

Recreation Land Use Adjacent to an Active Heron Rookery: A Management Study

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During Spring 1981, the National Lakeshore, supported by the Indiana Department of Natural Resources (IDNR) conducted a management study of the northern Porter County great blue heron (*Ardea herodias*) rookery, in order to develop a land use policy compatible with maintaining this 30 plus year old colony. Specific objectives included determination of colony size, nesting and fledging dates; the impact of recreational activities along the Little Calumet River (170 m south of the Main Colony); and the primary feeding areas.

The first bird arrived March 11 and nest construction and courtship activities were well underway by late March. Two low altitude helicopter flights established that hatching had occurred by May 5, and that most young were approaching fledging conditions by June 29. Photographs from the latter flight revealed at least 38 active nests and 108 nestlings. Intrusion impact tests indicated the birds rarely reacted unless the intruders were visible. After the leaf-canopy developed, activities adjacent to the rookery had little, if any, impact; however, intruders beneath the nest trees still created minor disruptions. A monitoring program provided evidence that the herons fed in two main areas southeast of the rookery and along Lake Michigan.

The resulting recommendations to management proposed utilization of the adjacent little Calumet River south bank for fishing and other park activities. The Rookery itself should remain closed.

Introduction

The Heron Rookery Unit (HRU) of the Indiana Dunes National Lakeshore was authorized for incorporation into the park by a congressional act in 1976. The unit, classified as a protected area and closed to the public, has the potential for a variety of recreational uses such as fishing in the Little Calumet River (which is designated as a Salmon Stream as part of the IDNR Salmonid Fisheries Program), study of spring wildflowers (one of the best areas in the National Lakeshore), bird watching and hiking. This study was undertaken to determine a management policy compatible with maintaining the integrity of the colony and providing for public recreational activities.

The portion of land containing the rookery proper is still under control of the Indiana Department of Natural Resources, Division of Nature Preserves. We would like to acknowledge their permission for allowing us to conduct this study.

Study Area and Methods

The heron rookery, active since the early 1950's (Raymond Grow, Pers. Comm.) is situated in a fairly isolated woods surrounded by cultivated fields. This 12 ha woodlot is in Section 26 of Township 37N, Range 5W of northern Porter County, Indiana.

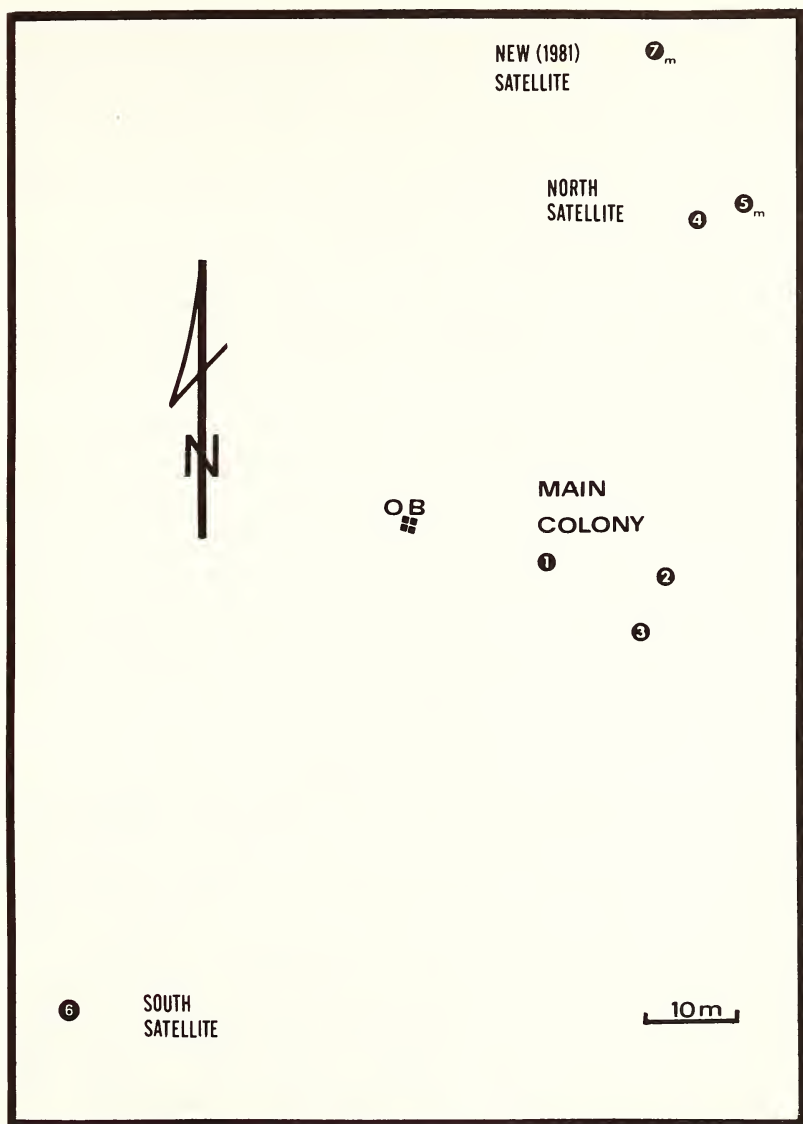


FIGURE 1. Details of the blue heron rookery. "OB" represents location of observation blind. All nest trees (numbers) are beech except those designated "m" (maple). The southern margin of the woods is approximately 85 m south of "OB".

The rookery was mapped and nest counts made on February 26, 1981 (Figure 1). The February nest census revealed a main colony comprised of three closely spaced trees containing 41 nests, and two satellite colonies. The south satellite consisted of a single nest and the north satellite colony contained 5 nests in two trees. A post-season nest count conducted on November 19 after leaf-fall yielded 29-32

nests in the main colony and 4 and 9 nests in the two respective satellite colonies. The June 29 helicopter flight revealed a third satellite of one nest in a tree to the north of the main colony. The exact location was mapped during the November 19 ground survey; its position is approximately 18 m northwest of the north satellite. The pre-season and post-season nest counts are summarized in Table 1.

The herons selected the tallest trees in the area (mean height 28.7 m) with nest heights ranging from 19.7 m to 28.2 m. Five of the nest trees were beech (*Fagus grandefolia*) and two were maple (*Acer* sp.)

A blind was constructed 15 m west of the nearest nesting tree and was 14 m above the ground. While this height did not allow observation of nest contents it was sufficiently close so that courtship and nest repair were easily observed and dates established. Activities suggestive of incubation as well as the sounds of newly hatched chicks were also evident from the blind. The blind was also used to observe the behavior of the herons relative to various human impacts.

External observation points were established on county roads 1400N and 600E 1,065 m and 855 m from the main colony respectively. These observation points were used to determine arrival dates and numbers, the directions of flights to and from feeding areas and for additional observations during controlled human impact tests.

Park personnel were also alerted and random sightings throughout the National Lakeshore were recorded.

Two helicopter flights were made over the rookery (May 6 and June 29) to obtain productivity data. Additionally, a fixed-wing flight was conducted on August 20 to verify departure from the rookery and to test the feasibility of using the more economical fixed-wing aircraft for future observations.

Results and Discussion

The HRU heron population is monotypic, consisting only of the great blue heron. The first heron arrived on March 11. Late afternoon counts were made of

TABLE 1 *Summary of Pre-Season (February 26, 1981) and Post-Season (November 19, 1981) Nest Census Surveys**

Main Colony			North Satellite Colony			South Satellite Colony			New Satellite Colony		
Tree	Nest Counts		Tree	Nest Counts		Tree	Nest Counts		Tree	Nest Counts	
	Pre-Season	Post-Season		Pre-Season	Post-Season		Pre-Season	Post-Season		Pre-Season	Post-Season
#1 Beech	15	10	Beech	2	6	Beech	1	4	Maple	0	1
#2 Beech	21	16-19 ⁺	Maple	3	3						
#3 Beech	5	3									
Colony Totals	41	29-32		5	9		1	4		0	1
Rookery Totals	Pre-Season = 47 nests				Post-Season = 43-46 nests						

*See Figure 1 for tree locations.

⁺ Three very large nests may actually be composed of two adjoining nests. A positive separation cannot be made from the ground. Examination of one of the nests which had fallen during the season was a double nest. The sticks for the two nests had been intertwined but two distinct "nest pockets" were evident.

the herons as they returned to roost until counting could no longer be done accurately. The ultimate population was estimated at 86 to 92 individuals based on the post-season nest census (1). Kushlan (Pers. Comm.) uses this method annually in estimating colonial waterbird populations in the Everglades National Park. A strong correlation ($r = 0.9849$) exists between the increasing number of birds and time. These data show a mean arrival rate of 3.2 birds/day and extrapolation indicates the above population would have been reached by April 10-12 (Figure 2).

The rookery, situated in the tallest trees in a wooded area surrounded by cultivated fields, provides an excellent vantage point for detecting danger. These tall trees, coincidentally, happen to be centrally located within the woods providing additional security for the colony. The relative isolation of the area and the lack of encroachment of housing and industry undoubtedly also contributed to the perpetuation of the colony. Other local rookeries reported to have existed in the area have apparently been deserted.

Courtship was first observed on March 23. Throughout the observation period most of the courtship display described by Cottrille and Cottrille (2) and Mock (3 and 4) were observed.

Pair formation had begun by March 27 and continued rapidly for the next several days. During this pairing-off period extensive nest repairs were conducted; sticks were brought in from outside the colony or "stolen" from nearby nests. Twig stealing was common and any unoccupied nest was vulnerable. Repair of nests was continuous as they were frequently damaged by high winds. Six nests fell to the ground during particularly violent storms.

The first evidence of incubation was obtained on April 3 when a heron was observed rising from its nest and proceeding to poke about in the nest as if rolling an egg. This probing action was repeated with increasing regularity as the season progressed. Egg laying may have started on an earlier date with incubation delayed until the clutch was complete.

The sounds of young herons and the presence of egg shell fragments under the nests indicated that the initial hatching had occurred by May 3. Hatching was confirmed during the May 6 helicopter flight when it was observed that all eggs in two nests had hatched. From this date on, shell fragments were commonly found under the nesting trees.

Both Bent (5) and Palmer (6) report on average incubation period of about 28 days. Pratt (7) reports incubation periods ranging from 25 to 29 days. Assuming incubation did, in fact, begin on April 3 and that the first hatch occurred on or before May 3 the incubation period can be calculated as no longer than 29 days. This is consistent with the 28 day average listed in the above reports.

A juvenile bird, possible from the HRU was observed some 13 km west of rookery on July 2. Following this sighting the number of juveniles observed throughout the National Lakeshore increased markedly.

Although the July 2 observation does not in itself prove first fledging (the bird may have been a wanderer from some distant colony), an early July fledging is supported by data from several other sources. First, this date is consistent with the Graber et. al. (8) observation in northern Illinois. Second, the June 29 helicopter flight revealed that most of the young were in full juvenile plumage and moving actively about the rookery trees. And finally, Palmer (6) lists 60 days as a reasonable time between hatching and fledging; a May 3 hatching would, therefore, give rise to a fledging date of July 2.

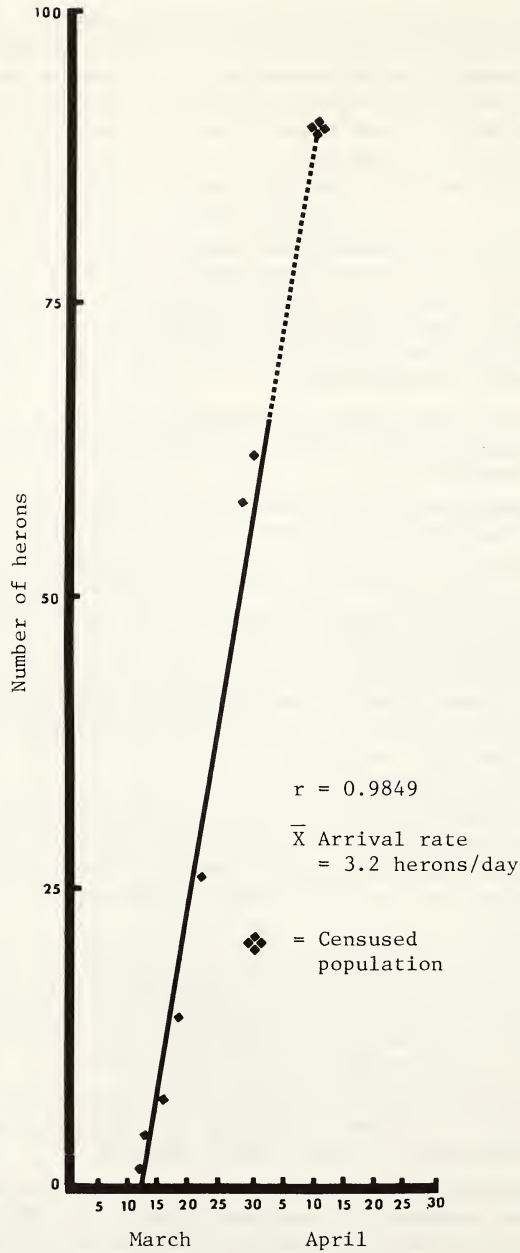


FIGURE 2. Maximum known great blue heron populations of the Indiana Dunes National Lakeshore heron rookery for seven census dates between March 11 and March 31, 1981. Broken line equals extrapolations of the data.

A number of additional observations closely support July as the month of fledging for the HRU birds. On July 23, 1981 at least three herons, positively identified as juveniles, were seen in the Cowles Bog Wetland area. A week later eight juveniles appeared in a flooded golf course at Gleason Park (Gary) suggesting a region wide post-nesting dispersal had commenced. On July 28, 1980 Bull (9) reported an unprecedented assemblage of at least 150 great blue herons in ponds near the Cowles Bog area, further documenting a late July post-nesting dispersal. Although it is tempting to assume that all of these late July birds were from the HRU, this assumption is unjustified.

Compelling evidence that young birds disperse widely after fledging exists. For example, a color tagged bird observed at Long Lake (West Beach Unit of the National Lakeshore) August 25, 1977 was, according to the Ohio Cooperative Wildlife Research Unit, "Banded as a nestling in a rookery at the Winous Point Shoot Club on Sandusky Bay, Ohio on May 28, 1977."

Following dispersal the herons did not return to the rookery which was completely vacated by August 7. Occasional herons were noted within the National Lakeshore as late as November 30.

The use of helicopter flights over the rookery yielded critical productivity data through the analysis of aerial photographs. A post-season fixed-wing flight made to test its usefulness for data collection proved to be unsatisfactory due to excessive air speed and lack of maneuverability. Kushlan (10) also found fixed-wing aircraft impractical for observing birds nesting in the crowns of trees.

Analyses of photographs taken during the May 6 helicopter flight showed that of 40 visible nests 37 contained five eggs each, 1 had six eggs and 2 contained chicks. The average clutch size was 5.0 eggs. Employing the method of McAloney (11) in considering any young heron living more than 45 days as "fledged", the 108 juveniles observed on June 29 hatched from 35 active nests (eliminating one nest containing chicks and two nests with incubating adults), give a mean of 3.1 birds per nest. This success rate is in excellent agreement with the 3.09 birds per nest obtained by McAloney (11) in Nova Scotia and is considerably higher than that reported by others. Graber et. al. (8) reported a production of 1.7 birds per nest in northern Illinois. Pratt (7) reported 1.5 and 1.7 birds per nest for 1967 and 1968 respectively in central California and Wilburn (12) found a production of 2.63 and 2.26 birds per nest for 1970 and 1971 respectively in northern California. Allowing for the known loss of five young birds late in the season the total production of the colony would have been a minimum of 113 juveniles from the 38 active nests observed during the June 29 flight. If, according to Owen (13), a 71% mortality of great blue herons occurs in the first year, then one could predict that 32 birds will survive to return next year. This provides a minimum replacement of 0.71 herons per breeding pair for the year.

Shell fragments with evidence of yolk, were occasionally found under the nests usually following periods of high winds. On May 25 a fully developed, but unhatched chick was found beneath the nest tree. On May 16 a nestling was found below the nests. This young heron apparently choked on a fish (a portion of a fish was protruding from its mouth) and was then removed from the nest by the adults. The partially devoured remains of the five juveniles were discovered beneath the rookery during the first week of August. These deaths occurred over a 4 day period after most of the herons had departed the rookery. A similar pattern was evident in each case; a single pile of highly localized feathers was observed beneath the nesting trees, suggesting that each bird died in the tree and fell to the ground

where it was devoured. Although the deaths of these birds may have been the result of predators, it is also possible that they were abandoned by the adults and starved to death. These birds were likely the result of late nesting attempts and, due to the lateness of the season, were abandoned when the adults dispersed from the rookery with the rest of the flock.

A strong indicator of feeding areas is given by the flight direction of birds arriving and departing the rookery. Of the 1,220 observations of herons flying to and from the rookery, over 56% were in the northwestern quadrant (Figure 3). Supportive of this were the many sightings of herons in isolated ponds in the Cowles Bog Wetland area and along the Lake Michigan shoreline north and west of the rookery. While the Little Calumet River very likely acts as a "leading line", which ultimately takes the herons westward very near the Cowles Bog Wetland; numerous sightings were made of birds flying over open areas on direct flight lines to or from the rookery. The other active flight direction was to the east (16%). On June 17 a freshly bulldozed area adjacent to Round Lake (ESE of the rookery) was found to be literally covered with heron tracks. Round Lake is only one of several ponds and lakes in the area around the HRU. The fact that Round Lake had a field which had been freshly bulldozed made it a good indicator of heron activity in the area. While none of the other small ponds and lakes had freshly turned soil conducive to tracks it is logical that they also are utilized by the great blue herons for feeding. These ponds along with the numerous small streams in the area would account for the other flights to and from the HRU as shown in Figure 3.

The presence of alewives (*Alosa pseudoharengus*), recovered from the beneath the Main Colony on May 16 and June 26, provides conclusive proof that the herons feed in Lake Michigan and their relative abundance (seven of the eight food

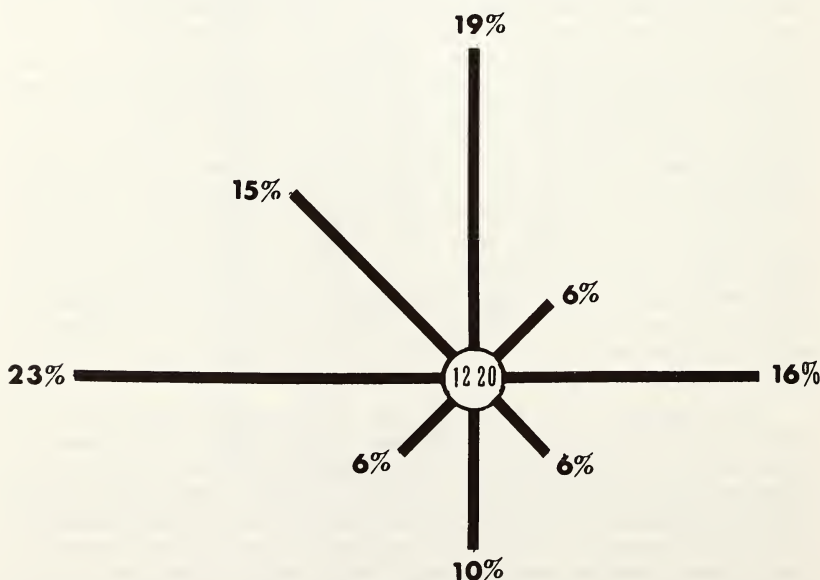


FIGURE 3. Great blue heron flights, by direction and percent of total (1,220), to and from the rookery during the 1981 breeding season.

items recovered on the two dates) coupled with the high percentage of flights toward the lakefront suggests that Lake Michigan is the primary feeding area for the HRU birds. Additionally, the coincidence of alewife movement into the shallow waters of southern Lake Michigan with the heron nesting season (R. Koch, IDNR, Pers. Comm.) provides an abundant food supply for the HRU birds during the critical period of their life cycle.

Several researchers have established that the great blue heron diet consists primarily of small non-game fishes (see for example Palmer, 6) and that a critical factor in the maintenance of any heron rookery is amply foraging areas. That great blue herons range far afield in search of food has been noted by several investigators. Mosely (14) indicates that half of the Sandusky County Rookery's total food intake was probably obtained at least 22.4 km from the rookery. Additionally, Krebs (15) shows primary feeding areas located more than 16 km from the British Columbia Colony he studied and Kushlan (Pers. Comm.) indicates that 24 km is a very reasonable distance for foraging flights. The HRU is located 7 km from the Lake Michigan, consequently a flight radius of only 16 km from the rookery would place 29 km of shoreline within range. Also within a circle of 16 km from the HRU is the Cowles Bog Wetland, plus scores of small lakes, ponds and streams.

A tacit assumption involved in the collection of field data on the HRU feeding areas was that all birds within 16 km of the rookery constituted HRU birds. Although great blue herons undoubtedly nest along the Kankakee River (40 km away at its nearest point) a literature search and consultation with local observers revealed the presence of no other active great blue heron rookeries in the Chicago Area of Illinois; northern Lake, Porter and LaPorte Counties, Indiana; and Berrien County, Michigan. Therefore, it is doubtful that any great blue herons from any adjacent colonies fed in the HRU study area. A few of the herons noted in the area may have been nonbreeding wanderers; however, we feel that most of the observations represent feeding HRU birds.

During the initial stages of the study, the blind was entered before dawn and exited after the herons left for the day's feeding, usually by 1000 hours—to reduce the possible impact on the colony. Once incubation had commenced, and herons were present throughout the day, they would take flight when anyone approached within their field of vision. The herons would return to the nests only after we were out of their sight. This flight response to our intrusions continually decreased until by mid April it was possible to walk beneath the herons in the south satellite (enroute to the blind); their reaction being one of scrutiny rather than flight.

The herons showed no response to the sounds of our activities in the blind. Movements of people and equipment, loud talking and even loud whistles did not elicit a reaction from the birds. It became obvious that they reacted primarily to visual rather than audible stimuli. Observations of occasional human activities (fishermen) within 175 m of the rookery and deliberate movements of one of the investigators through heavy brush along the Little Calumet River, 150 m from the rookery, while intentionally making excessive noise (breaking dead limbs etc.) had no observable effect on the population. On June 4 a training hike was conducted for the park's seasonal interpreters. Eighteen moderately noisy people hiked within 85 m of the nesting birds; there was no observable impact upon the herons.

Overflight by fixed-wing aircraft that routinely traversed the area also produced no obvious response from the birds. During the May 6 helicopter flight a series of passes were made over the nests at carefully controlled altitudes (Table 2). Only when the helicopter approached to within 18 m of the highest nests did

TABLE 2. *Results of May 6 Helicopter Intrusion Test*

Height above Ground	Height above Nests	Heron Reaction
183m	160m	None
122m	99m	None
91m	69m	None
61m	38m	One bird stood up
46m	23m	50% of the birds took flight
31m	8m	All birds flew

50% of the birds take flight. It was necessary to approach within 8 m of some of the nests before all birds flew.

Farming within 85 m of the colony apparently does not disrupt the nesting herons. Prior to the onset of incubation of the herons were frequently observed standing in the open fields—particularly during periods of high winds. Farmers have noted that as long as they do not stop their equipment they can pass within 20 m of such herons without the birds taking flight. This apparent lack of concern by the herons to various human activities is in agreement with Kushlan (Pers. Comm.) who states that great blue herons readily habituate to repeated activities that pose no direct threat to them.

Management Recommendations

Recreational Use

Results of this study reveal that in 1981 the rookery was active between March 11 and August 7. Graber et. al. (8) detected some annual variations in timing of the nesting cycle of Illinois herons; consequently, if a time buffer is added to accommodate early or late nesting activities, a comprehensive HRU nesting period might extend from March 1 to August 15. Within this time frame steps must be taken to insure the colony's integrity. Although Buckley and Buckley (16) recommend excluding all foot traffic within 1000 ft. (305 m) of any active colonial nesting waterbird site, it appears that, in view of results of the intrusion impact tests, that the south bank of the Little Calumet River (a minimum of 175 m from the rookery) can be safely opened to limited recreational use during the nesting period. All recreational activities should be excluded from the north side of the river in the immediate rookery area between March 2 and August 15.

As a result of this first year study (a second year is planned) a series of recommendations were made to the park managers. Based on these recommendations an interim management policy was formulated for implementation during the next year. This policy will allow fishing by permit and natural history hikes led by park interpreters. All such activities will be confined to the south side of the river and will be correlated with observations of the herons for further verification that there will be no negative impact on them. The rookery proper will remain closed. Future interpretation of the great blue herons is being considered by means of a video tape program.

Feeding Area

The maintenance of suitable feeding areas is essential for survival of the rookery. This study suggests that the primary feeding areas are along the Lake Michigan shoreline and in isolated ponds in the Cowles Bog Wetland area.

Additional data on feeding areas should be obtained in order to adequately protect these critical areas. It should be noted that the sightings of herons feeding along the lakefront were either at very early or late hours when few people frequent the beaches. If the herons dominant foraging activities occur along the beaches, it may prove beneficial (or indeed necessary) to isolate certain stretches of beach (perhaps for only a portion of the day) during the nesting season to provide quiet expanses of beaches for heron feeding.

Future Monitoring

Graber et. al (8) report a serious decline in the Illinois great blue heron population over recent decades. Although the exact causes of the Illinois decline have not been determined, the authors suggest that human activities played a dominant role. In this context it is imperative that the Heron Rookery Unit be monitored closely on a routine basis in order to quickly detect any decline in the colony. The following procedures will provide the necessary data to evaluate the colony's status.

- 1) Conduct a November-December (after leaf-fall) nest census annually when the nests can be counted accurately from the ground.
- 2) Perform routine remote observations from the nearby county roads and establish annual arrival and departure dates.
- 3) Have trained personnel enter the colony weekly (as inconspicuously as possible) to check for problem signs (dead birds or other evidence of disruption) on the rookery floor.
- 4) Pre-fledging (late June-early July) helicopter flights (for aerial photography) to provide definitive information on nesting success; a critical parameter in the long range health of any rookery.

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