BIOLOGY OF THE GREAT BLUE HERON AND PROBABLE RESPONSE OF NESTING BIRDS TO COTTAGE DEVELOPMENT NEAR THEIR BREEDING COLONY ON BOUGHTON ISLAND, PRINCE EDWARD ISLAND

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BEFORE THE LAND USE COMMISSION

in the matter of the appeal
of the Natural History Society of Prince Edward Island
from the granting
by the Department of Community and Cultural Affairs
of a conditional approval on May 24, 1988
to Solomon Inc.
to create a 46 lot subdivision
on Boughton Island, P.E.I.

DISTINCTIVE FEATURES OF THE GREAT BLUE HERON

(taken mainly from DesGranges 1979a)

The Great Blue Heron is the largest and most widely distributed heron in Canada. It ventures as far north as Alaska and Newfoundland during the post-breeding season and winters as far south as northern South America. A wading bird with long legs and a long neck, it feeds in shallow waters, usually along the edge of rivers, estuaries, or marshes.

The Great Blue Heron feeds mainly on small fish less than 10 cm long. Shellfish, insects, rodents, amphibians (mostly frogs), reptiles, small birds and plant seeds are also occasionally included in its diet.

The Great Blue Heron is a hardy bird which can live as long as 15 years. The adult birds have few natural enemies. Birds of prey occasionnaly attack them, but these predators are not an important limiting factor on the population. People are proving to be the bird's most formidable enemy. Altough hunting is forbidden, a number of birds are killed each year. Furthermore, people are often responsible for excessive disturbance of breeding colonies. When this happens mortality of the eggs and the young can be high. Unattended nests may be preyed upon by crows, ravens, gulls and raccoons.

Nesting

Great Blue Herons usually nest in colonies in woodlands which are relatively inaccessible to humans and mammalian predators (e.g. raccoons). The birds favour spots where they can see well in all directions such as islands, and trees flooded by beaver ponds. In coastal areas, they nest almost exclusively on offshore islands if these are available. This has been shown by surveys conducted in the Maritime Provinces (Smith 1989; Quinney 1983), in Maine (Gibbs et al. 1987) and in British Columbia (Forbes et al 1985). It is often the case that such habitats are rare, so birds may find themselves together in large colonies because they are all together in the only suitable habitat for miles around.

The Great Blue Heron is an obligate social species, and must feed and breed in groups. When herons are feedings, birds watch the behaviour of their neighbours to find out the locations of good food supplies. Information on the location of food supplies is also exchanged at the colony; a colony member can head directly for the spot from which other herons are returning after successful fishing trips (DesGranges 1978).

Nesting in colonies gives herons protection against predation. The large number of nesters in the colony means there are many eyes on the look-out for danger. Moreover, the colony's numbers are a definite advantage if the birds decide to defend their nests (DesGranges 1978). Even when herons are nesting on islands, which are inacessible to many land predators, they attempt to stay out of view of potential danger. In 17 of 19 island colonies along the Maine coast, the birds chose nesting locations that were invisible from the water (Gibbs et al. 1987).

In the spring, males and females reach the nesting grounds at about the same time. On Prince Edward Island, most adults are back to their nesting colony by the end of April. The males select the site of the colony, usually where there are nests from former years. Each male then defends his territory in the tree where he plans to build a new nest or restore an old one. Birds aged two years or more mate almost immediately upon arrival, usually at the heronry.

Recently built nests look like delicate platforms of interlaced dry branches, and older nests are bulky structures of various sizes. Usually, nest are about 1 metre in diameter and have a central cavity 10 centimetres deep with a radius of 15 centimetres. This internal cavity is sometimes lined with twigs, moss, lichens or conifer needles. Herons gather nest-building materials around the nest site, from live or dead trees, from neighbouring nests or on the ground.

Great Blue Herons normally nest near the tree tops (most commonly from 5 to 15m above ground - Short & Cooper 1985). In colonies made up of several species, they will take possession of the crown and leave the lower branches of the upper tree strata to Black-crowned Night Herons and Double-crested Cormorants. However, when Great Blue Herons and Double-crested Cormorants are both nesting in tree habitat on the same island, they may compete with each other for breeding habitat. Studies in Quebec have shown that cormorants return to the colony more quickly than herons after a disturbance, which allowed cormorants to destroy heron nests by stealing nesting material (DesGranges 1980; Drapeau et al. 1984). If the colony is frequently disturbed, cormorants can exert their dominance over herons and force them to move to the periphery of the colony, to another part of the nesting island (Scharf 1989) or, potentially, off the island altogether.

Ordinarily, a pair takes less than a week to build a nest solid enough for eggs to be laid and incubated. Construction continues during almost the entire nesting period. The male collects building materials and the female works them into the nest. The female may lay anywhere from 3 to 7 eggs. Incubation, which is shared by both partners, starts with the laying of the first egg and lasts about 28 days.

Eggs usually hatch when food is most abundant in the area. The parents immediately begin to feed their young, brooding them only during the first week. However for another two weeks, one adult remains present at the nest almost continually: during the day, the male watches the nest while the female hunts for food; at night the roles are reversed. After the first month, the pair spends most of its time outside the colony, returning only to feed the young and stand watch for short periods.

If the food supply is not sufficient to satisfy the growing appetites of all the nestlings, only the strongest will survive. Puny members of the brood weaken progressively and often end up falling from the nest, pushed aside by others eager for space to stretch their wings. On the ground, they are doomed to starve because the parents will not feed young outside the nest.

Young herons develop rapidly. At eight weeks of age, the young fly clumsily from one tree to another, but always return to the nest to be fed. At about ten weeks the young herons leave their nest for good. On Prince Edward Island, herons are active at their colony for a period of about four months extending from mid-April (early nesters) to mid-August (late nesters).

Nesting habitat requirements

Even in the absence of disturbance by humans or predators, Great Blue Herons periodically change colony sites. Their own presence eventually makes a site unsuitable for nesting. Excrement deposited on branches and on the soil beneath nests acts as a physical barrier to normal photosynthesis and transpiration. This results in abnormal needle loss (Julin 1986) and detrimental changes in soil conditions leading to the deterioration of nesting trees (Kerns & Howe 1967; Weselow & Brown 1971; Wiese 1978;), followed a few years later by general decline of the forest on the site (Dusi 1979). Short-lived trees which are found on shallow soils are more susceptible to root damage and more frequent blowdowns than long-lived tree species (Scharf 1989).

The need for alternate nesting habitat close by is thus apparent. Simply protecting an existing colony site is insufficient. Herons usually choose the same type of nest-tree (deciduous or coniferous) when shifting colony sites. The site chosen also tends to remain near the primary foraging area(s). When a particular colony-site is in a large stand of apparently uniform habitat in terms of the size, density and species of trees, proximity to feeding areas and disburbance, the probability of a successful relocation is higher (Forbes et al. 1985).

THE BOUGHTON ISLAND CASE

The many successive years of nesting at Boughton Island indicates that breeding habitat has been consistently favourable for herons. There is also an abundance of feeding habitat within easy reach of the colony, along the estuaries of Cardigan, Brudenell, and Montague Rivers. A combination of good feeding habitat and good breeding habitat is the probable reason for the large size of the Boughton heronry. With 135 nests in 1987, the island presently accounts for over three quarters of the heron population of Kings County (Smith 1989).

Further consideration should be given for large colonies. They contain a substantial proportion of the regional breeding population (B.I. makes for 10% of the provincial population), and their occupants usually exhibit a higher reproductive success than birds in smaller colonies (Des-Granges 1979b; Forbes et al. 1985). Large colonies are thus often a source of recruits and genetic variability for smaller colonies. The destruction of the Boughton Island colony could have far reaching effects.

A generous buffer zone around the colony would be most desirable in anticipation of clearing and cottage development on the island. The developer has proposed a buffer zone of 300m extending from the periphery of the colony. Human activity would be prohibited within this zone during the breeding season (1 April - 15 August). This zone, if strictly enforced, would appear to be sufficient to reduce human impact on nesting activities over the next several years (Vos et al. 1985; Table 1). However, three other factors must be considered before such a zone could be considered adequate protection for the heron colony.

Firstly, we must consider the requirement of a heron colony to move periodically as the trees beneath it die. Noting that the revised proposed buffer zone encompasses about 110 ha (Lane et al., 1989), let us assume the following:

(1) the heron colony currently occupies 4.65ha of woodland which is equal to about 5 percent of the suitable habitat in the western part of the island, or 7 percent of the revised minimum buffer zone (Lane et al., 1989),

(2) that nesting trees are likely to be used for a maximum of four years before the nests they support fall to the ground forcing birds to relocate their nest in new trees. David (in litt.) found that over the three years she studied a colony established in a riparian forest in the Montreal area, there has been a 6% loss of trees by falling with use of trees declining by 30% (or 10% per year) due to falling trees and nests falling. However, riparian forests are flooded each spring due to snow melt and thus bird dropings are regularly washed out which is not the case on Boughton Island where excrement accumulates from year to year. In such a maritime situation, it is more realistic to assume that the herons can nest in a particular tree for four years as suggested by Lane et al., (1989), since on Boughton Island, trees appeared to be especially susceptible to wind damage, insect infestations and pathogens, and

(3) that in such a maritime situation it would take about 45 years to grow suitable trees (Lane et al., 1989) if new spruce trees (or fir trees more susceptible to budworm infestations) were to be planted regularly on the degraded sections of the conservation area (Corbett 1985).

With such reasonable assumptions, one can estimate that less than 45 years from now the actual colony (without allowing for any expansion in size of the colony) would have used just about half the available nesting habitat in the buffer zone

- i.e. ({4.65ha X (45 years ÷ 4 years)} ÷ 110ha) X 100 = 47.5%

It is possible that during these years the colony could come uncomfortably close to the boundary of its protected habitat and could suffer unacceptable human disturbance. In 45 years, the original site will have regrown its trees (<u>if trees are regularly planted</u>), and would be ready to re-colonize. However, we can not be sure that the colony would have not disappeared long before it could reestablish itself on its original site if we dont take into consideration the following;

<u>Secondly</u>, the likelihood that the proposed buffer zone could be effectively enforced must be evaluated. At the present time, the edge of the heron colony lies within a few tens of meters from the island's periphery. This means that the buffer will only be effective if residents of the proposed cottage subdivision are prevented from walking around the island's shoreline. Because the residents have been attracted to Boughton Island primarily because of its exposure to salt water, it seems unlikely that they will voluntarily refrain from walking along the shoreline near the heron colony. Fences are also unlikely to be effective barriers, because a fence that extends into the water is likely to be destroyed by ice in the winter. It is also uncertain how subdivision residents could legally be prevented from walking along this shoreline below high tide mark.

In view of these considerations it becomes obvious that the sustained protection of the colony would require a credible method of preventing human disturbance along the shoreward margin of the colony.

Thirdly, as mentioned by Vos et al. (1985), it should be noted that the response of herons to disturbance could vary widely among sites (Table 1). Guidelines presented in Table 2 have been set up for colonies without cormorants. There is a sizeable cormorant colony on Boughton in the same area as the heronry. This means that the effects of flushing the herons could be much more serious than in a "cormorant-less" colony, for which the guidelines were designed. It might only take a single disturbance event in which nesting herons flush to produce widespread damage to the reproductive effort of the colony. Such widespread nesting failure would substantially increase the chances that the colony would be subsquently abandoned. THE FOUNDATION AND EXTINCTION OF COLONIES ARE TO A CONSIDERABLE DEGREE CHANCE EVENTS; WE CANNOT SAY THAT IF THE DEVELOPMENT GOES AHEAD THE COLONY WILL INEVITABLY BE ABANDONED, BUT THERE IS AMPLE EVIDENCE THAT THE LIKEHOOD OF ABANDONMENT WILL VASTLY INCREASE IF THE COTTAGES ARE BUILT, EVEN IF THE CONSTRUCTION OF COTTAGES WAS TO TAKE PLACE OUTSIDE OF THE BREEDING SEASON as recommanded by Lane et al (1989).

Studies that investigate distance at which herons flee from disturbance are important in understanding their tolerance to human activities. However, such studies do not tell the whole story. Research on gulls using special radios that transmit heart-rates has shown that a gull's heart-rate may rise dramatically when a human approaches, even when the bird shows no visible reaction to the intruder (Kanwisher et al. 1978). This means that birds may be highly stressed, even though they show no external sign of anxiety.

One of the crucial questions we must ask is "What is the level of disturbance which would cause the herons at Boughton Island to abandon their colony?" Certainly disturbance which causes the birds to flee their nests would increase the chances of colony abandonment. As we have seen, this kind of disturbance is quite possible because the beach, which will probably be subject to foot traffic by cottagers, lies well within both the proposed 300 m buffer zone and the reaction distances listed in Table 1.

dowever, we must also be conscious of the more subtle effects of disturbance that does not cause the birds to immediately flush from their nests. Each spring, birds come back from their wintering ground and together they must "decide" whether to nest in the same spot again. Assuming that the nesting trees are still there and food is plentiful nearby, this decision will likely be based on the birds' collective evaluation of whether they feel the site is "safe". THE PROPOSED COTTAGE DEVELOPMENT WOULD RESULT IN A VERY SUBSTANTIAL INCREASE IN THE GENERAL LEVEL OF HUMAN ACTIVITY ON BOUGHTON ISLAND. THIS INCREASE IN HUMAN ACTIVITY, BOTH OUTSIDE THE 300 m BUFFER ZONE AND WITHIN IT ON THE BEACH, WOULD HAVE THE LIKELY EFFECT OF INTENSIFYING STRESS AMONG NESTING BIRDS AND INCREASING THE CNANCES OF COLONY ABANDONMENT.

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TABLE I
Documented response of breeding herons to human disturbance

(2036y)

LOCATION	SIZE OF COLONY*	TYPE OF DISTURBANCE	DISTANCE OF DISTURBANCE FROM THE COLONY	HERON RESPONSE	REFERENCE
St.Lawrence Estuary, Qc	50 nests (GBH)	Regular human intrusions (film making) in the colony combined with cormorant competition.	inside the colony	Progressive abandonment of colony because lost of nests to cormorants and no suitable habitat to move into on the island.	DesGranges & Laporte 1979 DesGranges 1980
St.Lawrence Estuary, Qc	380-537 nests (BCNH)	Regular human intrusions (scientific study) in the colony.	inside the colony	BCNH were most susceptible to disturbance just before and during egg-laying. It provoked abandonment of newly constructed nests and predation of eggs and young.	Tremblay & Ellison 1979
Indiana	38 nests (GBH)	Intrusion impact tests	inside the colony	Birds rarely reacted unless the intruders were visible. Intruders beneath the nest trees created minor disruption once leaf-canopy has developed.	Taylor et al. 1982
Illinois	750 nests (GBH, BCNH, Great Egret)	Clearcutting.	margin of colony	Colony retreated toward a river. It lost half of its nests during logging years and finally disapoared following regular flooding of the nesting trees.	Bjorklund 1975
Baie des Chaleurs, Qc	136 nests (BCNH)	Deforestation outside of the breeding season.	10m	Following spring, 1/3 of nests were abandonned; relocation of the birds 50m away from deforested site. Colony was abandonned a few years later.	Mousseau 1985 Bélanger & Tremblay 1989
Eastern Township, Qc	70 nests (GBH)	Deforestation during the breeding season.	70m	Two years later, 2/3 of nests were abandonned; relocation of remaining birds at 200m from the site of past disturbance.	Mousseau 1988
Montana	5 nests (GBH)	Housing development surrounding the colony.	?	Progressive abandonment of colony.	Parker 1980
Colorado, 2 sites	22-115 nests (GBH)	Human intrusions in the colonies (Scientific study)	25-175m	Herons were most responsive to human intrusions early in the breeding season. Based on results of this study, a buffer zone of 250m on land and 150m in water is recommended. Authors recommand that each heronry should be examined indepently because heron response varies significantly between sites.	Vos et al. 1985
P.E.I. National Park	150 nests (GBH)	Deforestation outside of the breeding season.	150m	Progressive abandonment of colony because it was restricted to a small site of dying and falling trees with no suitable habitat to move into on the island	Corbett 1985
Oregon	15-1161 nests (GBH)	Clearcutting.	200m	Colony shifts away from points of disturbance, nest density and occupancy was higher in undisturbed VS disturbed heronnies	Werschkul et al. 1976
Baie de Gaspé, Qc	12 nests (GBH)	Excessive disturbance on feeding ground.	500m	Relocation of the colony closer to an alternate feeding site.	DesGranges 1978

* GBH = Great Blue Heron; BCNH = Black-crowned Night Heron

TABLE 2

Some management guidelines for the protection of heronnies in North America

ORGANISATION	Minimum Buffer Zone[a]	Maximum Buffer Zone[b]	Aquatic Buffer Zone[c]	Buffer around foraging	REFERENCE
Alta Energy Nat. Res.	500m	500m	--	--	Brechtel 1981
Ont. Min. Nat. Res.	300m	1 000m	300m	--	Bowman & Siderius 1984
Corp. Héritage St-Bernard, Qc	300m	800m	--	--	David 1987
U.S. Nat. Park Serv.	300m	--	--	--	Buckley & Buckley 1976
Univ. of Colorado	250m	--	150m	--	Vos et al. 1985
USFWS	250m	--	150m	100m	Short & Cooper 1985
Qc. Min. Energy Res.	200m	500m	--	--	MERQ 1986
Can. Wildl. Serv. - Pacific Region	100m	500m	--	--	Forbes et al. 1985

a) No foot travel is permitted within that zone during the heron breeding season. Removal or disturbance of trees or ground vegetation prohibited at all times. Habitat management to enhance colony site is permitted during the non-nesting season.

b) No heavy construction activities, including logging, road and cottage construction, should take place within that zone during the heron breeding season.

c) Posting of an aquatic buffer should be established to protect heronries situated on the shores of islands, lakes or rivers. Landing on the shore near the colony should be prohibited.