

Monitored release of captive-born Binturongs *Arctictis binturong* in the southern Cardamom Mountains, Cambodia

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Abstract

Two unrelated Binturongs *Arctictis binturong*, born at Phnom Tamao Wildlife Rescue Centre near Cambodia's capital city Phnom Penh, were taken to a release enclosure near the village of Chi Phat in the southern Cardamom Mountains, southwest Cambodia, in March 2010. They were kept in the enclosure, within forest, for one year to allow time to acclimate. In June 2010 a single cub was born; six months later a further two were born. The adults were fitted with radio collars so that post-release movements could be monitored. The release door was opened, giving all the Binturongs access to the forest, at the season of peak fruiting; the second litter was then three weeks old. The adult male and the older cub left the enclosure that night, but remained close by the following morning. The female was inside or near the release cage for the next two weeks, after which she disappeared with her young cubs. Waypoint transmission from the female's radio collar, which dropped off prematurely, was erratic. The male's collar functioned better but also dropped off before programmed to do so. The male stayed within about 1½ km of the release site. The female stayed closer. Camera-traps around the enclosure, where supplementary food remained available, showed that all five Binturongs survived more than two years after release and by late in this period were coming only erratically for food.

Keywords: camera-trapping, captive breeding, rehabilitation, soft release

ការដោះលែងសត្វឈ្លូសប្រេង *Arctictis binturong* ដែលកើតពេលចិញ្ចឹមដោយមានការតាមដានត្រួតពិនិត្យនៅតំបន់ជួរភ្នំក្រវាញភាគខាងត្បូងនៃប្រទេសកម្ពុជា

សង្ខេប:

កាលពីខែមីនាឆ្នាំ២០១០កន្លងទៅ ឈ្លូសប្រេង *Arctictis binturong* ចំនួនពីរក្បាលដែលបានចាប់កំណើតនៅមណ្ឌលសង្គ្រោះសត្វព្រៃភ្នំតាម៉ៅស្ថិតនៅជិតរាជធានីភ្នំពេញនៃប្រទេសកម្ពុជានោះ ត្រូវបានយកទៅដោះលែងនៅ តំបន់ហ៊ុមព័ទ្ធក្បាលជិតភ្នំក្រវាញភាគខាងត្បូងផ្នែកនិរតីនៃប្រទេសកម្ពុជា។ ឈ្លូសប្រេងទាំងពីរត្រូវបានរក្សាទុកនៅតំបន់ហ៊ុមព័ទ្ធក្នុងព្រៃនោះអស់រយៈពេលមួយឆ្នាំដើម្បីទុកពេលឲ្យពួកគេអាចបន្ស៊ាំទៅនឹងអាកាសធាតុនៅទីនោះ។ នៅខែមិថុនាឆ្នាំ២០១០ ពួកគេបានបង្កើតកូនចំនួនមួយក្បាល ហើយខែក្រោយពួកគេក៏បានបង្កើតកូនចំនួនពីរក្បាលថែមទៀត។ ឈ្លូសប្រេងទាំងពីរក្បាលត្រូវបានបំពាក់វិទ្យុតាមដាននៅនឹងក្បាលរបស់ពួកគេ ដូច្នោះសកម្មភាពក្រោយការដោះលែងរបស់ពួកគេត្រូវបានគ្រប់គ្រង។ ទ្វារសម្រាប់ដោះលែងត្រូវបានបើកចំហ ដើម្បីផ្តល់ឱកាសឲ្យសត្វឈ្លូសប្រេងទាំងអស់ចូលទៅរស់នៅក្នុងព្រៃនាវេសន៍សម្បូរផ្លែឈើ ស្របពេលដែលកូនលើកទីពីរបស់ពួកគេអាចរក្សាបានពីរសប្តាហ៍ទៅហើយ។ ឈ្លូសប្រេងឈ្លាន និងកូនដប្បងរបស់គេបានចាកចេញពីតំបន់ហ៊ុមព័ទ្ធនៅពេលយប់ ប៉ុន្តែនៅតែមានវត្តមាននៅជិតតំបន់នោះនាព្រឹក បន្ទាប់ពីចំណែកឯមេរបស់ពួកគេវិញ គឺស្ថិតក្នុងឬក្បែរទ្រុងដោះលែងអស់រយៈពេលពីរសប្តាហ៍ បន្ទាប់ពីពេលនោះមក នាងបានទៅបាក់ជាមួយនឹងកូនដែលទើបនឹងកើត។ ការបញ្ជូនចំណុចនិយាមភាពពីឧបករណ៍តាមដានពាក់ជាប់នឹងក្បាលប្រេងឈ្លូសដែលបានជ្រុះបាត់មុនកាលកំណត់នោះគឺមានភាពមិនប្រាកដ។ វិធានការណ៍តាមដានពាក់ជាប់នឹងក្បាលប្រេងឈ្លូសប្រេងឈ្លានដំណើរការ ល្អប្រសើរជាង ប៉ុន្តែក៏បានជ្រុះបាត់មុនពេលដោះលែងសត្វឈ្លូសប្រេងឈ្លានស្ថិតនៅ ចម្ងាយប្រមាណជា ១,៥ គីឡូម៉ែត្រ ពីតំបន់ដែលត្រូវបានដោះលែង។ ចំណែកឈ្លូសប្រេងឈ្លានស្ថិត នៅជិតជាងអាណ្លាល។ ការមើលរកស្វ័យប្រវត្តិនៅជុំវិញតំបន់ហ៊ុមព័ទ្ធជិតកន្លែងអាហារបន្ថែមសម្រាប់ ពួកគេបានបង្ហាញថា ឈ្លូសប្រេងទាំងប្រាំក្បាលបានរស់នៅក្នុងព្រៃនេះលើសពីពីរឆ្នាំ បន្ទាប់ពីពួកគេត្រូវបានដោះលែង។

Background

Binturong *Arctictis binturong* is the largest member of the civet family (Viverridae), weighing up to 20 kg. It feeds chiefly on fruit, although it will take birds' eggs and a variety of animals. Its mostly nocturnal and arboreal habits hinder its study; little is known about its wild abundance or behaviour (IUCN 2013). In South-east Asia, many wild mammals have a commercial value, as food, medicine or pets, and are heavily hunted. Despite increasing enforcement efforts, few Binturongs have been confiscated from hunters or wildlife traders within Cambodia over

recent years (authors' own data), suggesting that the species may now be rare in the country (it is implausible that there is insufficient demand for them to enter the trade). Binturong has declined sharply in much of its range and is now classed as Vulnerable on *The IUCN Red List of Threatened Species* (IUCN 2013).

Location

A mosaic of grassland and forest about 8 km from the village of Chi Phat in the province of Koh Kong, on the edge of the southern Cardamom Mountains, southwest Cambodia, was se-

lected for The Wildlife Alliance Wildlife Rehabilitation Station. A stream flows throughout the year within the forest 200 m to the north of camp. The site, at about 11°22'N, 103°29'E and about 23 m asl, was selected after surveys in several Cambodian forests assessed their suitability as release areas for wild animals. The need for remoteness had to be balanced with accessibility. Suitability of habitat and availability of permanent water were also considered.

Before Wildlife Alliance's involvement in Chi Phat, illegal hunting and logging were major village activities. This previous heavy hunting means that the area's wildlife populations are currently low, as evinced by villagers' reports and the authors' personal experience. This area is within many hundred km² of evergreen lowland forest. Wildlife Alliance has six police patrol stations, manned by Cambodian military police and Forestry Administration officials. One patrol station, Stung Proat, lies around 7 km from the rehabilitation station. Teams of community rangers from Chi Phat also patrol the forest for wildlife crime. This protection, coupled with the hunting-induced low density of wild populations of most species of larger mammals, renders the area suitable for rehabilitation and release of rescued wildlife. Few if any large predators remain.

The rehabilitation station is too new to have reached its full potential. So far the only mammals besides Binturongs (see below) to have been released there are Long-tailed Macaques *Macaca fascicularis*, Bengal Slow Lorises *Nycticebus bengalensis* and East Asian Porcupines *Hystrix brachyura*. Birds released here include hand-raised parakeets *Psittacula* and Hill Mynas *Gracula religiosa*. Three keepers maintain the camp and care for the animals. Their constant presence ensures the safety of the area. Hunting-reduced wildlife populations seem to be rebounding. Sambar *Cervus unicolor*, Red Muntjac *Muntiacus muntjak*, chevrotain *Tragulus*, wild pig *Sus*, Common Palm Civet *Paradoxurus hermaphroditus*, Small Indian Civet *Viverricula indica*, Large-spotted Civet *Viverra megaspila*, ferret badger *Melogale*, Leopard Cat *Prionailurus bengalensis*, East Asian Porcupine, Long-tailed Macaque and Pileated Gibbon *Hylobates pileatus* are seen regularly, whilst bird populations are apparently increasing. Local villagers say that Binturongs are presently rare in the area, presumably because of the former heavy hunting. A high density of fruiting trees suggests the area is good habitat for Binturongs and other animals relying largely on fruit, such as other civets, gibbons and macaques.

Narrative

As of late 2013, five pairs of Binturongs are held at the Phnom Tamao Wildlife Rescue Centre, set in 23 km² of regenerating forest 40 km south of Phnom Penh. The founders of this population were confiscated from the illegal wildlife trade. Most of the original pairs have now produced young, some of which have also been paired. A pair of unrelated Binturongs born to confiscated animals was selected for release. They were isolated, checked for condition, and moved to a rehabilitation enclosure closed to visitors. Most wild animal diseases can currently not be checked at veterinary laboratories in Cambodia, although TB was tested for. Blood readings came back within normal parameters for Binturongs. Moreover, the pair remained healthy for over a year isolated in their rehabilitation enclosure. Animals were treated for internal and external

parasites, using Ivermectin and Frontline, before release. During this time they were fed once per day, in the late afternoon, with market-purchased fruit, including banana and papaya, two duck eggs and a small amount of meat or fish. The 30 × 30 m enclosure, built using steel uprights and chain link fencing, was open-topped so that the Binturongs could climb in the tall trees growing inside. Metal sheeting around the top of the fencing prevented escape. The substrate is soil with grasses and other wild plants. Once in this enclosure, the Binturongs quickly reverted to apparently natural behaviour, generally shunning the nest boxes provided and sleeping in the tree tops, even during heavy rain storms.

A 10 × 8 × 4 m release enclosure was erected in forest at the Wildlife Rehabilitation Station for the Binturongs, around 100 meters from camp. The enclosure was well branched out and contained a small pool for drinking and, if wanted, bathing. Two blue plastic barrels, or potential nest boxes, were tied to the higher branches. On 2 February 2010 the Binturongs were transported from Phnom Penh to Chi Phat and then by ox cart to the rehabilitation station, which is not accessible by truck. The pair settled into their new environment well, evidently adapting quickly to the change of climate and surroundings. Phnom Tamao Wildlife Rescue Centre has a long extremely hot dry season, whereas temperatures are lower in the southern Cardamoms, where it rains for nine months of the year. In this forest enclosure the Binturongs became more wary although they remained unafraid of their keepers, who brought their food (bananas, papaya, other fruit and duck eggs) each evening. Wild fruit from the forest was provided when readily available.

The release for the Binturongs was scheduled to allow a long acclimation to the new area and climate, and for forest fruiting to peak (March–April, around Chi Phat; pers. obs.). On 3 June 2010, four months after their move, a faint mewling heard from one of the blue plastic barrels that served as nesting boxes indicated that a cub had been born. Keepers then minimised all involvement, with entry into the enclosure restricted to feeding purposes, for around six weeks – best practice for most captive births of wild animals (personal experience). Once the cub was seen outside its barrel, it was considered to be past the danger stage (many wild animals will either reject or kill their offspring if they feel the young are in danger or are interfered with), so cage cleaning resumed.

In preparation for a March release, the adults were sedated using Xylazine and Ketamine and fitted with Tellus 1C radio collars purchased from Followit, Lindesberg, Sweden, on 6 February 2011. Each collar weighed 240 grams. VHF frequencies for the collars were 150.000 and 150.020 MHz. Although the collars looked uncomfortable for the Binturongs, the animals made no obvious attempt to rid themselves of the collars. The collars had a VHF option that allowed manual tracking; GPS waypoints were also transmitted via satellite and downloaded by email, which enabled the animals to be located if the VHF signal was lost. Both collars had been programmed to remain on the animals for six months, although both dropped off somewhat prematurely.

Just when the release was being considered, two more cubs were born to the pair, on 14 February 2011. Were release to be delayed until these cubs were moving around independently, the prime fruiting period would be missed. Experience

with Leopard Cats *Prionailurus bengalensis* (Marx 2008) indicated that a recent birth need not complicate the release of wild animals: it may even stabilise the adults and make it easier to monitor the released animals. A female may be unwilling to move far from dependant young until they are older and mobile. This approach entails minimisation of all disturbance, and provision of food for the released animals while they learn a new area. Thus, the release was not delayed.

On the evening of 7 March a slide door was permanently opened to allow the Binturongs to leave the enclosure and to return at will. Supplementary food was provided each evening following release at two points, both around six feet from the ground: one at the entrance to the enclosure, the other a feeding platform inside the cage. After trade-confiscated Long-tailed Macaques also released at the rehabilitation station began taking the Binturong food, the latter was put out after dark. Common Palm Civets and ferret badgers have been photographed coming to feed when Binturongs are absent. The food is also eaten the following day by the macaques and by Variable Squirrels *Callosciurus finlaysonii* and chevrotains.

Radio-collar monitoring was supplemented by two other sources of records: direct sightings of the adults and older cub waiting at dusk in the trees for the supplementary food (Fig. 1); and photographs from single camera-traps placed inside the enclosure and at the two supplementary feeding sites. This camera-trapping is ongoing, supplemented by information from other camera-traps placed elsewhere around the rehabilitation station (for other wild animals).

Observations

On 8 March 2011, the morning following release, the male and the oldest cub were outside but close to the enclosure. The female was inside the nest barrel with the new cubs. The following days the male Binturong moved further afield, identified from waypoints and manual tracking conducted each day at this stage. The adults came to the supplementary feeding sites periodically, although not daily: they must have started



Fig. 1. Released captive-bred adult Binturong *Arctictis binturong* waiting in trees near release-cage, waiting for food to be provisioned (predictable time and place), Chi Phat Wildlife Rehabilitation Station, southwest Cambodia.

taking significant quantities of natural food soon after release. The Binturongs were camera-trapped regularly at the feeding sites, but as of late 2013 had never been photographed by the camera-traps placed elsewhere. Both adults wore collars and looked very similar, hindering differentiation on camera-trap photographs. The older cub was recorded only when it came to the supplementary food: its size and the absence of a radio collar allowed easy distinction from the adults.

The female remained in or near the enclosure for around three weeks post-release, tending to her second litter. These were too young to eat solid food and could not have survived without their mother and good shelter from the wet season's daily torrential downpours. On 23 March 2011, the female left the vicinity of the enclosure and the two cubs were no longer in the nest barrel. The adults' collars were delivering GPS waypoints indicating their movements (Fig. 2). The female's collar was less reliable than the male's and often late in giving her position: it stopped delivering GPS waypoints on 1 April, although manual tracking could still be conducted. It dropped off (before programmed to do so) around 25 May 2011 and was never found. Following this, the only method of monitoring her was if she came to the supplementary food: and the loss of collar ensured easy distinction from the male on camera-trap photos. She had moved largely to the north and east, always within the forest, but remained close to the release enclosure, probably to care for her cubs. However, readings were few because of the collar's unreliability.

The male's collar functioned better. In March he moved west and the south of the release enclosure, but returned to feed regularly. In April he changed direction and explored also to the north. Over time he moved somewhat over 1 km in every direction from the release enclosure; the forest seems uniform throughout this area. The collar gave its last waypoint on 8 May 2011 and was recovered on 12 June, having dropped off. He had visited and crossed a small stream to the north of camp. Both Binturongs were always located in forest habitat when tracked using VHF, but might have crossed grassland to enter some areas of forest.

For seven weeks following release it was uncertain whether any cubs survived, but the two adults were camera-trapped



Fig. 2. Waypoints from GPS collars attached to two captive-bred adult Binturongs *Arctictis binturong* (one male, one female) released in the southern Cardamom Mountains, Cambodia. The darker areas are tall forest, the plainer, paler, areas a mosaic of grass, scrub and non-woody cultivation.

regularly at the two feeding sites, both now positioned outside the release enclosure, one 2 m away, the other 20 m away. The camera-traps had been moved so that each focused on a feeding platform.

On 10 May 2011, nearly seven weeks after the new litter had disappeared from the nest box, the female and two younger cubs were camera-trapped at a feeding site (Fig. 3). They were then photographed regularly. The oldest cub, forced to survive independent of the mother since the arrival of the second litter, was first positively identified on camera-trap in late June 2011. Following this, if close to the feeding site when food was being put down in the evenings, it would sometimes take food from the keepers' hands (Fig. 4).

The Binturongs' visits to the feeding sites decreased gradually over time. The most significant change took place on the morning of 14 February 2012. The adult female was found once again in the nest barrel inside the release enclosure. A faint mewling indicated that she was not alone. The female and new-born cub disappeared about a week later. The new cub was first camera-trapped just over five weeks later, on 23 March 2012. Following this, both mother and new cub appeared at the feeding sites regularly (Fig. 5).

By September 2013, animals came to the supplementary food on only around half the nights. By then, the original five animals were harder to distinguish, but all seemed still to be alive and were camera-trapped. The Binturongs have also on occasions entered camp by night and killed and eaten chickens that roosted outside their small coop.

There were obvious differences in reaction of the different individual Binturongs to people. The adults, captive born but raised by their natural mothers, were unafraid of people and took food from their keepers' hands on occasions. The older cub also did the same. The anti-poaching patrols in the area meant that a lack of fear of humans posed no overt threat to the Binturongs, which anyway showed great caution in the unusual event of a stranger's presence. However the second litter of cubs, with very little experience of people, was frightened if people approached. Even though the adults fed at the supplementary feeding sites while being watched, these two cubs always raced away at if approached while feeding.



Fig. 3. Released captive-bred adult Binturong *Arctictis binturong* and captive-born cub visiting provisioning station at release site, Chi Phat Wildlife Rehabilitation Station, southwest Cambodia.



Fig. 4. Released captive-bred young Binturong *Arctictis binturong* taking food from keeper's hand at release cage, Chi Phat Wildlife Rehabilitation Station, southwest Cambodia.



Fig. 5. Released captive-bred adult Binturong *Arctictis binturong* and wild-born cub visiting provisioning station at release site, Chi Phat Wildlife Rehabilitation Station, southwest Cambodia.

Discussion

We know of no other Binturongs, captive-bred or otherwise, that have been released, anywhere in their range. All five animals released have survived for more than two years. A female, inexperienced in the wild, cared for two very small, dependant

cubs during a period of difficult weather immediately following her release. These cubs she removed from their nest-box at an evidently appropriate time. The older cub, deprived of maternal attention at any early age, also survived. Survival of the five animals was presumably assisted by the full year inside an enclosure to acclimatise to the new environment; supplementary feeding; the high level of protection of the area; a constant benign human presence maintaining the safety of the release site; the appropriate habitat; release at the optimal season for wild fruit; and the scarcity of predators and wild Binturongs.

The released Binturongs still take supplementary food over two years after their release, but these visits have decreased markedly over time. This food will be supplied each evening for an indefinite period, because it now allows the only means of monitoring survival. Over time, records of visits to the feed stations could be investigated to check for seasonal patterns that might reflect cyclical availability of fruit in the forest.

To maintain a population of Binturongs in this area, other individuals are probably needed to forestall inbreeding. There are probably still wild Binturongs around, but this has not been proven. It would be possible to release another unrelated pair using animals born at Phnom Tamao Wildlife Rescue Centre.

The protocols for this are being considered, including attention to territoriality and the merit of another enclosure at a different location, or whether cessation of supplementary food would stimulate the Binturongs already released to move far enough away to permit the release of another pair in the same area.

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