

SUCCESSFUL CAPTIVE BREEDING OF AMERICAN ROUGH-LEGGED HAWKS

by

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ABSTRACT. Three pairs of American Rough-legged Hawks (*Buteo lagopus*) were placed together at the Macdonald Raptor Research Centre in March 1974. A 16L:8D photoperiod regime was begun in April. The pair with the greatest exposure to outside disturbance and the most equal temperaments laid five fertile eggs over a period of ten days. Copulation was seen 19 times preceding the first oviposition, 15 times between the first and fifth ovipositions, and 27 times following egg-laying. All eggs were artificially incubated at 37.5°C, 50 to 60 percent humidity. Four hatched. The chicks, two of each sex, were hand-raised successfully.

Procedure

On 25 March 1974 three adult pairs of American Rough-legged Hawks (*Buteo lagopus*), all zoo birds originating from northern Canada, were introduced into breeding pens designated G, I, and J. These pens varied only in size, availability of perches, and exposure to the outside. All were constructed of particle board with floors of loose coarse gravel of 1.5 cm pebbles (Fig. 1). Each had an access door from a central hall with an observation port of 10-by-15-cm one-way glass. Mirrors, placed so that the birds could not see themselves, were installed to facilitate observations of the nest platforms. Pens G and I were 6.5x3.5x2.5 m (length x width x height) with an opening approximately 4 m² covered by 2.5 cm galvanized wire grid at one end of the pen. Pen J was twice the width.

A nest platform 2.6x1.8x1.8 m was provided in each pen in a corner opposite the opening and about 1.5 m from the floor. Perches consisted of stumps, stripped fir trees, and logs running the full length of the openings and the nest platforms.

Pens I and J were exposed to a field where eagles were tethered. Pen G faced a kennel of several noisy dogs and a road heavily traveled by pedestrians and vehicles.

With the exception of one melanistic male in pen G, all birds were of the medium phase.

All birds except the females in pens I and J had dispositions similar to wild individuals. The two calmer females had been handled occasionally, but seemed not to be imprinted on humans. The tame females were paired with the wildest males in hopes that the latter would eventually settle down more in captivity. With the exception of the males in pens I and J, which were obtained in the fall of 1973, all birds had been unsuccessfully paired with different mates in 1973. During the nonbreeding seasons of 1973 and 1974, the females and males were held in separate wintering quarters.

Nesting material, provided in fairly copious amounts, consisted of scrub-tree branches and long grasses, both fresh and dry.

A basin of fresh water for bathing and drinking was available to all birds. Food consisted of laboratory rats and six-week-old chickens provided ad lib in hopes that the birds would be stimulated to lay clutches of maximum size (Brown and Amadon 1968). Except during egg-laying, the pairs were disturbed only once a day for feeding, watering, and occasional introduction of nest material. With one exception (to be discussed later) none of the birds were removed from their pens during the breeding season.

Natural daylight was supplemented by artificial lighting to simulate light conditions at 62° north latitude at the same time of year (table 1). Artificial lighting in the pens consisted of one 200-watt incandescent bulb recessed near the middle of the ceiling. The larger pen (J) had two such lights evenly spaced. Dimmers and nightlights were not used.

Because of other commitments, observations were more extensive than intensive. The birds were observed once or twice daily for two- to three-hour periods two days a week during the pre-egg-laying period and five days a week during and after egg laying.

Pre-egg-laying Behavior

Pen G. Breeding activity of the male was first observed on 6 May. Head-bobbing actions and flights back and forth in the pen were frequent. Occasionally the perched male leaned toward the female with wings half-opened or offered a twig broken from the tree. He used either a foot or his beak to offer nest material, but his mate did not respond in either case. Any time she approached him, he became excited. At one point he leaped onto her back as if to copulate, but both fell to the ground.

At this stage both birds made repeated efforts to leap straight up into the air from their perches. Since much of the courtship of this species is aerial (Bent 1937), perhaps these were courtship flight attempts.

On 10 May much nest material had been carried to the nest platform. Only the male was seen active in nest building. The first two copulations occurred on 13 May within 20 minutes of each other.

In most cases, the birds faced the window and copulated on the log perch; only one copulation took place on the tree perch. Just prior to most copulations the male would sidle to and fro on the window log perch. Once the male was seen gently pawing the female's breast before climbing onto the almost horizontal back of the submissive female. In general, the female's tail was raised to the left and the male's tail was lowered to the left. The female held her wings low and bent out; the male flapped for balance. High-pitched squeals were emitted by the male, and as he climbed down a strangled squawk was given by the female. The entire act usually lasted about 8 to 10 seconds.

On 19 May the male leaped onto his mate's back three times before successful copulation took place. Nineteen copulations were observed prior to oviposition. Six incomplete attempts were noted through the season. Copulations occurred at all times of day.

Both birds were generally active after copulation, often flying to each other's side and issuing a variety of calls. Frequently the male uttered whistling noises slurred downward; the female often gave a short-syllabled clucklike "nar-nar" call. A common defensive call used by both sexes was a "kee-eer" with the last syllable slurred downward, similar to that of a Red-tailed Hawk (*Buteo jamaicensis*). Defensive behavior by the male was noted on 23 May when he flew at the observation window. Only once were the birds actively disturbed by the barking dogs outside their pen.

Finally, on 26 May, the female refused to leave an egg-laying posture even upon our entry into the pen. We left quickly.

Pen I. Although this pair failed to breed, behavioral attitudes are of interest. On 7 May upon being approached by the male, the female gaped at him as if in fear or threat. He advanced no closer. The male was extremely active throughout the season, literally running around, arranging twigs in a rather sloppy attempt to build a nest on the ground, and calling as often as 100 times in 42 minutes. His calls varied from soft "mews" increasing to high-pitched whistles slurred downward to a shrill scream.

This male exhibited strong territorial behavior and, on occasion, attacked the keepers. In contrast, the female was docile and paid little attention to the male's activities. The one time she showed brief interest in fresh green grass placed in the pen excited the male greatly.

The male bowed to her several times during the season; she failed to respond. The most puzzling behavior exhibited by the male, however, was what appeared to be a masturbatory act carried out on rat carcasses immediately upon their introduction into the pen as food for the birds. His actions and vocalization were identical to that of the Pen G male during normal copulation. This behavior was observed on many occasions.

With the exception of slight nest construction and pseudoincubation by the female on August 12, no further breeding activities occurred in this pen.

Pen J. The situation in this pen was similar to that in Pen I. An active male built a well-organized nest on the platform. On 2 June he attempted a food transfer to the female without success. On two occasions, 31 May and 15 June, the female was seen on the nest in an incubation posture. She was observed arranging twigs on the nest only once.

At this stage, on 4 June, the females in Pens I and J were interchanged. In Pen I both birds exhibited a gaping response to each other. Then the male chased the female around the pen while uttering "cheep" calls. The female, extremely nervous, chattered back at him. The male and female in Pen J were mutually aggressive on the nest ledge almost immediately upon meeting and chased each other around the pen. The male, normally an extremely shy and excitable bird, attacked the nervous female even in the presence of a keeper. The females were returned to their respective cages within the hour.

From this point on, only the pair in Pen G will be considered in this paper.

Egg-laying Behavior

On 27 May, at 0930 hours, the female, which appeared to be in an incubation posture upon our entry, moved to the tree while we discovered and marked the first egg. Later, with high-pitched cries similar to those made during copulation, the male dropped a rat in front of her on the nest. The female responded with a soft clucking of two syllables.

The second, third, fourth, and fifth eggs were discovered and marked on 29 and 31 May, and on 2 and 5 June, respectively. Copulation was noted fifteen times during the egg-laying period. Much addition and rearrangement of nest material also occurred during this period. As egg laying progressed, the male became more aggressive towards the keepers, attacking in several instances.

Because of inconsistent observation, the actual onset of serious incubation was not determined. The female appeared to settle with great care on the first egg laid. On 29 May, with two eggs laid, she apparently incubated all day. However, on 30 May, with the exception of two sitting periods of 24 and 4 min by the male, very little incubation was noted. The next day the male was observed incubating three eggs for 16 min, now and then emitting a "mewing" call and rearranging nest material. He readily left the nest at the female's arrival. Although the eggs were uncovered at least twice for periods of up to 6 min, it was assumed (on the basis of other observations) that serious incubation had begun with the third egg laid, if not at the beginning of the clutch.

On 10 June in an attempt to "double-clutch" the birds (induce them to lay a second clutch upon removal of the first), all five eggs were taken and placed in an incubator with very little protest from the parents. No more eggs were laid. The failure of recycling may be attributable to the inexperience of the birds or to human interference. However, one must rule out lateness of season, since Bent (1937) noted eggs laid as late as 13 July in Arctic Canada. In our conditions, light was maintained constant and temperatures were still rising in June.

Although the birds copulated again one hour after their eggs were removed, there was a noticeable difference in the behavior associated with the fourteen copulations seen during the post-egg-laying period as compared to the pre-egg-laying period. The birds did not copulate less frequently, but simply did so less enthusiastically. For example, rather than eagerly climbing onto the female's back, the male would slowly position himself for copulation. The calls emitted during the act were not as loud as before. By 21 June the foreplay leading to copulation lessened. In one instance the male attempted copulation with one of his feet on the perch. Previously, introduction of new nest material into the pen would occasionally stimulate the birds to copulate. On two occasions prior to removal of the eggs the birds copulated upon our exit from the pen. After 23 June neither of these factors stimulated the birds. Finally, on 12 July, the male fell off the female while attempting copulation. From then on no breeding activities were observed.

Incubation, Hatching, and Hand-rearing

The color and sizes of Rough-legged Hawk eggs, and the clutch size, were as described by Bent (1937). Only the fifth egg laid in Pen G was paler and smaller than Bent described.

Upon their removal on 10 June the eggs were immediately placed in a forced-air Marsh Farms Roll-X incubator, with an automatic turner cycling every hour and a grid designed for quail eggs. This small grid, used primarily for Kestrel (*Falco sparverius*) eggs, did not turn the larger Rough-legged Hawk eggs. Thus we placed the eggs at a 10° angle on the small end and turned them by hand four times a day. The temperature at the middle height of the eggs was maintained at 37.5°C; humidity was kept at approximately 50-60 percent.

The eggs weighed 51.6, 52.7, 50.2, 49.8, and 44.7 gm (in order of laying) on 29 June. Candling was not feasible because of the thickness and color of the eggshells.

The first four eggs pipped two days prior to hatching. Upon pipping, they were placed in a hatcher, a second Marsh Farms Roll-X incubator with the automatic turner switched off and both grids inverted so that the 0.6 cm mesh was on top. A layer of crinolin was placed over the mesh for sanitary purposes and to prevent the chicks' legs from slipping through the mesh. The temperature was maintained at 37.0°C. The humidity was raised to between 80 and 90 percent to prevent drying of membranes.

The first chick hatched on 5 July, followed by the second and third chicks on 6 July. The fourth chick hatched the next day, and the fifth failed to hatch. Examination of the fifth egg revealed an embryo about 2 cm long. This nearly synchronized hatch seems to point toward a delayed onset of serious incubation as discussed above.

Assuming that incubation began with the first egg laid, the mean incubation period was 37 days. This is much higher than the 28 days reported by Burns (1915) for natural incubation, though Burns does not mention his sample size.

No assistance was given to the pipping chicks. Within 24 hours of hatching each chick was placed for two weeks in a homemade styrofoam brooder with heating tape and a small wire mesh set over a pan of water. During that period, the temperature was decreased gradually from 32.2°C to room temperature. When they were between two and four weeks of age, the birds were kept in a cardboard box lined with excelsior. Between four and five weeks of age, a polyethylene swimming pool 1.3 m in diameter lined with wood shavings, with the sides low enough to allow them to defecate out of the nest, served well.

With the exception of the fourth chick, fed on the second day, all were fed on the first day as soon as their down was dry and fluffy and they could lift their heads. This usually occurred within six hours of hatching. The begging call can be described as a rising, high-pitched whistle. Food for the first two or three days consisted of halves of day-old mice and was offered to them with blunt forceps. Occasionally feeding could be stimulated by an imitation of the whistle call. Afterwards they were fed day-old cockerels (excluding the down and legs) and adult mice (excluding fur) thoroughly mashed in a Waring blender. As the chicks grew older, the food was mashed less and less and more feathers and fur were included. Through ten days of life, the chicks were fed four times a day. From the eleventh day they were fed only three times a day. Young with pin feathers starting to show, at just over three weeks of age (Fig. 2), were feeding themselves on bite-size pieces of adult mice and day-old chicks. At four weeks of age the birds were supporting themselves on their feet rather than on their tarsi. At just over four weeks of age they were given larger chunks of food to tear up twice a day. Three days later the oldest chick frequently left the artificial nest and was soon followed on later dates by its nest mates. At five weeks the birds were tearing up three whole day-old chicks apiece each day. A few days later all the chicks were released into a large pen and given a water bath and low branches on which to climb. By this time each bird was fed three to four chicks or a whole rat daily.

At hatching, the chicks were covered with white down which later was replaced with a buffy white down. One exception was the third oldest chick whose second down was dark grey. The oldest chick was a medium-phase female, the second a melanistic male (Fig. 3), the third a medium-phase female, and the youngest a medium-phase male. Their weights during the hand-rearing period are shown in figure 4. The only difficulty encountered in hand-rearing the young was between 2½ and 3½ weeks of age. They all contracted rhinitis, commonly referred to as "the snurts." This condition was due to exposure to rather cold nights with possible drafts. The symptoms included aphagia, excessive sneezing, and crusty deposits about their nares. We cured them by placing them in a room kept at around 22°C and giving them 2 ml oral doses of 4.59 percent nitrofurazone twice daily for about three days, followed by gradually decreasing doses. We have since learned that nitrofurazone might cause sterility (Cooper pers. comm.) and therefore advise against its use.

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Table 1.
Photoperiod Schedule Used on
American Rough-legged Hawks in 1973 and 1974.

	<u>Date</u>	<u>Photoperiod</u>	
1973	Jan. 1	natural daylight	
	Apr. 1	16 L:8D	no twilight
	Sept. 1	natural daylight	
1974	Mar. 25	13L:11D	no dawn; no twilight
	Mar. 27	13½L:10½D	no dawn; no twilight
	Mar. 30	14L:10D	no dawn; no twilight
	Apr. 1	14½L:9½D	no dawn; no twilight
	Apr. 9	15L:9D	no dawn; no twilight
	Apr. 15	15½L:8½D	no dawn; no twilight
	Apr. 30	16L:8D	no dawn
	Sept. 6	natural daylight	

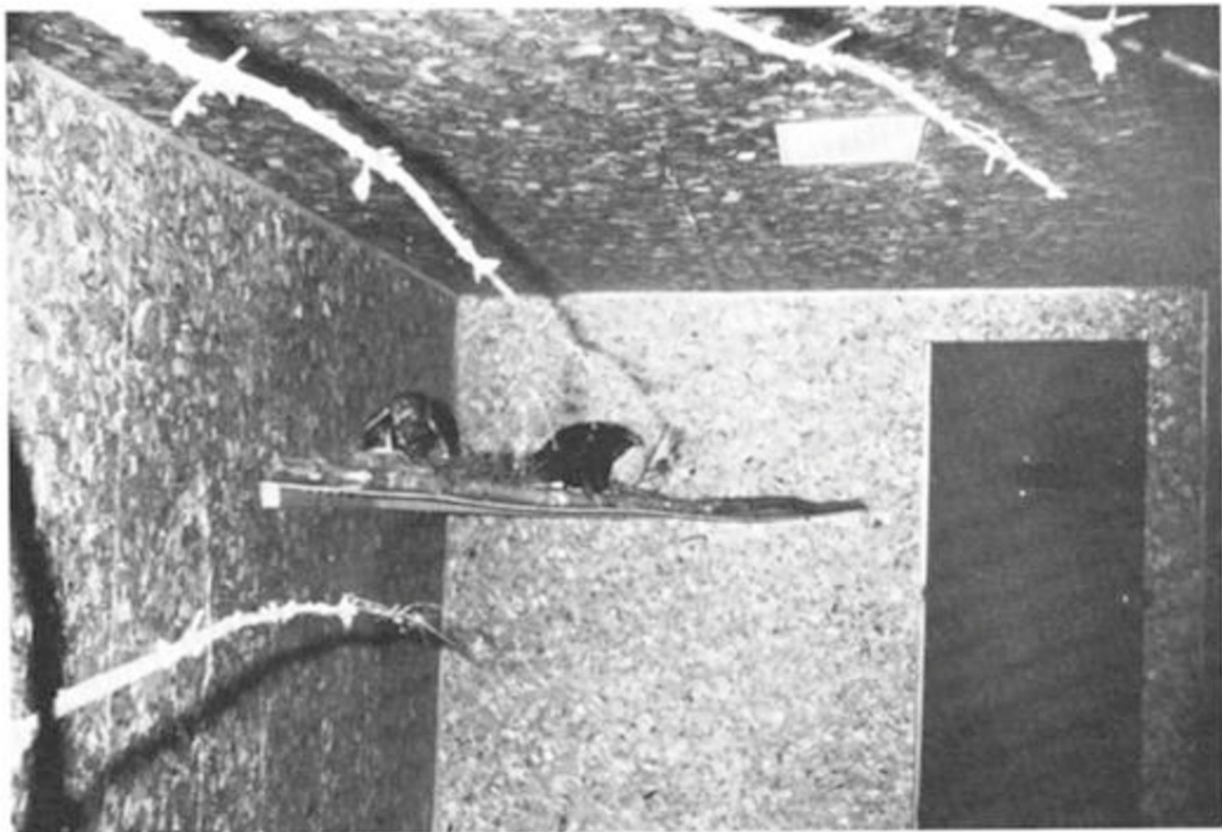


Figure 1. The light-phased female settles upon her eggs as her melanistic mate stands guard in Pen G.



Figure 2. Three-week-old Rough-legged Hawk losing second coat of down as feathers push out of their sheaths.



Figure 3. On the left is shown the fledged melanistic male Rough-legged Hawk and on the right, one of the two medium-phase females.

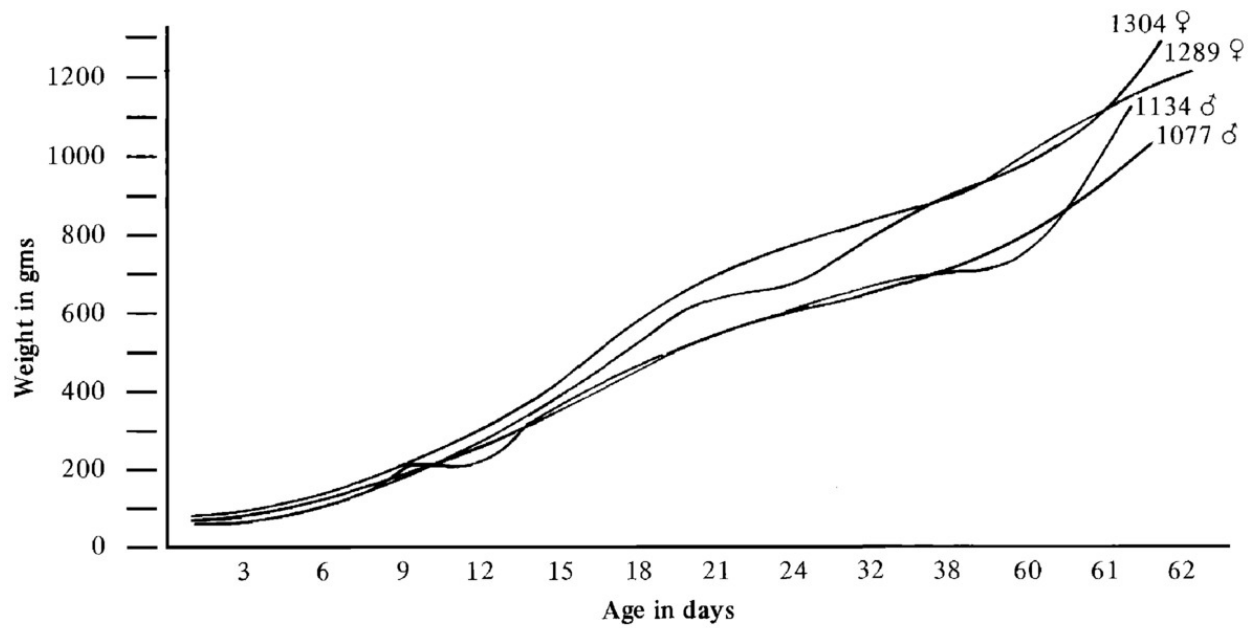


Figure 4. Graph of growth weights of the four Rough-legged Hawk chicks. Note the leveling-off of all curves at 2½ weeks of age when the chicks contracted rhinitis.



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