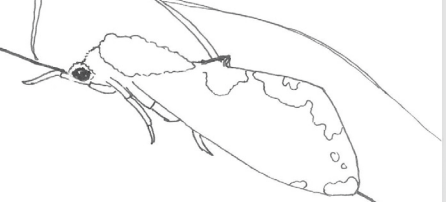
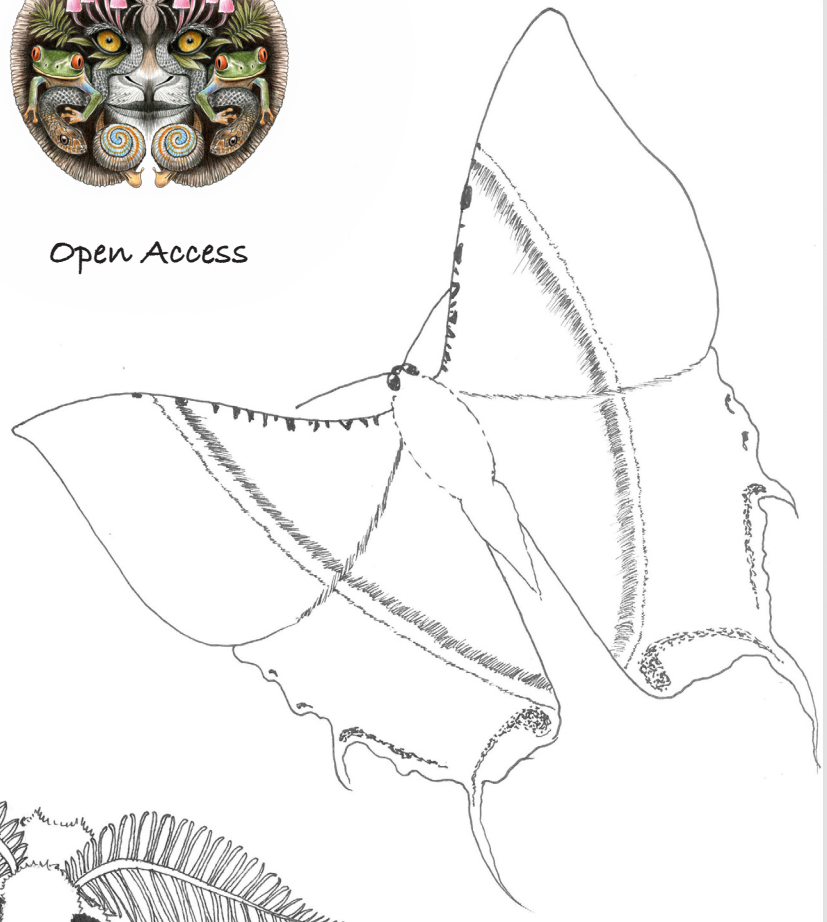
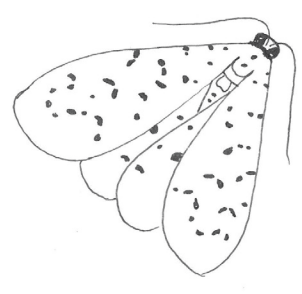


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Cover: Celebrating the unsung heroes—moths, our nocturnal pollinators. © Priyanka Iyer.



Breeding of Himalayan Vulture *Gyps himalayensis* Hume, 1869 (Aves: Accipitriformes: Accipitridae) in the Assam State Zoo, Guwahati, Assam, India

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Abstract: Himalayan Vulture *Gyps himalayensis* has been bred successfully at the Assam State Zoo, Guwahati in 2022. This is the first record of captive breeding of the species in India. The adults were kept in a display aviary in the Zoo where they constructed a nest on ground and laid an egg. The nestling was hand reared in temperature and humidity-controlled boxes and air-conditioned room. It was fed on goat meat and bone pieces and the consumption records maintained. The records of weight gain and body growth were maintained. It took about five months to fledge out.

Keywords: Captive breeding, food consumption, hand rearing, high altitude species, vulture nestling, weight gain.

Himalayan Vulture *Gyps himalayensis* is the largest vulture among the old-world vultures. Its distribution covers a wide range that includes the countries Afghanistan, Bhutan, China, India, Kazakhstan, Kyrgyzstan, Mongolia, Nepal, Pakistan, Tajikistan, and Uzbekistan. In India, this species breeds in the Himalaya and in winter the immature population visits the plains (Ali & Ripley 1983). The species is categorised as 'Near Threatened' considering that about 66,000–334,000 individuals exist in the wild (Botha et al. 2017). The

species is a common winter visitor to plains of India that includes Assam. This migration is done only by the immature birds in winter while the adults remain in the breeding ground. The Himalayan Vultures feed on livestock carcasses along with the local resident *Gyps* vultures – the White-rumped Vulture *Gyps bengalensis* and the Slender-billed Vulture *Gyps tenuirostris*. Their feeding habit makes them vulnerable to the unintentional poisoning (Botha et al. 2017). As the feral dogs attack the livestock, in retaliation, the poison baits are used by the cattle owners to kill the dogs and wild carnivores. The vultures get attracted towards these poisoned baits and feed on them. The victimized vultures in such incidences were rescued and saved by the team of the Bombay Natural History Society and Forest Department in Assam. The Himalayan Vultures saved from such incidences in 2011–12 were kept in the display of the Assam State Zoo and Botanical Park at Guwahati.

Housing and diet in the Zoo

Ten Himalayan vultures were kept for display in a 40 x 30 ft aviary, covered with galvanized mesh. The

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vultures were provided with meat daily. Water trough and perches were provided for vultures. The vultures took more than five years to mature and one pair was formed in the flock. The mating pair did not prefer the nest ledge that was provided to them. Instead, they constructed a nest in a secluded corner of aviary on ground when pine twigs were made available to the pair during the months of December and January. In the first two years (2019–20), the parents failed to construct a nest and incubate the egg, and the egg perished. In 2021, a hatching problem was noted when the chick was stuck at the piping stage. It is the stage at which the developed embryo breaks the shell with an egg-tooth on its upper mandible and try to come out. The hatchling was rescued that survived for six days but died due to unknown reason. The systematic post-mortem could not provide any clue and tests for bacteriology and virology were negative. In 2022, the successful hatching was noted on 14 March and the nestling was shifted to the artificial brooding facility on 15 March.

Housing for nestling

During first month, the nestling was kept in the brooder made up of a plastic box (1 x 1 x ½ ft) with a mat for the grip. The temperature was maintained around 30–35° C with a lamp, a water bowl and it was monitored with a thermo-hygrometer. The nestling was provided with sufficient space to move towards and away from the heat source.

As the nestling grew up in size during the second, third and the fourth months, the nestling was transferred to larger boxes successively. The room temperature and humidity were maintained with air conditioner and de-humidifiers.

During the fifth and the sixth month, the nestling was kept in a temperature and humidity-controlled room, on an artificial nest. The nest consisted of a layer of leaves that would soak up excreta. Perches were provided on all four sides that not only avoided the accidental fall of the nestling but also encouraged the nestling to perch on it.

Food for nestling

The nestling started to feed from the second day after hatching (16 March 2022). The nestling was fed with very small pieces of goat meat in the first week and the food quantity was increased as the days passed. From seventh day onwards, the nestling was fed on pieces of ribs as Calcium supplement. From one month onwards, the nestling was provided with goat tail that contained bones. In addition, the nestling was fed with small pieces

of muscles, liver and skin. In the beginning, the nestling digested the bones pieces completely but on day 138, it regurgitated bone pieces and hairs in casts for the first time. Taking it as a cue, the daily feeding of additional bone piece was stopped though the goat tail was fed till end of the sixth month.

Frequency of feed

In the first month, feeding was carried out six times a day, from second to fifth month, feeding was done four times a day while in the sixth month it was twice a day. The average fortnightly food consumed by the nestling is represented in the graph. The graph shows steep hike in food consumption in first three months—April, May, and June. After that the graph rises gradually, forming a plateau from September onwards. As the bird had fledged out in mid-August, by that time it was almost completely developed. In the next couple of months, only the primaries and tail grew up to the fullest. It could be the reason of decreased appetite of the fledgling in October, but it resumed again once the energy consuming flight exercise was added to the daily routine (Figure 1).

Growth of nestling

The weight of the nestling was recorded with a digital weighing balance. The nestling growth took place somewhat exponentially till it fledged out in August. Afterward, the bird gained weight gradually in next two months and stabilized at 7 kg. In nature, the juveniles of Himalayan Vulture migrate to plains in November and must be evolutionary programmed to gain weight as the energy reserve for the purpose (Figure 2). The periodic photographic record was maintained to understand the development of the plumage (Image 1–6).

A few important physical and behavioural milestones achieved during the nestling phase:

Day	Important event
0	Successful hatching took place on 14 March 2022
2	The nestling opened its eyes fully
5	The nestling showed first attempt to preen itself
8	It quivered the wings to grab attention for feeding
10	The nestling was able to feed itself from a bowl. Its downy coat became dense
19	Its claws began to harden
50	Interscapular, humeral and wing coverts started to appear as the brush
90	Primaries started to appear as the brush
107	It showed reaction to its own image by hissing at it
111	The nestling opened its wing for sunning
120	The nestling was introduced to ground with grass for half an hour.
150	Primaries developed completely, though tail was a bit short

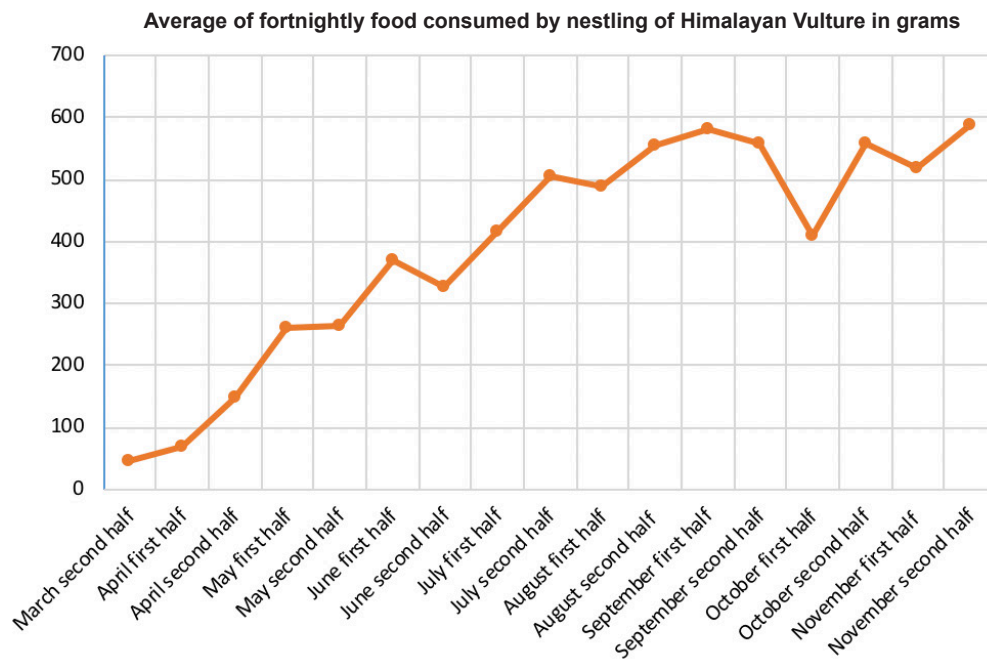


Figure 1. Average fortnightly food consumed by the hand reared nestling of Himalayan Vulture at Assam, India 2022.

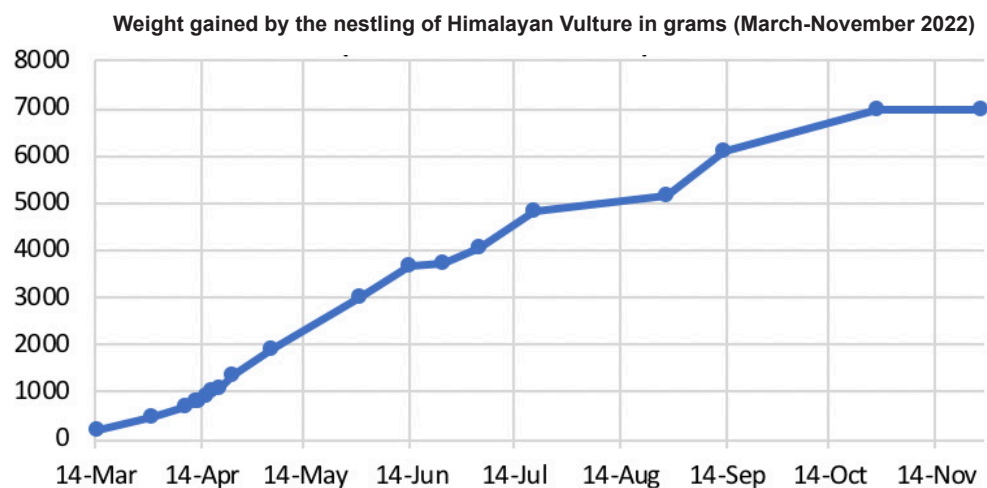


Figure 2. Weight gained by the nestling of Himalayan Vulture.

Colouration of nestling

In the first week, the skin around the eyes of the nestling was grey coloured. The skin around tail portion was also grey in colour. The cere and legs of the nestling were pink while rest of its body was covered in whitish downy. Till one and a half month, the nestling appeared whitish after which the coverts grew very fast. The coverts were chocolate brown coloured with an off-white streak along the rachis. The primary and secondary outer coverts on wings had an off-white blotch at terminal position. The overall body

of the nestling started to appear chocolate brown in colour which is a typical coloration of the juvenile. The primaries grew up by the end of fifth month (Image 1–6). The morphometric records were taken on the day 160, when the bird attempted to leave the nest-ledge and jumped out. The morphometrics recorded were as follows: beak 50 mm, cere 30 mm (depth 32 mm), tarsus 120 mm (width of tarsus 14 mm and height of tarsus 17 mm), wing cord 680 mm and tail 380 mm. Even after the event of jumping out of the nest-ledge, the fledgling continued to stay on the nest or remained nearby the



Image 1. Nestling with white downy coat in first week (Day 6)



Image 2. The coverts started to appear as brownish colored brush tips among the thick downy feathers (Day 67).



Image 3. Coverts growing on interscapular tract, humeral tract and wings (Day 82).



Image 4. Well developed coverts, while the primaries and tail begun to grow (Day 130).



Image 5. Fledgling in the nest with well-developed coverts and primaries.



Image 6. The juvenile Himalayan Vulture (Day 293).

nest in temperature-controlled room. The nestling was kept in the natural environment in an aviary from day 190 onwards.

DISCUSSION

The Himalayan Vulture is a common winter migrant in Indian plains and resident of the high Himalayas, yet never kept in any zoo for breeding purpose. The Assam State Zoo has a record of keeping a few Himalayan Vultures for display, although all the birds were rescued ones. Till the end of 20th Century, vultures were quite a common sight in the wilderness and very few of them were appreciated, kept in zoos and bred in captivity. Schlee (1989) recorded the first successful breeding of the Himalayan Vulture in the menagerie in Paris. A few more examples of vulture species being hand-reared are Ruppell's Griffon Vulture *Gyps rueppelli* (Schlee 1998), breeding of White-rumped Vulture *Gyps bengalensis* (Sarker & Iqbal 1997), husbandry of Cinereous Vulture *Aegypius monachus* in the North American Zoos (Diebold & White 1989), captive breeding of Lappet-faced Vulture *Torgos tracheliotus* (Mendelssohn & Marder 1983; Beall 1992), breeding of Eurasian Griffon *Gyps fulvus* (Gardener 1980), breeding of Bearded Vulture *Gypaetus barbatus* (Zwart et al. 1991) and rearing of Andean Condor *Vultur gryphus*, and King Vulture *Sarcoramphus papa* (Zwart & Louwman 1978). In India, the Bombay Natural History Society has bred the three species of vultures- White-rumped Vulture *Gyps bengalensis*, Indian Vulture *Gyps indicus* and Slender-billed Vulture *Gyps tenuirostris* in captivity for the conservation and reintroduction purpose (Bowden et al 2012)

The Himalayan Vulture being a high-altitude bird, it is not usual for the species to breed in the low land with tropical and humid climate. Yet, like many mammals and birds, the species acclimatized and managed to breed (Lague 2017).

REFERENCES

- Ali, S. & S.D. Ripley (1983). *Handbook of the birds of India and Pakistan together with those of Bangladesh, Nepal, Bhutan and Sri Lanka*. Compact ed. Oxford University Press, Delhi, xlii+737 pp.
- Beall, F.B.C. (1992). A successful hatching and rearing of the Lappet-faced Vulture (*Torgos tracheliotus*) at the Baltimore Zoo. AAZPA Regional Conference Proceedings 53–58
- Botha, A.J., J. Andevski, C.G.R. Bowden, M. Gudka, R.J. Safford, J. Tavares & N.P. Williams (2017). Multi-species Action Plan to Conserve African-Eurasian Vultures. CMS Raptors MOU Technical Publication No. 4, CMS Technical Series No. 33, Coordinating Unit of the CMS Raptors MOU, Abu Dhabi, United Arab Emirates.
- Bowden, C.G.R., V. Prakash, S. Ranade, A. Routh, R.D. Jakati, R.J. Cuthbert, A.R. Rahmani, R.E. Green, N. Prakash & J. Parry-Jones (2012). Conservation breeding for the future release of the Critically Endangered Asian *Gyps* vultures – progress of the programme in South Asia and why it is so important. *Journal of the Bombay Natural History Society* 109(1 & 2): 43–45
- Diebold, E.N. & E.S. White (1989). The husbandry of the Cinereous Vulture (*Aegypius monachus*) in North American Zoos. American Association of Zoological Parks and Aquariums (AAZPA) Regional Conference Proceedings, 651–661 pp. <https://eurekamag.com/research/021/939/021939305.php>
- Gardener, A. (1980). Breeding the Griffon Vulture *Gyps fulvus*. *The Journal of the Avicultural Society* 86(1): 61–66.
- Lague, S.L. (2017). High-altitude champions: birds that live and migrate at altitude. *Journal of Applied Physiology* 123: 942–950
- Mendelssohn, H. & U. Marder (1983). Hand-rearing Israel's Lappet-faced Vulture for future captive breeding (*Torgos tracheliotus negevensis*). *International Zoo Yearbook* 23(i): 47–51.
- Sarker, S.U. & M. Iqbal (1997). Hatching and rearing of Indian White-backed vulture *Gyps bengalensis* in captivity. *Vulture News* 37: 21–27
- Schlee, M.A. (1989). Breeding the Himalayan Griffon *Gyps himalayensis* at the Paris Menagerie. *International Zoo Yearbook* 28: 234–240
- Schlee, M.A. (1998). Hand-rearing Ruppell's Griffon Vulture *Gyps rueppellii* at Paris Menagerie, Milwaukee County Zoo and Burger's Zoo, Arnhem. *International Zoo Yearbook* 36: 179–194
- Zwart, P. & J.W.W. Louwman (1978). Feeding a hand-reared Andean Condor and King Vulture *Vultur gryphus* and *Sarcoramphus papa* at Wassenaar Zoo. *International Zoo Yearbook* 20: 276–277.
- Zwart, P., M.H. Van der Hage, F.J.M. van Rest & J.W.W. Louwman (1991). Hand raising a Bearded Vulture (*Gypaetus barbatus*) with the Aid of a Commercial Cat-food. *Der Zoologische Garten* 61(3): 149–156.



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