ONTARIO PARKS

Presqu'ile

Annual Report on the Management of Double-crested Cormorants for 2006

Copies of this publication may be obtained at no charge on-line at
http://www.ontarioparks.com/english/pres_planning.html

Cover photo: Cormorants at High Bluff Island, Presqu'ile Provincial Park
Photo taken by: Ontario Parks staff

51860
ISSN 1710-3797 (electronic)

Executive Summary

This report summarizes the results of cormorant management activities at Presqu'ile Provincial Park in 2006.

The fourth year of the four year management strategy for double-crested cormorants *(Phalacrocorax auritus)* was implemented at Presqu'ile Provincial Park in 2006. The goal of this strategy is "*to protect representative woodland flora and fauna of High Bluff Island while retaining maximum diversity of nesting colonial bird species"*.

In 2003, management activities occurred only in the western woodland of High Bluff Island and the ground colonies on Gull and High Bluff Islands. Since 2004, in accordance with the amended Management Strategy for Double-crested Cormorants (Ontario Parks 2004 a), management was carried out on ground-nesting and tree-nesting cormorants on both Gull and High Bluff Islands.

The following activities occurred at Presqu'ile, 2003-06;

Management Activity	2003	2004	2005	2006
oiling eggs in ground nests	√	√	√	√
culling of adult cormorants from tree nests		√	√	√
composting of cormorant carcasses		√	√	√
removal of tree nests	√	√	√	√
disturbance of post-breeding season roosts		√	√	√
artificial ground colony habitat creation		√	√	
habitat restoration (tree planting)		√	√	√
removal of dead roost trees			√	√
monitoring of non-target species	√	√	√	√

In 2006, 2,077 nests were removed from trees, eggs in 801 ground nests were oiled and 2,927 adult cormorants were culled from tree nests during April 15 to July 13, 2006. Roost disturbance was conducted during August and September.

The carcasses of culled cormorants were disposed of in a composting facility in accordance with a provisional Certificate of Approval to operate a waste disposal facility issued by the Ontario Ministry of the Environment. Some cormorant carcasses were involved in companion studies with partners, including the Cooperative Centre for Wildlife Health in Canada (University of Guelph), the National Wildlife Research Centre (Environment Canada) and Carleton University

Three hundred trees were planted in 2006 to continue habitat rehabilitation efforts begun in 2004. Four dead trees used by roosting cormorants were cut down to provide protection to sub-canopy vegetation suffering from the effects of cormorant guano deposition.

Great egret (*Ardea alba*) and great blue heron *(Ardea herodias)* numbers declined in 2006, while black-crowned night-herons (*Nycticorax nycticorax)* reached the highest levels on record for Presqu'ile.

Studies conducted in association with the Canadian Wildlife Service compared the behaviour and breeding success of

i) great blue herons and great egrets at Presqu'ile and an unmanaged (control) colony at Chantry Island, Lake Huron,
ii) behaviour of black-crowned night-herons at Presqu'ile and Hamilton Harbour, and
iii) breeding success of black-crowned night-herons at Presqu'ile and Chantry Island.

These studies indicated that nest failure rates were higher at Presqu'ile for great blue herons and lower for great egrets and black-crowned night-herons. All three non-target colonial waterbird species living in proximity to the managed areas on High Bluff Island were successful in producing broods in 2006. The number of fledged chicks produced by successful nests for all three species was similar at Presqu'ile and the control sites. Fledging success for great blue herons has risen steadily since cormorant management began in 2003, while great egret fledging has remained relatively constant. Black-crowned night-heron fledging success was not studied prior to 2006.

Data from the annual cormorant census (late-June) indicate that in 2006, the number of cormorant nests at Presqu'ile (2819 nests) had declined 39% from 2005 and 77% from 2002 (the last year before management began). In 2002, the Presqu'ile cormorant colony represented 42.8% of the Lake Ontario population, while in 2006, the Presqu'ile colony represented only 13.6% of the Lake Ontario population.

Background Information

Pre-1900 distribution of double-crested cormorants (*Phalacrocorax auritus;* hereafter referred to as cormorants) in the Great Lakes is the subject of much discussion (Wires and Cuthbert 2006).

By 1945, cormorants had established colonies as far east as the St. Lawrence River in the Great Lakes Basin (Weseloh et al., 1995). Recently, cormorant populations have increased in Ontario from a low of about 120 nesting pairs in the early 1970s to 115,000 nesting pairs in 2001 (Ontario Parks 2000a).

Cormorants first began nesting at Presqu'ile in 1982 with a single tree nest on Gull Island. Since then, cormorant nesting has spread to the adjacent High Bluff Island and numbers have risen steadily to a peak of 12,082 nests in 2002. As a result of the nesting activity of these birds, all trees on Gull Island have died, most super-canopy trees on High Bluff Island have died and the remaining mid and lower vegetation on both islands is threatened (Koh and Carr 2003).

To prevent further negative impacts on the existing island ecosystem, Ontario Parks implemented the 'Management Strategy for Double-crested Cormorants' (Ontario Parks 2002). The 2003 breeding season was the first year of the program and the results of that year's work are summarized in the annual report (Ontario Parks 2004b; http://www.ontarioparks.com/english/planning_pdf/pres_annual_report.pdf). In 2004, the Presqu'ile Cormorant Management Strategy was amended to allow nest removal in all remaining woody vegetation on both Gull and High Bluff Islands and to allow for the culling of adult tree-nesting cormorants.

In 2002, the last year in which no management occurred at Presqu'ile, the Presqu'ile colony constituted approximately 43% of the Lake Ontario population. In 2002, 12,082 of Lake Ontario's 28,180 nests were located at Presqu'ile. In 2006, after four years of management, the Presqu'ile colony constitutes approximately 13.6% of the Lake Ontario population. In 2006, 2,819 of Lake Ontario's 20,692 cormorant nests were at Presqu'ile.

The goal of cormorant management operations at Presqu'ile Provincial Park is:

- *to protect representative woodland flora and fauna of High Bluff Island, Presqu'ile Provincial Park, while retaining maximum diversity of nesting colonial bird species.*

There are four objectives associated with the goal:

- *to limit cormorant use of trees for nesting on High Bluff Island,*
- *to reduce cormorant use of trees for roosting on High Bluff Island,*
- *to reduce recruitment from ground nesting cormorants on Gull and High Bluff Islands, and*
- *to minimize impacts of cormorant management on other colonial bird species nesting on Gull and High Bluff Islands.*

This report summarizes the results of cormorant management activities at Presqu'ile Provincial Park in 2006.

Methods[1]

Site description

Management activities were conducted on High Bluff Island and Gull Island at Presqu'ile Provincial Park (Figure 1). High Bluff Island (38.16 ha) lies 2 km southwest of the Presqu'ile peninsula and is adjacent to Gull Island (7.25 ha). High Bluff Island is a low, essentially flat limestone outcrop that has a thin mantle of lacustrine sands and clays at its interior, shingle beach at its periphery, and remnant shingle beach at its interior. Gull Island is an exposed shingle and gravel bar expanding towards the peninsula.

High Bluff Island supports two major woodlands; a 8.75 ha western woodland and a 2.88 ha eastern woodland. In the recent years, both woodlands have suffered serious degradation as a result of the cormorant nesting and roosting activity. In 2003, the focus of the management program was in the western woodland due to its significant species association. In this area, most super-canopy trees have died and many have fallen over but the mid-canopy and lower vegetation remains relatively intact. In 2004, 2005 and 2006, management activities were expanded to include the eastern woodland and other areas of woody vegetation.

Mature sugar maple (*Acer saccharum*), red oak (*Quercus rubra)* and black maple (*A. saccharum ssp. nigrum*) made up the dominant tree cover in the western woodland. The eastern woodland is dominated by white ash (*Fraxinus americana*), white cedar (*Thuja occidentalis*), crack willow (*Salix fragilis*) and white birch (*Betula papyrifera*). Trees are found scattered throughout much of the island's interior, as well in successional fields and thickets of choke cherry *(Prunus virginiana)* and Canada plum *(Prunus nigra)*. Provincially significant species on the islands include bushy cinquefoil *(Potentilla paradoxa*) and Smith's club-rush (*Schoenoplectus smithii*) and the regionally rare black maple. The woodland on the island was considered significant due to the age of the trees, the uncommon species association, and the rarity of mature forest on Lake Ontario islands (Blaney 1997).

At present, cormorants (DCCO) nest on the ground on Gull Island (they formerly nested here in trees which have since died and fallen). In recent years they have also nested in the remaining shrub on Sebastopol Point, Gull Island but these nests have been removed since 2004. On High Bluff Island cormorants nest both in woody vegetation and on the ground.

[1] The Methods and Results sections use acronyms for bird common names as follows:
cormorant - DCCO, great egret - GREG, great blue heron - GBHE, black-crowned night-heron - BCNH

Figure 1. Aerial photo of High Bluff Island in the foreground, Gull Island in the background (1997 photo).

DCCO Management

DCCO management activities that occurred from March 27, 2006 to October 20, 2006 included egg oiling, nest removal, disturbance of roosting birds and culling of nesting adults. Egg oiling smothers the embryos within the eggs thereby reducing recruitment of young into the population. Adults continue to incubate the eggs and do not re-nest. Nest removal discourages nesting and reduces damage to vegetation from the guano of incubating adults and young. Disturbance of roosting birds in the post-breeding season reduces damage to vegetation from guano deposited while roosting. Culling has multiple effects, including population reduction, reduced recruitment and a reduction in deposition of guano on vegetation and soil.

Egg oiling. On both islands, eggs of ground-nesting DCCOs were treated with white mineral oil (Daedol 50 Waterbird Control Oil), approved by Health Canada. Backpack-style agricultural sprayers were used to deliver the oil (Figure 2). Each sprayer carried 12 L of oil. Hearing protection was worn by all staff to reduce noise associated with the bird colony. All nests were identified and marked prior to oil spray application. One person followed the oil sprayer to document the number of eggs treated, number of nests treated and number of unoccupied nests (nests without eggs).

Predation of DCCO eggs by gull species causes DCCOs to re-lay new eggs in the same nests. Due to these new clutches of eggs and some late nesting DCCOs, it was necessary to oil nests repeatedly. Ground nests containing eggs were treated on four separate sessions between May 08 and July 07, 2006. In order to minimize disturbance to ground-nesting DCCOs, visits to the ground colonies were kept to an absolute minimum.

As per recommendations of the 2005 Double-crested Cormorant Management Scientific Review Committee, a portion of the ground colony was not oiled (Ontario Parks, 2005 a.). The area selected was estimated to be approximately 10% of the overall number of ground nests anticipated in the 2006 breeding season. This area was not oiled to allow young DCCOs to hatch so that they could be banded.

Figure 2. Oiling of ground-nests.

Culling Culling occurred on five separate days between May 15 and May 26, 2006. DCCOs were shot with .22 caliber rifles fitted with 4 power scopes, using a .22 calibre hollow-point subsonic bullet. Up to five shooters operated in the field simultaneously. Each shooting event took approximately 30 minutes to complete. Spotters were stationed in appropriate locations to ensure public safety. An observer of non-target (GREG, GBHE and BCNH) species accompanied the shooters whenever culling was conducted.

Carcass disposal The carcasses of culled DCCOs were collected and delivered to a composting facility on High Bluff Island (Figure 3). To minimize the time and potential disturbance to non-target species within the colony an all-terrain vehicle fitted with a trailer was used to transport carcasses to the composting facility. The site location, design and operations of this facility were in accordance with a provisional Certificate of Approval, issued by the Ontario Ministry of the Environment, to operate a waste disposal facility. High carbon material is required as a substrate for effective composting. In 2006 wood chips derived from tree-trimming in the park's development zones were utilized, in accordance with the park management plan (Ontario Parks 2000b; http://www.ontarioparks.com/english/planning_pdf/pqplan.pdf).

Nest removal. Nests were removed from trees in all wooded areas of the Presqu'ile Islands using forestry poles. Forestry poles (square cross-sectioned fibreglass poles in 8-foot (2.46 m) sections) were used to knock nests down from trees (Figure 4a). As in previous years, high-level nests (Figure 4b) that required 8 or more sections of poles (22.5 m or higher from the ground) required significant amounts of time and effort to remove (up to 20 minutes for a single nest). Many nests were beyond the reach of forestry poles. For detailed information on nest removal techniques refer to the 2003 annual report (Ontario Parks 2004b; http://www.ontarioparks.com/english/planning_pdf/pres_annual_report.pdf).

Figure 3. 2006 Composting facility on High Bluff Island.

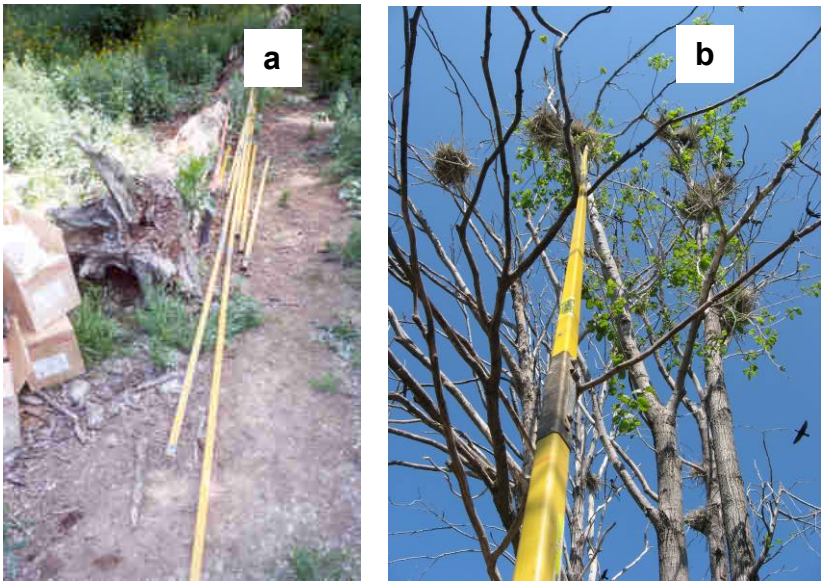

Figure 4a. Forestry pruning poles, in sections, used for knocking down nests
4b. Poles in use for nest removal on High Bluff Island.

Roost Disturbance. During August and September 2006 staff actively discouraged DCCOs from roosting in areas containing living vegetation on High Bluff Island. This was achieved through the presence of humans within these areas, and by discharging noise-making devices such as whistles, air-horns and blank shot-gun shells. Staff located at the island's lighthouse and north shore observed DCCOs to determine the reaction and ultimate destination of roosting birds after disturbance activities. Roost disturbance typically occurred every third day.

DCCOs arriving to roost on the island were tallied prior to roost disturbance activities (Appendix 1). This was achieved by placing an observer at the western tips of either High Bluff or Gull Island. The observer faced west and counted birds as they arrived to roost from areas offshore. Only flocks flying from the open water horizon towards the island were counted and birds flying about in close vicinity to the island were excluded from totals.

Vegetation Management

Tree Planting. Trees were planted on High Bluff Island in 2004 (autumn), 2005 (spring and 2006 (spring). The planting stock originated from the park's native tree nursery where trees are grown from seeds collected at Presqu'ile and only species currently growing on High Bluff Island were planted. Most planted trees were over 1.5 m in height to discourage browsing by white-tailed deer (*Odocoileus virginianus)*.

In 2006 three hundred trees were planted on High Bluff Island in April and early May (Figure 5a). The sites selected for tree planting were former woodland areas that now consist largely of dead trees and shrubs that have not attracted roosting or nesting DCCOs since the removal of the nests.

In 2006, 200 of the newly planted trees were wrapped with plastic tree-guards in an effort to prevent tree-girdling by rodents (Figure 5b). The remaining 100 trees were collared with 11.4 liter plastic pails (empty ice-cream pails with the bottoms removed; Figure 5c). These pails essentially acted as large diameter tree guards, providing both rodent protection and a means to deeply soak root systems by pouring water into the pails during drought periods. The pails were dug into the soil approximately 10cm to provide stability to the pails and to discourage rodents from digging beneath the pails. Sinking the pails into the soil also ensured minimal loss of water when they were used as irrigation aids.

An additional method used in 2006 to reduce rodent damage was the cutting of the thick herbaceous vegetation layer to eliminate the cover this vegetation provided to rodents. Grass and other herbaceous plants were cut with mowers and weed-cutters in the newly planted areas (see Figure 5b.) Cutting occurred in late-August, September and October.

To prevent deer-browsing and buck-rubbing behaviour, fencing was also erected around the planted areas (see Figure 5b.). The fences were 2 meters high and the tree planting areas was sub-divided into smaller areas. This partitioned design was intended to minimize damage should a deer enter a portion of the planted area.

Figure 5a) Tree-planting on High Bluff Island, spring 2006.
5b) Rodent guards and trimmed ground level herbaceous layer to discourage tree-girdling by rodents. Fencing to discourage browsing and antler rubbing by deer.
5c) A tree planted with a 11.4 liter pail "collar" (bottom removed) as rodent protection and for deep-root watering.

Roost Tree Cutting. Dead roost trees were removed in areas where living vegetation was being affected by the guano produced by the roosting DCCOs. The trees were cut with chain saws at waist level and the trunks were left where they fell.

Non-Target Species Monitoring

The nesting status of the park's great egret (GREG), great blue heron *(*GBHE) and black-crowned night-heron (BCNH) populations were closely monitored prior to and during the management period of 2006 (as in 2003, 2004 and 2005) (Figure 6). The behaviour of nesting herons (GREG, GBHE, BCNH) was monitored to ensure that adults were not kept away from their nests for extended periods of time.

Figure 6. Monitoring of non-target species occurred before, during and after management activities.

Monitoring of behaviour and breeding success of the heron and egret species began on April 10 and concluded on August 9, 2006. On non-cull days, a single person monitored the nests of non-target species, recording nest status and the presence and behaviour of adults at each nest. On cull days, two staff persons were dedicated to the monitoring of non-targets. Monitoring was conducted both in the morning, before activities were initiated on the island, and again after the day's management activity had concluded. During all culling operations, activity was directed away from the vicinity of nesting non-target herons whenever possible. Since each of the three heron species responded differently to human presence and management activity, a different monitoring protocol was developed for each species (see sections that follow). Nest observations were made from fixed locations throughout High Bluff Island, at distances determined from other studies to minimize disturbance to breeding herons (GBHEs, $\geq$110m; GREGs and BCNHs, $\geq$75 m; Erwin 1989; Rodgers and Smith 1995). The locations of these permanent monitoring stations are presented in Figure 7.

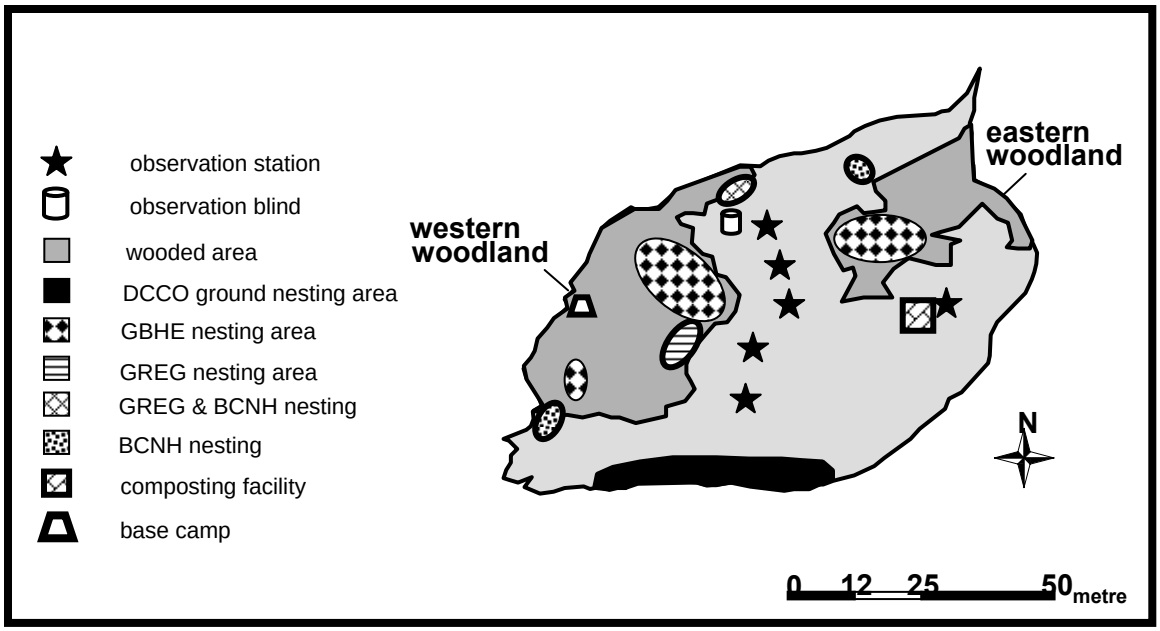

Figure 7. Locations of DCCO, GBHE, GREG and BCNH nesting and monitoring sites on High Bluff Island in 2006.

GREG. All GREG nests were observed, using binoculars (10 power with 50 mm objective lens) and spotting scopes (15-45 power with 70 mm objective lens), at least five days per week (Mon. to Fri.) from April 10 to July 17, 2006, and weekly from July 18 to August 9, 2006. Six permanent observation stations were arranged throughout the island (Figure 7) so that access to and use of these stations did not cause disturbance to breeding GREGs. Each nest was visited twice per month to confirm its status. GREG nesting areas were entered on July 7 and 17 for the final assessments of fledging success.

GBHE. All GBHE nests on High Bluff Island were monitored on the same schedule and using the same protocols as for GREGs (see above; Figure 7). For assessment of fledging success, it was necessary to approach GBHE nests more closely (in some cases, this involved standing beneath the nesting tree). GBHE nesting areas were entered on July 7 and 17 for the final assessments of fledging success.

BCNH. Several factors made the monitoring of BCNH nests a challenge in 2006, as in previous years. First, BCNHs nested in densely-foliated shrubs and trees in 2006. Second, of the three heron species nesting at Presqu'ile, BCNH adults are potentially the most sensitive to human disturbance and nestlings are prone to fleeing from the nest site when disturbed (much more so than the other heron species). To minimize potential negative impacts on breeding BCNHs, nest monitoring and the collection of behavioural observations were conducted from a blind, placed 75 m from one of the BCNH sub-colonies (the choke cherries on the northern shoreline). Each BCNH nest was visited bi-monthly, to assess or confirm nest status. BCNH nesting areas were entered on July 7 and 17 for the final assessments of fledging success.

One concern associated with culling activity was the movement of displaced or disturbed cormorants to roosting sites on Sebastopol Point, thereby disrupting nesting BCNHs at

this location. To address this issue, a boat was anchored approximately 150 m off Sebastopol Point during cull events. The boat deterred DCCOs from roosting on the island, while eliciting no response from incubating BCNHs.

Actions taken to minimize disturbance to non-targets. A variety of general protocols and techniques were employed to reduce disturbance to the non-target species during monitoring and culling activities. The behaviour of non-target species was monitored by a biologist during each cull event. Whenever possible, personnel were directed away from areas used by herons and egrets. These actions included:

1) **Delaying management activity until mid May**. For herons and egrets, nest attentiveness increases and the probability of nest abandonment decreases during the later phases of their nesting cycle. Delaying DCCO management activity until later in the nesting phenology of these non-target species (hatching or nestling stage for most GBHEs; late incubation for most GREGs), reduced the potential impacts and consequences associated with any management-related disturbances.

2) **Reducing foot traffic on the island**. On a daily basis, only the minimum number of staff required to complete specific tasks were present on High Bluff Island. During times when monitoring or management activities were not occurring, all staff were restricted to either the area of the composter or the base camp (Figure 7). When traveling between these sites, staff traveled either by boat, or as a group along marked paths that were established to minimize potential disturbance to all of the colony locations. Whenever possible, personnel were directed away from areas used by herons and egrets. Access to the BCNH sub-colony on the western end of High Bluff Island, and foot traffic around that end of the island, were restricted from late April onward.

3) **Minimizing time spent in the woodlots during culls**. The duration of culling events (10 - 90 min) was designed to minimize the amount of time parent herons spent away from the nest. Dead DCCOs were collected, processed and composted by all available staff, usually following each cull event, thereby reducing the time spent in the colony. An all-terrain vehicle and trailer were utilized to ensure the shortest possible pick-up period.

4) **Staggering culling events**. At least several hours elapsed between culling events. The goal of these breaks was to allow non-target species to return to their nests and resume incubation and chick-rearing.

5) **Shooting direction**. It was noted that if the direction of muzzle sound was angled away from the nests of non-target species then parents often would not flush during culls (especially GREGs). Efforts were made to ensure the sound projected from firearm muzzles was not in alignment with non-target species.

Heron and egret behaviour and nesting success – comparing Presqu'ile with control sites at Chantry Island and Hamilton Harbour.

In addition to the monitoring of non-target species at Presqu'ile, two non-managed (control) colonies were monitored to determine if management activities had an impact on non-target species at Presqu'ile. This study was conducted in partnership with the Canadian Wildlife Service. Chantry Island in Lake Huron (Figure 8) was selected as a

control site for herons and egrets as it represented the most similar mixed species colony available, in terms of species present and the relative abundance of each species. Chantry Island was also used as the control site for GBHEs and GREGs in 2005. Chantry Island is designated as a Migratory Bird Sanctuary and the waterbird colony was subjected to a low level of human disturbance in 2006 (one observer, one visit per week; monitoring was conducted from the lighthouse to avoid the need to enter the breeding colonies). Private, guided tours of the Chantry Island lighthouse were conducted during the summer months but tourists were restricted to the immediate vicinity of the lighthouse and caused no disturbance to tree-nesting birds at this site.

Hamilton Harbour was selected as the control site for the collection of BCNH behavioural data, as BCNH nests on Chantry Island were widely dispersed and located in densely-foliated shrubs, making direct observation of nest sites difficult. At Hamilton Harbour, BCNHs and DCCOs nested on three man-made islands, located 75 – 150 m offshore. This feature of the site facilitated monitoring and the collection of behavioural data from observation points on the mainland shoreline adjacent to each of the nesting islands, thereby eliminating the need to visit the islands and disturb nesting birds.

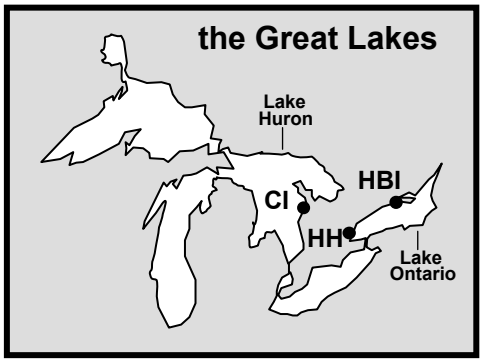

Figure 8. Locations of High Bluff Island (HBI), Presqu'ile Provincial Park, Chantry Island (CI), Lake Huron and Hamilton Harbour (HH), Lake Ontario.

As part of this study, behavioral data were collected weekly at High Bluff Island (HBI), Chantry Island (CI) and Hamilton Harbour (HH) for GBHEs (39 nests at HBI, 30 nests at CI), GREGs (16 nests at HBI, 30 nests at CI) and BCNHs (10 nests at HBI, 50 nests at HH) over a nine week period (May 7 to July 7, 2005). Behavioural data were collected for all GBHEs and GREGs nesting on HBI; only 10 BCNH nests were followed on HBI, as this was the total number visible from the observation blind. For the control sites, a representative sample of nests was monitored. To assess the effect of the DCCO cull on GBHE, GREG and BCNH nest attendance and behaviour, time budget data (45 min/nest/week) were collected during: (i) the two weeks prior to the start of culling activity, (ii) the week of the cull and (iii) the week following the termination of the cull.

During the week of the cull, additional time budget samples were collected at HBI that were associated directly with cull events. Nest attendance and behaviour of GBHEs,

GREGs and BCNHs were quantified during pre-cull (45 min/nest/week), cull (23-55 min/nest/week), and post-cull periods (45 min/nest/week), and compared to data collected on days when no shooting occurred on HBI (45 min/nest/week). During culling events, behavioural samples were collected both in the woodland (eastern or western) where shooting occurred and in the adjacent woodland, where culling was not occurring, to determine the spatial scale of disturbance effects on non-target species.

During all observation periods (at HBI, CI and HH), the following behavioural data were recorded for each nest: (a) the presence of a bird at the nest site and its behaviour, (b) the presence of a mate and (c) the intensity, duration and outcome of aggressive interactions between focal birds and either conspecifics, other herons/egrets or DCCOs. Behaviour at the nest was categorized as (i) incubating/brooding, (ii) standing in the nest while preening, turning eggs, interacting with chicks or interacting with a mate, (iii) standing in the nest in an 'alert' posture, (iv) perched near the nest or (v) away from the nest. Nest attendance was defined as the time spent engaged in activities (i)–(iv).

During the ninth week of the study, nesting success and brood size were recorded for nests at HBI and CI, to determine if there were any prolonged, cumulative effects of DCCO management on non-target GBHEs, GREGs and BCNHs.

Heron Roost Monitoring. The possible impact on roosting herons and egrets of DCCO roost disturbance was a concern. Observations of herons and egrets flying to and from High Bluff Island were made on 6 days between July 31 and August 10, 2006, in an attempt to determine if the island was being used as a significant roosting location. Observation periods ranged in length from 45 minutes to 1.25 hours. Either sunrise or sunset occurred mid-way through these observation periods.

Typically two observers were placed at vantage points facing east and west where they could record herons moving to and from HBI. On one occasion a third observer was used. Observers were equipped with 7 power binoculars with 42 mm objective lenses. The observers were able to contact each other with two-way radios to ensure observation errors (such as double-counting) did not occur.

Companion Science.

Culled Birds. With the opportunity to conduct a large number of post-mortem examinations of cormorants, a variety of companion science projects was undertaken in 2006. These projects include:

- stomach contents sampling,
- sexing by dissection,
- weight,
- collection of cloacal swabs for viral analysis (e.g. West Nile Virus, Avian Influenza, Newcastle Disease),
- collection of morphometric data,
- parasites,
- feather isotopes,
- aging.

All sampling was conducted by project staff within 2 hours of the birds being culled and prior to the birds being composted. Weighing, stomach sampling, gender determination, and morphometric measurements were performed on a sample of birds from all five culling events.

Birds were weighed using an Acculas digital scale. Cloacal swabs were collected (Figure 9) from a sample of culled cormorants using Viral Culturettes^{TM} (manufactured by Becton Dickinson Ltd.): a rayon-tipped swab was inserted into the cloaca of each bird and then preserved in an ampule of 0.5 mL modified Hanks-balanced salt solution. These swabs were placed in cooler packs and immediately shipped to the Cooperative Centre for Wildlife Health in Canada at the University of Guelph.

Intact stomachs, crops and their contents were then removed, bagged, labeled and frozen for later analysis. Cormorant gender was determined by visual inspection of the gonads following removal of the stomach.

Morphometric data (stomach mass, head-bill length, bill depth, tarsal length and wing chord) were collected after sexing was completed. Head-bill length, bill depth and tarsal length measurements were made with a vernier caliper measured to the nearest tenth of a millimeter. Wing chord measurements were made with a meter-stick and measured to the nearest millimeter.

Figure 9. Collection of cloacal swabs for viral analysis.

In 2006, 140 gastro-intestinal tracts, 100 carcasses of birds of unknown age and 28 carcasses of birds of known age (i.e. banded) were provided to the Environment Canada's National Wildlife Research Centre (NWRC) in Ottawa. The stomachs are being used for a joint NWRC/Carleton University study of the parasite burden of fish-eating birds. A second NWRC/Carleton study is using the feathers to determine information about the wintering grounds used by the cormorants. A third study will attempt to develop a molecular method for aging cormorants.

Live Birds. In addition to post-mortem data collection, 30 juvenile cormorants from ground nests on High Bluff Island were banded by qualified Canadian Wildlife Service staff. Flightless juvenile cormorants were captured by hand and fitted with standard aluminum bands on one leg (Figure 10a). The other leg was fitted with a white plastic colour band with black alpha-numerics (Figure 10b). These birds were released

immediately after banding in the vicinity of their nests and the banders withdrew from the colony.

Figure 10. Juvenile cormorant receiving a metal band (left). Juvenile cormorants after receiving bands (right). Note white colour bands with black numerics.

Results

In total 2,819 cormorant nests were counted at Presqu'ile on June 19, 2006, a decline of 39% since 2005. Cormorant nests have declined by 77% since 2002, the last year before management of cormorants began (Table 1).

Table 1. Cormorant annual nest counts at Presqu'ile, 2002 to 2006.

Site	Nest Location	Number of Nests by Year*				
		2002	2003	2004	2005	2006
High Bluff Island	tree	6893	4631	3656	1976	2108
	Ground	3491	2948	1683	1305	498
Gull Island	Ground	1698	1117	1601	1328	213
Total	tree	6893	4631	3656	1976	2108
	Ground	5189	4065	3284	2633	711
	all	12082	8696	6940	4609	2819

* Nest data is tallied in late June.

As in other years, tree nests were found in both the eastern (1,286 nests) and western (822 nests) woodlands of High Bluff Island in 2006.

In total, 498 ground nests were counted during the annual nest count (third week of June) on High Bluff Island, a decline of 61.8% from the 1,305 nests counted in 2005. Similarly, the number of ground nests on Gull Island decreased from 1,328 nests in 2005 to 213 nests in 2006, a reduction of 83.9%. Overall, ground nests have declined 73% since 2005.

Cormorant Management

Cormorant management activities occurred at Presqu'ile during the period of May 15 to October 20, 2006.

Egg oiling. Egg oiling occurred four times during the period May 8 to July 7, 2006. In total, 4,515 eggs were treated with mineral oil on both Gull and High Bluff islands (Table 2). The highest nest count during oiling was 801 nests. Egg oiling successfully prevented all eggs from hatching in ground nests that were treated, and adults continued to incubate oiled eggs and did not re-nest. However, predation on cormorant eggs by gulls was apparent, and when predation occurred, cormorants would re-lay their eggs (in the same nests). Cormorant egg-laying also naturally occurs over a prolonged period of time. For these reasons it was necessary to continue oiling nests throughout the egg-laying period.

Culling. In 2006, 2,927 cormorants were culled at Presqu'ile on five separate shoot days between May 15 and May 26 (Table 2).

Carcass Disposal. The carcasses were placed into a composting facility. Specifications and operational procedures for this facility were outlined in a Provisional Certificate of Approval for a Waste Disposal Site provided by the Ontario Ministry of the Environment.

Nest removal. In 2006, 2,077 nests were removed from trees on High Bluff Island (Table 2). The ability to remove nests using forestry poles depended largely on nest height. Mid-level nests demanded the most attention due to their relative abundance. As in previous years cormorants appeared reluctant to return to areas that had been completely cleared of nests (trees, small trees and shrubs). Removal of high-level nests was an extremely slow process and required a high degree of effort.

Table 2. Totals associated with cormorant management actions at Presqu'ile.

Activity	Year			
	2003	2004	2005	2006
eggs oiled	28648	26311	23732	4,515
nests removed	3980	2098	1861	2,077
adults culled	0	6030	1867	2,927

Roost Disturbance. The techniques employed in 2006 (noise-makers and human presence) worked to varying degrees in encouraging roosting cormorants to vacate High Bluff Island. The loudest noise-makers (blank shot-gun shells) were most effective especially when backed up by human presence within the colony following the initial noise. The range of impact of the disturbance varied with the intensity of the noise, with the loudest sounds having the largest disturbance range.

Flushed birds were watched by observers from several locations around the perimeter of the island. These birds typically circled the island, with some landing in the adjacent woodlot. However, most landed on the waters of Lake Ontario and, after a period of five to fifteen minutes, the majority flew to Sebastopol Point on Gull Island where they roosted on the ground overnight. The roosting flock on Sebastopol Point was extremely dense, appearing as a solid covering of cormorants. This roosting flock dispersed onto Lake Ontario the following morning to feed.

The majority of the island's roosting cormorants were displaced from the islands in the first few days of disturbance activities. However, a group of about 500 cormorants refused to leave the island. Many of these birds were young cormorants that remained in the highest trees, the same trees that were not accessible to nest removal.

In August and September cormorants arriving to roost were observed and counted (Appendix 1). The observations commenced on August 2 and concluded on September 11. The maximum number of cormorants seen arriving to roost during the observation period was 4068 on August 9. The smallest number seen was 907 on September 11.

Vegetation Management

Tree-Planting. In total, 300 trees were planted on High Bluff Island in the spring of 2006. The relatively abundant rainfall may have contributed to nearly 100 percent survival rate over the first growing season. It was noted in the spring of 2006 that approximately 50 percent of the trees planted in 2005 had died, due to the drought conditions during the summer of 2005, damage by deer and girdling by rodents. Despite these issues, the surviving trees from plantings in 2004 and 2005 are experiencing

significant growth. In some cases tree height has doubled and planted trees are producing seed.

Roost Tree Cutting. Four dead trees were cut in October 2006 in areas where roosting cormorants were damaging nearby living vegetation (Appendix 2). After cutting the trees were left where they fell.

Non-target Species Monitoring

All three non-target species had successful breeding seasons in 2006 (Tables 3 and 4). The number of successful great blue heron nests declined from the previous year, great egret nest numbers were essentially stable, and the number of nesting black-crowned night-herons increased (see Table 4). Fledging rates for herons and egrets were similar in 2005 and 2006; fledging rates for black-crowned night-herons were not measured previously.

Great Egret. In total 33 nests were initiated by 16 egret pairs in 2006. Thirteen of these pairs (all in the western woodland) had their nests destroyed or taken over by cormorants early in the breeding season, between April 27 and May 23; three pairs nesting in the choke cherry thicket along the northern shoreline of High Bluff Island were unaffected. Sixty-five percent of nest losses to cormorants occurred prior to commencement of the cull. Following the removal of cormorant nests from the western woodland colony, all displaced egrets were successful in establishing a second nest. Fourteen of these 16 pairs fledged young. The maximum 2006 nest count occurred on June 5 with 16 nests. In total, fourteen successful nests produced 35 young. An average of 2.5 chicks fledged per successful nest.

Great Blue Heron. The high point for the great blue heron population in 2006 occurred on April 21 when there were 39 active nests (active nests were defined as a discernable collection of sticks of any size attended by accompanying herons). These nests were distributed between the eastern (22 nests) and western woodlands (17 nests). Seventeen nests did not fledge chicks: cormorants replaced the original occupants in 15 cases, one nest was destroyed by cormorants and one failed for unknown reasons. Thirty-eight percent of cormorant-related nest losses occurred prior to the start of culling. Twenty-two nests were successful, producing 51 young – 27 in the eastern woodlot and 24 in the western woodlot. An average of 2.27 chicks fledged per successful nest.

Black-crowned Night-Heron. Eighty-four black-crowned night-heron nests were counted in 2006. Seventeen of these nests were on Sebastopol Point, Gull Island and 67 were located on High Bluff Island. On High Bluff Island, black-crowned night-herons nested mainly at two sites: in a clump of cedar trees at the western tip of the island and in the choke cherry thicket along the northern shoreline. Fifty-one of the 67 black-crowned night-heron nests on High Bluff Island were monitored regularly. Forty-one of these nests were successful and produced 80 fledged young, an average of 1.95 chicks per successful nest. The nests on Sebastopol Point were not monitored for success rates.

Table 3. Maximum nest count data for the three heron species at Presqu'ile, 1998-2006

Species	Maximum number of nests								
	1998	1999	2000	2001	2002	2003	2004	2005	2006
great blue heron	1	5	14	na	12	38	63	42	39
great egret	0	1	2	3	3	5	10	17	16
black-crowned night-heron	na**	nc***	nc	na	73*	80*	59	71	84

* Canadian Wildlife Service data

** na – not available

*** nc – not counted to avoid disturbance to newly established egret nests

Table 4. Nesting success of non-target species at Presqu'ile, 2003-2006.

		Year			
Measure of Nesting Success	**Species**	**2003**	**2004**	**2005**	**2006**
Maximum nest count	GBHE	38	63	42	39
	GREG	5	10	17	16
	BCNH	80	59	71	84
Number of successful nests	GBHE	25	38	32	22
	GREG	4	10	16	14
	BCNH	?*	?	?	?*
Number of fledged young	GBHE	37	75	75	51
	GREG	10	26	42	35
	BCNH	?	?	?	80*
Number of young fledged per nest	GBHE	1.48	1.97	2.34	2.27
	GREG	2.50	2.60	2.60	2.50
	BCNH	?	?	?	1.95*

? – unknown

* - 51 of 84 nests were monitored in 2006; 41 of these successfully fledged 80 young

Heron and Egret Behaviour and Nesting Success – comparing Presqu'ile and control sites (Chantry Island and Hamilton Harbour).

The following results are for the study comparing heron, egret and night-heron behaviour and nesting success at High Bluff Island with Chantry Island (GBHEs and GREGs) and Hamilton Harbour (BCNHs), two unmanaged (control) sites.

For both GBHEs and GREGs, there was no difference in mean nest attendance between Chantry Island and High Bluff Island during: (i) the two weeks prior to DCCO cull (weeks 1 and 2 of the study), (ii) non-cull days during the week when culling occurred (week 3), and (iii) the week following termination of the cull (week 4). These results are similar to the pattern seen in 2005 (Moore et al. 2005). For BCNHs, there was no difference in

mean nest attendance between High Bluff Island and the Hamilton Harbour control site during any of the periods described above.

On cull days, nest attendance of GBHEs (n=33) in the cull woodlot during culls (33%) and following (76%) culls was reduced compared to pre-cull (100%) levels. Nest attendance of observed GREGs (n=12) and BCNHs (n=10) in the cull woodlot did not differ significantly between pre-cull (100%), cull (100%) and post-cull (100%) periods. Culling had no effect on the nest attendance of herons, egrets or night-herons in the non-cull woodlot (100% nest attendance during pre-cull, cull, and post-cull periods). Although the pattern observed for GBHEs and GREGs in 2006 was similar to that recorded in 2005, birds spent slightly less time away from nests during the 2006 cull than they did in 2005.

The rate of nest failure (measured in week 9) was higher for GBHEs (44%) at High Bluff Island and lower for GREGs (13%) and BCNHs (20%), compared to control sites. Almost all of the GBHE (15 of 17) and GREG (11 of 13) nest failures on High Bluff Island can be attributed to destruction or usurpation of nests by DCCOs (see earlier sections). For GBHEs, the average number of chicks fledged from successful nests was higher at High Bluff Island than at Chantry Island. For GREGs and BCNHs, there was no difference between High Bluff and Chantry islands in the mean number of young fledged from successful nests (Table 5).

Table 5. Nesting success for three non-target species at High Bluff and Chantry islands in 2006.

	Nesting Success					
Site	**Failed Nests**			**Successful Broods**		
	GBHE	**GREG**	**BCNH**	**GBHE**	**GREG**	**BCNH**
High Bluff Island	44%	13%	20%	2.27±0.83 chicks	2.50±0.65 chicks	1.95±0.84 chicks
Chantry Island	33%	20%	32%	1.75±0.55 chicks	2.38±0.77 chicks	2.08±0.64 chicks

A more detailed report on non-target behaviour and fledging success was in progress at the time of preparation of this report.

Heron Roost Monitoring

Non-target species flying to and from High Bluff Island were counted during 13 hours of observation over 6 surveys dates between July 31 and August 09, 2006. The number of herons observed was variable, with a peak of 7 herons observed flying to the island on August 2 (Appendix 3).

Companion Science

Sub-samples of the 2927 cormorants culled were used for additional studies (Table 6). Other information (e.g. sex ratio) was derived from this sampling.

Table 6. Samples sizes for additional studies conducted using culled cormorants.

Purpose of sampling	Sample Size (# carcasses)
Stomach contents	279
sexing	279
weight	251
cloacal swabs for viral analysis	100
morphometric measurements	see Table 8
parasites	140
feather isotopes	128
aging	128

Sex ratio. The sex ratio of the 279 birds sexed was 168 males to 111 females (1.51:1). The male:female sex ratio varied among cull events, ranging from 0.79:1 to 4:1 (Table 7).

Table 7: Sex ratios of cormorants culled in 2006.

Date	Total Birds	# of Male*	# of Female*	Male : Female
May 15 am	30	24	6	4:1
May 15 pm	39	31	8	3.87:1
May 16 pm	50	30	20	1.5:1
May 23 pm	50	22	28	0.79:1
May 24 am	60	32	28	1.14:1
May 26 pm	50	29	21	1.38:1
TOTAL	279	168	111	1.51:1

* Gender of birds determined by dissection.

Viral analyses As of October 2006, the cloacal swabs analyses had not yet been completed.

Analysis of stomach contents Stomach contents are being analysed. The results of this analysis are pending.

Morphometric data. Morphometric measurements were collected from cormorant carcasses (males n=128, females n=105; Table 8). Measurements indicate males were significantly larger than females for all parameters except tarsus length.

Table 8. Summary of morphometric measurements and associated statistical analysis.

VARIABLE	MALES		FEMALES		F test	P
	MEAN (SD)	N	MEAN (SD)	N		
mass (g)	2043.2 (155.8)	128	1820.6 (118.2)	100	140.8	**<0.0001**
mass (GI tract removed) (g)	1827.1 (135.3)	94	1627.2 (102.3)	66	102.8	**<0.0001**
stomach mass (g)	208.3 (69.3)	93	166.1 (70.6)	66	14.1	**0.0002**
head-bill (mm)	142.7 (4.6)	117	134.7 (4.3)	104	177.5	**<0.0001**
bill depth (mm)	13.6 (2.5)	117	11.7 (2.4)	105	33.8	**<0.0001**
tarsus (mm)	74.6 (3.9)	117	73.8 (3.7)	105	2.4	0.12
wing chord (cm)	32.1 (1.0)	117	30.6 (0.7)	105	173.2	**<0.0001**

Banded Birds

Band returns. Eight of the 2,927 cormorants culled in 2006 were banded (Table 9). All of the birds were banded at their natal colonies, one in Lake Huron and seven from Lake Ontario (either High Bluff Island or nearby Scotch Bonnet Island). The average age of the banded birds was 5 years. A summary of information pertaining to banded birds culled at Presqu'ile from 2004 to 2006 is presented in Appendix 4.

Table 9. Details regarding banded cormorants culled in 2006.

Band #	Date banded	Age when culled	Banding Location	Jurisdiction
0978 77456	June 20, 2002	4	Lake Huron	Ontario
0868 92416	June 26, 2000	6	Lake Ontario – Presqu'ile	Ontario
0978 77185	July 23, 2002	4	Lake Ontario – Presqu'ile	Ontario
0978 77149	July 23, 2002	4	Lake Ontario – Presqu'ile	Ontario
0978 77141	July 23, 2002	4	Lake Ontario – Presqu'ile	Ontario
0868 92469	June 26, 2000	6	Lake Ontario – Presqu'ile	Ontario
0868 92826	June 26, 2000	6	Lake Ontario – Presqu'ile	Ontario
0868 92821	June 26, 2000	6	Lake Ontario – Presqu'ile	Ontario

Cormorant banding at Presqu'ile in 2006. Thirty young (i.e. pre-fledging) cormorants were banded at Presqu'ile on June 23, 2006. Each bird was fitted with a standard aluminum band on one leg (Series 0828-98601 to 0828-98630) and a white plastic colour-band with black alpha-numerics (63Q to 63Z and 64B to 64V) on the other leg.

Discussion

The purpose of the cormorant management strategy at Presqu'ile Provincial Park is to protect woody vegetation used for nesting by great blue herons, great egrets and black-crowned night-herons.

Activities associated with the cormorant management strategy at Presqu'ile in 2006 fell within seven categories; 1) cormorant population management, 2) roost disturbance, 3) vegetation management, 4) monitoring of non-target species 5) composting of cormorant carcasses,6) companion science studies, and 7) banding birds.

Cormorant population management activities on High Bluff and Gull islands have lead to a substantial decline in the number of cormorants nesting at Presqu'ile. Since 2002, the last year before management began, the park's cormorant nesting population has declined by 76.7%. This reduction in nest numbers has been achieved through the combined effects of egg oiling, nest removal and culling of adult birds. Woody vegetation on High Bluff Island has been monitored every other year, beginning in 2000, and most recently in 2006.

Cormorant Management

The cormorant management strategy in 2003 involved a reduction in cormorant reproduction through egg oiling and nest removal. Egg-oiling reduces recruitment of young into the population, and does not immediately affect the adult population. Since cormorants are a long-lived species, the adults continue to attempt breeding for many years and population reduction is through attrition. However, although these adult cormorants did not reproduce, they still remained a part of the overall population, depositing guano, and damaging vegetation and surviving to possibly breed in future years. Experience elsewhere has shown that egg-oiling should be considered a long-term method of reducing avian populations (Bedard et al. 1999 and Blackwell et al. 2002).

Another factor to consider is the fact that egg oiling can only be applied to ground nests, and not to tree nests. A significant proportion of Presqu'ile's nesting cormorants does not nest on the ground. In 2006, three quarters of the park's nesting cormorants were tree-nesters, inaccessible to oil-spraying equipment. The use of culling in 2004, 2005 and 2006 reduced the size of the adult breeding population by a cumulative total of 10,716 birds (6030 in 2004, 1867 in 2005, 2,819 in 2006). Concurrent with the removal of the adult birds, the immediate effects on living vegetation through the collection of nesting material and the deposition of guano were also removed. The impacts of culling are also long-term since future reproduction and recruitment associated with the culled individuals is removed.

Numbers of both ground and tree nesting cormorants have been declining since management began in 2003 (Table 1). However, in the period from 2002 until 2005 the tree colony declined 71%, while the ground colony declined by 49%. The larger decline in the tree-nesting component of the population is likely due to more focused management efforts to reduce numbers in the tree-nesting segment of the population and more immediate nature of culling compared to the longer term impacts of egg oiling. Ground-nesting birds have been managed through egg oiling as a gradual means of

population reduction to limit potential recruitment into the tree-nesting segment of the population.

Since management began, the number of tree nesters has been declining by an average of 23.7% per year while the ground nesters have been declining by 16.4% per year. In 2006 the rates of decline in these two segments of the overall population changed dramatically. The tree-nesting population increased slightly while the ground nesting population declined 72.9%. A number of factors likely have contributed to the decrease in ground nesters in 2006: direct human interference, attrition due to a lack of recruitment and predation.

Human disturbance is not considered to be a major contributing factor. Since there were fewer ground nests, the number and duration of visits required to effectively oil the ground colony were reduced in 2006 from previous years and thereby reduced exposure to human presence.

With the exception of 104 young hatched in 2003, there has been almost a complete lack of recruitment from the ground-nesting segment of the population at Presqu'ile for four years. However, while egg oiling is considered a slow mechanism for population reduction, the first effects of this lack of recruitment would have been felt in 2006, since birds that would have hatched in 2003 would be returning as breeders for the first time as three-year-olds in 2006.

Predation associated with cormorants at Presqu'ile is usually limited to predation on cormorant eggs by gulls. This was sometimes the result of disturbance caused by egg oiling. However, a coyote (*Canis latrans*) was frequently seen in the ground colony in 2006, and based on the animal's behaviour and the number of broken eggs found, the coyote was likely feeding on cormorant eggs. The coyote's activities in the colony would also have scared cormorants from their nests making the nests more vulnerable to predation by gulls. The area most affected was the portion of the ground colony in closest proximity to the coyote's den. Ultimately this portion of the ground colony was abandoned as a nesting site. Peak cormorant nest counts have typically occurred in June in previous years. However, the highest ground nest count on High Bluff Island in 2006 occurred in early May, a time when these coyote depredations had just begun.

In 2006, Gull Island became connected to the mainland through the formation of a sand and gravel spit. This neck of land may have provided a route by which ground-based predators could access Gull Island and this may have contributed to the reduction in the ground-nesting colony. Predation by a member of the weasel family (Mustelidae) was known to occur.

Despite culling and a greater number of tree nests removed in 2006 than 2005, the number of tree nests recorded during the annual nest count at Presqu'ile in 2006 was slightly higher than in 2005. This may have been a response to coyote predation on ground nests. Since management began in 2003, high level nests have remained beyond reach for removal. Low and medium level nests can be effectively removed and hence are the focus of nest removal efforts. A method of dealing with high-level nests is required to provide maximum protection to the ecosystem. However, as large nesting trees which have died in previous years fall the relative numbers of high level nests will drop.

Roost Disturbance

In 2005, the majority of displaced birds flew in the direction of Scotch Bonnet Island, 25 kilometers to the southeast. When roost disturbance activities were initiated at Presqu'ile in 2006, relatively minimal efforts were required to displace the majority of cormorants from the trees to roost on the ground at Sebastopol Point on Gull Island, thereby reducing their guano impact on living vegetation. As in other years, a small group of cormorants refused to leave the island, either ignoring the disturbance or simply shifting locations within the island. This group was approximately twice as big in 2006 compared to 2005. Many of these birds were young, flightless birds unable to flee the disturbance, while others shifted about the island and may have been the parents of these young birds. Despite the reluctance of this group to leave, the majority of the roosting population departed soon after the initiation of roost disturbance activities, thereby reducing further deposition of guano.

Vegetation Management

Tree Planting. Two factors appear to significantly influence the survival rate of trees planted on High Bluff Island. These are: 1) weather conditions during the first growing season following the initial transplant of saplings and; 2) the degree of damage caused by herbivores.

After an autumn planting in 2004, damage by white-tailed deer browsing and antler rubbing was noted. Male white-tailed deer using the young planted trees as "rubbing-posts" in autumn to clean their antlers and to define their territories have caused structural damage to many trees. In some cases they snapped off the upper parts of the planted trees. The fencing of planted areas in 2006 should discourage rubbing behaviour and browsing in future years.

In 2005, tree mortality of spring-planted saplings was high (approximately 50%) due to drought conditions that occurred in that summer. Weather conditions were favourable in 2006 and nearly 100% survival of planted trees was noted in the autumn.

Tree-girdling of planted trees by rodents was noted in the spring of 2006. This damage occurred during the winter of 2005/2006 and was likely caused primarily by meadow voles (*Microtus pennsylvanicus*). Voles favour areas containing a thick, ground level herbaceous plant community. The cutting and removal of this herbaceous "thatch" was implemented in 2006 in an attempt to reduce rodent girdling of young trees.

Despite losses to deer, drought and rodent damage, the surviving trees are experiencing significant growth. In some cases tree height has doubled and planted trees are producing seed. This may accelerate the rate of forest recovery in the planted areas. Many of the deer damaged trees are also suckering from lower sections and quickly recovering lost growth.

Roost Tree Cutting. The goal of roost tree cutting is to provide protection (from the deleterious effects of guano accumulation) to living vegetation found beneath dead roost trees. The four trees removed in the autumn of 2006 were found in areas where high-

value living vegetation (actual and potential black-crowned night-heron nest sites) was being threatened by roosting cormorants. However it should be noted that if too many roost trees are removed from High Bluff Island then it is likely that roosting cormorants will use living trees. To minimize the risk of this occurring, roost tree cutting has been kept to a minimum.

Monitoring of Herons and Egrets

Wading bird species living in association with cormorant management activity at Presqu'ile successfully nested and reared young in 2006. Great egret nest numbers were essentially stable, the number of nesting black-crowned night-herons increased and the number of successful great blue heron nests declined from the previous year. In addition, for great egrets and great blue herons, nesting productivity was similar to 2005 (for great blue herons, a marked improvement over 2003 and 2004).

During the 2004 breeding season at High Bluff Island, 10 pairs of great egrets re-nested multiple times (29 nesting attempts by 10 pairs). This trend was not observed on High Bluff Island in 2005 (only 21 nesting attempts by 17 pairs), but occurred again during 2006 (33 nesting attempts by 16 pairs). In 2006, the failure of 13 nests was directly attributed to nest destruction (theft of nesting material) and occupation of nests by cormorants. It is not known why the pattern of great egret re-nesting varied so dramatically among years. All areas that were ultimately successful in 2004 and 2005 were re-occupied by successful nests early in the 2006 season. Great egret fledging rates remained constant from 2003 to 2006.

While the maximum number of great blue heron nests has decreased slightly, nesting productivity for great blue herons has steadily risen since the initiation of cormorant management. In 2003 an average of 1.48 young were fledged from each successful nest while in 2006 each successful nest fledged 2.50 young. Forty-four percent of great blue herons nest on High Bluff Island failed in 2006: 16 of 17 breeding failures in 2006 resulted from the destruction or usurpation of nests by cormorants. The phenomenon of re-nesting following the loss of a first nest, as seen in great egrets, was not observed for great blue herons in either 2005 or 2006.

The black-crowned night-heron nest count in 2006 was up from that of the previous year (71 nests in 2005, 84 nests in 2006) and the highest recorded nest number for this species at Presqu'ile. In 2006, an average of 1.95 chicks fledged from successful nests, the first time breeding success has been assessed at this site. The proportion of failed nests at High Bluff Island (20%) was lower than observed at the Chantry Island control site (32%), while there was no difference in the number of chicks fledged from successful nests (1.95 chicks/nest at High Bluff Island vs. 2.08 chicks/nest at Chantry Island).

The study of great egret, great blue herons and black-crowned night-heron behaviour and breeding success involving the control sites at Chantry Island, Lake Huron and Hamilton Harbour, Lake Ontario demonstrated that the effects of cormorant culling activity on these non-target species at High Bluff Island were minimal. While the cull was occurring, adults did flush from nests. However, the results indicate that the effects of the cull were short-lived (the birds exhibited normal nesting behaviour, compared to controls, in the period following the cull) and localized (the cull did not affect the

behaviour of great blue herons, great egrets or black-crowned night-herons nesting in the adjacent, non-cull woodland). At High Bluff Island, great blue herons appear to be more sensitive to human disturbance associated with cull activities than great egrets and black-crowned night-herons, as they spent more time away from the nest during the cull (the same pattern observed in 2005). This may be due, partly, to the spatial distribution of nests within High Bluff Island: great blue herons nest in the centre of the woodlots while great egrets and black-crowned night-herons nest on the periphery (i.e. are less directly exposed to disturbance during cull events). There was no difference in breeding success of great egrets and great blue herons between the High Bluff Island and Chantry Island. In addition, the breeding success for great egrets, great blue herons and black-crowned night-herons at Presqu'ile are within the normal range reported in other studies (e.g., Butler 1992). Therefore, based on these findings, there do not appear to be any long-term, negative impacts of cormorant management activities on other tree-nesting, colonial waterbird species on High Bluff Island.

Heron Roost Monitoring

As in previous years, data from 2006 roost monitoring suggests that High Bluff Island is not a significant roosting location for herons and egrets. Heron and egret activity was low throughout August and was likely limited to lingering resident birds.

Composting

An improved method of compost handling was used in 2006. Instead of turning the compost material by hand, an all-terrain vehicle fitted with a snow-plow was used. This equipment allowed for more frequent turning ensuring even moisture content throughout the pile and more efficient composting. The compost will be left on-site until the composting process is complete. It will then be tested according to the Provisional Certificate of Approval. Decisions regarding the handling of the composted material will be determined by the outcome of these tests.

Companion Science

The sex ratio of the 279 sexed birds culled in 2006 was 168 males to 111 females (1.51:1). The male:female sex ratio varied among cull events, from 0.79:1 to 4:1 (Table 7). There is no clear pattern when comparing the sex ratios between morning and afternoon cull sessions.

The sex ratio of 1.51:1 in 2006 is similar to the sex ratio in 2005 of 1.6:1 (n =251). However, both 2005 and 2006 are different than 2004, when the sex ratio in 2004 was 2.7:1 (n=540). The significance of this difference is not understood at this time.

Results of other companion science studies are pending.

Banded Birds

Band data from 32 adult cormorants culled at Presqu'ile indicate that these cormorants originated from locations throughout much of the Great Lakes basin. Since banding cannot occur with chicks from tree nests, all banded birds were raised in ground-nests and were subsequently culled from tree-nests. Thirteen of these 32 birds culled since 2004 were banded at Lake Ontario colonies (either High Bluff Island or nearby Scotch Bonnet Island). In 2006, 7 of 8 banded birds culled originated at Presqu'ile or Scotch

Bonnet Island. This is particularly noteworthy as relatively few cormorants have been banded at Presqu'ile.

The representation of locally-reared, younger birds has increased over the three cull years. In 2004, 22% of the banded birds culled were hatched on Lake Ontario (Ontario Parks, 2005). In 2005, the percentage of Lake Ontario hatched birds culled was 33 %, and in 2006, the percentage had increased to 87.5%. In addition, the average age of banded birds shot dropped from over eight years old in the 2004 and 2005 culls to 5 years old in 2006. The reason for the increasing percentage of locally hatched birds and the decreasing average age of banded birds in not understood at this time.

References

Bedard, J. A. Nadeau and M. Lepage. 1999. Double-crested cormorant culling in the St. Lawrence River estuary: results of a 5-year program. Pages 147-154 in M.E. Tobin (ed.). Symposium on double crested cormorants: population status and management issues in the Midwest. USDA, Animal and Plant Inspection Services, Tech. Bull. 1879.

Blackwell, B.F. M.A. Stapanian and D.V. Chip Weseloh. 2002. Dynamics of the double-crested cormorant population on Lake Ontario. Wildl. Soc. Bull. 30:345-353.

Blaney, S.C. 1997. Checklist of the Vascular Plants of Presqu'ile Provincial Park. Unpublished report prepared for the Ontario Ministry of Natural Resources. 40 pp.

Butler, R.W. 1992. Great Blue Heron. In: The Birds of North America, No. 25 (A. Poole, P. Stettenheim, and F. Gill, Eds.). Philadelphia: The Academy of Natural Sciences; Washington, DC: The American Ornithologist's Union.

Erwin, M.R. 1989. Responses to human intruders by birds nesting in colonies: experimental results and management guidelines. Colonial Waterbirds 12: 104-108.

Koh, S. and L.W. Carr. 2003. Follow-up assessment of tree damage: Effect of Double-crested Cormorants on the Western Forest, High Bluff Island, Presqu'ile Provincial Park. Terra Systems Research. Toronto, Canada. 27 pp.

Moore, D.J, D.V. Weseloh and R. Joos. 2006. The management of Double-crested Cormorants (Phalacrocorax auritus) and its effect on Great Blue Herons (Ardea herodias) and Great Egrets (Ardea albus) at High Bluff Island (Lake Ontario) in 2005 (Final Draft, 24 January 2006). 61 pp.

Ontario Parks. 2000a. Double-crested Cormorants at Presqu'ile Provincial Park: an analysis of their effects. Ontario Ministry of Natural Resources. 38 pp.

Ontario Parks. 2000b. Presqu'ile Provincial Park Management Plan. Ontario Ministry of Natural Resources. 36 pp.

Ontario Parks. 2002. Management Strategy for Double-crested Cormorants. Ontario Ministry of Natural Resources. 20 pp.

Ontario Parks. 2004a. Amendment of the Management Strategy for Double-crested Cormorants at Presqu'ile Provincial Park. Ontario Ministry of Natural Resources. 26pp.

Ontario Parks. 2004b. Annual Report on the Management of Double-crested Cormorants for 2003. Ontario Ministry of Natural Resources. 13 pp.

Ontario Parks, 2005a. Presqu'ile Double-crested Cormorant Management Scientific Review Committee. 2006. Presqu'ile Provincial Park Double-crested Cormorant

Management: Recommendations. Unpublished report to the Minister of Natural Resources, January 2006. 14pp.

Ontario Parks. 2005b. Annual Report on the Management of Double-crested Cormorants for 2003. Ontario Ministry of Natural Resources. 35 pp.

Rodgers, Jr., J.A. and H.T. Smith. 1995. Set-back distances to protect nesting bird colonies from human disturbance in Florida. Cons. Biol. 9:89-99.

Weseloh, D.V., P.J. Ewins,J. Struger, P. Mineau, C.A. Bishop, S. Postupalsky and J.P. Ludwig. 1995. Double-crested Cormorants of the Great Lakes: Changes in population size, breeding distribution and reproductive output between 1913 and 1991. Colonial Waterbirds

Wires, L.R. and Cuthbert, F.J. 2006. Historic Population of the Double-crested Cormorant (*Phalacrocorax auritus)*: Implications for Conservation and Management in the 21st Century. Waterbirds 20(1): 9-37.

Appendices

Appendix 1. Evening counts of double-crested cormorants arriving to roost at Presqu'ile on 12 dates from August 2 to September 11, 2006.

August 2/2006 **High Bluff Island**

Time (PM)	# of DCCO	Time (PM)	# of DCCO
7:30-7:35 (start)	250	8:05-8:10	75
7:35-7:40	140	8:10-8:15	200
7:40-7:45	300	8:15-8:20	25
7:45-7:50	345	8:20-8:25	105
7:50-7:55	330	8:25-8:30	40
7:55-8:00	160	8:30-8:35	95
8:00-8:05	75	8:35-8:40 (end)	100
		Total	**2240**

Had to leave at 8: 40 p.m. due to approaching storm.

August 9/2006 **High Bluff Island**

Time (PM)	# of DCCO	Time (PM)	# of DCCO
5:40-5:45 (start)	105	7:20-7:25	75
5:45-5:50	235	7:25-7:30	220
5:50-5:55	55	7:30-7:35	230
5:55-6:00	225	7:35-7:40	195
6:00-6:05	155	7:40-7:45	175
6:05-6:10	315	7:45-7:50	80
6:10-6:15	385	7:50-7:55	295
6:15-6:20	90	7:55-8:00	255
6:20-6:25	100	8:00-8:05	80
6:25-6:30	105	8:05-8:10	85
6:30-6:35	65	8:10-8:15	30
6:35-6:40	85	8:15-8:20	40
6:40-6:45	35	8:20-8:25	25
6:45-6:50	21	8:25-8:30	35
6:50-6:55	22	8:30-8:35	0
6:55-7:00	60	8:35-8:40	10
7:00-7:05	15	8:40-8:45	0
7:05-7:10	20	8:45-8:50	10
7:10-7:15	90	8:50-8:55	0
7:15-7:20	45	8:55-9:00 (end)	0
		Total	**4068**

August 11/2006 **Gull Island**

Time (PM)	# of DCCO	Time (PM)	# of DCCO
5:30-5:35 (start)	50	7:10-7:15	90
5:35-5:40	65	7:15-7:20	290
5:40-5:45	35	7:20-7:25	150
5:45-5:50	75	7:25-7:30	200
5:50-5:55	60	7:30-7:35	90
5:55-6:00	80	7:35-7:40	80
6:00-6:05	75	7:40-7:45	305
6:05-6:10	90	7:45-7:50	110
6:10-6:15	100	7:50-7:55	95
6:15-6:20	90	7:55-8:00	115
6:20-6:25	175	8:00-8:05	50
6:25-6:30	55	8:05-8:10	35
6:30-6:35	30	8:10-8:15	20
6:35-6:40	50	8:15-8:20	25
6:40-6:45	15	8:20-8:25	10
6:45-6:50	25	8:25-8:30	0
6:50-6:55	70	8:30-8:35	0
6:55-7:00	90	8:35-8:40	0
7:00-7:05	70	8:40-8:45	0
7:05-7:10	155	8:45-8:50	0
		8:50-8:55 (end)	0
		Total	**3120**

August 14/2006 **High Bluff Island**

Time (PM)	# of DCCO	Time (PM)	# of DCCO
4:15-4:20 (start)	60	5:25-5:30	65
4:20-4:25	5	5:30-5:35	33
4:25-4:30	5	5:35-5:40	80
4:30-4:35	5	5:40-5:45	30
4:35-4:40	10	5:45-5:50	65
4:40-4:45	15	5:50-5:55	85
4:45-4:50	20	5:55-6:00	40
4:50-4:55	55	6:00-6:05	35
4:55-5:00	35	6:05-6:10	61
5:00-5:05	10	6:10-6:15	34
5:05-5:10	15	6:15-6:20	18
5:10-5:15	15	6:20-6:25	5
5:15-5:20	10	6:25-6:30	3
5:20-5:25	15	6:30-6:35 (end)	25
		Total	**854**

Had to leave at 6:35 p.m. due to waves and approaching storm.

August 16/2006 **High Bluff Island**

Time (PM)	# of DCCO	Time (PM)	# of DCCO
5:30-5:35 (start)	15	6:40-6:45	85
5:35-5:40	30	6:45-6:50	75
5:40-5:45	20	6:50-6:55	200
5:45-5:50	10	6:55-7:00	150
5:50-5:55	5	7:00-7:05	285
5:55-6:00	10	7:05-7:10	110
6:00-6:05	5	7:10-7:15	175
6:05-6:10	5	7:15-7:20	50
6:10-6:15	5	7:20-7:25	60
6:15-6:20	35	7:25-7:30	45
6:20-6:25	30	7:30-7:35	70
6:25-6:30	25	7:35-7:40	115
6:30-6:35	30	7:40-7:45	35
6:35-6:40	50	7:45-7:50 (end)	50
		Total	**1780**

August 18/2006 **High Bluff Island**

Time (PM)	#of DCCO	Time (PM)	#of DCCO
5:05-5:10 (start)	10	6:30-6:35	460
5:10-5:15	13	6:35-6:40	280
5:15-5:20	0	6:40-6:45	270
5:20-5:25	6	6:45-6:50	180
5:25-5:30	18	6:50-6:55	65
5:30-5:35	55	6:55-7:00	30
5:35-5:40	16	7:00-7:05	65
5:40-5:45	10	7:05-7:10	20
5:45-5:50	41	7:10-7:15	60
5:50-5:55	228	7:15-7:20	40
5:55-6:00	175	7:20-7:25	70
6:00-6:05	160	7:25-7:30	200
6:05-6:10	5	7:30-7:35	75
6:10-6:15	10	7:35-7:40	55
6:15-6:20	70	7:40-7:45	105
6:20-6:25	300	7:45-7:50	30
6:25-6:30	355	7:50-7:55	100
		7:55-8:00 (end)	70
		Total	**3647**

August 21/06 **High Bluff Island**

Time (PM)	# of DCCO	Time (PM)	# of DCCO
5:30-5:35 (start)	10	6:25-6:30	84
5:35-5:40	0	6:30-6:35	15
5:40-5:45	3	6:35-6:40	8
5:45-5:50	0	6:40-6:45	22
5:50-5:55	12	6:45-6:50	12
5:55-6:00	46	6:50-6:55	16
6:00-6:05	15	6:55-7:00	8
6:05-6:10	11	7:00-7:05	12
6:10-6:15	185	7:05-7:10	7
6:15-6:20	149	7:10-7:15	5
6:20-6:25	29	7:15-7:20 (end)	3
		Total	**652**

August 30/2006 **Gull Island**

Time (PM)	#of DCCO	Time (PM)	#of DCCO
4:45-4:50 (start)	10	6:15-6:20	62
4:50-4:55	25	6:20-6:25	278
4:55-5:00	10	6:25-6:30	22
5:00-5:05	15	6:30-6:35	20
5:05-5:10	91	6:35-6:40	20
5:10-5:15	31	6:40-6:45	14
5:15-5:20	15	6:45-6:50	0
5:20-5:25	37	6:50-6:55	19
5:25-5:30	22	6:55-7:00	41
5:30-5:35	10	7:00-7:05	22
5:35-5:40	8	7:05-7:10	17
5:40-5:45	34	7:10-7:15	29
5:45-5:50	38	7:15-7:20	10
5:50-5:55	153	7:20-7:25	5
5:55-6:00	201	7:25-7:30	0
6:00-6:05	90	7:30-7:35	8
6:05-6:10	186	7:35-7:40	3
6:10-6:15	232	7:40-7:45 (end)	0
		Total	**1778**

Sept 1/2006 **Gull Island**

Time (PM)	# of DCCO	Time (PM)	# of DCCO
4:30-4:35 (start)	10	6:15-6:20	78
4:35-4:40	5	6:20-6:25	45
4:40-4:45	0	6:25-6:30	109
4:45-4:50	29	6:30-6:35	84
4:50-4:55	85	6:35-6:40	13
4:55-5:00	9	6:40-6:45	5
5:00-5:05	15	6:45-6:50	123
5:05-5:10	5	6:50-6:55	134
5:10-5:15	9	6:55-7:00	82
5:15-5:20	0	7:00-7:05	20
5:20-5:25	8	7:05-7:10	60
5:25-5:30	22	7:10-7:15	61
5:30-5:35	17	7:15-7:20	105
5:35-5:40	20	7:20-7:25	150
5:40-5:45	30	7:25-7:30	250
5:45-5:50	22	7:30-7:35	85
5:50-5:55	10	7:35-7:40	57
5:55-6:00	8	7:40-7:45	78
6:00-6:05	11	7:45-7:50	33
6:05-6:10	30	7:50-7:55	25
6:10-6:15	23	7:55-8:00 (end)	10
		Total	**1975**

Sept 5/2006 **Gull Island**

Time (PM)	# of DCCO	Time (PM)	# of DCCO
4:35-4:40 (start)	8	5:40-5:45	26
4:40-4:45	23	5:45-5:50	18
4:45-4:50	44	5:50-5:55	33
4:50-4:55	46	5:55-6:00	20
4:55-5:00	42	6:00-6:05	28
5:00-5:05	67	6:05-6:10	23
5:05-5:10	39	6:10-6:15	29
5:10-5:15	184	6:15-6:20	14
5:15-5:20	54	6:20-6:25	28
5:20-5:25	102	6:25-6:30	23
5:25-5:30	48	6:30-6:35	17
5:30-5:35	151	6:35-6:40	29
5:35-5:40	139	6:40-6:45 (end)	15
		Total	**1250**

Sept 7/2006 **Gull Island**

Time (PM)	# of DCCO	Time (PM)	# of DCCO
4:45-4:50(start)	25	6:00-6:05	35
4:50-4:55	59	6:05-6:10	13
4:55-5:00	11	6:10-6:15	22
5:00-5:05	14	6:15-6:20	17
5:05-5:10	27	6:20-6:25	36
5:10-5:15	65	6:25-6:30	66
5:15-5:20	36	6:30-6:35	50
5:20-5:25	41	6:35-6:40	41
5:25-5:30	9	6:40-6:45	42
5:30-5:35	14	6:45-6:50	25
5:35-5:40	27	6:50-6:55	21
5:40-5:45	25	6:55-7:00	45
5:45-5:50	37	7:00-7:05	32
5:50-5:55	27	7:05-7:10	11
5:55-6:00	53	7:10-7:15	7
		7:15-7:20 (end)	13
		Total	**946**

Sept 11/2006 **Gull Island**

Time (PM)	# of DCCO	Time (PM)	# of DCCO
4:55-5:00 (start)	3	6:05-6:10	8
5:00-5:05	12	6:10-6:15	13
5:05-5:10	11	6:15-6:20	38
5:10-5:15	22	6:20-6:25	25
5:15-5:20	6	6:25-6:30	29
5:20-5:25	8	6:30-6:35	21
5:25-5:30	34	6:35-6:40	25
5:30-5:35	75	6:40-6:45	100
5:35-5:40	102	6:45-6:50	69
5:40-5:45	81	6:50-6:55	67
5:45-5:50	6	6:55-7:00	12
5:50-5:55	22	7:00-7:05	6
5:55-6:00	47	7:05-7:10	13
6:00-6:05	44	7:10-7:15 (end)	8
		Total	**907**

Appendix 2. Details on Roost Trees Cut in 2006.

#	DATE CUT	SPECIES	DETAILS
1	Oct. 20/06	Sugar Maple	30 CM DBH* - DEAD - CUT
2	Oct. 20/06	Sugar Maple	25 CM DBH - DEAD - CUT
3	Oct. 20/05	Red Oak	40 CM DBH - DEAD
4	Oct. 20/05	Sugar Maple	35 cm DBH - Dead - Cut

*DBH – diameter at breast height – 1.3m above ground

Appendix 3. Heron Roost Monitoring Data from High Bluff Island, Presqu'ile, for 6 dates from July 31 to August 10, 2006

N = north, S = south, E = east, W = west

July 31, 2006
Observer: D. Tyerman and C. McRae
Observer Location: Flights to and from High Bluff Island were observed from Owen Point and the termination of Union Road at Lake Ontario (3 kilometers north of High Bluff Island)

AM watch			
Time	Species	To Island from	From Island to
5:57	*Sunrise*		
6:15	*Start*		
7:01	*Finished*		

Summary: 0 GBHE, 0GREG and 0 BCNH seen moving to or from High Bluff Island. Observations concluded at 7:01 am due to arrival of mist.

August 02, 2006
Observer: D. Tyerman and C. McRae
Observer Location: Flights to and from High Bluff Island were observed from the eastern tip of High Bluff Island and a boat moored 0.5 kilometers northwest of High Bluff Island

PM watch			
Time	Species	To Island from	From Island to
19:30	*Start*		
19:58	1 GREG	NW	
20:07	1 GREG	ENE	
20:14	2 BCNH		ENE
20:19	1 GREG	ENE	
20:35	*Sunset*		
20:36	2 GREG	ENE	
20:45	*Finished*		

Summary: 0 GBHE, 5 GREG roosted. 2 BCNH departed island. Depart at 20:45 due to thunderstorm.

August 03, 2006
Observer: D. Tyerman and C. McRae
Observer Location: Flights to and from High Bluff Island were observed from Owen Point and the termination of Union Road at Lake Ontario (3 kilometers north of High Bluff Island)

AM watch			
Time	Species	To Island from	From Island to
5:30	*Start*		
6:00	*Sunrise*		
6:30	*Finished*		

Summary: 0 GBHE, 0 GREG and 0 BCNH seen leaving or arriving High Bluff Island

August 08, 2006
Observer: D. Tyerman and C. McRae
Observer Location: Flights to and from High Bluff Island were observed from Owen Point and the termination of Union Road at Lake Ontario (3 kilometers north of High Bluff Island)

AM watch			
Time	Species	To Island from	From Island to
5:45	*Start*		
6:03	1 GBHE	SE	
6:05	*Sunrise*		
6:30	1 GBHE		SW
6:45	*Finished*		

Summary: 1 GBHE roosted, 1 GBHE departed High Bluff Island.

August 09, 2006
Observer: D. Tyerman, D. Moore and C. McRae
Observer Location: Flights to and from High Bluff Island were observed from the eastern tip and the western shoreline of High Bluff Island .

PM watch			
Time	Species	To Island from	From Island to
19:50	*Start*		
20:13	1 GREG	NE	
20:26	*Sunset*		
20:35	1 BCNH		N
20:41	2 BCNH	NE	
20:42	1 BCNH		N
20:44	1 GREG	NE	
20:52	1 BCNH		NW
20:55	*Finished*		

Summary: 0 GBHE roosted or left island, 2 GREG roosted on island, 2 BCNH roosted on island, 2 BCNH left island.

August 10, 2006
Observer: D. Tyerman and C. McRae
Observer Location: Flights to and from High Bluff Island were observed from Owen Point and the termination of Union Road at Lake Ontario (3 kilometers north of High Bluff Island)

AM watch			
Time	Species	To Island from	From Island to
5:40	*Start*		
6:00	1 BCNH	NE	
6:08	*Sunrise*		
6:40	*Finished*		

Summary: 0 GBHE and 0 GREG roosted or left island, 1 BCNH roosted.

Appendix 4. Natal origins and ages of banded double-crested cormorants culled at Presqu'ile 2004-06.

Year bird culled	Band #	Date banded	Age *	Jurisdiction where banded
2004	1247 89460	June 20, 1995	9	Ontario – Lake Huron
2004	1247 34518	June 19, 1991	13	Ontario – Lake Huron
2004	1137 85347	June 20, 1995	9	Ontario – Lake Huron
2004	1247 85871	June 21, 1995	9	Ontario – Lake Huron
2004	1227 59597	June 21, 1993	11	Ontario – Lake Huron
2004	1247 89682	June 20, 1995	9	Ontario – Lake Huron
2004	0767 82310	June 23, 1995	9	Ontario – Lake Huron
2004	0978 77126	July 23, 2002	2	Ontario – Lake Ontario
2004	0868 92424	June 26, 2000	4	Ontario – Lake Ontario
2004	0868 92372	June 26, 2000	4	Ontario – Lake Ontario
2004	0978 78060	July 31, 2003	1	Ontario – Lake Ontario
2004	1247 88798	June 22, 1994	10	Michigan – Lake Huron
2004	1247 87423	June 18, 1994	10	Michigan – Lake Michigan
2004	1247 66246	June 02, 1995	9	Michigan – Lake Michigan
2004	0878 07716	July 18, 1995	9	Wisconsin – Lake Michigan
2004	878 09671	July 22, 1996	8	Wisconsin –Lake Michigan
2004	0837 61667	June 30, 1988	16	Wisconsin – Lake Michigan
2004	0848 93823	July 28, 1995	9	New York – Lake Champlain
2005	1247 50059	June 09, 1992	13	Wisconsin – Lake Michigan
2005	0868 92848	June 26, 2000	5	Ontario – Lake Ontario – Presqu'ile P. Park
2005	0868 92418	June 26, 2000	5	Ontario – Lake Ontario - Presqu'ile P. Park
2005	1247 85405	June 20, 1995	10	Ontario – Lake Huron - Presqu'ile P. Park
2005	1247 64754	July 02, 1995	10	Michigan – Lake Michigan
2005	0878 07161	July 18, 1995	10	Wisconsin – Lake Michigan
2006	0978 77456	June 20, 2002	4	Ontario – Lake Huron
2006	0868 92416	June 26, 2000	6	Ontario – Lake Ontario – Presqu'ile P. Park
2006	0978 77185	July 23, 2002	4	Ontario – Lake Ontario - Presqu'ile P. Park
2006	0978 77149	July 23, 2002	4	Ontario – Lake Ontario - Presqu'ile P. Park
2006	0978 77141	July 23, 2002	4	Ontario – Lake Ontario - Presqu'ile P. Park
2006	0868 92469	June 26, 2000	6	Ontario – Lake Ontario - Presqu'ile P. Park
2006	0868 92826	June 26, 2000	6	Ontario – Lake Ontario - Presqu'ile P. Park
2006	0868 92821	June 26, 2000	6	Ontario – Lake Ontario - Presqu'ile P. Park

*** = age when culled**