NATURAL BREEDING OF *ACCIPITER FASCIATUS* IN CAPTIVITY

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The Brown Goshawk (*Accipiter fasciatus*) is common and widespread in Australia, including Tasmania. It is also found on New Guinea, Timor, Christmas Island and in Indonesia (Brown and Amadon 1968) but does not occur in Fiji as reported by some (e.g., Slater 1970; Condon 1975 and Morris 1976). Very little has been published on its biology and there are no records of successful captive breeding. Our objective in captive breeding was to supplement studies on wild pairs. In addition, the endemic Christmas Island *A.f. natalis* is considered endangered (Curry-Lindahl 1977), and captive breeding may help ensure its survival.

Methods and Results

Both goshawks used in this study had been taken illegally, as nestlings from the wild, and later were confiscated by the National Parks and Wildlife Service in South Australia. They may have been siblings and neither appeared to have been trained nor tamed.

1975

In their second year they were sent to us in Canberra. The male weighed 390 gms, the female 790 gms. Females usually weigh less than 600 gms; Brown and Amadon (1968) give weights of 436 and 593 gms. The female was relatively tame from the outset and the male was extremely timid. They were housed in a large outdoor cage for 6 months before being placed for the breeding season in a 3 m × 10 m × 2½ m solid brick room with no windows and a cement floor, to try to eliminate disturbance. An exhaust fan kept the air fresh and 8 automatically-controlled fluorescent tubes provided light. Lights were regularly adjusted to switch on 0.5 h. before sunrise and off 0.5 h. after sunset, which simulated the natural photoperiod. An oil-filled electric heater kept the temperature of the chamber approximately the same as outdoor temperature.

Nesting platforms, of wooden frames with chicken wire bottoms, were attached to Eucalypt branches in 2 corners of the room. Food was laboratory rats and mice, day old chicks, beef and fresh road-killed birds, given daily in excess of the birds' wants. Water was provided in a shallow round dish. To reduce disturbance, observations were made

through a peephole and lights were turned off when we entered the pen.

Little overt breeding behaviour was observed. The male appeared very nervous in this environment, although not overly fearful of the female. On several occasions she begged him for food and raised her tail, assuming a copulatory position, but was ignored. No nest building was evident. The Australian Kestrel (*Falco cenchroides*) pair in an identical adjoining pen bred successfully.

1976

Two factors from the breeding season seemed worthy of attention:

1. The 1975 housing may have been lacking in necessary visual stimuli. The pair was moved outdoors to a smaller 3 m × 3 m × 2.5 m wire cage completely lined with hessian stapled to the inside of the wire. A bushy wattle tree (*Acacia* sp.) filled about half of the cage and sand covered the floor. This facility received visual (through hessian) and auditory disturbance from men working within 15 m for short periods daily. Wedge-tailed Eagle (*Aquila audax*) and Whistling Kite (*Haliastur sphenurus*) were visible in adjoining pens. Few precautions were taken to minimize disturbance but the cage was entered only once daily, at about the same time (1:00 p.m.), for feeding.
2. The male appeared very timid and unwilling to feed the female in 1975. In February 1976 he was placed in the cage 1 week before the female with the aim of establishing some territorial priority, or advantage through familiarity with the cage. He was removed in April 1976 to be tamed and trained as in Mavrogordato (1973), and then released outdoors daily for 2 weeks to chase House Sparrow (*Passer domesticus*) before being placed back in the breeding pen. He was noticeably tamer and would often come down immediately to obtain food (similar to that given in 1975) when we left the cage.

Both goshawks developed a strong formic acid-type odor (possibly from anting) that is present in most wild Brown Goshawks but was absent when this pair was housed in the solid brick chamber.

On 14 September the female was heard soliciting the male for food, so a nest tray was placed in the tree with the nest of an Australian Magpie (*Gymnorhina tibicen*) secured inside it. They destroyed this nest and built another in its place. A variety of fresh and dried leaves and twigs was supplied; Ribbon Gum (*Eucalyptus viminalis*) was chosen, almost exclusively, by the goshawks for their nest.

On 5 October the female first showed signs of aggression toward us. On 15 October the first of 3 fertile eggs was laid. All were numbered with a felt pen on the day of laying. Unlike falcon or other accipiter eggs we have seen, hers were very thick, completely opaque and impossible to candle. The female began incubating on 21 October. The male was seen incubating on 6 occasions during the 30-day incubation period. Two eggs pipped but 1 young was eaten during or shortly after hatching; the other survived and was cared for by the parents. The third egg contained a dead, full-term embryo. The female continued to attack us until after the chick was removed about 2 months of age.

1977 and 1978

The pair was kept together in the 1976 breeding pen, and bred again in 1977 and 1978. Breeding occurred earlier (Table 1) possibly because the nest was introduced earlier, or because the pair was older or more experienced. In addition, clutch size increased (Table 1) and all eggs hatched. All chicks survived possibly because food was

provided twice daily during the days when eggs were expected to hatch.

In 1978 the young were removed when 24–28 days old, and the pair relayed 18 days later, fledging a second brood in February.

1979

The pair was moved, in late July, to a new room 3 m × 3 m × 3 m made of asbestos sheeting, with sand on the floor. Most of the ceiling and the upper one-third of 1 wall was covered with 5 cm wide slats placed 5 cm apart. Food and water were given through 2 small doors in 1 wall. A nest tray was nailed to a crossbeam in one corner on 24 August. As they had not finished a nest by 14 October, much later than in previous years, a large eucalypt branch was placed in the cage and the nest secured on it. Their first egg was laid 2 days later (Table 1).

Table 1. Clutch sizes and dates when first eggs were laid and tree and nest tray introduced.

Year	Date of first egg	Clutch size	Dates when tree and nest tray introduced
1975	—	—	both always present
1976	15 October	3	tree present, nest tray introduced 12 Sept 1976
1977	28 September	3	tree present, nest tray introduced 9 Aug 1977
1978	a. 29 September	4	tree present, nest tray introduced 27 Aug 1978
	b. 17 December	3	
1979	16 October	4	nest tray introduced 24 Aug 1979. Tree introduced on 14 Oct 1979

Release of Young

Traditional hack (e.g., Mavrogordato 1973) was used for release. Nestlings and nest were placed in a 2-story tower which had previously been modified into a pigeon loft. The loft afforded a good view of surrounding fields. Swinging bars opened inwards only, and could be raised to release the goshawks. After they had fed on the ledge, at the wire barred entrance to the loft for about ten days, the bars were opened. The nestlings were retrapped for measurement approximately once a week during hack by lowering the bars. All young were banded.

Young continued to return for food for 2 weeks to 2 months. They were secretive and, even though in a suburban setting, were seldom noticed. One band was recovered—a male hit by a car in Brisbane, Queensland, 960 km away, 9 months after release.

Discussion

Aggression

Accipiters have generally proven more difficult to breed in captivity than falcons often because females reject or kill males (Berry 1972, Amadon 1975). Reasons why this was not a problem with our pair may include:

1. The extreme dimorphism in this pair; the male was half the size of the female. Some other highly dimorphic accipiters, for example, *A. nisus*, are more often reported to have bred naturally in captivity (e.g., Hurrel 1973; Herren 1970) than less dimorphic species such as *A. gentilis*. Perhaps very small specimens of male *A. gentilis* paired with large females would be more effective. This may decrease the male's vulnerability to injury from the female by making him less threatening or more agile compared to larger males. D. Fleay (pers. comm.) has bred the Grey Goshawk (*A. novaehollandiae*) in captivity. Their size and dimorphism is equivalent to that of our Brown Goshawks (Brown

and Amadon 1968, give the weight of a male Grey Goshawk as 430 g and 2 females 846 g and 990 g). The natural breeding of *A. gentilis* reported by Belcher (1979) was by a 1358 g European female and a 622 g American male. Berry (1970) had considerable difficulty with aggression between an American female (*A. gentilis*) and a European male that was probably larger than an average-sized American male.

2. This type of aggression may not be as common in the Brown Goshawk, or its absence may be an individual characteristic of this female. The fact that she allowed the male to incubate so often suggests considerable tolerance on her part when compared to some accipiters (e.g., Schnell 1958, Kemp and Kemp 1975); however, incubation by the male is frequent in others (e.g., Tarboton 1978).
3. The male was never introduced into a pen where the female had been resident first. Kent (1970) recommended placing the female into the pen before the male, based on his observations of wild goshawks; however, we have seen no evidence in captive breeding research to recommend this practice.
4. We have no evidence that our female was ever imprinted to man, used for hunting or had ever killed anything as is the case with many other goshawks used for captive breeding (e.g., Berry 1972). The male killed prey readily and showed more interest in food.
5. The pair may have been siblings and were raised and kept together.

Breeding Facilities

A comparison of the 2 outdoor and 1 indoor facilities may suggest some requirements for breeding this species. Various stimuli were present in the outdoor cages, e.g., a bushy tree, other vegetation, rain, sunlight, wind, insects (including ants), and the view from the cage. In addition, the provision of dried and fresh leaves and twigs of *E. viminalis* may have facilitated breeding.

Human disturbance may not be as detrimental to the captive breeding of accipiters as we had earlier thought. Though the facilities used may be unsuitable for other accipiters, they were similar to those used successfully by Hurrel (1973) for European Sparrowhawk (*A. nisus*), and David Fleay (pers. comm.) for Grey Goshawks, both of whom found that these species ignored auditory disturbance. Fleay's Goshawks breed annually in his private zoo though subjected to considerable daily disturbance from hundreds of visitors.

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Figure 1. Adult female Brown Goshawk feeding day old chick.