CAPTIVE BREEDING OF HARPY EAGLES

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Abstract

A breeding project involving a pair of Harpy Eagles (*Harpia harpyja*) was initiated at the Los Angeles Zoo in January 1970. To date, a total of 11 eggs and three hatchings have resulted. The first two eaglets were lost within hours, but the third survived 16 days. Data on procedures, behavior, incubation and rearing are presented as well as recommendations.

Introduction

Birds of prey have been maintained in captivity for hundreds of years with few breedings reported. It has only been in the past decade that some of the more common species have bred for the first time under artificial conditions. Fortunately, interest in raptor conservation is increasing and a real emphasis is being placed on breeding as the priorities of zoological gardens begin to shift.

Unfortunately, most institutions will not make the commitment necessary to carry out successful propagation of birds of prey. Raptor breeding is a long-term project. All phases of the nesting process, from nest building to care of the young, apparently have to be learned. Each successive nesting attempt must be carried further than the previous one until success is ultimately achieved. Once successful, a pair should breed annually. Even in the wild, the learning process is long, often with the first nesting attempt ending in failure. It is unlikely that two year-old birds would form a pair bond, so one (the new breeder) has an opportunity to learn from the other (the older, experienced breeder).

Zoological gardens are rapidly awakening to the fact that it is impossible to specialize in everything. Most raptors are merely exhibited, since aviary designs usually preclude nesting. Therefore, at the Los Angeles Zoo we placed most of our emphasis on the breeding of a single species, the Harpy Eagle (*Harpia harpyja*) of the American neotropics. Although the laying of a few eggs by captive pairs has been recorded in the literature, harpies have never until now been bred in captivity.

The status of the Harpy Eagle in the tropical lowlands of Central and South America is not known, but it is believed that they are not numerous. Their future in the wild may be in doubt as the virgin forests which they inhabit are rapidly dwindling. Few reliable observations have been made of them under na-

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tural conditions and there is little available information relative to their breeding biology.

Procedure

To initiate the breeding project at Los Angeles, an isolated circular mammal exhibit with three individual pie-shaped units was selected. The eagles were housed in the middle, flanked by spider monkeys and margays. It is interesting to note that the close proximity to the monkeys (which form a large part of their diet in the wild) did not concern either the primates or the eagles. This particular pair of eagles (the zoo has two pair) is extremely aggressive. No one is allowed to enter the aviary which is maintained externally. This is necessary both to insure the safety of the personnel assigned to the section and to increase breeding potential.

Although the exhibit has proved to be functional, it is by no means ideal. It does provide the necessary isolation. Seclusion may be of primary importance in insuring a successful raptor breeding program, although it has been suggested that large aviaries might be just as important. However, the size of the aviary may not be as critical as previously suspected. Our harpy unit is surprisingly small, measuring only 11x18x23 feet by 11 feet tall. The back and two sides are concrete to a height of 7½ feet. Chain link fencing extends up to 11 feet and over the top. The front is covered with 1x2 inch wire mesh. The floor is concrete with a pool.

In the far corner of the aviary we constructed a nest six feet from the ground that measured five feet across with an 18-inch depression. A variety of materials was used including large oak branches to form the bottom of the nest, and smaller eucalyptus branches for the top. The nest was lined with dried palm leaves, straw, green leaves and soft grass. The roof and sides above and adjacent to the nest were covered with palm leaves to provide greater security and to offer some protection from the weather.

Results

The first sign of nesting activity occurred during July 1970, when the female was observed working at the nest. The entire exhibit was immediately closed to the public. By 24 July both sexes were actively engaged in nest building and the male became increasingly aggressive. On 1 August the first egg was laid, but it was precariously balanced on several crossing branches outside the nest depression. We were able to recover the egg and replace it in the nest. The male was visibly upset and attacked on several occasions. The female began to incubate immediately. Unfortunately, the egg was broken on 3 August.

For the next month and a half both eagles worked at the nest. On 3 October another egg was laid but, apparently, it slipped through the nest and broke. The nest was rebuilt by the zoo staff and reinforced with wire mesh. Additional nesting material was offered and the eagles began immediately to court again. On 13 and 14 October breeding activity was observed and, on 26 November an egg was laid. It was removed on 1 December as the female failed to incubate. The egg was placed in an incubator where it ultimately proved to be infertile.

An additional egg was laid on 12 December, but it was discovered broken outside the nest on 1 January 1971. More nesting material was offered and on 2 February copulation was noted. The fifth egg was laid on 28 February. Unfortunately, the eagles destroyed the egg on 3 April. There was no sign of an embryo.

No further breeding activity occurred until 9 September 1971, when a great deal of courtship took place and copulation was observed. By the 13 September the nest was completely rebuilt by the eagles and again the exhibit was closed to the public. On 19 October two eggs were discovered in the nest, although it was felt that the first egg had probably been laid on the 16th. Both sexes incubated, but the female assumed most of the responsibility. During incubation she sat very low on the nest and was reluctant to leave for any reason. She was frequently fed on the nest by the male.

On 11 November a broken egg was found on the ground some 10 feet from the nest and the male had traces of yolk on his breast. During incubation the eagles were subjected to adverse and diverse weather conditions. The temperature extremes ranged from 36 F to 105 F. In addition, cold winds up to 75 mph pounded the zoo one night. Rain fell on several occasions and once, during a hail storm, the male was observed on the nest with his wings extended; he appeared to be shielding the female from the falling hail.

About noon on 15 December the eaglet hatched. It was consumed shortly thereafter by the female. Efforts to prohibit her from destroying the chick were unsuccessful. As far as could be determined this was the first instance of a captive hatching for the species. The incubation period of 58 days seemed long, but was close to the 60 days reported for the Philippine Monkey-eating Eagle (*Pithecophaga jefferyi*), its counterpart of the Philippines. The incubation period for *Harpia* is heretofore unrecorded, to my knowledge.

On 20 December the exhibit was thoroughly cleaned and the nest was rebuilt. By the 21st the eagles were already attempting copulation and working at the nest. For the next month the eagles courted constantly. Many attempts at mating occurred. Nesting material was added daily and work on the nest continued. Throughout this time the eagles continually called back and forth, employing a variety of calls.

Copulation usually lasted from six to ten seconds, but ranged from three to 30 seconds. In many instances it was not preceded by detectable signs of courtship. Normally the male merely mounted the female by placing his feet at the base of her wings and dropped to his tarso-metatarsal joints. The male's wings were usually half extended and used as balancing aids. Interestingly, the female always moved her tail to the left and the male to the right. The female frequently called during mating which took place either on the ground or on a perch, but most often on the rim of the nest. Occasionally after mating the pair faced one another with half extended wings and fully erected crests. They would then touch bills several times and follow with a bout of allo-preening. Normally, this activity was very brief, one to two minutes in duration. There did not seem to be any ritualized behavior patterns and it was usually impossible to predict

when copulation would occur. Possibly, the frequent mating attempts strengthened the pair bond.

On 25 January 1972 another egg was laid. When the female came off the nest in the afternoon to feed, the male immediately flew up and turned the egg. On 3 February the second egg was laid. Incubation commenced with the laying of the first egg. Clearly, two eggs form a normal clutch. On 11 March one of the eggs disappeared. As incubation advanced, the egg became increasingly stained. Both eagles incubated and turned the egg, but the male usually spent less than an hour a day on the nest. Incubation by the male up to three hours at a time was recorded. Occasionally, both eagles would sit on the edge of the nest and allopreen. Throughout incubation the nest was constantly reworked and fresh nesting material was provided daily. We believe the availability of new nesting material was of prime importance. The constant reworking and rebuilding of the nest during incubation may be a form of displacement activity or it may act as a safety valve for excess or nervous energy. In most instances the male brought material to the nest for the female.

Several weeks before the egg was due, rats were offered to the eagles every day. Normally, they were fed horse meat spiced with bone meal and chicken parts, with rats and day-old chicks given but twice a week.

On 29 March, at 12:42 PM, the remaining egg hatched [Ed.—56 days after second egg laid]. The male perched on the edge of the nest to observe. The nest had been freshly lined with green leaves. At 12:48 the female settled on the chick and began brooding. At 2:10 the eaglet was still wet. By 4:15 it still had not dried and was visibly weak. We removed it at 4:30 and placed it in an incubator, but it died at 5:01. Removal of the chick proved to be very risky and was done only as a last resort. We were attacked continually by the pair.

The eaglet weighed 75.4 g and was 127 mm long. The bill was well formed, hard and strongly hooked. The cream-colored egg tooth was located at the bend of the upper mandible. The upper bill itself was very dark, whereas the lower mandible was blue-gray basally, fading to dirty cream distally. The dorsal aspect was covered with a heavy white down. The down was much more sparse ventrally, particularly in the abdominal area, which was bare. A puncture wound was evident in the right thigh. The chick was probably inadvertently crushed during brooding.

Again the aviary was cleaned and the nest rebuilt. Immediately upon being reintroduced to the exhibit the pair flew to the nest and began to rearrange it. By 17 April copulation was observed. Thereafter, mating occurred daily, often two or three times a day. This behavior continued up to and after the laying of the next egg on 1 June. The egg was noted at 10:10 PM and by 10:20 the harpies were breeding again. The second egg was laid on 9 June. By 20 June one egg had been discarded. It was removed and found to be punctured and empty.

On 2 August, at 4:10 PM, the remaining egg hatched after 56 days of incubation. By 5:45 the chick had dried completely and was covered by the female at 5:51. She appeared to be feeding it early the next morning. The first *confirmed* feeding occurred on 4 August, but from their behavior it would seem that the chick had been fed on a number of previous occasions. Typically, the

male would take a partially skinned rat to the nest where the female would receive it and encourage him to leave.

By the fifth day the chick was obviously stronger and could hold its head up for short periods of time without bobbing. Vocalizations ranged from a faint cheep to a cat-like purr that was clearly audible from four to five feet away. At that age there did not appear to be a distinct hunger call. The female would place her bill very close to the eaglet. This appeared to stimulate a feeding response causing the eyass to tap her beak to initiate feeding.

Non-fresh rats were preferred. Conceivably, aged meat is easier on the digestive system of newly hatched Harpy Eagle chicks. Muscle meat from the fore- and hindlimbs was fed most often. Small pieces (approximately 7 mm^2) were offered the chick on the tip of the female's bill. To feed, the parent had to turn her head nearly upside down. Even at five days the eaglet ate voraciously. During one feeding it was offered in excess of 30 pieces and remained upright for more than 25 minutes. Its chin and upper breast were covered with gore. If the female offered too large a piece, the chick would attempt to consume it, but usually dropped it. This was later removed by the female; the nest was kept very sanitary. The chick was fed as often as five times a day. Although the male brought the food, he was not observed feeding or brooding the chick. He entered the nest occasionally, however. By the ninth day the egg tooth was still evident.

Nest rebuilding and reworking continued even after hatching. It was re-lined daily, usually with fresh green material. The importance of a constant supply of nesting material cannot be over-emphasized.

Discussion

It became apparent after a few days of observing the chick and adult behavior, that the nest might be too confining. The female had to enter very carefully to avoid stepping on the eaglet with her massive feet, although she soon became very skillful at it. Serious consideration will be given to enlarging the structure in the future, particularly the rim. This would facilitate the female backing out of the nest without endangering either an egg or chick. It was also observed that as she moved about in the nest, some twigs had a tendency to spring up. Conceivably, one of these could hit the chick. Therefore, these twigs should be either larger or smaller to prevent a possible accident.

By 17 August the chick had grown considerably and was becoming active in the nest. For the first time since the hatching, the female was observed to fly down and secure her own rat rather than take it from the male. On that occasion she fed the eaglet in excess of 50 pieces of meat.

On the morning of the 18th, the behavior of the adults had changed drastically and we were immediately alerted that something might be wrong. The female was in the nest with half spread wings covering the nest contents. She was calling continually. The high pitched screeches were accompanied by wing flexing. As each call commenced, the female would look up with her crest erect, but as the call was terminated, her head was lowered into the nest. The male was perched nearby emitting a low, resonant "goose-like" call.

Due to the female's position on the nest, it was impossible to observe the condition of the chick. To facilitate better viewing, I climbed to the top of the exhibit and remained there for 30 minutes, hoping she would move. However, before I was able to ascertain the condition of the chick, the male attacked through the palm fronds and chain link. My left eye was struck with two talons and extensive damage was sustained about the eye. Several hours of surgery were required. In the meantime, it was confirmed that the eaglet had died and the partially consumed remains were recovered.

The fact that the eaglet was partially eaten did not necessarily indicate that it had been intentionally killed. In the wild, a dead chick is frequently consumed for sanitary purposes and to prevent possible predation. Inasmuch as only the torso was recovered, the cause of death was undetermined. Circumstantial evidence indicates that a mechanical agent was responsible, *i.e.* a piece of meat caught in the throat, struck by a nest twig, inadvertently stepped on by an adult, etc.

Even though the loss of the chick at 16 days was tragic, much useful information was obtained. The fact that the chick survived the first two weeks without serious mishap, and that both parents learned and accepted their roles, indicates that captive breeding of large raptors is not an impossibility. A sudden and unexpected behavioral change is usually a good indication that something unusual is occurring. The fact that the male became ultra-aggressive may or may not be significant, but it illustrates that personalities may change significantly if conditions alter. We feel the loss of the eaglet can probably be attributed to the size of the nest.

On 29 August 1972 both eagles were caught and had their bills coped. The old nest was completely removed and a new one constructed. The new nest measures 10x10x14 feet with an eight-inch lip across the front. We feel the size of the new nest structure will preclude accidental damage to a chick or eggs and will allow much easier access. Upon completion of the nest, the pair flew to it immediately and began to mouth nesting material.

Throughout the entire project, I found myself under considerable pressure to place at least one egg of a clutch in an incubator. There was also strong feeling that perhaps the chicks should be removed and hand reared. It is at this juncture that many breeding projects fail due to indecisiveness. The decision of what should be done must be the responsibility of one person. Once the course of action has been determined, it must be adhered to unless the situation changes. However, there must be some room for flexibility.

My decision to leave both eggs and chicks with the adults was influenced by a number of factors. Due to the aggressive nature of the birds involved, an egg or chick could easily have been destroyed by their unpredictable movements on the nest if disturbed. Placing an egg in an incubator would simply be risky, since we know nothing of temperature or humidity requirements. Furthermore, the problems of hand raising newly hatched raptors are numerous. Even if successfully hand raised without major mishap, the probability of imprinting is great. However, most important of all is the fact that if the eggs or young are removed the adults will probably never learn to rear their offspring. It is my firm belief

that it is better to risk sacrificing several of the initial breeding attempts than to possibly successfully hand-rear deformed or imprinted birds.

Summary

Status of Eggs

1 August 1970	Broken, 3 August
3 October 1970	Fell through nest, 3 October
26 November 1970	Incubator, 1 December, infertile
14 December 1970	Broken, 1 January 1971
28 February 1971	Broken, 4 April
16 October 1971	Broken, 23 November
19 October 1971	Hatched, 15 December, consumed
25 January 1972	Disappeared, 11 March
3 February 1972	Hatched, 29 March, survived 4 hours
1 June 1972	Punctured, 20 June
9 June 1972	Hatched, 2 August, died 18 August

Two eggs probably form a normal clutch. Three hatchings were recorded with incubation periods of 58, 56, and 56 days, respectively. It would appear from data collected that nesting occurs year round, at least in captivity.

Conclusions and Recommendations

1. Provide the raptors with as much seclusion as possible.
2. Do not hesitate to close an exhibit to the public if breeding activity commences.
3. Do not lose patience; the learning process is long, both for the raptors and institutions involved.
4. Formulate a basic philosophy and stick with it. Do not hesitate to consult with those who have been successful, as there is no need to duplicate failures.
5. Consider seriously the size of the nest. Make sure the bottom is covered to prohibit an egg from slipping through.
6. Have fresh nesting material available at *all times.*
7. Record all data carefully as they will be invaluable during the next breeding attempt. Some of the data may be new and unrecorded in the literature.
8. Use a whole-body diet.
9. Be alert for behavioral changes.
10. Perhaps the most important and frequently overlooked factor is the role of the keeper. The project is doomed to failure without a thoroughly dedicated and observant individual. If such a keeper is on the project, do not ignore his advice. Usually it will have some merit as it is at his level that the intimate contact occurs. Therefore, in conclusion I with to acknowledge the assistance of Tom Meacham who, as much as anyone, is responsible for our success.

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