Great Blue Herons in the Lake Champlain Ecosystem

An Assessment of the Great Blue Heron Rookeries on Shad Island, VT and Valcour Island, NY in 2002.

Prepared for the Lake Champlain Ecosystem Team
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Table of Contents

Abstract

In the 2002 breeding season, we evaluated the status of the two largest Great Blue Heron (*Ardea herodias*) rookeries on Lake Champlain—one on Valcour Island, NY and the other on Shad Island, VT. The Great Blue Heron rookeries on Valcour Island and Shad Island are the third and fourth largest rookeries in the Great Lakes region respectively. These two rookeries alone are likely to represent a large proportion of the region's breeding Great Blue Herons.

Shad Island, historically the largest rookery on Lake Champlain, has two nesting species, Great Blue Herons and Double-crested Cormorants (*Phalacrocorax auritus)*. In 2001, herons on Shad Island experienced a complete nesting failure. However, in 2002, 150 Great Blue Heron nests were established and most nesting pairs appeared to fledge young. Double-crested Cormorants (*Phalacrocorax auritus*), a relative newcomer to this 60 year old Great Blue Heron rookery, continued to build nests in 2002. Cormorants have been nesting in the rookery for the past 7 years, and in 2002 we counted 27 nests, the lowest number recorded since detailed studies of this rookery began in 1999. As in past years, cormorants slowly abandoned their nests over the course of the breeding season. We were able to detect the presence of young cormorants in nests, but none survived to fledging age.

The Valcour Island rookery, like past years, was highly successful in 2002. We speculated that there might be an increase in the size of the Valcour Island rookery in response to the complete failure of the Shad Island rookery in 2001, but this was not the case. We found 421 active nests this season, 79 less than last year.

Currently, we know of only four Great Blue Heron rookeries on Lake Champlain. In addition to Shad Island and Valcour Island, there is a small rookery on Island D of the Four Brothers Islands, NY with 11 nests and a medium-sized rookery on the east side of Porter Bay, VT with 93 nests. Although the evidence is anecdotal, it appears that the rookery in Porter Bay has increased dramatically in size during the past few years. Lake Champlain continues to house a large successful heron population.

Introduction

Lake Champlain is a biological "hotspot" for Great Blue Herons. It is the home to four rookeries, two of which are very large. Total heron numbers on Lake Champlain rival some of the other great nesting areas for herons across North America. Chesapeake Bay is estimated to have 4,600 pairs, which accounts for a quarter of the Atlantic nesting population. By comparison, Lake Champlain has about a quarter of the Chesapeake population, roughly 1,000-1,200 nesting pairs in recent years. The rookeries on Valcour and Shad islands have been among the largest in the Great Lakes region.

Lake Champlain's large and healthy wetlands are likely to be the greatest contributor to the robust population we see on the lake. A map of Lake Champlain wetlands reveals that rookeries tend to be located near large wetland complexes (Figure 1). The rookeries at Missisquoi and Porter Bay are located in large wetland complexes. Herons nesting in the Valcour rookery feed at the large wetlands at Sandbar Wildlife Management Area (Richards and Capen 2001) which are approximately 14 kilometers from the rookery. It is likely that the remote location and low disturbance of Valcour Island, combined with the productive wetlands at Sandbar, makes the energetic cost of travel to these wetlands worthwhile for Great Blue Herons.

Disturbance from Bald Eagles is on the rise in the Lake Champlain region as the population of Bald Eagles increases. Direct observations on both Shad Island and Valcour Island in 2002, as well as published reports, suggest Bald Eagles (*Haliaeetus leucocephalus)* disturb nesting Great Blue Herons. If eagle populations continue to grow (Sauer et al. 2001) we are likely to have a larger vagrant as well as breeding population of these raptors. Although eagle predation may be considered a natural problem, the vulnerability and population status of herons must be evaluated in the context of their highly limited nesting areas—a direct result of increasing shoreline development and ongoing human disturbance.

Although Lake Champlain appears to have a robust heron population, increasingly researchers are realizing that there is a complex interplay of factors affecting populations of Great Blue Herons. Lack of appropriate nesting habitat, human disturbance, eagle disturbance, invading cormorants, and habitat loss have been identified as problems for Great Blue Herons in many parts of the country (Butler 1997, Skagen et al. 2001, and Sheildcastle and Martin 1997). Lake Champlain appears to be no exception to these stresses. Because herons nest colonially, they are particularly vulnerable. Disturbance of just a few acres can lead to many hundreds of nest failures.

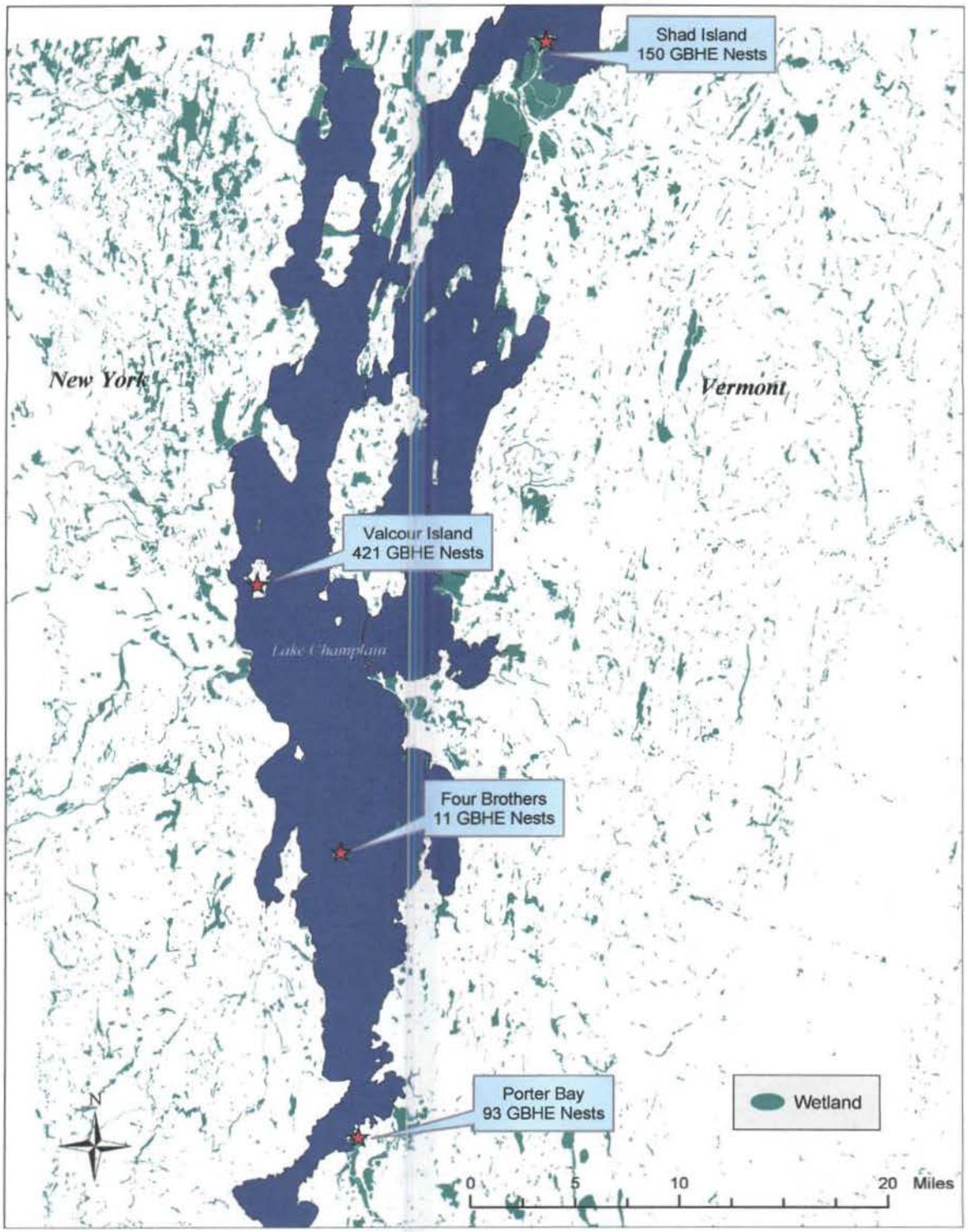

Figure 1. Location of Great Blue Heron rookeries on Lake Champlain and surrounding wetlands. Wetland data is derived from the National Wetland Inventory Mapping Program of United States Geological Service.

Shad Island

Introduction

In 2001, the Great Blue Heron rookery on Shad and Metcalfe Islands was abandoned in the middle of May. Both Great Blue Herons and Double-crested Cormorants left nests, and no young of either species fledged. We examined a number of plausible theories to ascertain the cause of the abandonment. Many theories were floated but the most plausible were raccoon predation and eagle predation. Although herons have coexisted with raccoons in many rookeries, we speculated that the addition of cormorants to the rookery may have emboldened raccoons to go after not only the cormorants that are easy prey, but herons as well. The other theory was that eagle predation, a known cause of rookery abandonment, (Butler 1997) was responsible for the Shad Island failure.

The prospects for successful nesting on Shad and Metcalfe Islands were unclear in2002. Would Great Blue Herons return to nest and, if so, would they produce any young? Although greatly reduced in size from a high of 580 nests in 1999, we were pleased to find 150 nesting pairs of Great Blue Herons, most of which appeared to fledge young. Double-crested Cormorants also nested on Shad Island. Total numbers of cormorant nests were down, and like past years, no pair successfully fledged young.

The Missisquoi National Wildlife Refuge, in which Shad and Metcalfe Islands are located, is an ideal nesting spot for Great Blue Herons. Wetlands abound, and herons need only travel short distances to forage. The colony on Shad Island has been active for more than 50 years. Research indicates that herons nesting in older, larger colonies fledge more young than in newer smaller colonies (Butler et al. 1995) suggesting that established colonies such as Missisquoi play an important role in ecosystem-wide heron population dynamics.

Methods

Nests were observed weekly from mid-May through early July from a blind near Shad Island. Because it was unclear if the rookery would establish this year, our aim was simply to observe and monitor the rookery to see if we could detect anything unusual and note the chronology and success of nesting herons and cormorants. The blind was approached by boat until the water level was too low to access the blind. Observations were then made from a boat farther from the rookery. Each observation period lasted between two and four hours.

We also counted nests on Shad Island from below the rookery. We waited until just after all the young had fledged to avoid any disturbance to the rookery. Most of the nest trees had been previously marked with a numbered metal tag, but we mapped any new trees

and noted the numbers of existing trees with nests. All nests were identified as either heron or cormorant nests. Nests that were comparatively smaller and contained marsh grasses were considered cormorant nests.

Results

Nesting Success

Great Blue Herons established nests in late March and early April on Shad Island. Double-crested Cormorants established nests in mid to late April on Shad Island as well. Although there was some activity on Metcalfe Island in the early season, with the presence of a small number of both herons and cormorants standing on old nests, it was short-lived and we did not consider it a nesting attempt. Both herons and cormorants established nests in the area considered the "heart" of the rookery (Figure 2). We observed regular nesting activity in Great Blue Herons, with about two-thirds of the visible nests raising young of roughly the same age, and a smaller group of birds that appeared to be about two weeks behind.

As in previous years, we saw no interaction between herons and cormorants. Cormorants were observed slowly abandoning nests over the course of the season. Most nests were abandoned later than usual, mostly in mid-June. In previous years, nests were abandoned in late-May. Young cormorants were visible in some of the nests, but none survived to fledge. We found the bones and feathers of young cormorants in piles on logs below the cormorant nests. Also, on one occasion, a raccoon was observed sleeping in a tree just below some active cormorant nests.

We also documented eagle disturbance this year. On one occasion, May 20th, all herons temporarily abandoned their nests and stood in nearby trees while a juvenile Bald Eagle was observed on the ground at the edge of the rookery. When the eagle took off, all herons returned to their nests.

Nest Mapping

Herons set up nests only on Shad Island in what has been the "heart" of the rookery in past years. This is the area that has most consistently been used over the years by nesting herons and tends to have the greatest density of heron nests. Cormorant nests were located on the edge of the heron rookery (as they were in 2000) and cormorants shared nest trees with Great Blue Herons (Figure 2). We counted 150 heron nests and 27 cormorant nests on Shad Island. We noticed some nesting activity by herons in the Eel Creek area. Five birds were seen building nests in late-May, and all were abandoned by early-June so we did not count these short bursts of nesting activity as nest attempts.

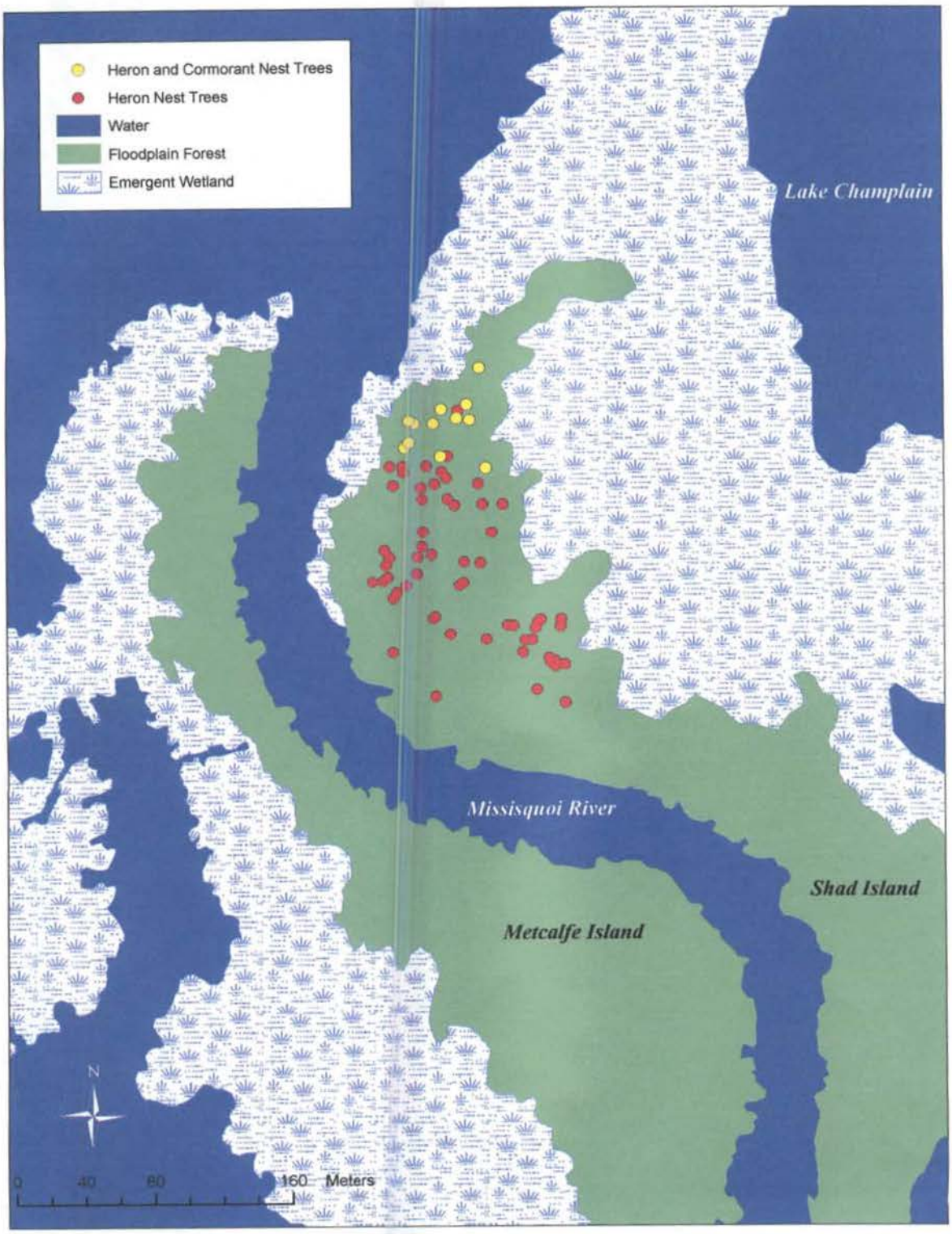

Figure 2. Location of Nesting Great Blue Herons and Double-crested Cormorants in 2002.

Discussion

After last year's abandonment, it was unclear whether herons would return to Missisquoi to nest. And, if they did nest, would they again abandon nests or fledge young? We were pleased to find a smaller, but successful, rookery established on Shad Island this year. It appears that most nests within the rookery succeeded.

Nesting Location, Timing, and Success

The longer a colony has been established the more likely it is to be successful (Butler et al. 1995), so it is no surprise that this year, as in past years, the most successful nests occurred on Shad Island. Shad Island has historically been the only location in which Great Blue Herons have nested. Additionally, research on other Great Blue Heron colonies shows that early season nest attempts are almost always the most successful (Butler 1997). These patterns are consistent with what we have seen at Missisquoi in past years (Figure 3). In 2000, a large part of the colony established itself in a new nesting area, on Eel Creek, and these new attempts were not successful. Because the area was both new and established late (nest building in late-May), it had two strikes against it. In retrospect, it is also worth considering whether late nest establishment in 2000 on Metcalfe Island, which ultimately failed, may have been a re-nest attempt after disturbance such as an eagle attack.

Similarly, in 2001, after Shad Island was abandoned, we saw new nesting attempts (initiated in early-June) along the west branch of the Missisquoi River; this attempt also failed. It is not surprising that birds with such long nesting cycles (3.5 months) do not fledge young successfully if they get a late start.

This year, two-thirds of the rookery nested synchronously and early. About one-third of the nests appeared to be 2-3 weeks behind the first set of nesters but many of these nests fledged young suggesting that although this second group of nests was started later than the initial larger group, they were still early enough to be successful.

Nesting Material

As in past years, we noted that herons continued to use nesting material that they stripped from nearby, unused nests. Of particular note was the orderly fashion in which this stripping occurred. Herons appear to go the shortest distance possible to gather nesting material, so all of the unused nests in the Eel Creek area were cleaned out systematically. All the sticks from an old nest were used before the herons moved even a few meters farther away from Shad Island to gather nesting material from additional old nests. This left the trees closest to Shad stripped clean and a clear line where old nests still remained.

Eagle Predation

Last year, we speculated that Bald Eagle predation at the Shad Island rookery could have been one of the causes of failure in the rookery. The speed with which the rookery abandoned was consistent with an acute disturbance such as an eagle attack (Butler 1997). Although eagles were spotted in 2001 near the rookery, and in many places on the refuge, none were sighted disturbing the rookery. In contrast, this season, 2002, the presence of an eagle caused all nesting herons to temporarily abandon nests. In 3 years of work with this rookery, this is the first time we have seen all birds leave active nests. The herons did not permanently abandon nests and quickly returned when the eagle flew off.

Eagles are well documented predators of adult Great Blue Herons, juvenile Great Blue Herons, and Great Blue Heron nestlings. They have been observed catching herons in mid-air and then dragging them to the nearest land to eat them. Bones of herons have been found in eagle eyries (Butler 1995, Butler 1997, and Vermeer et al. 1989). Abandonment is common in Great Blue Heron rookeries after multiple attacks, though presence of eagles or nesting eagles does not appear to deter Great Blue Herons from establishing rookeries nearby. This suggests that even if eagle activity increases on the lake, which we should expect if populations continue to increase, herons are unlikely to stop nesting at Missisquoi, though they may not always be successful nor will they necessarily stick to the same nesting area.

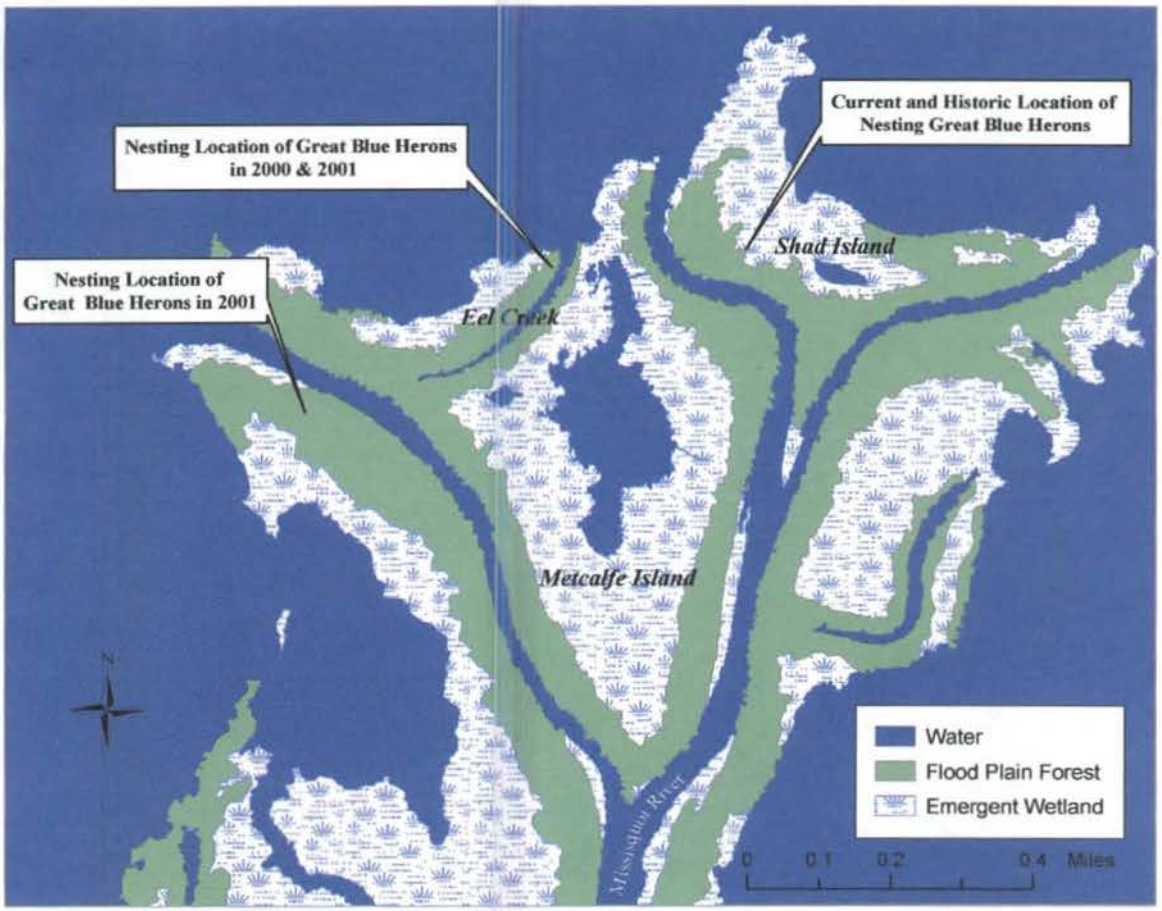

Figure 3. Past and present location of nesting Great Blue Herons on the Missisquoi National Wildlife Refuge.

Cormorants and Nesting Great Blue Herons

Cormorants nested with Great Blue Herons again this year, although numbers were the lowest they have been since 1999. The cormorants were nesting on the northern-most end of the active heron rookery on Shad Island (Figure 2). Last year, cormorants abandoned nests and no young were in evidence. In 2002, like 1999 and 2000, all cormorants eventually abandoned their nests but appeared to get farther along in the nesting cycle. Young were observed in at least 5 of the visible nests.

We were able to locate the remains of many young cormorants after the nests were abandoned. Because the water was high, only a few logs were above the water level. These logs were densely covered with the bones and pin feathers of young cormorants. In 2000, we found similar remains of young cormorants below nests that were recently abandoned. Raccoons are the most likely source of this predation as they are the predominant mammalian predator.

In past years, there has been concern that an overabundance of raccoons moving through trees in which both herons and cormorants were nesting could cause disturbance to herons because raccoons might opportunistically prey on heron nests. We wondered if this type of disturbance could be enough to cause the abandonment in 2001. While we can not rule this out, the success of the herons year after year, while cormorants were still being predated, suggests that this does not cause significant heron nest failure in the rookery. Further, herons nesting near cormorants appeared to succeed just as well as away from cormorants, though this is only anecdotal evidence and may be worth testing again.

Persistence of Cormorants at Shad Island

Given that cormorant nests continue to fail at Missisquoi, we wondered why they persist in this location. Research in the Great Lakes suggests that the presence of nesting Great Blue Herons is a strong positive factor in colony establishment for cormorants (Trexel, pers. comm., 2001). This affinity for colonially nesting Great Blue Herons may be one reason cormorants persist.

It is possible, also, that fluctuations in numbers of cormorants are associated with management activities on Young Island (Table 1). Cormorants appeared to colonize many new islands on Lake Champlain the year after initial cormorant management, through egg oiling, on Young Island. For example, we see a spike in the number of cormorants on Shad and Metcalfe Islands in 2000. Recent changes in how cormorant eggs on Young Island are oiled may reduce nest disturbance, encouraging cormorants to stay on oiled nests and prevent cormorants colonizing new areas such as Shad and Metcalfe Islands. No cormorants banded on Young Island have been sighted at Missisquoi, so it is still unclear whether cormorants at Missisquoi have previously nested at Young.

Table 1. Number of cormorant nests on Lake Champlain (before and after nest controls) from 1996-2002. Adapted from Vermont Fish and Wildlife Department. [1,2.]

Year	Young	Four Brothers	Mud (Panton)	Popa-squash	Bixby	Missis-quoi	Sloop	Dai-mond	Hen	Lazy Lady	Rock	Savage	Woods	Lapan Bay	Crown Point	Total
1996	1,665	1,184	0	2	180(0)	25										3,056
1997	1,886	836	0	0	180(0)	25										2,927
1998	2,597	1,499	0	0	0	32										4,128
1999	3,053(0)	1,372	0	0	0	34										4,459
2000	1,741(0)	1,436	42(0)	0	0	156	23(0)	1	1	9	10(0)	45(0)	68(0)	34	70	3,636
2001	1,294(518)	2,425	0	0	0	175	0	0	0	0	0	0	0	0	(+)	3,894
2002	1,325(485)	2,498	0	0	0	27	0	0	0	0	0	0	0	0	30	3,880

1. Only certain islands have had any control of nest productivity, either by destruction of nests and eggs, or the oiling of eggs. The first (and often only) number in each column represents the peak number of naturally occurring nests. The number in parentheses after some of these numbers indicates the numbers of nests remaining after controls were done that year.

2. Data are from VDFW and UVM files. (+) indicates that nests were confirmed present, but uncounted. (Blank) means that no data are available, and cormorants probably did not nest.

Conclusions

The rookery on Shad Island, and its large population of nesting Great Blue Herons, continues to be at risk. The presence of predatory Bald Eagles, nesting Double-crested Cormorants and the potential for human disturbance (Drapeau et al. 1984, Trembaly and Ellison 1979) continue to threaten the suitability of this rich area for nesting. Although it is difficult to sort out which threats, or combination of threats, has caused reduced nesting success at Missisquoi, we know that in the past 3 years nesting has been less successful than it was in 1999 (and likely through most of the 1980's and 1990's though records of rookery size during these years are incomplete). Although fluctuations in nesting success are considered normal and are well documented in other colonies of nesting Great Blue Herons, what the degree and scope of potential disruptions will be over the upcoming years is unclear but could have a significant effect on the ecosystem-wide population.

Valcour Island

Introduction

In 2002, Valcour Island continued to be a large and active rookery (Figure 4). We found synchronously nesting Great Blue Herons and most nests appeared to be active, fledging young in early July. Similar to 2001, Great Blue Herons were the only species nesting in the rookery on Valcour Island. Unlike Shad Island, trees on Valcour appear to suffer damage and mortality due to Great Blue Heron nesting activities. Tree mortality appears to be the cause of southward movement in the rookery. The remote and inhospitable location of the Valcour rookery protects it from human disturbance.

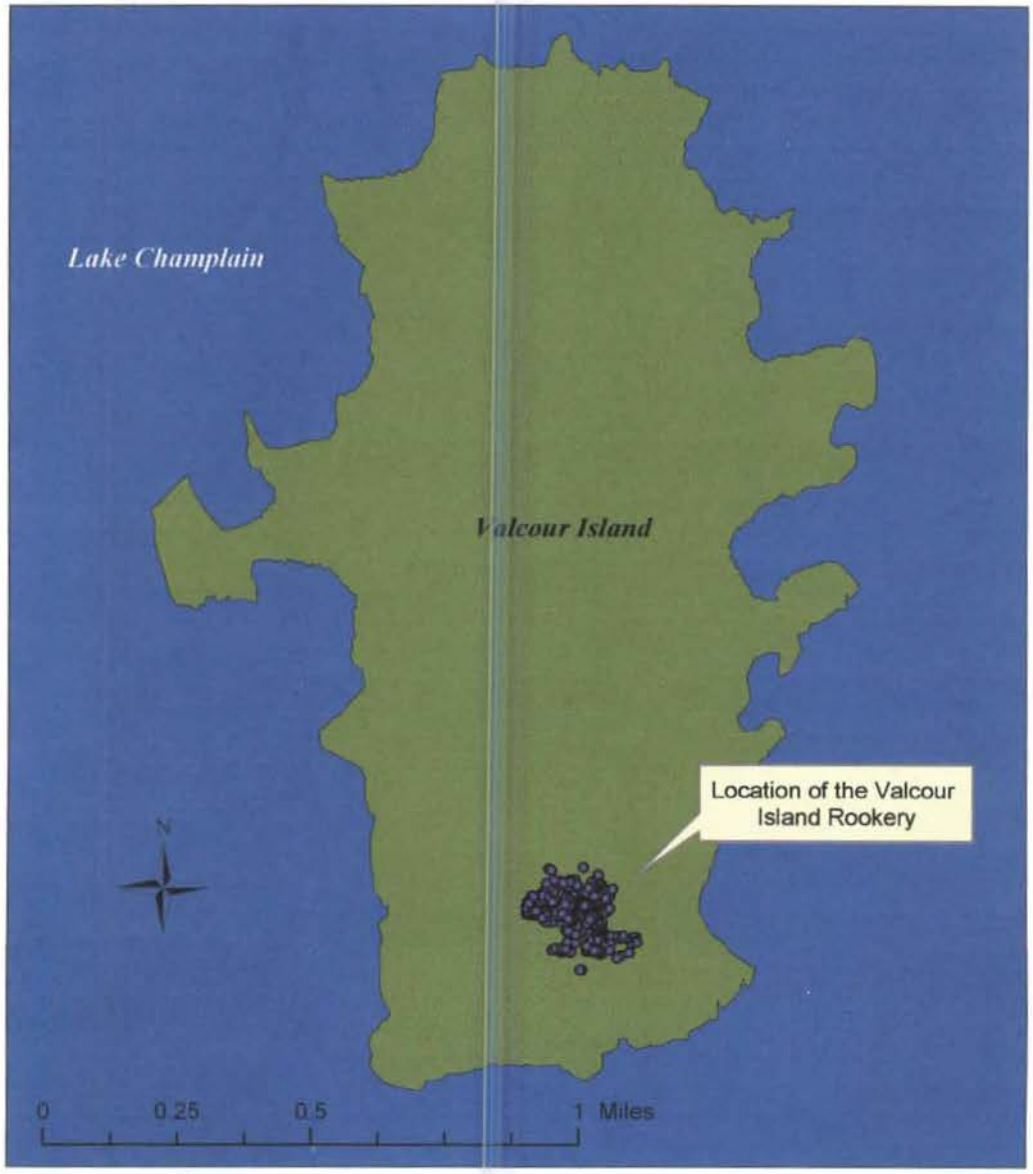

Figure 4. Location of the Great Blue Heron Rookery on Valcour Island.

Methods

We counted all nests twice during the spring and summer of 2002. We made a quick initial count of the active rookery in early-June by walking transects through the rookery and counting active nests. In July, we returned to count all nests and map the location of the nests. We labeled trees with numerical aluminum tree tags and then mapped the location of these trees based on distance from a known transect. Many of the trees had tags from 2001. The transects were established in 2001 and their locations were mapped using a global positioning device (Figure 4).

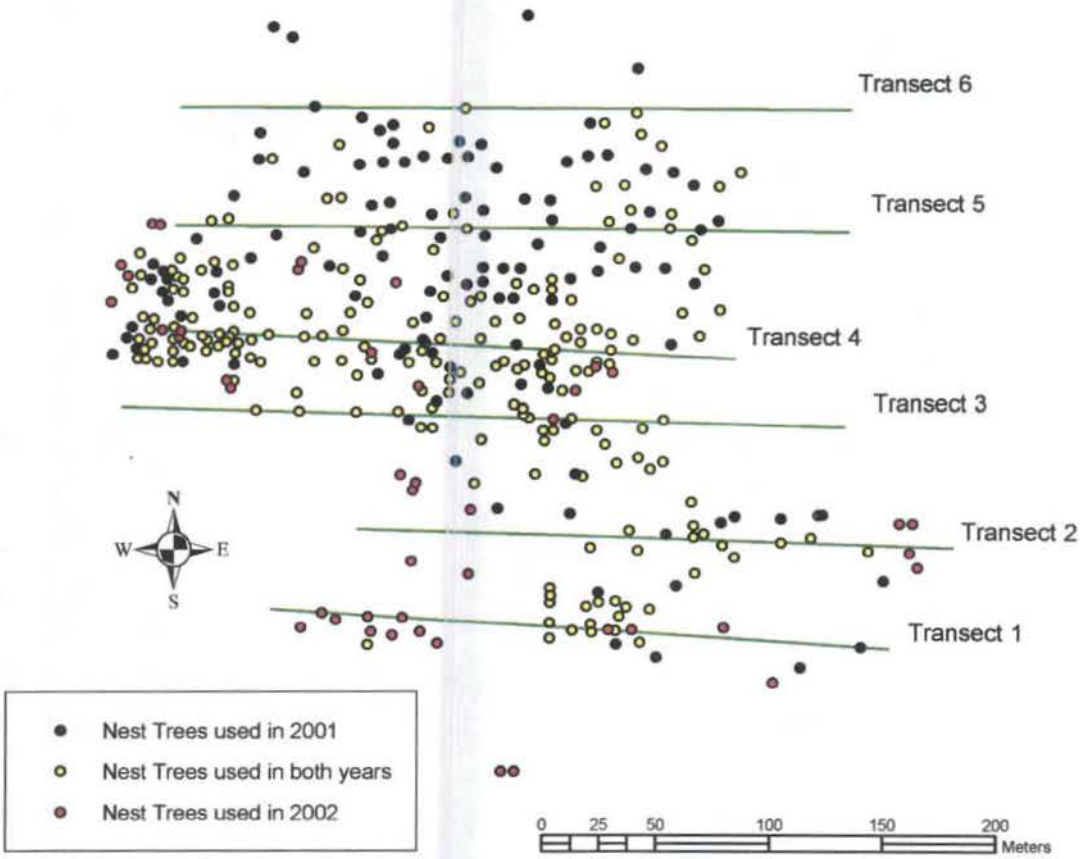

Figure 4. Location of Nest Trees on Valcour Island in 2001 & 2002.

Fledging success was estimated by counting the number of young herons in the nest about a week before the birds fledged. A sample of 44 nests was used to estimate the average number of young per nest. All observations were made from a small knoll at the southwest side of the rookery that has cover from hemlock trees, and affords a good view into many nests in the rookery.

Results

We found that total numbers of nests were down from last year as were total numbers of young fledged per nest. The rookery appears active and healthy and continues to shift in a southwesterly direction, likely in response to the loss of nest trees on the northern fringe of the rookery.

Nest Mapping

This year, there was a large discrepancy between the numbers of nests we counted using our early- and late-season census methods. In the early season, we counted 500 nests and in the late season we counted 421 nests. Our initial count was conducted in early June. This method is not as accurate as the late count because each nest is not uniquely mapped and identified. In the early-season count, a number of observers walk through the rookery on a transect and count all visible nests while communicating with each other about which nests have been counted, to avoid double counting but each tree is not uniquely identified. In the late-season count observers go to each tree, locate its tag number and then count nests; this tends to be more accurate. In general, our early- and late-season counts have been closer, leading us to wonder if the difference represents a loss of nests from early to late season, or is the difference due mostly to the counting techniques.

We did notice that many of the dying cottonwoods came down during the course of the breeding season. We found trees that were marked with aluminum tags from last year on the ground and there were remains of heron nests in the crowns. Also, an area at the south end of the rookery, which we identified early in the season, appeared to be gone by our final count. We found 25 nests in June south of transect 1 and only found two nests there in July. Overall, the rookery appears to have moved in a southwesterly direction since last year (Figure 4).

Fledging Success

Nests were evaluated 7-10 days before fledging to get a measure of fledging success in the rookery. Forty-four nests were sampled. An average of 1.4 young per nest were counted and presumed to fledge. This is down from last year's estimated rate of 2.9 young per nest. Most nests that were visible from our observation point appeared to be active, which suggests that the Valcour Island rookery fledged roughly 590 herons.

Eagle Disturbance

Similar to Missisquoi, we noted disturbance of this rookery by a Bald Eagle on June 10th. We watched a juvenile eagle circle the rookery in ever tightening circles until it appeared

to make a relatively low pass over the rookery. Great Blue Herons alarm called through this time period. The Great Blue Heron alarm call is very distinct, and, is what drew us to look for an approaching predator. It is a loud and very long call lasting on average 20 seconds, which makes it unmistakable. We saw no obvious sign of predation and none of the herons left their nest during this disturbance.

Although Great Blue Herons on Valcour get a reprieve from human disturbance and terrestrial predators, they are not immune to aerial predators. This year we watched a Bald Eagle incite alarm calling among nesting Great Blue Herons as it circled over the rookery. It did not cause adults to leave their nests and eventually moved on. Eagle disturbance is likely to continue to be an issue for heron rookeries on Lake Champlain and will bear watching on Valcour in the upcoming years.

Discussion

Valcour Island continues to be a healthy, single species, breeding colony for Great Blue Herons. No cormorants were detected in this rookery in either year of the study, 2001 or 2002. The location of the heron rookery on Valcour Island makes human disturbance of the rookery unlikely. Human disturbance is known to be very hard on Great Blue Heron rookeries (Tremblay and Ellison 1979, Watts and Bradshaw 1984). Although Valcour gets heavily used in the summer time, the rookery is not located near any walking trail. Also, the bulk of campers that come to Valcour tend to use the Island at the very end of the heron's breeding season when they are much more immune to disturbance. In April, Additionally, the rookery is not visible from the shoreline and is surrounded by white cedar (*Thuja occidentalis*) blow down and dense balsam fir (*Abies balsamea*) thickets. Stinging nettle (*Urtica dioica*), which thrives on the heron guano, comprised most of the understory in the rookery; yet another deterrent.

Although Valcour is a wonderfully quiet spot for the herons, they do need to travel some distance to feed. Studies with light aircraft that followed Great Blue Herons leaving rookeries in order to forage showed that average distances that herons flew to feed was between 3-6 km (Butler 1997). About three-quarters of the Valcour herons appear to travel to Vermont (Richards and Capen 2001) with the other one-quarter feeding in New York State. Figure 1 shows that on Valcour, herons need to travel 8-15 kilometers to get to the Vermont shore and roughly 5 kilometers to get to the New York shore, which must have a high energetic cost, possibly being mitigated by low disturbance and predation. Nesting in the rookeries at Missisquoi and Porter Bay, on the other hand, require short travel distances to suitable foraging because both rookeries are located on the edge of large wetland complexes (Figure 4).

Shifts in Nesting Location and Nest Number

Nests in the Valcour Island rookery shifted in a southwesterly direction this year. The presence of the rookery appears to be killing many nest trees. Many trees with heron nests are standing dead trees. Wind throw of these dead trees is a common occurrence, and often destroys active nests. Studies have shown that leaf death and inhibited

photosynthesis causes tree death in heron rookeries and not alteration of soil chemistry (Butler 1997).

It is likely that the rookery has been moving south for some time. Last year we found tree tags 400 meters north of the rookery. These trees had been tagged previously by Charlie Mitchell of Plattsburg State University when he studied the rookery in the 1980's. He indicted that in the 1980's, the rookery was also moving south as the herons killed the green ash (*Fraxinus pennsylvanica*), which was the predominant nest tree (pers. comm. Mitchell 2001).

In 2002, nest numbers were down from 2001. We thought we might see an increase in the number of nests on Valcour in response to the nesting failure in 2001 at Missisquoi. It is possible that Great Blue Herons have moved over the border to nest in some of the large rookeries in Southwestern Quebec, or along the St. Lawrence River. Rookeries tend to vary in size based on past success and recruitment. Studies in British Columbia (Butler 1995, Butler 1997) suggest that a very successful nesting season will increase rookery size in two years. In other words, young birds are not recruited into the breeding population for two years. In this case we have no information on the success of the Valcour breeding season in 2000. If nest success was low, this could account for the decrease in number of nesting herons this year.

Breeding Success

Our estimate of young fledged was down in 2002, from 2001. These yearly fluctuation are likely due to availability of prey for Great Blue Herons. Water levels remained fairly high until late in the season which can decrease the amount of accessible shallows for Great Blue Herons. In a healthy breeding population, other studies suggest that a large range in breeding success is normal and mostly due to prey availability (Butler 1997).

Conclusions

The Valcour Island rookery continues to be an active rookery. Though numbers of young fledged and total nest numbers were down, it is likely that these are normal oscillations in rookery size and productivity which are affected by many factors. Valcour is currently the largest rookery on Lake Champlain and has more active breeding pairs than all the other rookeries on Lake Champlain combined. Based on its size, and contribution to the breeding population of Great Blue Herons on Lake Champlain, it merits continued protection and routine observation.

Four Brothers and Porter Bay Rookeries

There are two other active rookeries on Lake Champlain, both in the southern half of the lake. One is on Island D of the Four Brothers Islands, New York, and one is in Porter Bay in Ferrisburg, Vermont.

There were 11 Great Blue Heron nests on Island D of the Four Brothers. This is a large mixed colony of birds which includes Double-crested Cormorants, Great Egrets (*Ardea Albus*), and Black-crowned Night Herons (*Nycticorax nytcticorax*). Great Blue Herons nest in the top of the trees. The large number of nesting cormorants has hastened the decline of the white pine trees on this island. This rookery had as many as 39 Great Blue Heron nests in 1999, but is unlikely to increase in size as appropriate nesting habitat continuously is lost to tree death.

We visited the Porter Bay rookery in January 2003. We accessed the rookery from the ice and counted 93 nests that were presumably built and used in 2002. This rookery is located at the mouth of Otter Creek, which has extensive wetlands. Vermont state biologists report that this rookery was active in 2002 and it appears that the rookery has grown in size over the past 5 years or so. This rookery has an extensive shrub swamp between it and the open waters of the lake, which protects it from boaters who might approach it too closely in the sensitive early part of the herons nesting cycle.

Great Blue Herons in the Lake Champlain Ecosystem

Lake Champlain provides excellent breeding habitat for a very large population of Great Blue Herons. There are four breeding colonies on the lake, all of which appear to have fledged young in 2002. As far as we know, there were 675 nests established in these 4 colonies. Currently, we appear to be at a low ebb for nest numbers, when compared with 2000, when there were likely more than 1000 nests on Shad and Valcour Islands alone (though these numbers can not be confirmed by actual counts).

Great Blue Herons numbers are easily monitored ecosystem-wide. Quick visits from a safe distance are easily accomplished during the breeding season, and more detailed counts of nest numbers can be accomplished post-season with no disturbance to the rookeries. With the potential for significant disturbance from humans, cormorants and eagles, we suggest that ecosystem-wide monitoring is justified in the upcoming years.

Literature Cited

Butler, R.W., personnel communication, July 2001.

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

Butler, R. W., Whitehead, P.E., Breault, A.M. and I.E. Moul. 1995.
Colony effects on fledging success of Great Blue Herons in British Columbia. Colonial Waterbirds 18:159-165.

Butler, R.W. 1997. The great blue heron. UBC press, Vancouver, CA.

Drapeau, P., McNeil, R. and J. Burton. 1984. Influences du derangement humain et de l'activite du cormoran a aigrettes, sur la reproduction du grand heron, aux isles de la Madeleine. Canadian Field Naturalist: 219-222.

Richards, Z.L. and D.E. Capen. 2001. A study of behavior and nest distribution in the shad island rookery, missisquoi national wildlife refuge, Swanton, VT. School of Natural Resources, Burlington, VT 05401.

Tremblay, J., and L.N. Ellison. 1979. Effects of human disturbance on breeding of black-crowned night herons. The Auk 96: 364-369.

Sauer, J. R., J. E. Hines, and J. Fallon. 2002. The North American Breeding Bird Survey, Results and Analysis 1966 - 2001. Version 2002.1, USGS Patuxent Wildlife Research Center, Laurel, MD.

Sheildcastle, M.C and L. Martin. 1997. Colonial waterbird nesting on West Sister Island National Wildlife Refuge and the arrival of Double-crested Cormorants. "Symposium on Double-crested Cormorants population status and management issues in the Midwest". USDA technical bulletin.

Skagen, S.K., Melcher, C.P. and E. Muths. 2001. The interplay of habitat change, human disturbance and species interactions in a waterbird colony. American Midland Naturalist 145:18-28.

Trexel, D., personal communication, Novemeber, 2001.

Watts, B.D., and D.S. Bradshaw. 1994. The influence of human disturbance on the location of Great Blue Heron colonies in the lower Chesapeake bay. Colonial Waterbirds 17:184-186.