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**An Investigation Into the Decline of Great Blue Heron Nestlings at the
Seneca Pool Colony of Iroquois National Wildlife Refuge**

Environmental Studies

International Baccalaureate Extended Essay

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Abstract

This scientific investigation deals with a topic of environmental concerns. There has been a statistically substantiated decrease in the Great Blue Heron population at the Seneca Pool Colony of Iroquois National Wildlife Refuge. This decrease has caused concern on the part of the management of the Refuge, environmentalists (as it is likely caused by an environmental factor), and bird watchers who do not desire to see the bird's presence in the area come to an end.

An investigation into the decline of the Great Blue Heron's population at Iroquois is the main focus of this research. Specific issues such as the possible factors in the decline are also examined.

The study includes background research on the Great Blue Heron and its nesting patterns, a field count to gather data for the 1994 breeding season, analyses of the data at hand, and a discussion of possible factors that could be causing the heron's population at Iroquois to decline.

Through this investigation, the decline at Iroquois is documented using data gathered between 1971 and 1993 by the Refuge's staff. The 1994 field count revealed hope for a rebound in the heron's population (in that a healthy number of incubating nests were observed) but was not able to trace the developmental stages from the egg to the surviving young adult. It is very possible that after the field count was taken, many birds did not survive into adulthood.

In response to a desire to find the factors involved in the decline of the herons at Iroquois, research, interviews with Refuge Manager Donald Tiller, and observations help to formulate the hypothesis that Turkey Vulture predation is causing the decline. Without further observations—which require near constant monitoring of the colony—this hypothesis, and the conclusion of this research remains unproven.

Introduction

With environmental concerns over the destruction of animal habitats, pollutants in ecological systems, and ineffective, often detrimental human intervention on the rise, even the most minor changes in the lifestyles and cycles of varying species are scrutinized to the fullest extent. This increase in environmental awareness has led wildlife biologists and ornithologists to closely monitor populations and colonies. Any discrepancy in data or irregular pattern is promptly analyzed.

One such “discrepancy” has arisen over the past few years at the Iroquois National Wildlife Refuge. The species: the Great Blue Heron; the problem: a reduction in colony size and nesting productivity at the Seneca Pool Colony of the refuge. This reduction, causing concern on the behalf of bird-watchers—or birders (as they are commonly named), wildlife biologists, and ornithologists alike, has been documented with supporting statistical evidence obtained in field counts and observations. The presence of the majestic bird is enjoyed by people of all ages and backgrounds, while the decline, though not known to all, is causing heartbreak at the thought of the Great Blue Heron’s departure from the area.

What the researchers—many employed at the refuge—and observers have not been able to determine, however, are the causes of this reduction, which if revealed, could possibly lead to the ‘ways and means’ of solving this enigma, thus preserving the bird’s presence in the area. As of yet, only speculation has arisen—no ‘in depth’ research attempts have been undertaken with the goal of analyzing the possible factors involved. The speculation focuses on a question frequently asked by those closely associated with

the Great Blue Heron's presence at the Seneca Pool Colony of the Iroquois National Wildlife Refuge— "What are the factors involved in this problem?"

On a larger scale, the Great Blue Heron's population since the early 1980s has been documented in decline over a larger region than that of the Iroquois National Wildlife Refuge. The heron's population and distribution were the focus in several studies performed between 1977-1981 which covered several regions of the northeast United States and Canada. Significant reports of reductions in local and regional populations caused the National Audubon Society to place the Great Blue Heron on the "Blue Listing" (a list similar to that of the endangered species list, meant to protect the species).

Specifically, during the 5 years in which several studies were performed, grand-scale reductions took place in the Midwestern states causing great concern on behalf of the National Audubon Society.¹ The Great Blue Heron's population increased in the Iroquois Seneca Pool Colony in the early 1980s, however, that rise gave way to the present downward trend in population and colony size.

Thus, with concern present over the Great Blue Heron's population, and the documentation at hand, this research set out to answer some of the following, more specific, questions. What are some of the possible environmental factors leading to a decline in the heron population? Could the downward trend in colony size and nesting productivity be the result of contaminants in the water, the presence of Bald Eagles in the area, predation by Turkey Vultures, habitat destruction, some form of human intervention, or possibly a cyclical population change?

¹ Mc Crimmon Jr. p89: Colonial Waterbirds

This study has spanned the past 9 months and includes statistically documenting a decline in the population, observing the birds during the 1994 breeding season (this will aid in determining if the downward trend is continuing), brainstorming as to the possible causes of this problem, and analyzing each as worthy studies. The purpose of researching these environmental and ecological factors is to discern which factor, or combination of factors, is causing the Great Blue Heron's formerly flourishing population in this area to fade in drastic proportions.

At the beginning of the study, it was hoped that the research and studies undertaking would, in some way, aid local birders and wildlife biologists in their efforts to preserve the Great Blue Heron's presence in the area. Predation is often a cause of population declines and was the hypothesized cause of the decline before the study was undertaken.

The study strictly followed the scientific method—by observing the problem, documenting it to ensure its validity, hypothesizing as to where the research might lead, exploring those pathways, and in the end, narrowing down the possible causes of the problem, thus, hopefully, determining the factor or factors involved.

The following is an investigation into the decline of the Great Blue Heron Colony at the Seneca Pool area of the Iroquois National Wildlife Refuge. The goal of this investigation is to answer the aforementioned puzzle—what is the cause or causes of this staggering and frightful decline?

The Bird Under Study

In order to fully understand the interactions between the Great Blue Heron and the environmental factors which may or may not be causing the decline in their population, background research on the bird itself was essential. For technical reasons, it is important to know that recently scientists have classified the Great White Heron, formerly its own species, as a morph of the Great Blue Heron.² Thus, when speaking of a large scale heron decline (over a larger area), this may include the Great White Heron which does not nest among the Great Blue Herons being studied at Iroquois.

The heron is one of the most well-known and loved birds in North America. In fact, it is the direct result of the slaughter of Great Blue Herons for plumage during the late 1800s to the early 1900s that led to the establishment of the United States Audubon Society and the British Royal Society for the Protection of Birds.

During those trying years, bird hunters were paid \$32 an ounce for plumes which required the death of four herons or egrets to equal one ounce. One single auction in London, 1902, yielded 3,000 pounds of heron plumes, which translates to 192,000 deaths of birds for 48,000 ounces of plumage.³ The heron was an endangered species whose survival was aided by the forming of new societies geared towards protecting the bird. As a consequence, the majestic bird has become the centerfold of many a picture-taker's camera, and less of a trophy for a hunter's gun.

John James Audubon remarks on the apparent stoicity of the bird, scientifically known as *Ardea herodias*

Look on the one that stands near the margin of the pure stream. See his reflection as it were into the smooth water. How calm, how silent, how

² Scott p53

³ Allen p10

grand is the scene. You might imagine what you see to be the statue of a bird, so motionless it is.⁴

While Audubon may indeed sound like a poet, vividly describing the apparently placid bird, the Heron at hand was most likely preparing to dive for food, to snatch an unsuspecting small to mid-sized fish.

More specifically, the bird is a large heron, nesting generally in hardwood trees anywhere from 25 to 100 feet above the ground. The Great Blue Heron lives across the continental United States as seen on the following map.⁵



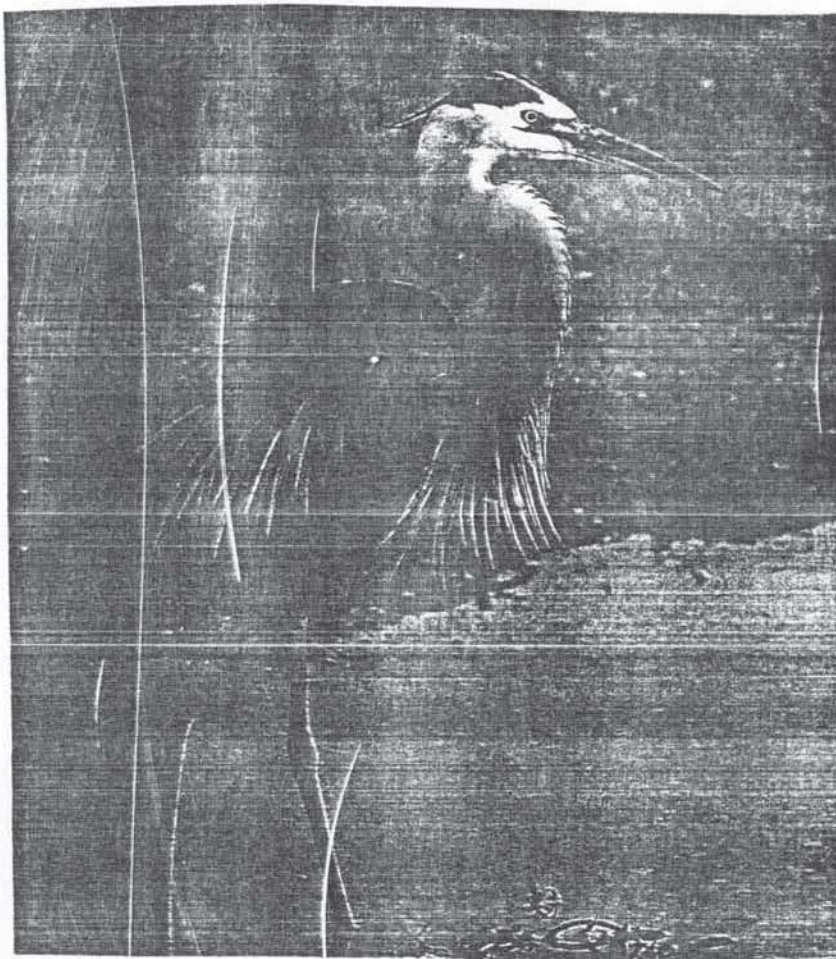
The heron ranges from 42 to 52 inches long with a slaty blue color on its back, wing coverts, and streaks of gray on parts. The characteristic that distinguishes this heron

⁴ Allen p13 excerpted from Birds of America

⁵ Allen p45

from others of its genus is the presence of a long black crest originating from the back of the head.

Heron is expert predators of unsuspecting fish. They will stand placid as Audubon described them, until they spot a fish. Then, with a quick, flowing movement, they stab their bill into the fish. They will also stalk their prey, moving covertly through the water, with slow motions as to call no attention to themselves. The heron will live amongst a hundred or more birds in a nesting-site, called a heronry or heron rookery.⁶ This is the location where my experiment is primarily concerned. A picture of the bird is shown below.⁷



⁶ Comptons p142 (H)

⁷ Allen p8, photo by Lynn M. Stone

The Great Blue Heron's nesting patterns, essential to an understanding of this research at hand, are as follows. The New York State egg dates of the Great Blue Heron range from March 16 to June 9.⁸ These are the earliest and latest dates within which eggs have been found for each species.

The next stage in the breeding season analysis is the incubation period. In Great Blue Herons, this period tends to be from 25 to 29 days. This is the period in which each species incubates and hatches its clutch of eggs. Following the incubation period, the hatched young are referred to as nestlings—the stage in the young bird's life where it is dependent on its parents for survival. The young then enter the nestling, or unfledged juvenile stage in which the young are about to undergo plumage growth and are not yet prepared to fly. For Great Blue Heron nestlings, this period is from May 19 to July 17. Generally, the young are able to fly at 60 days and tend to leave the nest between 64 days and 90 days. The earliest reported fledgling date for Great Blue Herons—the date after which many can fly and leave the nest—is July 17.⁹

This knowledge of nesting patterns is necessary if an accurate count of nesting productivity is to be done. The observations can either catch the herons in their mature nestling stage—the stage where the nestling is large enough for the crest of its head to be seen above the rim of the nest (from an observation standpoint on the ground), or make a count of incubating birds during the incubation period (anywhere between March 16 and June 9). Thus, we can conclude that an accurate count to formulate nestling productivity

⁸ Andrie and Carrol p513, March 16 date sighting, William Watson

⁹ Andrie and Carrol p514

can be made somewhere between March 16 (the earliest likely date to find a bird incubating) and July 17 (the latest likely date for a fledgling to still be in the nest).

While the range of dates surrounding the development and departure of Great Blue Heron nestlings suggests that we could make counts into July, it is necessary to remember that if these birds are under predation as nestlings (or unfledged juveniles), the field counts would likely show a decline if taken later than the egg dates (generally if predation is going to occur, it occurs after the eggs hatch). Predation is most likely to occur during this stage due to the fact that the young bird is young enough that it is unable to escape predation yet developed enough that the mother heron does not pay as close attention as she did during the incubation period. This period, where parental protection of the young nestlings decreases because the parents must spend more time hunting for food for the young as well as themselves, is critical in terms of timing the investigation so that data can be considered accurate. With this information at hand, and a knowledge of the Great Blue Heron's breeding season habits, we knew when it was time for the investigation to be undertaken.

The Investigation Itself

The first step in this experiment was to gather data that substantiated the decline in the Great Blue Heron's population at the Seneca Pool Colony. To begin with, this decline was first recognized, documented, and made generally known by Wildlife Biologist Eric Derlith, who up until three years ago was the head researcher at the Iroquois National Wildlife Refuge. Leading field teams on counts during the breeding season (generally early to mid June) and winter nest counts—which are extremely effective since the trees

are absent of foliage—Derlith compiled data that continued a list of nest counts and productivity counts started by then Refuge Manager John Morris in 1971. Since 1991, Derlith has been working on research in California, however, his field notes and statistical compilings were obtained through the Iroquois National Wildlife Refuge's limited, yet effective library. The chart shows the data that has been compiled by observers at Iroquois since 1971.

<u>Year</u>	<u>Rookery Nest Count</u>	<u>Productivity Survey</u>
	Number of Nests	Nestlings per Occupied Nest
1994	69	n/a
1993	117	1.09
1992	317	1.25
1991	568	1.67
1990	543	1.91
1989	597	1.95
1988	662	3.15
1987	782	2.87
1986	698	2.22
1985	834	2.06
1984	n/a	1.92
1983	716	2.76
1982	670	n/a
1981	579	n/a
1980	395	2.5
1979	441	n/a
1978	436	2.6
1977	356	1.54
1976	179	2.43
1975	201	2
1974	140	2.03
1973	79	2
1972	80	1.94
1971	62	n/a

Derlith's bi-annual censuses of the Great Blue Heron colony and its nestling population have been continued since his departure in 1991 by now Wildlife Refuge Manager Donald Tiller. In following the basis for documentation of the colony that

Derlith laid forth, Mr. Tiller and his field teams compiled the evidence in 1992 and 1993 that substantiate a continuing decrease in the productivity of the colony.

The chart shows that the colony's size (in terms of number of nests) reached its peak in the year 1986 with 834 nests. Since 1986, the colony has been in decline. Presently, the most recent count shows the colony is composed of a meager 69 nests.

With a decline in the colony from its peak in 1986, my research looked to explore the downward trend in order to find evidence that it is either continued its downward trend for 1994, or the colony has rebounded. Additionally, the field study looked to observe patterns in the Great Blue Heron's behavior. This type of observation is difficult over a period of an entire afternoon because the study of a bird's specific behavior requires years devoted to a specific experiment.

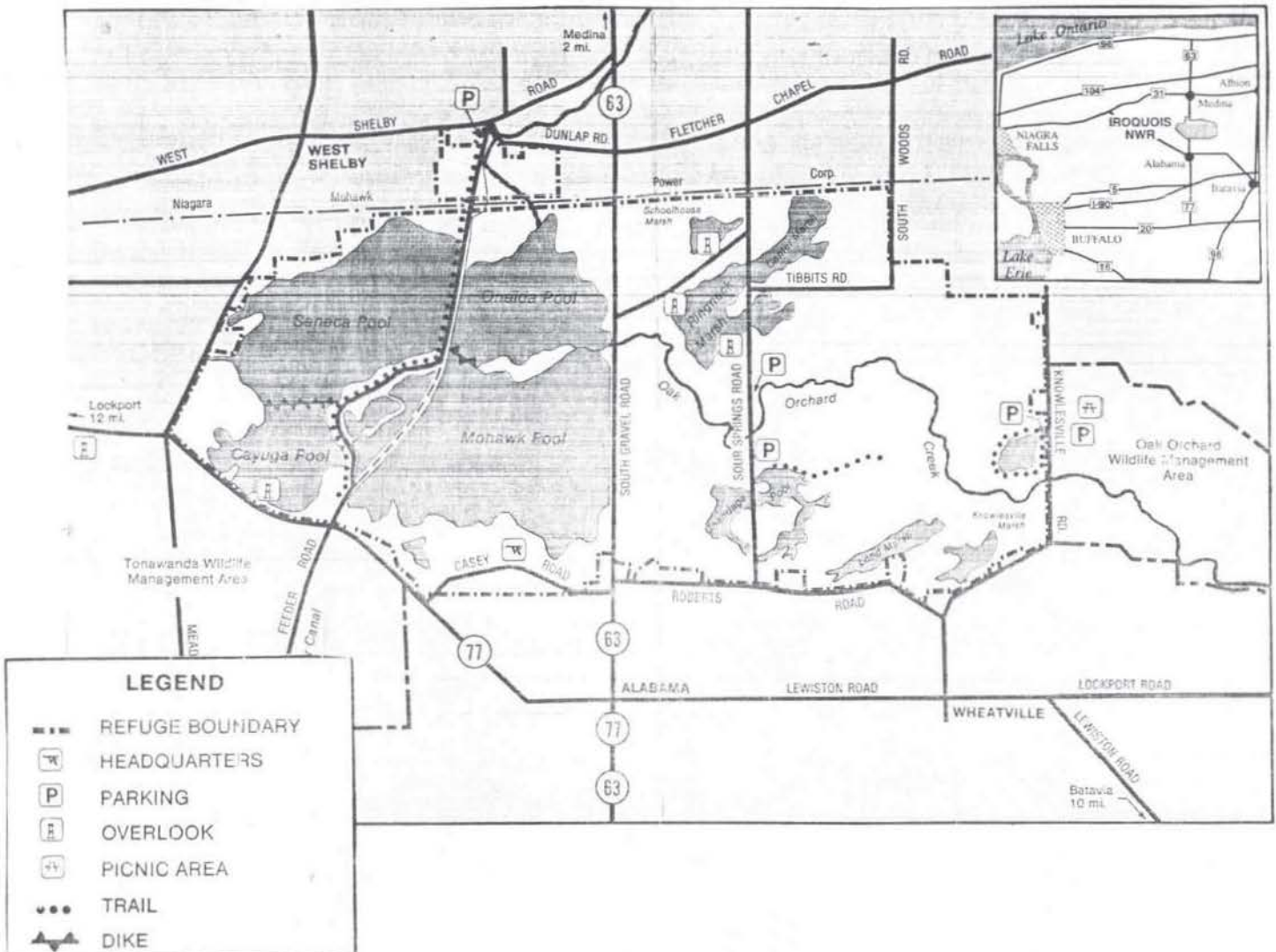
However, from an observation standpoint, there was the looming possibility that the possible factors in the decline of the colony could be revealed. For example, on several instances, my mentor Mr. William Watson, an avid birder himself, has observed a Turkey Vulture and Red-Tailed Hawk presence near the colony.¹⁰ Observations like these are what my field study hoped to reveal.

The Field Study and Its Results

Looking to document the status of the colony for 1994, it was imperative that the observations of the colony be done before the springtime foliage was in full bloom. Once there is a thick foliage cover on the trees, it becomes increasingly difficult to make an

¹⁰ Watson's 1994 Birder's notebook

accurate nest and nestling count because the colony stretches back through a relatively dense area of trees. The foliage serves as an impediment from our viewpoint at the Cayuga Overlook as shown on the map of the refuge below.



The Cayuga Overlook is approximately 3/4 of a mile from the colony itself which is located deep in the Seneca Pool area of the refuge. In order to conduct accurate observations of the colony and perform the counts of nests and productive nests, the field study required the use of two telescopes and a set of binoculars. The telescopes, one a Bushnell Space Master or often called a 'birder's telescope' with 15x to 45x

magnification, and the other a Celestron 8 inch lens with 50x magnification, allowed for an up-close look at the colony, which made a count of the nests possible. These telescopes, along with a pen, a notebook, and patience to perform several counts were the only materials required to undertake this field count.

The field counts were conducted on the morning of Saturday, April 16, 1994 beginning at 10: 30 A.M. with a temperature of 55 degrees (farenheit). Partly sunny skies and 40 miles per hour winds were also present that morning.

The actual counting of nests was performed by starting at one end of the colony and moving the scope's field of view along the stretch of the colony, counting the nests as we went along. Usually, one field of view would reveal several nests, and the scope would have to be moved several times to scan the entire colony. The view received through the scope can be seen in the following sketch. It shows the heron's nests, crudely composed of sticks of wood, lying in the tops of hardwood trees as seen through the birder's telescope.



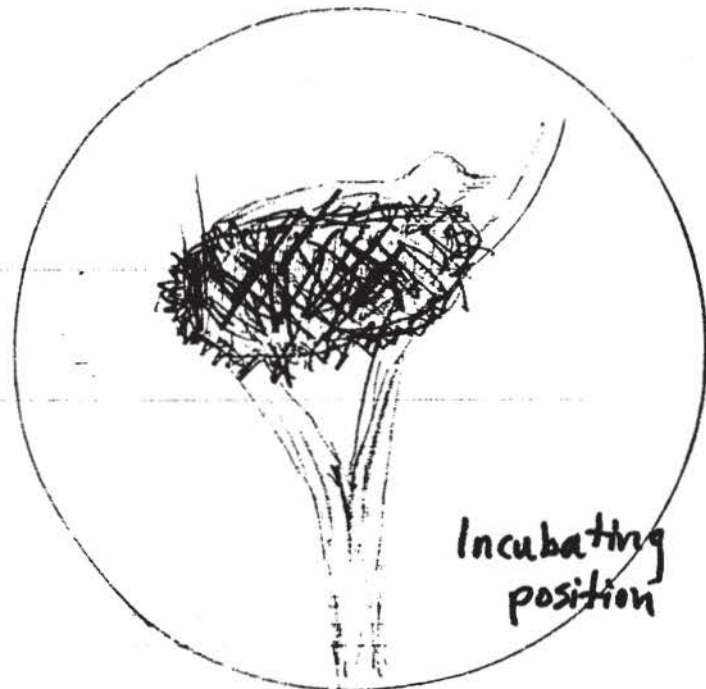
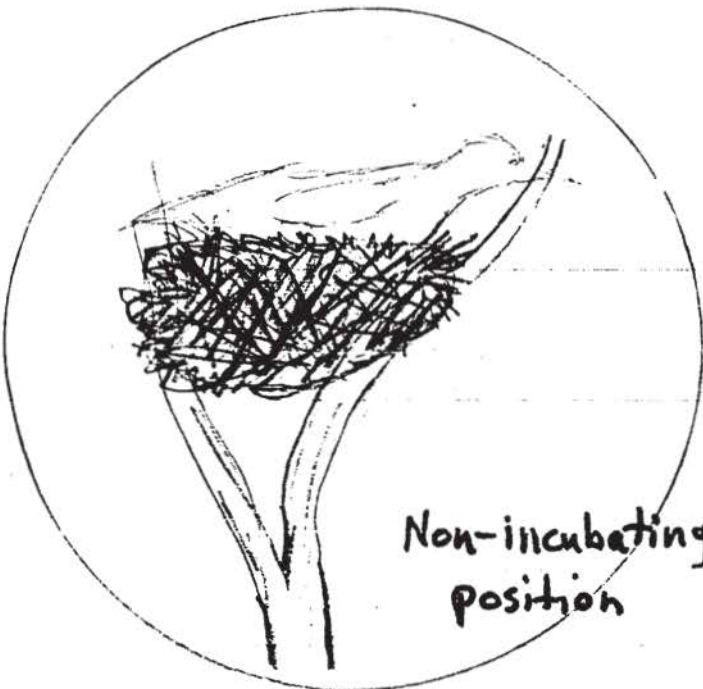
The field study undertaken revealed a good deal of information useful to the investigation. Several counts of nests and herons in the 'incubating position' were taken in order to validate the data. Specifically, 6 separate nest counts were performed where 64, 68, 69, 70, 70, and 74 nests were observed, for an average of approximately 69 nests.¹¹ Basically, the observations taken in my study included a count of the nests to evaluate colony size and the following tricky, yet essential, count of incubating nests.

When observing a bird in a nest through the birder's telescope, there are two positions one must distinguish between. One position is the incubating position where the bird is hunched lower in the nest to provide adequate warmth for the egg. The second position is slightly higher in the nest. The bird that is sitting higher in the nest is not believed to be incubating. Thus when performing the count for nestlings, one must recognize whether or not the adult heron that is in the nest is incubating an egg or eggs.

It is often difficult to distinguish between the incubating position of a bird and the non-incubating position. My mentor Mr. Watson aided me in this observation as he is a birder of decades with a better knowledge of the bird and distinguishing its positions. Watson notes "Of course, one of the best ways to determine whether a bird is incubating is how long it sits on the nest."¹² A sketch of the incubating and non-incubating positions as seen through the Celestron 8 inch telescope (at 50x magnification) shows the minute differences.

¹¹ Field Study April 16

¹² Watson, April 16



Even at 3/4 of a mile from the colony, and under telescopic enlargement, these positions still remain difficult to distinguish. Thus, to validate our data, several counts of the incubating nests were conducted.

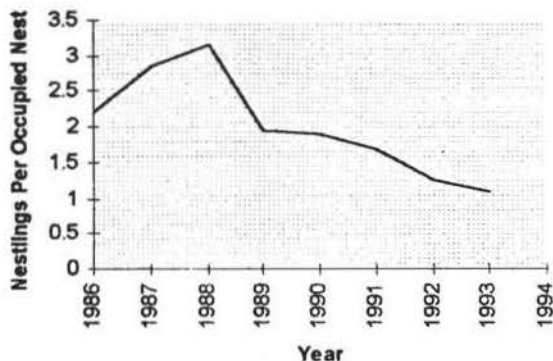
The count of incubating nests does not reveal how many eggs lie in one nest. Through a study of Eric Derlith's and other researcher's data in the past, it is evident that the greatest number of nestlings per occupied nest was 3.15, in 1987. Additionally, that decreased to a miniscule 1.25 by 1992. Thus, the count of occupied nests would be compared to past counts. For example, on June 28, 1991, Derlith and his team observed 100 randomly chosen, yet visible nests for an observation study. They found 97 to be unoccupied by nestlings and 3 occupied. Two nests out of those 97 were found to have a single nestling and one was found to contain three nestlings. Thus, on the average, 1.67 nestlings were found per occupied nest. This statistic was down from the peak measure in 1987.

My field count of incubating nests showed a surprisingly large percentage of the nests counted appeared to contain adult birds in the incubating position. In one specific count, 70 nests were counted and 32 likely contained eggs that were being incubated, for a 45.7% occupancy rate. This data would conclude that the colony had made a rebound for the 1994 breeding season, giving optimistic hope to heron lovers. Interestingly, though, from the beginning of the observation session (10:30 A.M.) to well into the afternoon, two turkey vultures were observed through the telescope hovering over heron nests that were unoccupied by an adult heron at the time. No other birds of prey were observed.

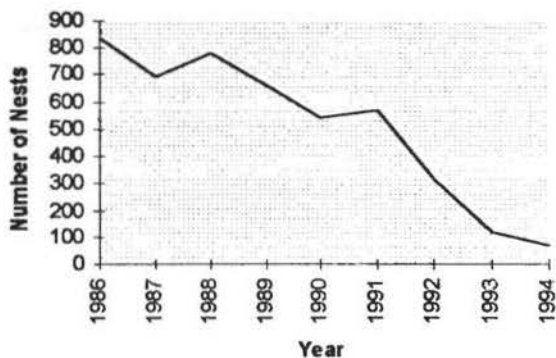
While the data showed that a healthy percentage of the nests contained eggs being incubated, this is not to conclude that all of those potential birds will survive into adulthood. If predation is the cause of the decline at Iroquois, this would likely not occur until later in April and early May (the young nestling period), as the data was compiled on April 16. Knowledgeable that the data could be incorrect due to observational errors and other factors, an analysis of the possible factors in the decline at Iroquois was performed. After all, the average nest count of 69 for 1994 is substantially lower than the count of 117 in 1993.

The decline in Great Blue Heron nesting productivity and colony size at the Seneca Pool colony of Iroquois National Wildlife Refuge is substantiated by the following data analysis. The data comes from the aforementioned research undertaken by Eric Derlith, Donald Tiller and myself. It is compiled in the chart shown below with each factor graphically depicted as a variable dependent on time in the two graphs.

Nesting Productivity



Rookery Nest Count



The Search for Possible Causes

In answering Derlith and many other birder's calls for a reason behind the decline in the size and productivity of the heron colony at Iroquois, it was necessary to organize the data obtained through our field study, and, utilizing research performed on the bird and its behavior, brainstorm a list of possible causes for the bird's decline in the area. The factors would then be analyzed as to the possibility of each having an effect on the downward trend in the heron population.

Consulting with several birders at a Buffalo Audubon Society meeting in November 1994, speaking to experts William Watson, Don Tiller—Refuge Manager at Iroquois, and referring to a book called Handbook of North American Birds, by Ralph Palmer, the following list of possible causes of the decline in the Great Blue Heron Colony at Iroquois was formulated.

1. The Human Intervention Factor
2. The presence of Bald Eagles in the area
3. Predation of the nestlings by Turkey Vultures
4. Contaminants in the area such as the presence of lead in the Seneca Pool area

5. Red-Tailed Hawk presence around the heron rookery

The following is an analysis of each possible factor on its own merit, attempting to find the true cause of this disconcerting problem.

The Human Intervention Factor

The presence of man is always a concern on behalf of environmentalists and nature lovers alike. The Iroquois National Wildlife Refuge was established in 1958 by the United States Fish and Wildlife Service. It is comprised of 10,818 acres of marshland, wooded swamps, wet meadows, pasture, and cropland.¹³ As with other refuges established by the U.S. Fish and Wildlife Service, Iroquois was set up to provide a safe haven for wildlife in which the animals and fish can co-exist in natural ecological triangles without negative human intervention.

Negative is the key word here. It is often difficult to discern as to where the line should be drawn and human intervention and presence should end. Hunting and Fishing are surprisingly allowed at the refuge, but this allowance is justified on the grounds of maintaining positive levels of specific populations. For example, the refuge will disallow the hunting of a population that is in any form of danger while hunting of overpopulated species is allowed to control the population.

While the refuge is geared towards allowing the wildlife freedom and a safe haven, wildlife biologists, ornithologists, and birders have made personal and grouped attempts over the years to preserve the refuge's heron colony as well as the refuge's diverse populations. Again the question must be asked. Are these personnel of the colony, in

¹³ INWR pamphlet

their attempts to protect and aid wildlife, having any negative effects on the Great Blue Heron's and other wildlife species.

Specifically, the Iroquois National Wildlife Refuge's administration has undertaken several major projects concerning the geographical and outlay aspects of the grounds. mechanical brush control, cooperative farming agreements, and grazing leases are utilized to curb succession. Additionally, a series of dikes and dams has been established to control water levels.¹⁴ Certainly, one would assume that the mere presence of farmers, and machines would serve as an intimidating factor that may drive species out of the area. Even if the presence of these aspects did not have a direct intimidating result on the wildlife of the area, there is certainly the possibility that some form of pollution was brought into the area in the form of emissions from gas-powered machinery. Habitat destruction is an additional concern, which is also a difficult arena when it comes to deciding what will be beneficial and what actions will be detrimental.

An investigation into these projects and cooperatives that the administration of Iroquois National Wildlife Refuge has set up, reveals that the programs are not just beneficial, yet they are vital. Without water control, the entire Oak Orchard Swamp (seen on the map of Iroquois, page 11) would dry up from April to November, and with the dam and dike systems in place, 4,000 acres flood every year or so. These structures help to control the floodage. Speaking to Don Tiller, present manager of the refuge, the presence of man is only allowed in the ways most beneficial to the largest percentage of the colony

¹⁴ INWR pamphlet

and its inhabitants. None of the alterations to the colony or hunting regulations appear to have harmed the herons in any way.¹⁵

The Presence of Bald Eagles

To many birder's delight, there is a rare Bald Eagle population at Iroquois. An unoccupied nest is monitored by video camera, showing two or more adult eagles and another nest has been observed to be containing one eagle nestling. While their rare presence is welcomed by many birders, they are an intimidating predator that possibly contribute to the departure of other species from the area.

A nesting pair of Bald Eagles moved onto Iroquois in 1986 which was peak year in the heron's colony size which saw 834 nests counted in 1986. Thus, it would appear that the Bald Eagles may have been an initiating force of the colony's decrease.

However, the possibility that the Bald Eagles contributed to the downfall looms eminent. In speaking to several administrators of the refuge, there have been no reports of the eagles circling or flying low over the rookery. Without such reports, there is no case for the possibility of predation or intimidation on behalf of the eagles.

Red-Tailed Hawk Presence

As with the possibility of Bald Eagles intimidating the herons to the point of their departure, the predator Red-Tailed Hawk must also be investigated. Whereas the population of Red-Tailed Hawks in the area is larger than that of the eagles, historically there have been relatively few sightings of the hawk around the rookery.

¹⁵ Tiller interview Sept 6, 1994

However, on Monday, April 4, 1994, Mr. Watson made a trip to Iroquois and noted in his birder's notebook: "Iroquois, 69 Great Blue Heron nests, 37 herons, some being harassed by 2 Red-Tailed hawks."¹⁶ With few observations like Mr. Watson's, this is not a likely predator.

Predation of Nestlings by Turkey Vultures

The investigation into the possibility that Turkey Vultures are predators of the young heron nestlings and are thus causing the members of the rookery to relocate is an important one. There have been many reports of Turkey Vultures hovering over the Seneca Pool rookery,¹⁷ and a passage in Ralph Palmer's book stating that Turkey Vultures have been seen snatching young heron nestlings from their nests. This suggests that the vultures could be a factor in the abandonment of some Pennsylvania heronries.¹⁸

To further substantiate these concerns, on the morning of our field study (April 16), two turkey vultures flew over the heron rookery, certainly an intimidating presence. This is likely the cause of the decline in the heron rookery's size at Iroquois. It is very possible that the birds are gradually moving out of the area due to this presence.

Presence of Toxic Substances in the Area

The refuge does not allow the dumping of any toxic or harmful waste that may endanger the constituents. According to the refuge's administration, tests of chemicals such as lead are performed periodically. Since the refuge was not built on land that was a

¹⁶ William Watson's birder's notebook, 1994

¹⁷ Tiller, September 6, 1994

¹⁸ Palmer, p398

harbor for waste, there is no concern of toxins harming the wildlife. The refuge is well run and maintained by the staff who look out for the welfare of the wildlife. The staff assured me that the decrease in the heron colony's size is not due to toxic substances. Were the herons getting into toxins, there would be mounting evidence in their excretions, and the simple uncovering of dead herons.¹⁹ Such evidence is not present.

Conclusion

This investigation undertaken has validated and documented the continuing decrease of the Great Blue Heron population through the 1994 breeding season. Exploration of some of the possible causes of the problem have led to my unproven hypothesis that Turkey Vulture predation is the cause of the decline in heron population due to evidence in the breeding studies and research performed.

Several questions lie unanswered, though. A true validifying observation of the Turkey Vulture, its hunting patterns, and its presence around the heron rookery is necessary to prove my findings. To do this, observations over the entire course of the breeding and nestling seasons must be performed. This will be a long and difficult process that will require the patience of a devoted birder or wildlife biologist. Isolated incidents of Turkey Vultures flying over the rookery cannot be used as hard evidence to support my hypothesis.

It is crucial to the preservation efforts of birders for the Great Blue Heron population at the Iroquois rookery, that the problem be identified in order to analyze possible solutions. Without knowledge of the problem, the solution is absent.

¹⁹ Tiller, September 6, 1994

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—William Watson's bird observing notebooks, which he archives, were also used.