observed loafing near the decoys on their North Island sub-area.

The areas covered in topsoil and leaf mulch, where the Common Terns nested in 1996, had extensive vegetation growing on them from mid-summer onward (after 10 June 1996). The vegetation remained, and was present during the 1997 nesting season. Common Terns did nest among the thick vegetation but it would appear that it was too dense since the colonies moved north on both Centre Island and South Island to less vegetated areas. On South Island Ring-billed Gulls nesting among the tall vegetation may have further deterred the Common Terns from nesting there.

#### 4.2 FARR ISLAND AND NEARE ISLAND

In 1996 cormorants nested in large numbers (n=240 nests) among the rocks and in the larger Manitoba maple on Farr Island (Figure 7, Table 2). In 1997, they again nested (both in the tree and on the ground) on Farr Island (n=119 nests) (Figure 7, Table 2). An egg-oiling study was conducted on this island in 1997 (Kevin Shonk, pers. comm.), this may have impacted the number of Doublecrested Cormorants which nested there that year.



Figure 7. Nesting areas of Double-crested Cormorants in Hamilton Harbour in 1996 and 1997. Labels represent the number of nests in the two years (1996/1997). Numbers marked by an asterisk indicate estimated counts for tree nests (for methods see sections 3.5.1 - 3.5.3). The total number of cormorant nests in Hamilton Harbour in 1996 was 819 and in 1997 it was 496.

In 1996 Black-crowned Night-Herons were observed nesting among large rocks on Farr Island (Table 2). The maximum number of nests counted was 11 (25 April 1996). Subsequently, 10 of the 11 nests were destroyed. They appeared to have been destroyed by a force which scattered the nest material and contents. This was thought to have been caused by Double-crested Cormorants usurping nest material. High winds may have been a factor though the cormorant nests on the island did not appear to have been affected. Cormorants were observed robbing nest material from Herring Gulls but not from NightHerons. The abandonment of Black-crowned Night-Heron nests on Farr Island appeared to be concomitant with the initiation of nesting on North Island. One Black-crowned Night-Heron nest on Farr Island produced hatchlings. Three fledglings were observed during an island visit (25 June 1996) and shoreline surveys revealed a maximum number of two fledglings on 12 July 1996. In 1997 one Black-crowned Night-Heron nest was observed on Farr Island (Table 2).

LOCATION	SPECIES					
· · ·	DCCO <sup>a</sup>	BCNH <sup>a</sup>	HERG <sup>a</sup>	RBGU ª	CATE <sup>a</sup>	COTE <sup>a</sup>
· · · · · · · · · · · · · · · · · · ·	1996/97	1996/97	1996/97	1996/97	1996/97	1996/97
FARR I. <sup>b</sup>	240/119	1/1 ·	9/N <sup>d</sup>	0/0	0/0	0/0
NEARE I. <sup>b</sup>	0/0	17/N <sup>d</sup>	135/118	0/0	0/0	14 <sup>e</sup> /0
EASTPORT	436/237 <sup>f</sup>	13/0	184/162	N <sup>d</sup> /N <sup>d</sup>	40 <sup>9</sup> /35 <sup>9</sup>	0/0
HICKORY I. <sup>b</sup>	114/121	0/0	0/0	0/0	0/0	0/0
CARROLL'S PT.°	29/19 <sup>f</sup>	0/0	0/0	0/0	0/0	0/0
WINDERMERE BASIN	0/0	0/0	0/0	0/0	0/0	365/350

TABLE 2. Number of colonial waterbird nests in Hamilton Harbour (excluding the three new wildlife islands) in 1996 and 1997.

<sup>a</sup> For abbreviations of species names see footnote for Table 1.

<sup>b</sup> I.: Island.

<sup>c</sup> PT.: Point.

<sup>d</sup> N: Nesting but not censused.

<sup>e</sup>Nests were abandoned (see text).

<sup>f</sup>Indicates estimated nest counts for tree nests (see sections 3.5.1 - 3.5.3).

<sup>g</sup>Caspian Terns nested only on the raft in the southern-most CDF pond at

Eastport. No Caspian Terns nested on the mainland at Eastport in 1996 or 1997.

In 1996 Black-crowned Night-Herons also nested (n=17 nests) among the large rocks on Neare Island (Table 2). A peak number of nine fledglings was observed from shore on 9 July 1996. In 1997 Black-crowned Night-Heron nests were observed on Neare Island but they were not counted (Table 2).

In 1996 Herring Gulls established nine nests on Farr Island and 135 on Neare Island (Table 2). Shoreline surveys recorded a peak number of 73 fledglings on

Neare Island (14 June 1996). In 1997 Herring Gulls were observed nesting on both Farr Island (nests were not counted) and Neare Island (n=118 nests) (Table 2).

In 1996 Common Tern nests were observed very close to the water on the southeast corner of Neare Island on three dates between 9 and 21 May 1996. A maximum number of 14 nests was observed (on 14 May 1996 (Table 2). The nests appeared to have been abandoned. This coincided with an apparent rise in the water level near the island. Common Terns nested on Neare Island in previous years. Moore *et al.* 1995 reported nest counts on Neare Island between 1988 and 1990 and Morris and Hunter (1976) reported nests on both Neare Island in 1972 and 1973.

#### 4.3 EASTPORT

In 1996 cormorants nested in the Cottonwood trees at Eastport (n=436 nests), though in slightly smaller numbers than in 1995 (n=461 nests) (Figure 7) (McMartin 1996b). In 1997 the number of nests counted on 24 September was 135. Of these 118 were tree nests and 17 were ground nests. The estimated total number of nests in July was 237 (Figure 7, Table 2).

In 1996 Black-crowned Night-Herons nested in trees on the north end of Pier 26 (Table 2). A maximum count of 13 nests was obtained 24 July 1996. Black-crowned Night-Herons did not nest at Eastport in 1997 (Table 2).

Herring Gulls nested on the northern-most dyke at Eastport in 1996 (n=184 nests) and in 1997 (n=162 nests).

Ring-billed Gulls continue to nest at Eastport in approximately the same numbers as in recent years. The nests have not been counted since 1990 (Table 3).

In 1996 Caspian Terns established 40 nests on the raft in the southern-most CDF on Pier 26 (Table 2) (McMartin 1996a). In 1997 they established approximately 35 nests on the tern raft (Table 2). From 1993 to 1995, the number of Caspian Terns nesting on the raft increased steadily (Table 3). In 1996 the number of pairs utilizing the raft decreased by 20 percent relative to 1995 (Table 3). In 1997 the number of Caspian Terns did not nest on the mainland at Eastport in 1996 or 1997 (Table 2).

#### 4.4 HICKORY ISLAND AND CARROLL'S POINT

In spite of the deterrent management activities conducted in 1996 to displace Double-crested Cormorants from their colony (in trees) on Hickory Island (in Cootes Paradise), they nested successfully at the site in 1996 (n=114 nests) and 1997 (n=121 nests on 14 July and 65 on 24 September) (Figure 7, Table 2). Cormorants also established a new nesting colony in 1996 (n=29 nests) in trees on Carroll's Point (Figure 7, Table 2). The colony on Carroll's Point continued to be occupied in 1997. A nest count on 24 September 1997 revealed 10 nests in trees. The estimated number of nests in July was 19 (Figure 7, Table 2).

#### 4.5 WINDERMERE BASIN

In 1996 and 1997 Common Terns nested on Spur Dyke Island in Windermere Basin. They established 365 nests in 1996 and approximately 350 in 1997 (Table 2). In 1996 twenty nests were found on the mainland (24 May 1996), these were predated shortly thereafter. Common Terns did not nest on the mainland at Windermere Basin in 1997.

YEAR <sup>1</sup>	DCCO <sup>a</sup>	BCNH <sup>a</sup>	HERG <sup>a</sup>	RBGU <sup>a</sup>	CATE <sup>a2</sup>	COTE <sup>a3</sup>
1987	51	212	225	21207	134	553
1988	157	194	N <sup>6</sup>	N <sup>6</sup>	242	644
1989	140	104	329	N <sup>6</sup>	175	667 (20)
1990	250	99	343	39621	184	1028 (246)
1991	416	60	N <sup>6</sup>	N <sup>6</sup>	220	585 (ND) <sup>5</sup>
1992	592	132	272	N <sup>6</sup>	337	753 (ND) <sup>5</sup>
1993	685	134	300	N <sup>6</sup>	301 (1)	954 (32)
1994	451	90	303	N <sup>6</sup>	313 (6)	868 (193)
1995	588	N <sup>6</sup>	124	N <sup>6</sup>	138 (50)	434 (ND)⁵
1996⁴	819 <b>[0]</b>	40 <b>[9]</b>	371 <b>[43]</b>	N <sup>6</sup> [25]	261 (40) <b>[221]</b>	762 (26) <b>[371]</b>
19974	496 <sup>7</sup> [0]	20 <b>[19]</b>	342 <sup>8</sup> [62]	N <sup>6</sup> <b>[184]</b>	399 (35) <b>[364]</b>	914 (ND) <sup>5</sup> <b>[564]</b>

TABLE 3. Total number of nests of colonial waterbirds at Hamilton Harbour, 1987-1997.

<sup>1</sup> Data for 1987 taken from Dobos *et al.* (1988),Table 1. Data for 1988-1994 taken from Moore *et al.* (1995), Table 1. Data for 1995-1997 were compiled from unpublished sources.

<sup>a</sup> For abbreviations of species names see footnote for Table 1.

<sup>2</sup> For Caspian Terns, numbers for 1993-1997 include nests on the raft (in brackets).

<sup>3</sup> For Common Terns, numbers for 1989-1997 include nests at Stelco Rod Mill No. 2 (in brackets).

<sup>4</sup> For 1996 and 1997, the numbers include nests on the new wildlife islands [in square brackets and bold text].

<sup>5</sup> (ND):No data are available.

<sup>6</sup>N: Nesting, but not censused.

<sup>7</sup> In 1997, at two out of four sites, cormorant nests were censused on 24

September. A correction factor was used to estimate the number of tree nests there would have been in July (see sections 3.5.1 - 3.5.3).

<sup>8</sup> In 1997, at one out of five sites, Herring Gull nests were observed but not censused, thus they are not included in the total.

#### 4.6 POPULATION TRENDS IN HAMILTON HARBOUR

Regression analysis on the number of nests of five species of colonial waterbirds in Hamilton Harbour indicated that:

- The number of Double-crested Cormorant nests in Hamilton Harbour increased significantly by approximately 79 nests per year during 1987-1996 (p=0.00) (Figure 8).
- The number of Black-crowned Night-Heron nests declined significantly by about 14 nests per year during 1987-1996 (p=0.02) (Figure 9).
- The number of Herring Gull nests decreased non-significantly during 1988-1997 (p=0.77) (Figure 10).
- The numbers of Caspian Tern and Common Tern nests increased during 1988 –1997 (Figures 11 and 12), but these increases were not statistically significant (p=0.20 and p=0.81, respectively).



Figure 8. Regression analysis of the number of Double-crested Cormorant nests in Hamilton Harbour during 1987-1996.



Figure 9. Regression analysis of the number of Black-crowned Night-Heron nests in Hamilton Harbour during 1987-1996.



Figure 10. Regression analysis of the number of Herring Gull nests in Hamilton Harbour during 1988-1997.



Figure 11. Regression analysis of the number of Caspian Tern nests in Hamilton Harbour during 1988-1997.



Figure 12. Regression analysis of the number of Common Tern nests in Hamilton Harbour during 1988-1997.

# 5. DISCUSSION

#### 5.1 DOUBLE-CRESTED CORMORANTS

The population of Double-crested Cormorants in Hamilton Harbour increased significantly from 1987-1996. One concern associated with this species is the death of mature trees in which they have been nesting (for example, the Cottonwoods at Eastport). Nesting of Double-crested Cormorants on Farr Island began as recently as 1991 (Quinn *et al.* 1996). However, the maximum capacity of the island may have already been reached, leading them to nest in other areas of Hamilton Harbour such as Hickory Island and more recently, Carroll's Point. It is unknown whether Double-crested Cormorants will nest on the constructed platforms on Centre Island, given that other habitat is available. The cormorants may have chosen not to nest on Centre Island due to the proximity to the busy QEW highway. Meier (1981) documented the success of artificial nesting platforms used in an area where natural habitat was threatened or decreasing. The likely preference for natural nesting sites by cormorants may necessitate additional management techniques, such as:

- 1.) the installation of cormorant decoys on the nesting platforms to attract them to the sub-area on Centre Island;
- 2.) more intensive disturbances at undesirable nesting sites elsewhere in Hamilton Harbour.

#### **5.2 BLACK-CROWNED NIGHT-HERONS**

Black-crowned Night-Herons were not expected to nest on the new wildlife islands until the native shrubs and trees were planted and established on the designated sub-areas of Centre Island and South Island. Since Common Terns nested in 1996 on some of the sub-areas designated for Black-crowned Night-Herons, these areas were left unplanted. Shrubs and trees were planted only on the west side of South Island, none were planted on Centre Island or the north end of South Island as was originally planned.

It is encouraging that Black-crowned Night-Herons did nest on one of the new wildlife islands in 1996 and 1997. Black-crowned Night-Heron populations have been declining significantly in Hamilton Harbour (1987-1996) and it is one of the three species whose populations warrant concern. The small number of Night-Herons breeding in the harbour in 1996 and 1997 would seem to indicate that there have been problems associated with their nesting sites to date. For example, they abandoned nesting sites in the Cottonwood trees at Eastport in 1986-1988. This corresponded with an increase in the use of the trees by Double-crested Cormorants (Moore *et al.* 1995). Moore *et al.* (1995) did not

collect data to test the theory but indicated that the abandonment of the cottonwood trees by Black-crowned Night-Herons probably resulted from defoliation caused by cormorant feces. Peck and James (1983) surveyed 168 Black-crowned Night-Heron nesting colonies in Ontario and they found only one where the nests were not located in shrubs and trees. These nests had been constructed in a cattail marsh on matted vegetation (Peck and James 1983). It is unusual that the Night-Herons in Hamilton Harbour have chosen to nest on rocky substrate. Though they have been observed nesting among rocks on Little Galloo Island and Snake Island in Lake Ontario (D.V. Weseloh, pers. obs.) this activity would appear to indicate that the Hamilton Harbour population has been under pressure to find suitable nesting habitat. There is a need for continued monitoring and management to ensure that both Black-crowned Night-Herons and Double-crested Cormorants can cohabit on the new wildlife islands.

#### **5.3 HERRING GULLS**

During both years, Herring Gulls nested on the new wildlife islands. Most of the nests they built were not on substrates intended for other species. They did not occupy the elevated ridge on Centre Island that was prepared for them. Herring Gulls nested in greater numbers on North Island than on Centre Island. Though the sub-area constructed on Centre Island was an elevated ridge it is lower in height than North Island. Herring Gulls may have preferred to nest on North Island since it is higher in elevation than Centre Island and closer to the established Herring Gull colony on Neare Island. Herring Gulls may choose to nest on the elevated ridge on Centre Island in future years, depending on events at the sites they have occupied to date. For example, Herring Gulls may choose to nest elsewhere if Ring-billed Gulls nest on the areas they have been occupying on North Island. Herring Gull populations in Hamilton Harbour do not appear to warrant concern since no significant trend was observed between 1987 and 1996.

#### 5.4 RING-BILLED GULLS

Ring-billed Gulls did not establish nesting colonies on habitats designated for any other species on the three wildlife islands. In 1996 this was due in part to the destruction of nests they had built early in the season on the plastic sheeting covering the tern sub-areas of North Island. The extremely large Eastport population did not seem to be suffering from overcrowding in 1996. Relative to 1996, the number of Ring-billed Gulls nesting on the new wildlife islands increased by 159 nests in 1997. The Ring-billed Gulls at Eastport were disturbed in 1997 by the use of a flare gun and falconry during the nesting season. These disturbances, coupled with the decrease in nesting habitat that can be expected

once construction of port facilities are initiated (in autumn/winter 1997-1998, D. V. Weseloh, pers. comm.), may mean that more Ring-billed Gulls will nest on the new wildlife islands in future years. Continued monitoring and management is recommended for the new wildlife islands to ensure that habitat remains available for the other intended species.

#### **5.5 CASPIAN TERNS**

Caspian Terns tend to move to new nesting sites if reproductive success has been threatened or terminated on traditional sites (Cuthbert 1988). The predation of nests at Eastport by red foxes, in 1995 and 1996, may account for the successful colonization of the designated sub-area on North Island in 1996. The decoys did not appear to influence the colonization of the intended site because they were placed after nesting had begun. Caspian Tern populations in Hamilton Harbour showed no significant trend between 1988 and 1997. Since their populations warrant concern, continued monitoring is recommended to ensure their numbers do not decline significantly.

#### **5.6 COMMON TERNS**

Common Terns nested in large numbers on the new wildlife islands in 1996 and In 1996 they utilized topsoil and leaf mulch substrate, which was 1997. unexpected. It was not known if the Common Terns would return in 1997 to renest on areas covered with extensive vegetation. Common Terns did nest among tall vegetation on Centre Island but the colony appeared to be moving to a less vegetated area since late-season nests were found on the sparsely vegetated gravel beneath the cormorant platforms. On South Island, Common Terns also established nests on less vegetated areas. This may have been due, in part, to the nesting of Ring-billed Gulls among the thick vegetation on South Native shrubs intended for Black-crowned Night-Herons were not Island. planted, as planned, on the sub-areas utilized by Common Terns in 1996. Common Tern populations showed no significant trend between 1988 and 1997. It is assumed that the Hamilton Harbour population is stable. Continued monitoring is recommended to ensure that the Hamilton Harbour population does not decline significantly as have other populations on the Great Lakes (Courtney and Blokpoel 1983, Blokpoel and Scharf 1991, Morris et al. 1992).

#### 5.7 OVERALL CONCLUSIONS

Evaluation of the results from the first two nesting seasons on the new wildlife islands is considered preliminary. Formal evaluation will occur after at least four nesting seasons (Quinn *et al.* 1996). Overall, the results to date are

encouraging, five of the six target species established and maintained nesting colonies on the three wildlife islands. Of these five species only two, Ring-billed Gulls and Caspian Terns nested on the sub-areas designed for their use. There is a need for continued monitoring and adaptive management to ensure that the species are able to cohabit on the new islands in the long-term. The six species of colonial waterbirds are not exclusive to Hamilton Harbour, and their respective population trends overall (including populations outside Hamilton Harbour), will greatly influence management efforts on the three wildlife islands in Hamilton Harbour.

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