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Jamestown Island Bald Eagle Monitoring: Year 2004 report

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CENTER FOR CONSERVATION BIOLOGY
COLLEGE OF WILLIAM AND MARY

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Center for Conservation Biology

Front Cover: *Six-week old Bald Eagle chick in nest. Photo by Catherine Markham.*

The Center for Conservation Biology is an organization dedicated to discovering innovative solutions to environmental problems that are both scientifically sound and practical within today's social context. Our philosophy has been to use a general systems approach to locate critical information needs and to plot a deliberate course of action to reach what we believe are essential information endpoints.

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EXECUTIVE SUMMARY

Plans to expand facilities on Jamestown Island in preparation for the 2007 celebration were reviewed by the U.S. Fish and Wildlife Service. This review resulted in the biological opinion put forth by the Service that proposed actions may result in a violation of the harassment clause of the Endangered Species Act. This opinion was based largely on the proximity of proposed traffic and construction activity to an existing Bald Eagle nest. One of several conditions of a compromise plan was to monitor the nest for potential impacts resulting from human activities. The objectives of this ongoing project were 1) to monitor the progress and success of during the breeding season of the Bald Eagle pair and 2) to evaluate the impact of human activities within the parking lot and proposed construction area.

We used two video-monitoring systems to monitor eagle nesting activity and potential human disturbance in areas close to the nest. The first video-monitoring system was installed within the Bald Eagle nest tree in early December, 2003. The second video-monitoring system was installed in a loblolly pine tree next to the main parking lot. Video feeds from both the nest and parking lot were recorded daily during daylight hours. Approximately every 8 days the video recorder with images stored on the hard disk was retrieved and replaced with an identical unit with a blank hard disk. Images from the retrieved unit were reviewed and then archived onto DVD.

More than 3,000 hours of digital video were recorded between early February and late June. The breeding pair laid 3 eggs in early February. All 3 eggs hatched in mid-March and all 3 chicks fledged around the end of May. Parental attendance at the nest was very high during both incubation and the first 2 weeks post hatching. On average, at least one parent was on the nest during this 6-week period for 99.6% of the daylight hours. The nest was exposed without adults present for less than 3 minutes/day. Prey delivery rates increased dramatically in the first 2 weeks post-hatching reaching an average of more than 5 items/10 hrs by the third week. Delivery rates were highest in the early morning followed by a mid-day lull and were high again in the late afternoon and early evening. Jamestown Island is open from 8:30 to 16:30 during most of the year and until 17:30 after late May. This pattern suggests that a considerable portion of the prey delivered to the nest is during the “off” hours.

A total of 497 potential disturbance events were evaluated for response at the nest by breeding eagles. In no case did eagles give any indication that they acknowledged the disturbance event. The pair appeared to be completely habituated to the level of activity in the area. Productivity, parental attendance, and prey delivery rates suggest that human activities did not interfere with breeding performance. Based on the behavior of adults, there is no indication that human activity (including boating activity, vehicular activity, or human activity) within the surrounding landscape had an impact on nesting activity. However, construction of the new visitor center was not initiated during this breeding season.

BACKGROUND

Context

Maintaining threatened ecosystems in the wake of a growing human population is the greatest conservation challenge faced by land managers within the mid-Atlantic region. Due to their broad distribution and regional abundance, government-owned lands represent one of the most promising opportunities to preserve threatened communities. However, finding the appropriate balance between resource conservation and ongoing operations is often a difficult task. This tradeoff may be particularly difficult when one of the primary missions involves public access. The Colonial National Historical Park contains a complex of historic lands that extend from Jamestown Island to Yorktown. In addition to their historic value, lands within the park support ecosystems that provide critical habitat to plant and animal populations of regional conservation concern. However, one of the primary missions of the National Park Service in managing this land is to provide public access to historic sites.

Historically, Jamestown Island has been an important breeding area for Bald Eagles. During the height of the population decline, Jackson Abbott conducted the first systematic aerial survey of eagles in the Chesapeake Bay region. In 1963, Abbott located three breeding pairs on Jamestown Island and indicated that the area supported the highest breeding density on the Bay at that time. For a five-year period, between 1974 and 1979, no Bald Eagles were known to nest on the James River. Since that time, the population has rebounded dramatically. In the spring of 2004, the James supported 98 breeding pairs and produced 155 chicks. Since 2001, Jamestown Island has once again supported 3 breeding pairs.

Plans to expand facilities on Jamestown Island in preparation for the 2007 celebration were reviewed by the U.S. Fish and Wildlife Service. This review resulted in the biological opinion put forth by the Service that proposed actions may result in a violation of the harassment clause of the Endangered Species Act. This opinion was based largely on the proximity of proposed traffic and construction activity to an existing Bald Eagle nest. One of several conditions of a compromise plan was to monitor the nest for potential impacts resulting from human activities.

Objectives

One of the Bald Eagle Nests (JC-01-01) on Jamestown Island is located near the main parking lot and the site for the new visitors center. The objectives of this ongoing project were 1) to monitor the progress and success of during the breeding season of the Bald Eagle pair and 2) to evaluate the impact of human activities within the parking lot and proposed construction area.

METHODS

Project Location

This project involved the nest site and surrounding areas on Jamestown Island (Figure 1). Nest JC-01-01 is located in a loblolly pine tree positioned along the margin of a small tributary that flows into the Back River. This water body forms the northern boundary of Jamestown Island. The nest faces out onto a marsh with a good avenue for ingress and egress out to the Back River. There is a direct line of sight out to the waterway to the north and out to the main parking lot/visitor center construction area. During the summer months, the line of sight to the parking lot is somewhat obscured by a tree buffer. Adults are frequently observed foraging out over the James River or along the shorelines of the Back River and main stem of the James. The primary locations for human activity are along the entry road and the main parking lot.

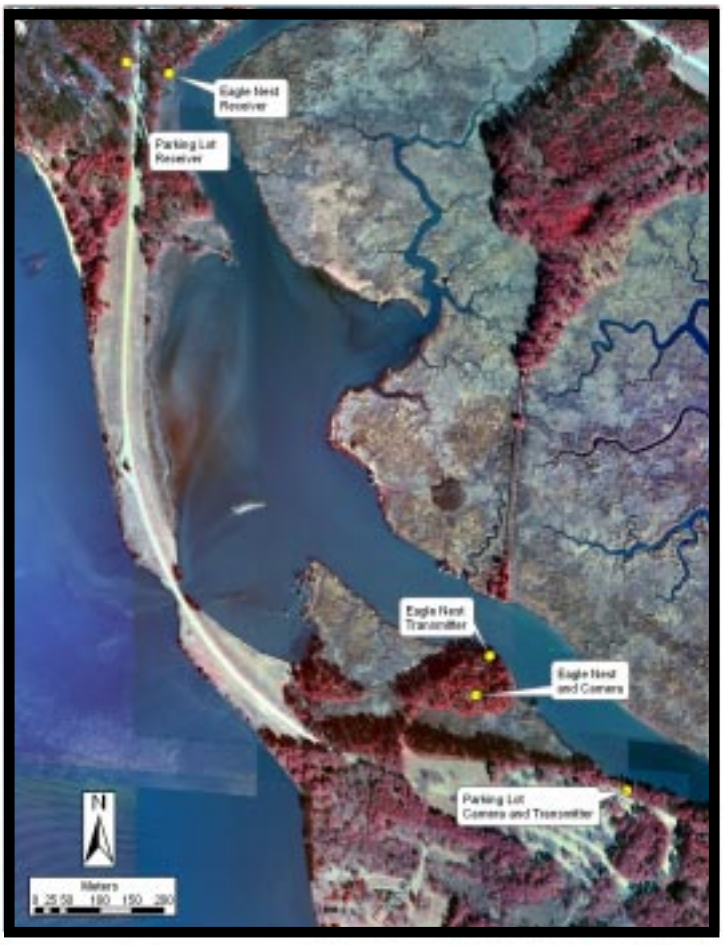

Figure 1. Map of existing equipment setup for video-monitoring of Bald Eagle nest and main parking lot.

Monitoring Approach

We used a video-monitoring system to monitor eagle nesting activity and potential human disturbance in areas close to the nest. Components of the system included an Extreme CCTV high resolution, color, weather proof camera (model EX27 C7 VA3580B), Siamese coaxial cable, a deep-cycle battery, 2 Unisolar US-64 solar panel arrays with a charge regulator, a 2.2 Ghz, UltraLink 90 long range video transmitter and 6db receiver, and a multi-channel, GE Kalatel DVMR^{e}-4CT 160GB digital video recorder. There were two of these video-monitoring systems built and deployed. The first was installed on the nest itself and the other just north of the parking lot.

The video-monitoring system was installed within the Bald Eagle nest tree in early December. The camera was mounted on a limb approximately 1 m above and to the west of the nest. A heavy-gage metal bracket was mounted to a large limb with wood screws and the camera was bolted to the bracket. The view of the camera was adjusted to include the entire nest surface including an additional 0.5 m to either side and the surrounding landscape to the southeast. The view included the primary entrance to the nest so that birds could be observed approaching and leaving. The view looked across the creek and provided a limited view of the western edge of the parking lot and the access road leading to it from the west. A coaxial cable was run from the camera down the nest tree and across the ground to a power station. The power station included a bank of 2 parallel wired group 27 deep cycle batteries, maintained by Unisolar US-64 solar panel arrays. Solar panels were mounted on a wooden stand to improve light exposure. Coaxial cable was run along the ground to a transmitter mounted approximately 5 m above the ground in a tree. This transmitter was tuned to a receiver mounted on a second tree near the entrance station. Video signals from the receiver were transmitted into the contact station using coaxial cable and recorded on GE Kalatel DVMR^{e}-4CT 160GB digital video recorders.

The second video-monitoring system was identical to the first and was installed in a loblolly pine tree next to the parking lot in early December. The camera was mounted on the tree trunk approximately 5 m high and the transmitter was mounted in the same tree. The camera was mounted to face southeast. The view was adjusted to include the parking lot, the construction area, and the road entering the parking lot. The receiver was located on the south side of the park entrance and wired into the office to the digital video recorder.

Video feeds from both the nest and parking lot were recorded daily during daylight hours (generally from 0.5 hours before sunrise to 0.5 hours after sunset), beginning on 2 February, 2004. Approximately every 8 days the video recorder with images stored on the hard disk was retrieved and replaced with an identical unit with a blank hard disk. Images from the retrieved unit were reviewed and then archived onto DVD.

Nest scenes throughout the breeding cycle. Photos captured from digital video of nest JC-01-01during 2004.

Tape Review and Data Collection

Approximately 12 hrs of video coverage were recorded daily. Review of coverage for extraction of information is time consuming. For this reason, 2-3 days of video coverage were chosen weekly for review. When possible, days chosen were split between weekends and weekdays so that the range of variation in disturbance would be reflected. Coverage for selected days was viewed on a computer monitor using custom software. For a variety of reasons (see below), equipment failure or signal corruption caused gaps in video coverage. However, based on review of coverage before and after gaps, the pair continued to progress with no apparent disruptions.

Although Bald Eagles are susceptible to human disturbance throughout the breeding cycle, there are specific times when disturbance is most damaging. The most sensitive time during the actual breeding period is when eggs or young require attendance by adults for thermoregulation. Eagles typically initiate incubation with the laying of the first egg. Depending on ambient temperature, eggs will require nearly constant incubation until hatching at approximately 35 days. Disturbance that forces adults away from the nest may cause egg mortality since adults are not able to meet thermal conditions. Eagle chicks are altricial and do not become endothermic until approximately 15 days of age. Up until this time they are completely dependent on adults to provide both heat needed for thermoregulation and food. Constant attendance on the nest is required during this period. Disturbance that forces adults away from the nest or interrupts foraging activity may cause chicks to die from exposure.

Once eagle chicks reach 15 days of age, dependence on adults to provide continuous body heat begins to diminish. Brooding rates typically begin to decline as chicks age beyond 15 days and their primary source of dependence transitions to food. Disturbance during the pre-fledging period, though not as damaging as during the earlier period, may impact feeding rates and chick development. Bald Eagle chicks begin to take their first flights when approximately 10-12 weeks of age. During the post-fledging period, chicks venture further and further from the nest and spend less and less time on the actual nest structure. However, for a considerable length of time after fledging, adults continue to provision fledglings on the nest. Although much less damaging at this time, continued disturbance at the nest may disrupt provisioning.

Digital video coverage for selected days was reviewed on a computer screen to extract nesting information. The amount of coverage for each day was the time when the nest was visible in the morning to the time it was not visible in the evening. Any gaps in coverage due to interference of the signal were recorded and subtracted from the total effort. The focus of data collection was attendance and feeding patterns. The presence of one or both adults at the nest was recorded to the nearest second. This was accomplished by recording each arrival and departure event. During the incubation phase, male/female exchanges at the nest were recorded. Exposure time for each day was the total of all periods when no adults were present on the nest. Attendance time for each day was the total of all periods when at least one adult was present on the nest. After chicks fledged,

occurrence of chicks on the nest was mapped in a similar fashion. The time of prey deliveries was recorded to the nearest second. Provisioning rates were calculated as the number of prey items delivered divided by the coverage for a given day. Values were standardized to items/10 hrs.

Potential disturbance events were sub-sampled for the days chosen for review of eagle activity. There are numerous locations where vehicles and people can move around the main parking lot and entry road. The parking lot camera was positioned to view where vehicles reach the location nearest the eagle nest. The times that cars, people, or buses appeared in view along the entry road were recorded to the nearest second. An attempt was made to sub-sample 20-40 potential disturbance events/day throughout the breeding cycle. Correspondence between the disturbance event and eagle behavior was evaluated as an assay for the impact on the pair.

Logistical Difficulties and Equipment Delays

Several equipment problems arose over the course of the breeding season. One week after the initial installation of the equipment signal was lost from the nest camera. Trouble shooting indicated that the signal loss was occurring at the transmitter. The transmitter was disassembled and a broken wire was located and repaired. Shortly thereafter signal was again lost from the nest camera, trouble shooting this time revealed that the signal loss was on the camera side of the transmitter. Cables and connections were checked on the ground while a climber ascended the tree to check the camera and connection above the ground. Before the climber could reach the camera at the nest, signal was restored and it was assumed that a faulty connection on the ground was the cause of the signal loss. Several days later signal was again lost at the nest camera, trouble shooting revealed that shortly after power was supplied to the camera, the auto iris in the lens would completely open totally overexposing the video image giving the impression of lost signal. The camera from the parking lot was removed and used to replace the nest camera that was removed and sent back to the company for repairs. The parking lot camera was replaced with a black and white camera while waiting for the return of the defective camera.

During early February, while reviewing recorded video, it became apparent that reliable signal reception was not occurring with the nest receiver located on the west side of the contact station. The receiver was removed and repositioned on a tree on the east side of the contact station at the edge of Powhatan Creek, additional coaxial cable was installed through a culvert underneath the road to facilitate this move. During mid April signal from the nest camera once again became sporadic. It was decided that this signal loss was transmission interference due to increasing foliage between the transmitter and receiver. The nest transmitter was repositioned to the north shore of the spit of land on which the nest is located, restoring reliable signal transmission. The repaired color camera was also replaced at the parking lot site at this time.

Throughout the course of the breeding season, signal corruption would occasionally occur, resulting in the nest video being picked up by the parking lot receiver. It may be beneficial to reposition the transmitters, receivers and the digital video recorders closer to the visitor's center. This would facilitate a direct coaxial feed from the parking lot camera, a shorter transmission distance from the nest transmitter and a better view of road traffic and construction activities, as well as the possibility of installing an addition camera to monitor boat traffic on Powhatan Creek, Sandy Bay, and the Back River.

RESULTS

Outcome of Nesting

The Bald Eagle pair nesting on Jamestown Island near the main parking area produced 3 chicks during the breeding season of 2004. This is the highest chick production recorded for this pair and the maximum number of young produced by this species. On average, approximately 10% of pairs produce 3-chick broods annually in the lower Chesapeake Bay. This pair produced 2, 1, and 2 chicks during the breeding seasons of 2001, 2002, and 2003 respectively.

Benchmark events during the breeding cycle were captured on digital video (Table 1). The first egg laid was on 6 February. This was followed 87 hrs later by the second egg and 182 hrs later by the third egg. According to observations from captive pairs and the very few observations of laying intervals from the field, this level of asynchrony is not typical for Bald Eagles. Expected laying interval is 24 to 48 hrs. With this level of asynchrony, the second and third eggs would be at an extreme disadvantage. However, all three eggs hatched successfully. Hatching asynchrony was similar to laying with the first, second, and third eggs hatching on 14, 17, and 20 March respectively. It is exceptional that the pair was able to accommodate the brood with this degree of separation. In years of food stress the third chick would be at a competitive disadvantage for food and would not likely survive.

Table 1. Phenology of Bald Eagle breeding activity for nest JC-01-01 in 2004.

Activity	Date	Time	Comment
Egg 1 laid	2/6/04	Approx. 19:00	
Egg 2 laid	2/10/04	Approx. 09:45	87 hrs after the first egg.
Egg 3 laid	2/14/04	Approx. 09:15	182 hrs after the first egg.
Chick 1 hatch	3/14/04	Approx. 16:45	886 hrs after egg was laid.
Chick 2 hatch	3/17/04	Approx. 06:00	860 hrs after egg was laid.
Chick 3 hatch	3/20/04	Approx. 17:00	848 hrs after egg was laid.
Chick 1 fledge	5/31/04	-----	78 days after hatching
Chick 2 fledge	6/1/04	-----	76 days after hatching
Chick 3 fledge	6/3/04	-----	75 days after hatching.

All three chicks fledged successfully. Throughout the second half of May, chicks were exercising their wings throughout the day and spent and increasing amount of time on branches around the nest. First sustained flights were observed on 31 May, 1 June and 3 June. Fledging events were more synchronous than either laying or hatching. Since chicks were not individually marked, it was not possible to determine if fledging order was consistent with hatching order.

Attendance at the Nest

Parental attendance at the nest varied considerably across the breeding cycle (Figure 2). During the incubation period, at least one of the adults was present at the nest attending eggs almost constantly. Parental attendance during the incubation phase averaged 99.6% during daylight hours. On average, exposure time was 2 min 41 sec per day or 24 sec/hr. Over the course of the incubation period, there was an average of 5.07 incubation exchanges per day such that average incubation stints were 2.2 hrs in length. Attendance during the first 2 wks post hatching was similar to incubation averaging 99.5% of daylight hours with an average exposure time of only 2 min 53 sec per day. After chicks reached 15 d of age, parental attendance declined dramatically (Figure 2). Attendance was less than 50% by age 6 wks and less than 5% by age 8 wks. This transition in attendance reflects a shift in responsibilities for the parents that corresponds to different stages of chick development. Early in chick development, adults provide both food and warmth. Once chicks can thermoregulate on their own, adults provide food. Because young chicks cannot tear and eat prey on their own the adults must prepare and feed the chicks directly. As the chicks develop, they transition to self-feeding by around 8 wks of age. Beyond this age, the chicks are very aggressive and the adults are only present at the nest to deliver food.

After fledging, chicks began to spend an increasing amount of time away from the nest (Figure 3). By 13 wks of age, the nest was empty nearly 70% of the time. This figure underestimates the decline in use because it represents the amount of time where there was even a single chick present rather than the entire brood. Chicks were still coming back to the nest periodically through the end of June (latest dates used for this report). During this time period, the nest continued to be the place where adults delivered food and most of the time chicks appeared at the nest was associated with prey delivery. Use of the nest will likely continue until the chicks are capable of foraging independently. By late June, chicks were not roosting at the nest site at night.

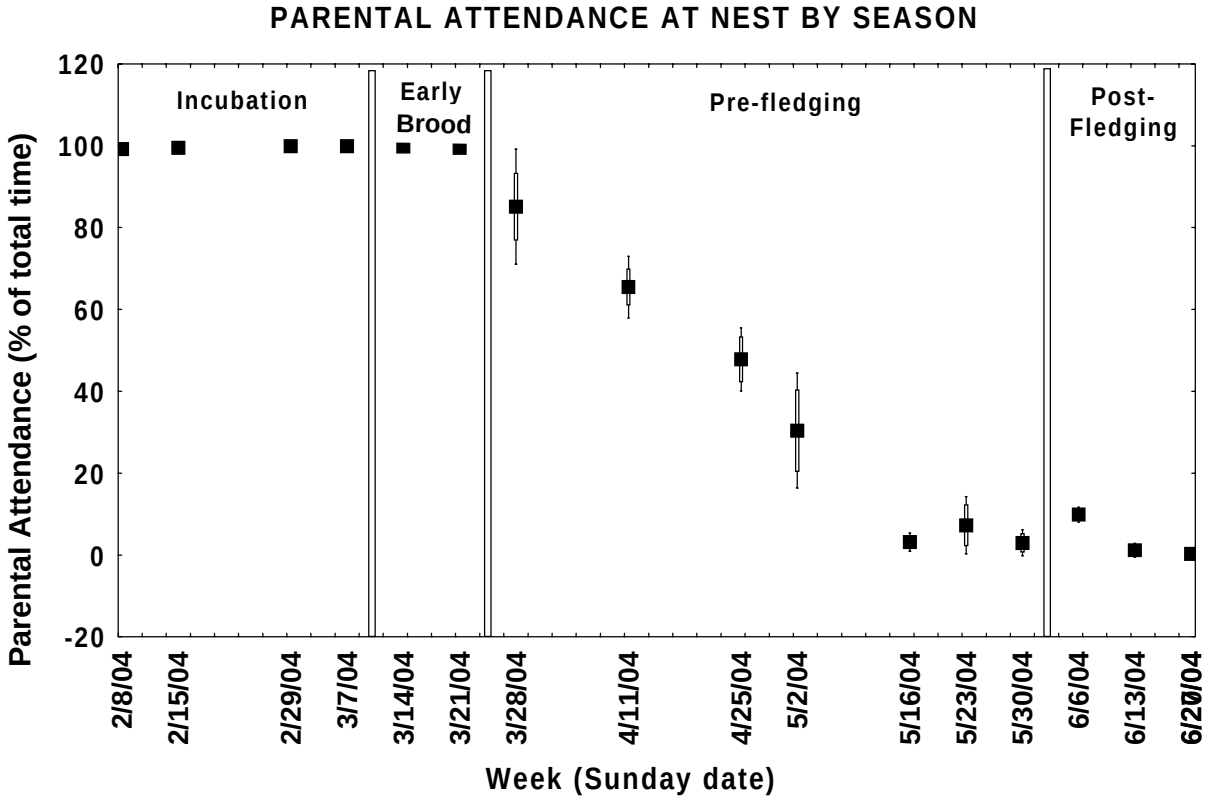

Figure 2. Seasonal pattern in parental attendance at nest JC-01-01 during the breeding season of 2004.

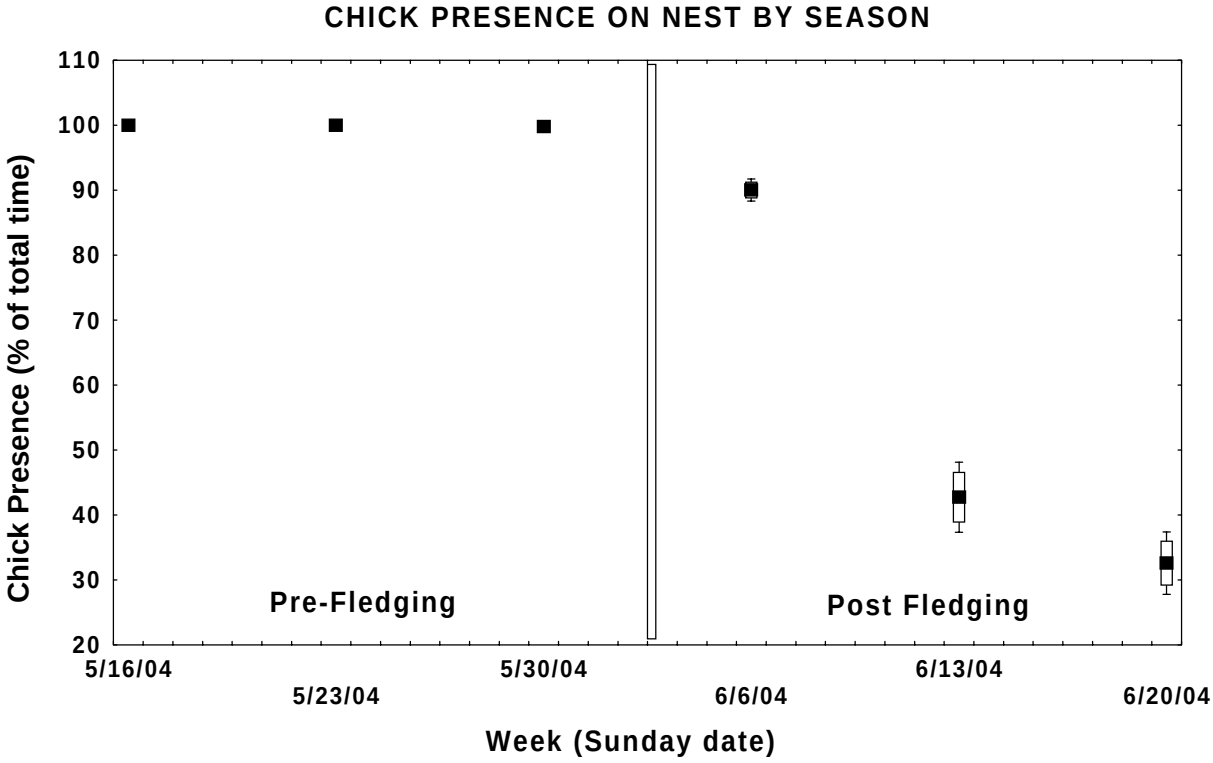

Figure 3. Seasonal pattern in presence of chicks at nest JC-01-01 during the breeding season of 2004.

Chick Provisioning

Prey delivery rates increased dramatically in the first 2 wks post-hatching reaching an average of more than 5 items/10 hrs by the third week (Figure 4). Although no statistical analysis was performed to test for any trends in provisioning rate with season, it appears from inspection that rates declined prior to and after fledging. It appears that the highest provisioning rates were in the month between 2 and 6 wks of age. This seems to correspond with the period of greatest tissue synthesis.

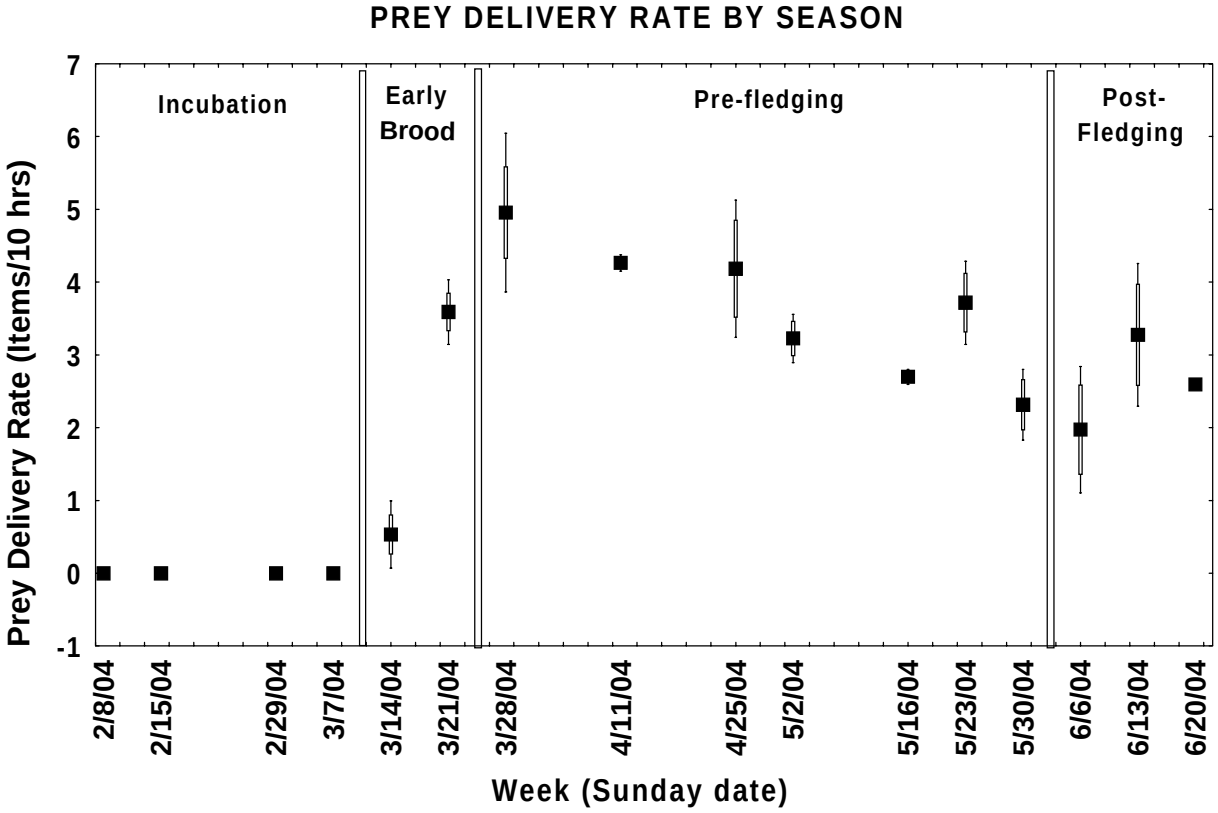

Figure 4. Seasonal pattern prey delivery rates at nest JC-01-01 during the breeding season of 2004.

Prey delivery rates were influenced by time of day (Figure 5). Rates were highest in the early morning followed by a mid-day lull and were high again in the late afternoon and early evening. Jamestown Island is open from 8:30 to 16:30 during most of the year and until 17:30 after late May. This pattern suggests that a considerable portion of the prey delivered to the nest is during the “off” hours.

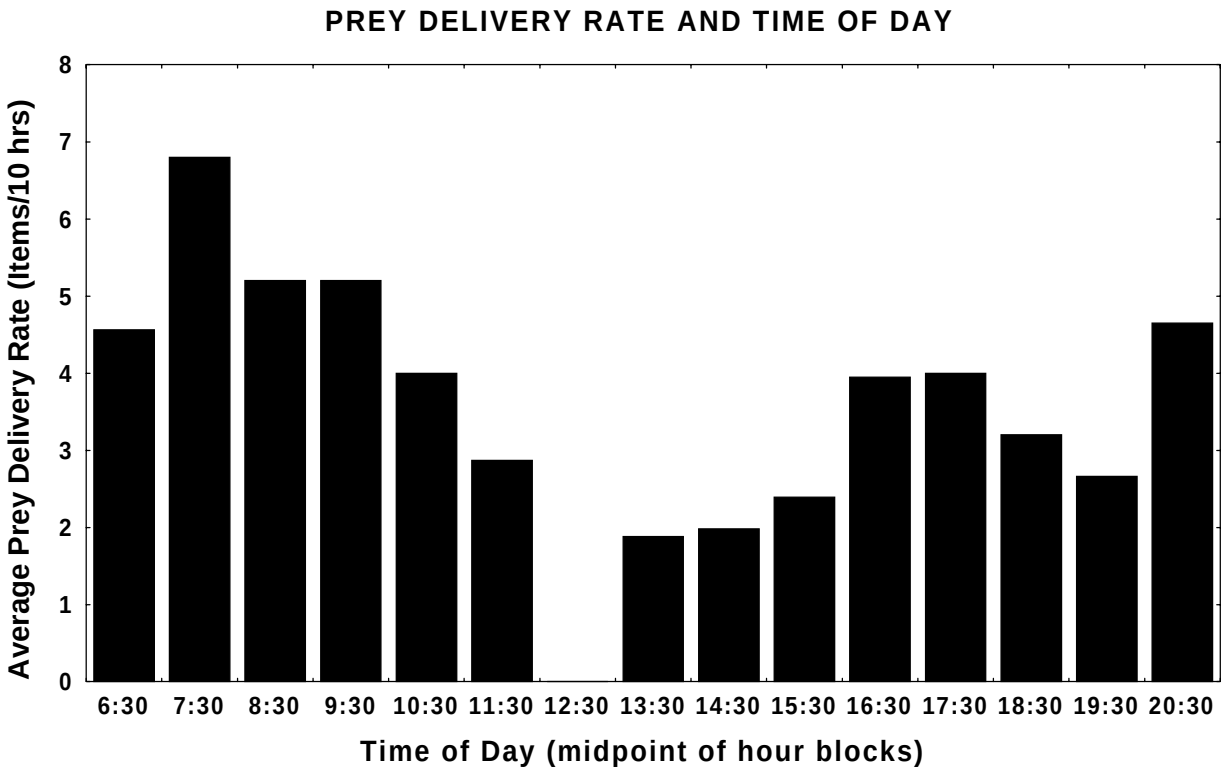

Figure 5. Relationship between prey delivery rates and time of day at nest JC-01-01 during the breeding season of 2004.

Disturbance

A total of 497 potential disturbance events were evaluated for response by the breeding eagles. These included 424 cars, 42 buses, and 31 groups of people passing along the entry road. These events occurred during all hours of the day and throughout the breeding period. Examination of eagle behavior during the times of potential disturbance indicated no response. Eagles did not appear to acknowledge these disturbance events. Evaluation of nest departure times for the eagles indicated that in 2 of the 497 instances, eagles departed within 10 seconds of potential disturbance events. However, in both cases, eagles departed the nest before the car reached the entry road suggesting that they were not likely responding to the event.

DISCUSSION

The pair of Bald Eagles nesting on JC-01-01 was highly successful during the breeding season of 2004. The pair fledged 3 chicks. This is the maximum reproductive output for the species and the highest number of young produced by this pair since the establishment of this territory in 2001. Only 53 of 428 (12.4%) Bald Eagle pairs were known to produce 3-chick broods in Virginia during 2004 (Watts and Byrd 2004).

Significant events during the breeding cycle were captured on digital video. Eggs were laid in early February. This timing is consistent with other pairs nesting on the James River (Watts and Byrd, unpublished data). Based on the literature, laying asynchrony documented for this pair was particularly high for this species. Asynchrony was roughly twice what would be expected based on published accounts. However, relatively little information is available for comparison. All three eggs hatched in mid-March and all three chicks fledged near the end of May. It is particularly surprising that all three chicks fledged given the level of asynchrony in hatching.

More than any other single parameter, parental attendance at the nest during the early phases of breeding indicates the level of disturbance experienced by a breeding pair. Parental attendance at the nest was very high during both incubation and the first 2 weeks post hatching. On average, at least one parent was on the nest during this 6-week period for 99.6% of the daylight hours. The nest was exposed without adults present for less than 3 minutes/day. Based on this attendance rate, there is no indication that human activity within the surrounding landscape had an impact on nesting activity.

Prey delivery rates reached a high of more than 5 items per 10-hr period in late March. This time period corresponds with when the chicks were young and likely experiencing their highest rate of tissue synthesis. Delivery rates documented during this period of development are consistent with or higher than those quantified previously in the lower Chesapeake Bay (Markham, unpub. data). Delivery rate appears to decline somewhat as the chicks reach 6-8 weeks of age and older. At this age, chicks should be reaching their asymptotic weights and feather development is nearly complete. There is no indication that human disturbance is having an impact on provisioning rates at this site.

In the weeks following fledging, the time spent at the nest by chicks diminished rapidly. In the last 2 weeks of June, chicks no longer roosted on the nest at night and only came to the nest when adults delivered food. It appears likely that chicks will be independent of the nest by mid-July. This time frame is consistent with current regulatory guidelines.

None of the observations or behaviors of the eagles indicated that there was any response to humans in the surrounding landscape. Although the birds were likely aware of activities in the vicinity there was never any indication of any direct disturbance. The pair appeared to be completely habituated to the level of activity in the area. Productivity, parental attendance, and prey delivery rates suggest that human activities did not interfere

with breeding performance. Eagles were never seen to flush from the nest in a way that suggested they were disturbed. It should be noted that construction of the new visitor center was not initiated during the breeding season of 2004. Although the area was fenced off and some equipment was present there was no construction activity. For this reason, it was not possible to evaluate potential impacts of planned activities on nest behavior.

Several technical problems were encountered during the first few months of this project. We are proposing that equipment be reconfigured to reduce these problems in the future. We believe that it will be beneficial to reposition the transmitters, receivers and the digital video recorders closer to the visitor's center (Figure 6). This would facilitate a direct coaxial feed from the parking lot camera, a shorter transmission distance from the nest transmitter and a better view of road traffic and construction activities, as well as the possibility of installing an additional camera to monitor boat traffic on Powhatan Creek, Sandy Bay, and the Back River.

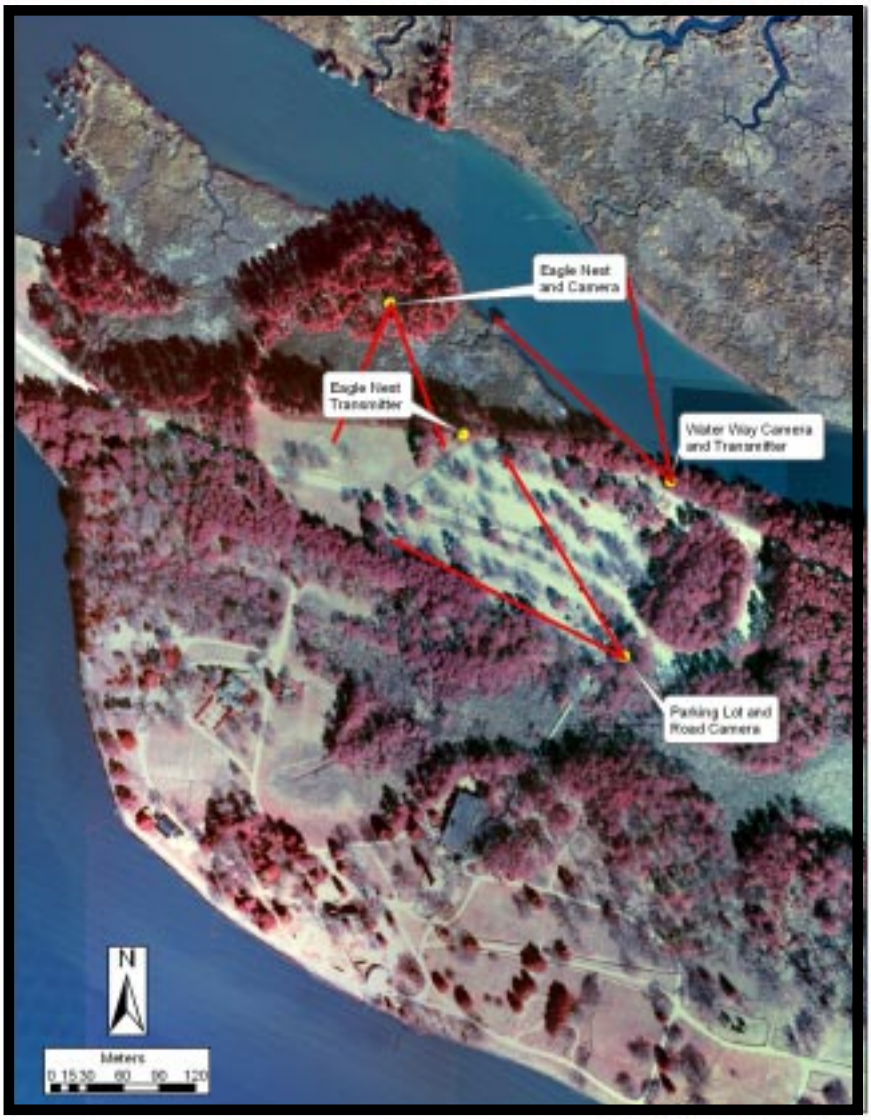

Figure 6. Map of proposed reconfiguration of equipment to monitor Bald Eagle nest and potential disturbance on Jamestown Island.

ACKNOWLEGMENTS

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