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Presqu'ile

Annual Report on the Management of Double-crested Cormorants for 2005

Ontario

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

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Executive Summary

Between April 04, 2005 and October 02, 2005, Presqu'ile Provincial Park implemented the third year of a management program to reduce the park's population of Double-crested Cormorants *(Phalacrocorax auritus)*. The goal of this program is *to protect representative woodland flora and fauna of High Bluff Island while retaining maximum diversity of nesting colonial bird species*.

In 2004 and 2005, management was carried out on ground-nesting and tree-nesting cormorants on both Gull and High Bluff Islands. This activity was in accordance with the amended Management Strategy for Double-crested Cormorants (Ontario Parks 2004 a). In 2003, management activities occurred only in the western woodland of High Bluff Island and the ground colonies on Gull and High Bluff Islands. The eastern woodland and other wooded areas of High Bluff Island were not managed in 2003.

The following methods were employed to meet the objectives of the management strategy:

1) oiling eggs in ground nests (2003, 2004, 2005)
2) culling of adult cormorants from tree nests (2004, 2005)
3) composting of cormorant carcasses (2004, 2005)
4) nest removal from trees (2003, 2004, 2005)
5) disturbance of post-breeding season roosts (2004, 2005)
6) artificial ground colony habitat creation (2004, 2005)
7) habitat restoration (tree planting) (2004, 2005)
8) removal of dead roost trees (2005)
9) monitoring of non-target species (2003, 2004, 2005)

In 2005 a total of 1,861 nests was removed from trees using forestry poles. Mineral oil was applied to a cumulative total of 23,732 eggs (from 2,633 ground nests). 1,867 adult cormorants were culled from tree-nesting locations between May 24 and June 01, 2005.

The carcasses of culled cormorants were disposed of in a composting facility. The site location, design and operations of this facility were determined by the Ontario Ministry of the Environment in accordance with a provisional Certificate of Approval to operate a waste disposal facility. Compost material from 2004 was removed from the island in the autumn of 2005.

Roost disturbance was conducted during September, 2005. Approximately 750 square metres of artificial ground nesting habitat were also created. Six hundred trees were planted to initiate habitat rehabilitation. In some areas, dead trees used by roosting cormorants were cut down to provide protection to sub-canopy vegetation suffering from the effects of cormorant guano falling from above.

Non-target colonial waterbirds living in proximity to the managed areas produced successful broods in 2005. The great egret (*Ardea alba*) continues to increase. A study comparing the breeding success of great blue herons *(Ardea herodias)* and great egrets at Presqu'ile and an unmanaged (control) colony at Chantry Island in Lake Huron indicated that nesting success for both species did not differ between the managed and control sites.

According to the late-June census period, the number of cormorant nests had declined 34% from 2004 and 62 % from 2002 (the last year in which management did not occur).

In 2002, the Presqu'ile cormorant colony represented 43% of the Lake Ontario population.
In 2005, the Presqu'ile cormorant colony represented 20% of the Lake Ontario population.

2005 Nest Count

Tree Nests	= 1,976	(1,040 in East Woodland, 936 in West Woodland)
Ground Nests	= 2,633	(1,305 on High Bluff Island, 1,328 on Gull Island)
Total Nests	= 4,609	

Background Information

Double-crested cormorants (*Phalacrocorax auritus;* hereafter referred to as cormorants) first colonized the Great Lakes in the early 1900s. The first known nesting colony was found in western Lake Superior in 1913. 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 2000 a). 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. 12,082 of Lake Ontario's 28,180 nests were located at Presqu'ile in 1982. In 2005, after three years of management, the Presqu'ile colony constitutes approximately 20% of the Lake Ontario population. In 2005, 4,609 of Lake Ontario's 23,530 cormorant nests were at Presqu'ile.

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 are 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 2004 b; 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.

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 2005.

Methods

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 of 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 population. 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 and 2005, 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 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 bush on Sebastopol Pt, Gull Island but these nests were removed in 2005. On High Bluff Island cormorants nest both in woody vegetation and on the ground.

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

Cormorant Management

Cormorant management activities that occurred from April 04 to October 02, 2005 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 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 cormorants 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 and full-face respirators with NIOSH Filters AM/CD/FM/HC/HFI(ESC.)/MA/OV/SD (part 755c) were worn by all staff to reduce noise and smell 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 treated eggs, number of treated nests and number of unoccupied nests (nests without eggs).

Predation of cormorant eggs by gull species causes cormorants to re-lay new eggs in the same nests. Due to these new clutches of eggs and late nesting cormorants, it was necessary to oil nests repeatedly. Ground nests containing eggs were treated on five separate occasions between May 12 and July 07, 2005.

Figure 2. Oiling of ground-nests.

Culling Culling occurred on five separate days between May 24 and June 01, 2005. Cormorants 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 after which all shooters would withdraw from the colony for one or more hours. Spotters were stationed in appropriate locations to ensure public safety. Whenever culling activity was conducted an observer of non-target species accompanied the shooters.

Carcass disposal The carcasses of culled cormorants 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 determined by the Ontario Ministry of the Environment in accordance with a provisional Certificate of Approval to operate a waste disposal facility. High carbon material is required as a substrate for effective composting. In 2004, cut hay was used as a carbon source. In 2005 wood chips derived from tree-trimming in the park's development zones were utilized, in accordance with the park management plan (Ontario Parks 2000 b; http://www.ontarioparks.com/english/planning_pdf/pqplan.pdf).

Figure 3. 2005 Composting facility on High Bluff Island.

Nest removal. In 2005, 1,861 nests were removed from trees in all wooded areas of the Presqu'ile Islands using forestry poles. Forestry poles (square cross-sectioned fiberglass poles in 8-foot (2.46 m) sections) were the primary tool used to knock nests down from trees (Figure 4a). As in 2003 and 2004, 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 2004 b; http://www.ontarioparks.com/english/planning_pdf/pres_annual_report.pdf).

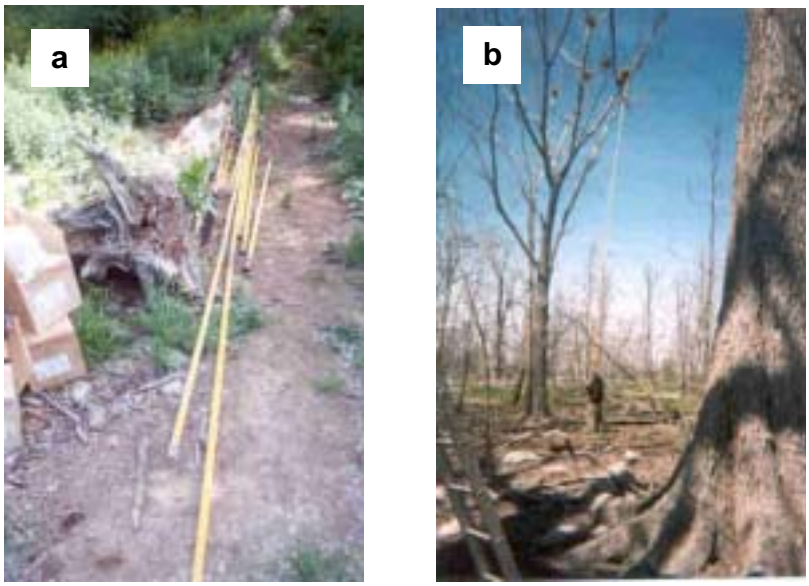

Figure 4a. Forestry pruning poles, in sections, used for knocking down nests
4b. Poles in use for nest removal on High Bluff Island.

Roost Disturbance. During September 2005 staff actively discouraged cormorants from roosting in areas containing living vegetation on High Bluff Island. This was achieved through the presence of humans within these areas, and use of an optical device (Figure 5) and noise-making devices such as whistles, air-horns and blank shot-gun shells. Observers located at the island's lighthouse and stationed on the island's north shore observed disturbed cormorants to determine if these birds left the island after disturbance activities. Roost disturbance typically occurred every other day.

Figure 5. Optical device "Avian Dissuader" used to disturb roosting cormorants.

Creation of Artificial Nesting Habitat. In 2003, it was noted that an area used as a former study site was favoured by ground-nesting cormorants. This area was defined from its surroundings by one-meter tall wooden stakes that had once been driven in to the ground to support a low fence. Although the fence material had been removed a grouping of cormorant nests had developed within the area defined by the fence posts.

With the goal of attracting tree-nesting cormorants to ground sites an area approximately 50 metres by 15 metres was prepared in 2005 by placing a grid of stakes adjacent to a cormorant ground-nesting site on High Bluff Island. The stakes were pounded in to the

ground with a spacing of 1 metre from adjacent stakes. In addition to stakes, pieces of driftwood and tree branches were placed within the staked area (Figure 6). Dummy nests procured from nest removal activities were also placed at this site.

Figure 6. Wooden stakes and "Dummy Nests" were used in an attempt to lure tree-nesting cormorants to use ground sites.

Vegetation Management

Tree Planting. A trial planting of trees on High Bluff Island was attempted in the autumn of 2004. The planting stock originated from the park's native tree nursery where trees are grown from seeds collected at Presqu'ile. In 2004, the trees were planted in late-September. Planted trees were over 1.5 m in height to discourage browsing by white-tailed deer. Only species currently growing on High Bluff Island were used. In 2005 about 600 additional trees were planted on High Bluff Island in April and early May (Figure 7 a, b). The sites selected for tree planting were woodland areas that now consist largely of dead trees and shrubs and have not attracted roosting or nesting cormorants since the removal of their nests.

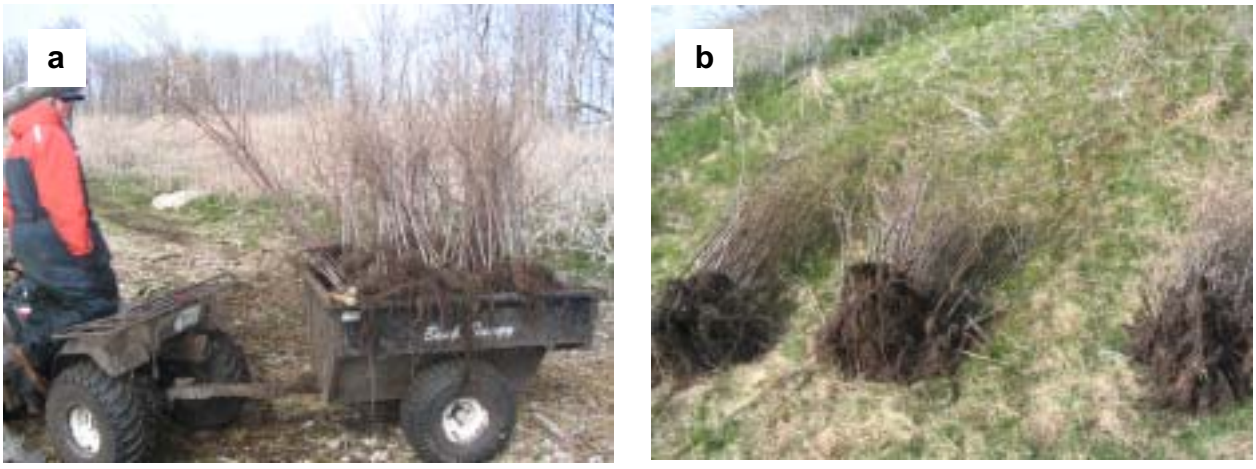

Figure 7. Tree-planting on High Bluff Island, spring 2005.

Roost Tree Cutting. In 2005 several dead roost trees were removed in areas where living vegetation was being affected by the guano produced by the roosting cormorants. Limbing of roost trees was attempted but abandoned for safety reasons due to extensive rot found within the tree bases. Instead 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 (*Nycticorax nycticorax,* BCNH) populations were closely monitored prior to and during the management period of 2005 (as in 2003 and 2004) (Figure 8).

Figure 8. Monitoring of non-target species occurred before, during and after management activities.

Monitoring of the three heron species began on April 21 and concluded on August 10, 2005. 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 other staff initiated activity 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. The behaviour of nesting herons was monitored to ensure that adults were not kept away from their nests for extended periods of time. 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 9.

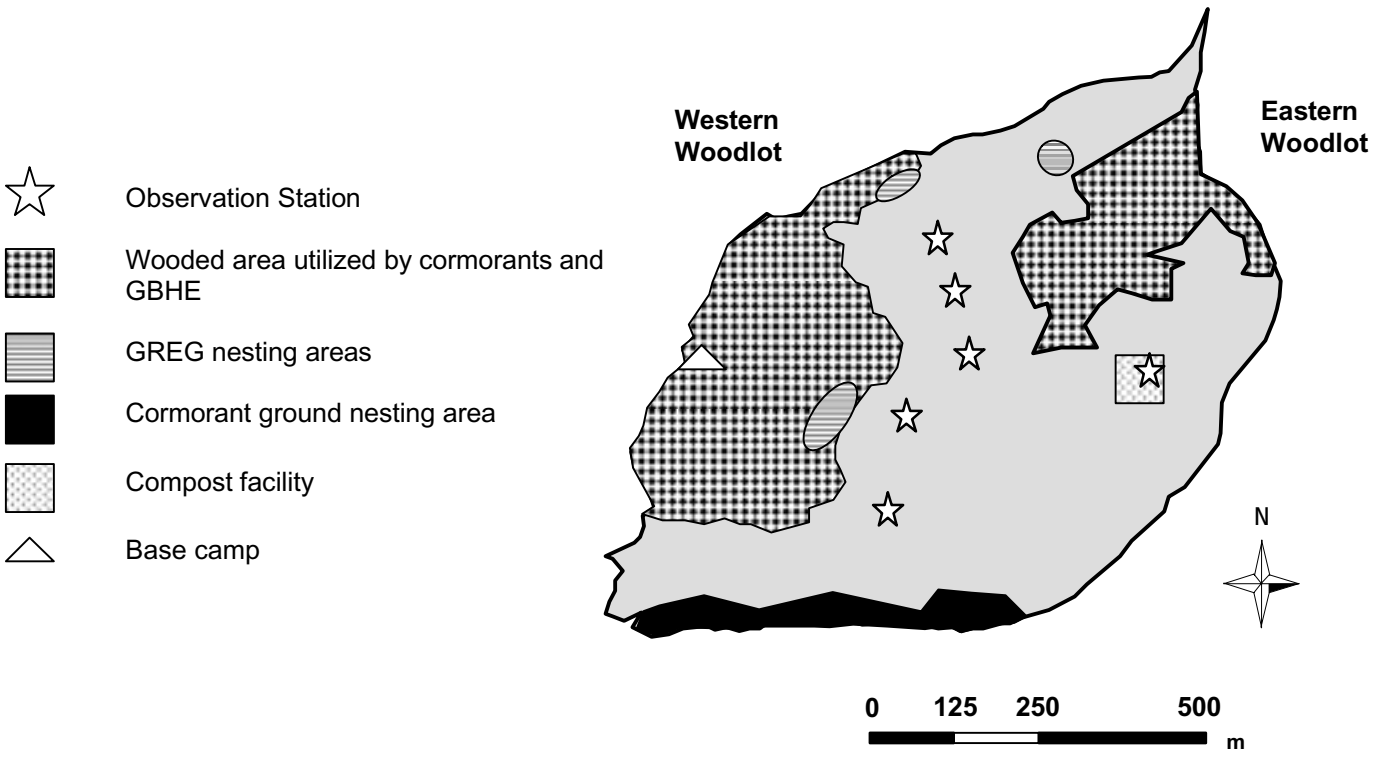

Figure 9. Locations of GBHE and GREG Nesting and Monitoring Sites on High Bluff Island.

Great Egret. All GREG nests were observed, using binoculars and spotting scopes, at least five days per week (Mon. to Fri.) from April 21 to Aug 10, 2005. Monitoring effort was increased to seven days a week during the period from May 03 to June 05, 2005 (which included the cull period: May 24 to June 01, 2005). Six permanent observation stations were arranged throughout the island (Figure 9) so that access to and use of these stations did not cause disturbance to breeding GREGs.

Great Blue Heron. The monitoring schedule for GBHEs was the same as that for GREGs for a sample of 25 nests (Figure 9). The sample group consisted of nests from four different nesting areas:

1) East woodland core (5 nests)

2) West woodland core (10 nests)

3) Periphery of east woodland (2 nests)

4) Periphery of west woodland (8 nests)

In addition, all GBHE nests on High Bluff Island were monitored bi-monthly (May 03 & 25, June 03 & 29, July 05). During these bi-monthly surveys, most nests were monitored from the permanent observation stations. For nests that were difficult to observe from the observation stations (n = 7), it was necessary to approach more closely to determine the nest status or brood size (in some cases, this involved standing beneath the nesting tree).

The colony-wide census was performed on a bi-monthly basis to minimize disturbance to nesting herons.

Black-crowned Night-Heron. Several factors made the monitoring of BCNH nests a challenge. BCNHs nested in densely-foliated shrubs and trees in 2005, which precluded the collection of behavioural observations and the remote monitoring of nests. 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). However, the only option available for monitoring BCNHs was to enter their nesting areas. To minimize potential negative impacts on breeding BCNHs, nesting areas were only entered twice during the breeding season (May 13 and June 08, 2005; on June 08 most nests contained either eggs or small nestlings).

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 cormorants 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 late May**. For herons and egrets, nest attentiveness increases and the probability of nest abandonment decreases during the later phases of their nesting cycle. Delaying cormorant 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 9). When traveling between these sites, staff travelled 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.

3) **Minimizing time spent in the woodlots during culls**. The duration of culling events (23 - 55 min) was designed to minimize the amount of time parent herons spent away from the nest. Dead cormorants 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 Chantry Island.

In addition to the monitoring of non-target species at Presqu'ile, a control colony was 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. The control colony selected was Chantry Island in Lake Huron (Figure 10). This site represented the most similar mixed species colony available, in terms of species present and the relative abundance of each species. Chantry Island is designated as a Migratory Bird Sanctuary and the waterbird colony was subjected to a low level of human disturbance in 2005 (one observer, one visit per week). 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.

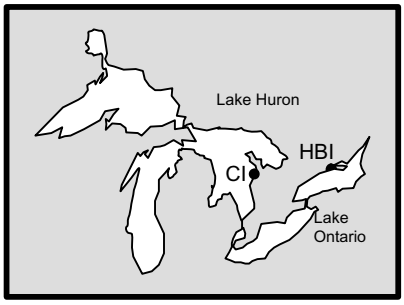

Figure 10. Locations of High Bluff Island (HBI), Presqu'ile Provincial Park and Chantry Island (CI), Lake Huron.

As part of this study, behavioral data were collected weekly at High Bluff Island (HBI) and Chantry Island (CI) for GBHEs (38 nests at HBI, 31 nests at CI) and GREGs (18 nests at HBI, 30 nests at CI) over a nine week period (May 05 to July 05, 2005). To assess the effect of the cormorant cull on GBHE and GREG 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 High Bluff Island that were associated directly with cull events. Nest attendance and behaviour of herons 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 High Bluff Island (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 both High Bluff Island and Chantry Island), 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 cormorants. 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).

The effect of polling cormorant nests on GBHE and GREG behaviour was assessed in the fifth week of the study. Time budget data were collected for a sample of GBHEs (9 nests) and GREGs (21 nests) occurring at various distances from nest polling activity.

During the ninth week of the study, nesting success and brood size were recorded for nests at High Bluff Island and Chantry Island, to determine if there were any prolonged, cumulative effects of cormorant management on non-target GBHEs and GREGs.

Heron Roost Monitoring. The possible impact of disturbing roosting cormorants on roosting herons was a concern. In an attempt to determine if a regional heron roosting site existed on or near High Bluff Island, observations of herons flying to and from High Bluff Island were made on 10 days between July 28 and August 26. A total of 22 hours of observation occurred. Eight of these observation periods occurred at dusk and four at dawn. Observation periods ranged in length from 1 to 3 hours. A single observer recorded all heron movements to and from High Bluff Island.

Companion Science.

With the opportunity to conduct a large number of *post-mortem* examinations of cormorants, a variety of companion science projects was undertaken in 2005. These projects include:

1) Stomach contents sampling
2) Sexing of birds by dissection
3) Weighing of culled birds
4) Collection of cloacal swabs for viral analysis (e.g. West Nile Virus, Avian Influenza, Newcastle Disease)
5) Collection of data from banded birds.

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

Birds were weighed using an Extech^{TM} Digital Hanging Scale. Cloacal swabs were collected from a sample of (Figure 11) 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. The gender of each cormorant was determined by visual inspection of the bird's gonads following removal of the stomach.

Figure 11. Collection of cloacal swabs for viral analysis.

Results

On June 23, 2005 a total of 4,609 cormorant nests was counted at Presqu'ile, a decline of 33.6% since 2004. Since the last year in which management of cormorants did not occur (2002) the number of cormorant nests has declined by 61.8% (Table 1).

Table 1. Double-crested cormorant nesting at Presqu'ile, 2002 to 2005.

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

As in other years, tree nests were found in both the eastern (1040 nests) and western (936 nests) woodlots in 2005.

Cormorant Management

Egg oiling. A total of 23,732 eggs from 2,633 ground nests was treated with mineral oil on both Gull and High Bluff islands (Table 2). Egg oiling successfully prevented all eggs from hatching in ground nests. Adults continued to incubate oiled eggs and did not re-nest. The ground nest colony on High Bluff Island declined by 22.5 % from 1683 nests in 2004 to 1305 nests in 2005. On Gull Island, the number of ground nests decreased by 17.0 % from 1601 nests in 2004 to 1328 nests in 2005.

Culling. In 2005, 1867 cormorants were culled at Presqu'ile on five separate shoot days between May 24 and June 01 (Table 2).

Carcass Disposal. The carcasses were placed into a composting facility and with the exception of the larger bones and primary feathers were fully decomposed. 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**.**

In May 2005, the 2004 compost was analysed for metals as specified by the Ministry of the Environment. Since levels of mercury exceeded the specified level the compost material was classified as solid non-hazardous waste and was removed from the island and disposed of in an approved disposal facility in the autumn of 2005.

Nest removal. In 2005, 1,861 nests were removed from trees on High Bluff Island (Table 2). The success of destroying a nest using forestry poles depended largely on nest height. Mid-level nests demanded the most attention due to their relative abundance. As in 2003 and 2004 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. Double-crested cormorant management actions at Presqu'ile.

Activity	Year		
	2003	**2004**	**2005**
eggs oiled	28648	26311	23732
nests removed	3980	2098	1861
adults culled	0	6030	1867

Roost Disturbance. All of the techniques employed in 2005 (optical devices, noise-makers and human presence) worked to varying degrees in encouraging roosting cormorants to vacate High Bluff Island. The optical device proved to be the least effective tool and worked only in near-dark conditions. Noise-makers were most effective especially when backed up by human presence within the colony following the initial noise. The range of the noise's impact varied with the intensity of the noise, with the loudest sounds having the largest disturbance range.

Flushed birds were observed from several locations around the perimeter of the island. After taking off, the birds typically circled the island and gathered into flocks over the island's southern shoreline. These flocks of 20 to 500 birds then headed southeasterly, in the direction of Scotch Bonnet Island 25 kilometres away. The flocks never varied in direction until they disappeared from sight.

The majority of the island's roosting cormorants were displaced by roost disturbance activities in the first few days of disturbance activities. However a group of around 250 cormorants refused to leave the island. Many of these birds were young cormorants remaining in the highest trees, the same trees that were not accessible to nest removal.

Creation of Artificial Nesting Habitat. There was limited utilization of the 2005 artificial ground colony site by cormorants. The new site consisted of an extension of the existing ground colony at the southwest corner of the island. Approximately one dozen additional cormorant nests were found in the newly created area. Weed growth was a potential problem within the artificial ground colony site, discouraging cormorants from using this location. This same problem occurred in the 2004 artificial colony location.

Vegetation Management

Tree-Planting. The 2005 stock used in tree-planting originated from the park's tree nursery. After planting in April and early May initial growth was good. However, a prolonged drought during the summer of 2005 may have affected the survival of the young trees. Another concern is destruction of planted trees by browsing deer and deer using the saplings as "rubbing-posts". This activity occurs primarily during the autumn months..

Roost Tree Cutting. In October of 2005, 14 dead trees were cut in areas where roosting cormorants were damaging nearby living vegetation. An attempt was made to remove only the limbs of these trees leaving the tree trunk standing. This practice was abandoned due to the presence of rotted wood around the base of the dead trees which prevented safe climbing by saw operators. After cutting the trees were left where they fell. Details on the trees removed are in Appendix 1.

Non-target Species Monitoring

All three non-target species had successful breeding seasons (Tables 3 and 4). Great blue heron nest numbers were comparable to the two previous years, but fledging rates were higher in 2005. Great egret nest numbers were higher again in 2005 and nest success was the same as in 2004. Black-crowned night-heron nest numbers were comparable to previous years, but nesting success was not determined.

Great Egret (GREG). Sixteen successful nests produced 42 young. An average of 2.6 chicks were fledged per successful nest. Eleven nests were clustered in the western woodland in small trees, 2 nests were located in a choke cherry grove in the eastern woodland and 3 nests were interspersed within the large BCNH colony located in the choke cherry thicket along the northern shoreline of High Bluff Island.

The maximum 2005 nest count occurred on June 8 with 17 nests. One of the 17 pairs using High Bluff Island this year re-nested late in the season and was unsuccessful in raising young. The other 16 pairs successfully reared young.

Great Blue Heron (GBHE). Thirty-two nests were successful, producing 75 young. An average of 2.34 chicks were fledged per successful nest. These nests were distributed between the east (15 nests) and west woodland (17 nests). A sample set of 25 nests was observed daily. Eighteen of the sample nests successfully produced 40 young (2.22 chicks per nest).

The high point for the GBHE population in 2005 occurred on April 21 when there were 42 active nests (active nests were defined as a discernable collection of sticks of any size attended by accompanying herons). There were relatively few cormorant tree nests at this time. By late May and early June, when cormorant nesting was at its peak, the number of GBHE nests reached its ultimate level of 32 active nests.

Black-crowned Night-Heron (BCNH). Seventy-one BCNH nests were counted in 2005. Fourteen of these nests were on Sebastopol Point, Gull Island and 57 were located on High Bluff Island. Due to the potential of observer disturbance it was decided to minimize time spent within BCNH colonies. It was deemed unacceptable to enter the BCNH colonies to determine nest productivity.

Table 3. Nest count data for the three non-target species at Presqu'ile, 1998-2005

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

* Canadian Wildlife Service data

** na – not available

*** nc – not counted to avoid disturbance to other species

Table 4. Nesting success of non-target species at Presqu'ile, 2003-2005.

Species	Maximum nest count			Number of successful nests			Number of fledged young			Number of young fledged per nest		
	2003	2004	2005	2003	2004	2005	2003	2004	2005	2003	2004	2005
GBHE	38	63	42	25	38	32	37	75	75	1.48	1.97	2.34
GREG	5	10	17	4	10	16	10	26	42	2.5	2.6	2.6
BCNH	80	59	71	?*	?	?	?	?	?	?	?	?

* ? - unknown

Heron and egret behaviour and nesting success – comparing Presqu'ile and Chantry Island.

The following results are for the study comparing heron and egret behaviour and nesting success at High Bluff Island with Chantry Island, a non-managed (control) site.

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 cormorant 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). The nesting behaviour of GBHEs and GREGs during non management periods did not differ between High Bluff Island and the control site at Chantry Island.

Nest attendance during culls was reduced for both species in the cull woodlot (herons spent an average of 20% of time at the nest; egrets = 74%). Once shooting had stopped, herons returned to their nests in 11 minutes on average; all egrets returned before the cull had ended. Post-cull nest attendance did not differ from pre-cull levels for either species. Culling had no effect on the nest attendance of herons in the non-cull woodlot (100% nest attendance during pre-cull, cull, and post-cull periods).

The reaction of birds to the polling of cormorant nests differed between GHBEs and GREGs (measured in week 5 of the study). For GBHEs, the distance at which polling activity affected their behaviour ranged from 136-153 m. GREGs, in contrast, showed no effects until nest polling occurred much closer, within 67-77 m.

At the end of the study (week 9), nesting success did not differ between the managed (High Bluff Island) and control (Chantry Island) sites for GBHEs or GREGs (Table 5).

Table 5. 2005 nesting success for two non-target species at High Bluff and Chantry islands.

Site	Nesting Success			
	Failed Nests		Successful Broods	
	GBHE	GREG	GBHE	GREG
High Bluff Island	28%	24%	2.3±0.7 chicks	3.0±0.6 chicks
Chantry Island	23%	31%	2.2±0.8 chicks	3.0±0.7 chicks

At the time of preparation of this report the control site report was undergoing peer-review (Moore et al 2006). The full report with further details regarding the results of this study will available upon request following completion of the internal review process.

Heron Roost Monitoring

Twenty-two hours of observations of non-target species flying to and from High Bluff Island were made during 11 surveys (7 conducted at dusk, 4 at dawn) on 10 dates between July 28 and August 26 (for details, see Appendix 2). Numbers of herons roosting were variable, with a peak of 14 herons observed to be moving to the island on August 07 and three or less seen to roost from August 16 onwards.

Companion Science

With the opportunity to examine a large number of cormorant carcasses a variety of companion science projects was undertaken in 2004. These include:

1) Stomach contents sampling - 251 birds
2) Sexing of birds by dissection - 251 birds
3) Weighing of culled birds (see Appendix 3) - 251 birds
4) Collection of cloacal swabs for viral analysis (e.g. West Nile Virus, Avian Influenza, Newcastle Disease) - 100 birds

Sex ratio. The sex ratio of the 251 birds sexed was 155 males to 96 females (1.61:1). However, the male:female sex ratio varied among cull events, from 1.2:1 to 3.5:1 (Table 6). This compares with a 2004 ratio of 2.7 males per every female culled. Detailed results are included in Appendix 3.

Table 6: Sex ratios of cormorants culled in 2005.

Date	Total Birds	# of Male*	# of Female*	Male : Female
May 24 am	46	30	16	1.88:1
May 24 pm	55	30	25	1.2:1
May 25 pm	50	27	23	1.18:1
May 27 am	50	29	21	1.38:1
June 1 am	50	39	11	3.54:1
TOTAL	251	155	96	1.61:1

* Gender of birds determined by dissection.

Viral analyses / analysis of stomach contents. As of May 2006, the cloacal swabs and stomach content analyses had not yet been completed.

Band returns. Six of the 1867 cormorants culled were banded (Table 7). All of the birds were banded at their natal colonies, three in Lake Michigan, two from Lake Ontario and one from Lake Huron. The average age of the banded birds was 8.4 years.

Table 7. Details regarding banded cormorants culled in 2005.

Band #	Date banded	Bird Age	Jurisdiction where banded
1247 50059	June 09, 1992	13	Wisconsin – Lake Michigan
0868 92848	June 26, 2000	5	Ontario – Lake Ontario – Presqu'ile P. Park
0868 92418	June 26, 2000	5	Ontario – Lake Ontario - Presqu'ile P. Park
1247 85405	June 20, 1995	10	Ontario – Lake Ontario - Presqu'ile P. Park
1247 64754	July 02, 1995	10	Michigan – Lake Michigan
0878 07161	July 18, 1995	10	Wisconsin – Lake Michigan

Summary and Discussion

Cormorant management activities on Presqu'ile's islands have lead to a substantial decline in the number of cormorants nesting at Presqu'ile. Since 2002, the last year in which management did not occur, the park's cormorant nesting population has declined by 61.8%. This reduction in nest numbers has been achieved through the combined effects of egg oiling, nest removal and culling of adult birds.

The management program in 2003 involved a reduction in cormorant reproduction through egg oiling and nest removal. However, adult cormorants deprived of the opportunity to reproduce still remained a part of the overall population - potential breeders in future years. In 2004 and 2005, the introduction of culling reduced the size of the adult breeding population by a cumulative total of 7,897 birds (6030 culled in 2004, 1867 culled in 2005). Concurrent with the removal of the adult birds, the effects of their guano on living vegetation were also removed.

Cormorant Management

Egg-oiling. Egg oiling again proved to be an effective tool to reduce production of young from the ground-nesting colony, as all eggs could be treated relatively quickly and the technique was successful in preventing hatching. Egg oiling also "fooled" adults into continuing to incubate eggs, thus pre-occupying their time for long periods. However, predation of cormorant eggs by gull species 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.

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). Egg-oiling only reduces recruitment of young into the population, and the adult birds remain within the population and continue to attempt breeding. The impact of these birds remains, since the guano produced by these unsuccessful breeders continues to affect vegetation used for nesting and roosting. Another factor to consider is the fact that a significant proportion of Presqu'ile's nesting cormorants do not nest on the ground. In 2005 43% of the park's nesting cormorants were tree-nesters, inaccessible to oil-spraying equipment. For these reasons, egg-oiling can only be considered as a part of the overall cormorant management scenario for Presqu'ile.

Culling. As in 2004 culling again proved to be an effective method of reducing the overall cormorant population (1867 cormorants culled) and the impact on wooded habitat. The most significant impact of culling is that it results in reduced numbers of adult birds, which reduces chemical and physical impacts on vegetation. These impacts are both immediate, and long-term since future reproduction and recruitment associated with the culled individuals is also eliminated.

Carcass Disposal. The composting of cormorant carcasses proved an efficient method of their disposal in 2005. This material will be left on-site until the autumn of 2006 when it will 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.

Nest Removal. A total of 1976 cormorant tree nests was counted in the third week of June. Many of these nests were too high for removal. 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.

Roost Disturbance. Roost disturbance operations removed most of the park's roosting cormorants from High Bluff Island. However a small group of cormorants refused to leave the island and simply shifted locations when disturbed. Many of these birds were the young-of-the-year and some were adults. Despite the reluctance of this group to leave the island, the majority of the roosting population departed soon after the initiation of roost disturbance activities, thereby reducing further deposition of guano.

Creation of Artificial Nesting Habitat. The site chosen for artificial ground-nest habitat creation in 2005 was adjacent to an active ground colony and hence was deemed as a good candidate site. Logs, branches and wooden stakes were placed in this area to simulate the terrain in the adjacent ground colony. Despite this effort only a few cormorant nests were established in the artificial habitat. In previous years, the rapid growth of grasses was felt to have deterred cormorant nesting. In 2005, the rapid colonization of this area by gulls may also have prevented cormorants from utilizing this area.

Vegetation Management

Tree-Planting. Initial growth of planted trees was good. However a prolonged drought during the summer may have affected the survival of the young trees. Another concern is the destruction of the planted trees by browsing deer and deer using the saplings as "rubbing-posts". Protection of planted trees from deer may be necessary while susceptible to both browsing and damage through rubbing. Survival of planted trees will be assessed in 2006.

Roost Tree Cutting. The desired situation was to limb roost trees used by cormorants while maintaining the trunks for cavity-nesting and feeding birds. However, the limbing of roost trees proved unsafe due to extensive rot at the bases of these dead roost trees. This forced the cutting down of selected roosting trees.

The removal of 14 dead trees utilized by roosting cormorants is hoped to reduce impact to living vegetation found within the "drip-zone" of the former canopy. Removal of roost trees has been selective to ensure that roosting cormorants will continue to have dead roost trees to use and will not be driven to living vegetation for roosting.

Non-target Monitoring

Heron species living in association with cormorant management activity at Presqu'ile successfully nested and reared young. In addition, GREGs at Presqu'ile were quicker to establish productive nests and great blue heron nestling productivity has risen compared to previous years.

During the 2004 breeding season 10 pairs of GREGs that nested on High Bluff Island re-nested multiple times (29 nesting attempts by 10 pairs). While more GREGs nested on High Bluff Island in 2005, there were fewer nesting attempts (only 21 nesting attempts by 17 pairs). This may be explained by a higher proportion of experienced birds that had successfully nested at the site in previous years or by a reduction in the competition or influence from cormorants as cormorant numbers have been reduced. All areas that were ultimately successful in 2004 were re-occupied by successful nests early in the 2005 season. GREG fledging rates remained constant from 2003 to 2005.

Nestling productivity for GBHE 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 2005 each successful nest fledged 2.48 young.

The BCNH nest count in 2005 was up from 2004 (59 nests in 2004, 71 nests in 2005) and within the normal range of nest numbers for this species for Presqu'ile.

The study of GREG and GBHE breeding success involving the control site at Chantry Island, Lake Huron (Moore *et al*., 2006) concluded that the effects of culling activity on herons and egrets 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 GBHEs nesting in the adjacent, non-cull woodlot). At High Bluff Island, GBHEs appear to be more sensitive to human disturbance than GREGs, as they (i) spent more time away from the nest during the cull and (ii) reacted to nest polling at further distances. There was no difference in breeding success of GREG and GBHE between the High Bluff Island and Chantry Island. In addition, the breeding success for GREG and GBHE at Presqu'ile are within the normal range reported in other studies (Butler 1992). Therefore, based on these findings, there does not appear to be any impacts of cormorant management activities on GBHEs and GREGs nesting on High Bluff Island.

The data from roost monitoring suggests that High Bluff Island is not a regional night roosting location for herons and egrets. Heron and egret activity declined throughout August and was likely limited to young resident birds.

Companion Science

Band data from cormorants culled at Presqu'ile in 2004 and 2005 indicated that cormorants breeding at Presqu'ile have originated from throughout much of the Great Lakes basin.

In 2005 the sex ratio of the 251 birds sexed was 1.6 males per female culled. This compares with a ratio in 2004 of 2.7 males per every female culled. It is not known why this difference has occurred.

Results of other companion science studies are pending.

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Appendix 1. Details on Roost Trees Cut in 2005.

#	DATE CUT	SPECIES	DETAILS
1	Oct. 06/05	Sugar Maple	50 CM DBH* - DEAD - CUT
2	Oct. 06/05	Sugar Maple	40 CM DBH - DEAD - CUT
3	Oct. 06/05	Sugar Maple	35 CM DBH - DEAD - CUT
4	Oct. 06/05	Sugar Maple	50 CM DBH - DEAD - CUT
5	Oct. 06/05	Sugar Maple	20 CM DBH - DEAD - CUT
6	Oct. 06/05	Red Oak	50 CM DBH - DEAD - LIMBED
8	Oct. 11/05	Sugar Maple	35 cm DBH - Dead - Cut
9	Oct. 11/05	Sugar Maple	35 cm DBH - Dead - Cut
10	Oct. 11/05	Sugar Maple	45 cm DBH - Dead - Cut
11	Oct. 11/05	Red Oak	30 cm DBH - Dead - Cut
12	Oct. 11/05	Red Oak	30 cm DBH - Dead - Cut
13	Oct. 11/05	Red Oak	15 cm DBH - Dead - Cut two 15cm stems from 5-stemmed tree
14	Oct. 11/05	Red Oak	10 cm DBH - Dead - Cut

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

Appendix 2. High Bluff Island Heron Roost Monitoring Data
N = north, S = south, E = east, W = west

July 28, 2005

Observer: P.D. Careless
Observer Location: Flights to and from High Bluff Island were observed from gravel bar between Owen Point and Gull Island.

PM watch			
Time	Species	To Island from	From Island to
19:40	*Start*		
20:10	GREG	East North East (ENE)	
20:27	2 BCNH		ENE
20:30	BCNH	ENE	
20:31	3 BCNH		North West (NW)
20:33	GREG	ENE	
20:35	*Sunset*		
20:37	GBHE	ENE	
20:39	3 GREG	ENE	
20:54	BCNH		ENE
20:56	2 GREG	North East (NE)	
20:59	BCNH		ENE
21:01	GREG	ENE	
21:04	BCNH		ENE
21:05	*Finished*		

Summary: 1 GBHE, 8 GREG and 1 BCNH roosted

July 29, 2005

Observer: P.D. Careless
Observer Location: Flights to and from Island were observed from gravel bar between Owen Point and Gull Island.

AM watch			
Time	Species	To Island from	From Island to
5:20	*Start*		
5:20	GBHE	feeding at Owen Point	
5:43	GREG		ENE
6:00	BCNH		North (N)
6:00	BCNH	ENE	
6:05	BCNH	ENE	
6:07	*Sunrise*		
6:15	3 Water spouts seen E of HBI in centre of lake (until 6:32)		
6:37	GBHE		North North West (NNW)
7:10	*Finished*		

Summary: 1 GBHE and 2 BCNH roosted

PM watch (July 29, 2005)			
Time	Species	To Island from	From Island to
19:40	*Start*		
20:11	BCNH		ENE
20:23	GREG	East (E)	
20:31	GREG	ENE	
20:31	3 GBHE	ENE	
20:34	*Sunset*		
20:34	GBHE		ENE
20:45	GREG		NE
20:45	GBHE	NE	
20:47	BCNH		ENE
20:49	BCNH	NE	
21:02	GREG	NE	
21:35	*Finished*		

Summary: 4 GBHE, 3 GREG and 1 BCNH roosted

August 7, 2005

Observer: P.D. Careless
Observer Location: Flights to and from Island were observed from western tip of Gull Island.

PM watch			
Time	Species	To Island from	From Island to
19:25	*Start*		
20:10	BCNH	NE	
20:18	GREG	ENE	
20:22	GREG	NE	
20:22	*Sunset*		
20:26	GREG	ENE	
20:29	GREG	NE	
20:32	4 GREG	ENE	
29:34	GREG	NE	
20:38	BCNH		NE
20:39	BCNH	NE	
20:41	BCNH		NE
20:49	BCNH	NE	
20:52	2 GREG	ENE	
20:52	*Finished*		

Summary: 11 GREG and 3 BCNH roosted

August 9, 2005

Observer: P.D. Careless
Observer Location: Flights to and from Island were observed from gravel bar between Owen Point and Gull Island.

AM watch			
Time	Species	To Island from	From Island to
5:40	*Start*		
5:54	GREG	ENE	
6:05	2 GBHE		NE
6:08	GBHE		ENE
6:09	GREG	NE	
6:10	GREG		ENE
6:17	*Sunrise*		
6:18	2 GBHE	NE	
6:53	GBHE	ENE	
7:17	*Finished*		

Summary: 3 GBHE and 2 GREG roosted

August 16, 2005

Observer: P.D. Careless and C. McRae
Observer Location: Flights to and from Island were observed from gravel bar between Owen Point and Gull Island.

PM watch			
Time	Species	To Island from	From Island to
19:15	*Start*		
20:09	GBHE	N	
20:09	GBHE		ENE
20:10	*Sunset*		
20:29	BCNH		NE
20:45	*Finished*		

Summary: 1 GBHE roosted

August 17, 2005

Observer: P.D. Careless
Observer Location: Flights to and from Island were observed from gravel bar between Owen Point and Gull Island.

AM watch			
Time	Species	To Island from	From Island to
5:45	*Start*		
6:25	*Sunrise*		
7:25	*Finished*		

Summary: 0 roosting herons seen

August 18, 2005

Observer: P.D. Careless, C. McRae and D.V. Weseloh
Observer Location: Flights to and from Island were observed from western tip of Gull Island.

PM watch			
Time	Species	To Island from	From Island to
19:10	*Start*		
20:10	*Sunset*	(cloudy, so the exact time of sunset was not known.)	
20:38	BCNH*	ENE	
20:38	BCNH*		ENE
20:40	*Finished*		

Summary: 0 roosting herons seen
* the same BCNH was observed to fly around the island and then leave – did not land

August 19, 2005

Observer: P.D. Careless and C. McRae
Observer Location: Flights to and from Island were observed from gravel bar between Owen Point and Gull Island.

AM watch			
Time	Species	To Island from	From Island to
5:45	*Start*		
6:15	BCNH	ENE	
6:25	*Sunrise*	(cloudy so the exact time of sunrise is not known)	
6:30	GBHE		ENE
8:45	*Finished*		

Summary: 1 BCNH roosted

August 23, 2005

Observer: P.D. Careless
Observer Location: Flights to and from Island were observed from western tip of Gull Island.

PM watch			
Time	Species	To Island from	From Island to
19:00	*Start*		
19:52	2 GBHE*	ENE	
19:56	GREG	ENE	
19:59	*Sunset*		
20:30	*Finished*		

Summary: 2 GBHE and 1 GREG roosted
* the GBHE were immature birds which flew directly to nests in the western woodlot where they roosted

August 26th 2005

Observer: P.D. Careless
Observer Location: Flights to and from Island were observed from western tip of Gull Island.

PM watch			
Time	Species	To Island from	From Island to
18:55	*Start*		
19:55	*Sunset*		
20:11	4 BCNH		ENE
20:18	6 BCNH		(from eastern woodlot to Sebastopol Point)
20:25	*Finished*		

Summary: 0 roosting herons seen

Appendix 3. Weight and Sex of Cormorants Culled at Presqu'ile Provincial Park in 2005

May 24, 2005 AM

Batch A	Weight (kg)	Sex
1	1.79	F
2	1.79	F
3	1.69	F
4	1.89	M
5	1.74	F
6	1.75	F
7	1.83	M
8	1.84	F
9	1.97	M
10	1.89	F
	1.818	

Batch B	Weight (kg)	Sex
1	2.06	M
2	1.97	F
3	2.19	M
4	2.09	M
5	2.04	F
6	2.06	M
7	2.17	M
8	2.25	M
9	2.1	M
10	2.25	M
	2.118	

Batch C	Weight (kg)	Sex
1	1.69	F
2	2.12	M
3	1.86	F
4	2.28	M
5	1.9	M
6	2.28	M
7	2.32	M
8	2.14	M
9	1.95	M
10	2.25	M
	2.079	

Batch D	Weight (kg)	Sex
1	2.04	M
2	1.81	F
3	2.35	M
4	2.33	M
5	1.88	M
6	2.1	M
7	2.06	M
8	2.12	F
9	2.18	M
10	1.91	M
	2.078	

Batch E	Weight (kg)	Sex
1	2.17	M
2	2.11	M
3	1.99	F
4	2.24	M
5	1.73	F
6	1.85	F
	2.015	

Note: "Batch" refers to a randomly selected group of 10 or fewer carcasses.

Weight and Sex of Cormorants, May 24, 2005 PM

Batch A	Weight (kg)	Sex
1	1.92	F
2	2.36	F
3	2.22	F
4	2.08	M
5	2.12	M
6	2.26	F
7	2.34	M
8	2.14	M
9	2.54	M
10	2.52	M
	2.25	

Batch B	Weight (kg)	Sex
1	2.02	M
2	2.22	F
3	1.94	F
4	2.22	M
5	2.1	F
6	1.82	F
7	2.02	M
8	1.76	F
9	2.14	M
10	2.24	M
	2.048	

Batch C	Weight (kg)	Sex
1	1.97	F
2	2.02	F
3	1.98	F
4	2.12	F
5	1.94	F
6	2.02	F
7	1.86	F
8	2.1	M
9	2.3	M
10	2.08	M
	2.039	

Batch D	Weight (kg)	Sex
1	2.18	M
2	2.18	M
3	2.14	M
4	1.98	F
5	2	F
6	2.1	F
7	2.24	M
8	2.36	M
9	2.2	M
10	1.84	F
	2.122	

Batch E	Weight (kg)	Sex
1	2.16	M
2	2.1	M
3	2.16	F
4	2.24	M
5	1.92	M
6	2.15	M
7	2.42	M
8	2.08	F
9	1.96	F
10	2.01	F
	2.12	

Batch F	Weight (kg)	Sex
1	2.23	M
2	1.94	F
3	2.36	M
4	2.44	M
5	2.2425	

Weight and Sex of Cormorants, May 27, 2005 AM

Batch A	Weight (kg)	Sex
1	1.93	M
2	1.84	F
3	2.12	F
4	2.15	M
5	2.07	M
6	2.04	M
7	1.79	M
8	1.93	F
9	2.29	M
10	1.82	M
	1.998	

Batch B	Weight (kg)	Sex
1	2.01	M
2	2.04	M
3	2.08	M
4	2.04	M
5	1.9	F
6	2.05	M
7	1.94	F
8	1.8	F
9	2.03	F
10	2.01	M
	1.99	

Batch C	Weight (kg)	Sex
1	1.82	F
2	2	M
3	1.87	F
4	1.85	F
5	2.04	F
6	2.37	M
7	1.95	F
8	1.89	M
9	2.12	M
10	2.31	M
	2.022	

Batch D	Weight (kg)	Sex
1	2.06	F
2	2.09	M
3	2.39	M
4	2.07	F
5	2.01	F
6	2.23	M
7	2	F
8	2.16	M
9	2.18	M
10	2.19	M
	2.138	

Batch E	Weight (kg)	Sex
1	1.98	M
2	1.84	F
3	1.98	F
4	2.26	M
5	1.98	F
6	2.07	F
7	1.77	F
8	1.98	F
9	2.05	F
10	2.01	M
	1.992	

Weight and Sex of Cormorants, May 27, 2005 AM

Batch A	Weight (kg)	Sex
1	2.1	M
2	1.98	M
3	1.74	M
4	2.3	M
5	1.5	F
6	1.84	F
7	1.88	F
8	2.34	M
9	1.62	F
10	1.82	F
	1.912	

Batch B	Weight (kg)	Sex
1	1.98	M
2	2.2	M
3	1.54	M
4	1.92	M
5	1.9	M
6	1.44	F
7	2.02	M
8	2.2	M
9	1.84	M
10	1.98	M
	1.902	

Batch C	Weight (kg)	Sex
1	1.84	F
2	2.06	M
3	1.78	F
4	1.84	M
5	1.92	M
6	1.94	M
7	2.2	M
8	1.74	F
9	1.86	F
10	1.82	F
	1.9	

Batch D	Weight (kg)	Sex
1	2.12	F
2	1.74	F
3	1.96	F
4	1.82	F
5	2.28	M
6	1.84	M
7	2.34	M
8	1.72	F
9	1.8	F
10	1.42	F
	1.904	

Batch E	Weight (kg)	Sex
1	2.44	M
2	1.86	F
3	1.86	F
4	1.96	M
5	1.8	M
6	2.06	M
7	1.92	M
8	1.74	F
9	1.98	M
10	1.84	M
	1.946	

Weight and Sex of Cormorants, June 01, 2005 AM

Batch A	Weight (kg)	Sex
1	1.91	M
2	1.89	M
3	1.98	M
4	1.85	M
5	1.96	M
6	2.26	M
7	2.15	M
8	1.95	M
9	2.12	M
10	2.12	M
	2.019	

Batch B	Weight (kg)	Sex
1	2.18	M
2	2.04	M
3	1.8	M
4	2.04	M
5	1.98	M
6	2.12	M
7	1.76	F
8	2.3	M
9	2.02	M
10	2.2	M
	2.044	

Batch C	Weight (kg)	Sex
1	2	M
2	1.88	M
3	2	M
4	2.18	M
5	2.02	M
6	2.16	M
7	1.84	M
8	2.12	F
9	1.89	M
10	2.04	F
	2.013	

Batch D	Weight (kg)	Sex
1	1.98	M
2	1.78	F
3	1.9	F
4	2.17	M
5	1.96	M
6	2.16	M
7	1.93	M
8	2	M
9	2.1	M
10	2.2	M
	2.018	

Batch E	Weight (kg)	Sex
1	2.18	M
2	2.24	M
3	1.74	F
4	1.95	M
5	1.84	F
6	1.8	F
7	2.22	M
8	1.8	F
9	1.72	F
10	1.73	F
	1.922	