CHAPTER

30

The rescue, rehabilitation and release of pangolins

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OUTLINE

Introduction

In part due to their inclusion in Appendix I of CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora), in 2016 (see Chapter 19), there is increased awareness of pangolins among national natural resource management, conservation, and law enforcement agencies in pangolin range states. Pangolins are protected species in most range countries, though the degree of protection varies between species and country. There is also variation in how effectively laws are implemented and a number of challenges to law enforcement concerning pangolins have been identified (Challender and Waterman, 2017). Nonetheless, seizures of pangolins and their parts are made frequently both in Africa and Asia (Chapter 16; Heinrich et al., 2017). This includes the recovery of live animals, which, in a number of range states, are taken to rescue centers for health assessments and rehabilitation, before being released back in to the wild. This process has

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allowed the development of expertise on pangolin rehabilitation, veterinary health and captive care. The aim of this chapter is to document and contrast experiences of rehabilitating pangolins in different countries and under different circumstances, with different species. It draws primarily on experiences in South Africa and Vietnam. The chapter starts by contextualizing rescue, rehabilitation and release efforts in the two countries before discussing a number of case studies on pangolins recovered from illegal trade.

Rescue

In Southern Africa, there are two main causes of Temminck's pangolin (*Smutsia temminckii*) needing rescue and rehabilitation. First, pangolins are poached and trafficked, typically individual animals, and on detection by law enforcement agencies (e.g., through sting operations) are transported to the closest appropriate veterinary hospital or wildlife rehabilitation facility with the necessary expertise to deal with pangolins (Fig. 30.1). Ideally, in these scenarios forensic sampling of the rescued animal will be conducted to inform judicial proceedings (see Chapter 20). Second, Temminck's pangolins are electrocuted on electric fences surrounding game farms and reserves (Beck, 2008; Pietersen et al., 2014; see Chapter 11). The animals inadvertently curl around the bottom strand of electrified wire and most pangolins do not survive, though a small proportion do. Some animals may be immediately released on detection by landowners with no knowledge of their survival. In addition, in Namibia and the Northern Cape, South Africa, estimates suggest that up to 280 pangolins are killed annually by vehicles while crossing roads (Pietersen et al., 2016). Pangolins that survive electrocution and traffic collisions also form part of rescue efforts.

In contrast, the situation is very different in Vietnam, principally because of the number of animals that are seized. Vietnam, as well as being a consumer market for pangolin products (see Chapter 22), also serves as a thoroughfare for pangolins trafficked from others parts of Southeast Asia, largely to China (Chapter 16; Nguyen, 2009). Save Vietnam's Wildlife (SVW), an established Vietnamese non-governmental organization (NGO), frequently liaises with the government in order to rescue pangolins from illegal trade. Seizures vary in size from one to more than 200 pangolins, primarily involving the Sunda pangolin (*Manis javanica*) but also the Chinese pangolin (*M. pentadactyla*). The number of animals in any given seizure greatly impacts the quality of care provided at the rescue site and the way animals are triaged. A typical seizure in Vietnam entails releasing the animals from the confinement of small netted bags, in

FIGURE 30.1 An adult Temminck's pangolin (*S. temminckii*) rescued from illegal trade in South Africa. *Photo credit: African Pangolin Working Group.*

which they have been kept and trafficked for an indeterminate period (see also Chapter 29). They are usually covered in their own feces and urine. In addition, many pangolins have been force-fed a mixture of cornmeal and water to increase their weight and thereby their financial value to traffickers. Animals that have been subject to this procedure have yellow, liquid diarrhea, and often display inappetance. This technique traumatizes the esophagus through forceful entry of the feeding tube and causes gastritis. Where large numbers of animals are seized the strongest individuals are prioritized for care. This selective process is used to stabilize individuals in preparation for transport to the nearest rescue center.

Rehabilitation

Rehabilitating pangolins for release back into the wild is complex, and not possible in all cases. Techniques applied to the captive care of a pangolin depends on the species concerned, location, access to veterinary and husbandry resources, and experience level of the rehabilitator. In Southern Africa, pangolin rehabilitation efforts range from professionally trained and equipped rehabilitation personnel with modern facilities to game farmers and local conservation officers in remote areas with little knowledge and few resources. Frequently, advice and treatment options are relayed over the phone to assist whoever is in possession of the animal.

Initial stabilization of rescued animals is crucial regardless of geography. Rescued pangolins in both South Africa and Vietnam are placed in quarantine enclosures of a suitable temperature, and provided with bedding (e.g., blankets), food and water. Unless the animal is critically compromised, they are left alone to de-stress. Caution is needed because handling pangolins can cause them stress (see Chapter 29).

Restoring an animal to optimal health begins with a thorough physical exam. At SVW, pangolin diagnostic tools are limited. Animals are treated preventatively with dewormers, gastroprotectants and a broad spectrum of antibiotics if any wounds or disease symptoms are detected on initial assessment or within the first week of quarantine. Dehydrated and anorexic pangolins undergo fluid therapy with added vitamins for a number of days in the initial quarantine period in an attempt to normalize hydration status.

Pangolins are inspected for wounds, infections, abnormal parasite loads (both external and fecal), eye infections and respiratory issues (see also Chapter 29). Where wounds are found they are cleaned and may be treated with oral antibiotics in Sunda and Chinese pangolins. Fractures are also checked for and if suspected confirmed via further physical examination and radiographs if available. Whether the fracture is bandaged or results in amputation, depends on the animal's ability to locomote and survive in the wild. Euthanasia is sometimes necessary if there are no options for life long captive management and the animal has a poor prognosis for survival in the wild. Neurological issues are common with animals that have been clubbed or hit by a motor vehicle (e.g., in Southern Africa).

Blood samples are taken and full blood counts and serum chemistry are important tools to measure the animal's condition. Most important are the blood glucose and albumin levels, which are also used for monitoring purposes (see Chapter 29). Blood smears are also done and attention is paid to thrombocyte number and morphology. Many pangolins display signs of poor clotting factors at SVW. A fecal floatation test and direct wet smear are also carried out to assess which parasites are present and to determine the parasite load (see Chapter 29).

Pangolins seized from illegal trade are typically malnourished and underweight (Fig. 30.2) and caution is exercised to avoid re-feeding syndrome. This consists of metabolic disturbance when nutrition is incorrectly given to a

FIGURE 30.2 An emaciated Temminck's pangolin (*S. temminckii*) following rescue from illegal trade. *Photo credit: African Pangolin Working Group.*

system which has been severely malnourished. The volume of food consumed each night is monitored, and if an animal is not eating, an alternative food option is offered: foraged live ants. For Temminck's pangolin this can be accomplished by allowing the animal concerned to forage naturally. In Vietnam, for Chinese and Sunda pangolins, ant nests are collected from local forests and offered in the animal's enclosure, while ant eggs manufactured for human consumption are also offered and may be mixed with farmed silkworms (*Bombyx mori*).

In South Africa, once a Temminck's pangolin is deemed fit enough, the animal is taken on foraging excursions to consume natural prey (see Richer et al., 1997). This species tends not to feed in captivity and does not consume a captive diet. For this reason, Temminck's pangolins under rehabilitation require daily walking in order to forage. This is not the case for the Sunda or Chinese pangolin.

Housing is provided that meets the pangolins' basic needs. This includes a strongly built enclosure to prevent escape, a resting place that simulates a burrow, with good ventilation, and potentially a heat source depending on the species and season, and age of the animal (see Chapter 28). For semi-arboreal species (e.g., Sunda pangolin), enclosure furniture is provided in the form of native plants, tree trunks and a network of tree branches so the animals concerned can exhibit natural climbing behavior. For animals that cannot be released and need long-term captive care, perhaps because they are being hand-reared or are in protractive recovery, the husbandry needs are somewhat different (see Chapter 28).

Release

Release back into the wild is the final step in the rescue, rehabilitation and release process. In Southern Africa, increasing experience is indicating that Temminck's pangolins have a higher probability of survival if they are subject to a "soft release" (R. Jansen, pers. comm.). This also applies to hand-reared pangolins. A soft release entails habituating the animal to the new environment while under close observation, i.e., animals remain at the rehabilitation facility but are walked daily in the new environment by a minder. In South Africa, soft releases take place over a five-day period. The animal is weighed before and after every feeding session in order to record weight gain. Experience with young white- (*Phataginus tricuspis*) and black-bellied pangolins (*P. tetradactyla*) weighing less than 1 kg at the Sangha Pangolin Project in Central African Republic suggests that they should have a soft-release with a dedicated minder (A. Kriel, pers. comm.); the local Baka monitor both species.

In South Africa, all pangolins are tagged on release and monitored with telemetry equipment. They are monitored twice a day for three weeks, then twice a week for three months, and thereafter weekly for a period of 12 months. This is to generate knowledge of dispersal behavior and survival rates. Release sites are chosen carefully. Key considerations include whether a site is free from poaching, or within game reserves, national parks or conservancy areas suitable for release, and the extent of monitoring by anti-poaching units (Pietersen et al., 2016). The presence of electric fences and vicinity of such fences to release sites is also considered. Encouragingly, some reserves in Southern Africa are mitigating the impact of electric fences thereby making it safer for smaller species including pangolins (Beck, 2008; Pietersen et al., 2014). This mitigation is done by either switching off the electric current to the trip wire or increasing the height of it to prevent smaller species being electrocuted.

In Vietnam, SVW aims to rehabilitate and release pangolins as efficiently as possible. After the quarantine period, clinically stable pangolins are listed as release candidates. The veterinary team performs visual exams with attention to ambulation, stress level, activity, body condition score, sleep habits, and weight. Currently, disease screening is done individually based on presentation of clinical symptoms. "Stable" animals are not screened for any pathogens prior to release. Pangolins are notorious for sustaining captive-related health issues and decisions on suitability for release are often made with a long-term view. For example, a pangolin may have minor a wound on its footpads, tail or nose and a decision has to be made on whether to attempt to heal such a wound to prevent further infection or leave it untreated to avoid causing the animal stress. If the animal is otherwise in good condition physically, eating well, producing formed feces regularly and maintaining weight, the protocol is for release as soon as possible to minimize risk of further captive related issues. Keeping these pangolins in captivity longer in an attempt to resolve superficial issues often ends in mortality. Many individuals will remain stable for weeks but a variable such as drop in environmental temperature can result in sudden inappetance. Once ready for release, pangolins are microchipped and dewormed.

SVW primarily rehabilitates and releases Sunda pangolins. This involves transporting animals to one of two national parks (270 km and ~1500 km away from the conservation center respectively) within the species' geographic distribution. The field team considers the fact that SVW has been releasing pangolins in these parks for several years, and an assumption is made that stable populations must exist where animals have been released previously. This is considered when planning releases. Finite protected natural habitat for wildlife in

Vietnam is a major limiting factor for the release of pangolins. The journey to the release site is very stressful on the animals, especially given the poor road surfaces in parts of Vietnam. The animals are transported in wooden boxes and are fed overnight, given a blanket and water in their transport boxes, and fed again before they are released. Typically, ~25 pangolins are released at a time due to transport limitations. Animals are released in separate locations to avoid potential stress between individuals given the solitary nature of the species.

Releases, as far as possible, follow best practice guidance (see IUCN/SSC, 2013).

Prior to release, sites are surveyed to confirm suitable food availability, habitat and ecological structures (e.g., tree hollows for resting). Workshops are also held with local communities surrounding release sites to generate support for pangolin conservation. Release sites must be able to accommodate new pangolins, as released animals will need to establish a home range. However, a key challenge to the release of Sunda pangolins in Vietnam is identifying that release sites can accommodate additional pangolins. This is due, in part, to the lack of standardized monitoring methods for pangolins (see Chapter 35) with which to determine that this is the case. It is also because pangolin populations in many parts of Vietnam have been heavily depleted meaning very extensive survey effort would be needed to confirm sufficiently low densities, or theoretically absence, to warrant release (see Willcox et al., 2019). Consequently, there is typically a lack of detailed knowledge of resident pangolin populations. In practical terms, the need to determine population status is weighed up against the need to release urgently, in some cases, up to 200 pangolins in a very short period, in order to give the animals the best chance of survival. Whenever possible, camera traps are set up at release sites and GPS trackers are attached to selected pangolins to monitor movement and survival rates, but a practical challenge is monitoring post-release behavior when so many pangolins are concerned.

Case studies

A badly compromised Temminck's pangolin

A 13 kg adult male Temminck's pangolin was received at the Johannesburg Wildlife Veterinary Hospital in April 2018, following confiscation from a sting operation. The animal was severely dehydrated and had a marked limp of the left hindlimb, and a wound on the outside of the same leg. It was strongly suspected that the animal had been tied up in captivity or had been caught in a snare. The pangolin was anesthetized with isoflurane gas to facilitate intravenous fluid administration, and given a full clinical examination. Radiographs revealed a left midshaft tibia and fibula fracture. The animal was stabilized and given pain medication and antibiotic therapy. After liaison with a veterinary surgical specialist, a plate and screws were used to repair the leg. The animal was allowed to walk following surgery, as is standard for all small animals after this type of fracture repair. For the first 24 hours, the pangolin was fed through a tube placed into the stomach through the mouth. The animal was lightly sedated because unrolling an adult Temminck's pangolin is practically impossible.

After two days, the animal was given the opportunity forage naturally. For the following 10 days, the animal fed well, consuming up to 600 g of pugnacious ants per night, and maintaining body weight. However, the wound on the left leg dehisced and it was determined that due to the muscle strength of the animal, the metal plate had moved. This caused a small piece of bone to protrude through the outside of the leg, underneath the scales, and caused a severe wound infection that led to the wound opening. The wound was cleaned

and flushed under sedation on a daily basis. Attempts were made to bandage the wound but it was almost impossible due to the animal's physiology. The pangolin was also tranquilized to limit movement using Valium, haloperidol, midazolam, but on this animal, these drugs lasted only a few hours at a time. Antibiotics and pain medication were also administered allowing the animal to forage for short bouts which appeared to have a calming effect. However, after two weeks, a follow-up radiograph revealed that the plate had sheared off the bone. A further round of surgery was needed to re-plate the leg, and a locking plate was used. However, due to the damage to the bone and the concurrent infection, the prognosis was guarded. The pangolin needed to be kept as still as possible post-operatively. Despite sedation, this proved impossible and within 48 hours of the second surgery, the locking plate had been broken and the tibia, dorsal to the plate, shattered. The decision was made to euthanize the animal.

Rehabilitation and release of a Temminck's pangolin

South African Environmental Law Enforcement Officers confiscated a male Temminck's pangolin, weighing 11.3 kg, in the Chinese quarter of Johannesburg in January 2018. The animal was taken to Johannesburg Wildlife Veterinary Hospital for treatment and rehabilitation.

The pangolin was heavily contaminated with motor oil as a result of being transported in the spare wheel hub of a vehicle. The animal was washed with a mild detergent in warm water to prevent ingestion/poisoning. Isoflurane was then used to sedate the animal enabling the belly and inner scales to be cleaned. A low dose of Valium was given, intramuscularly, to lower stress levels; blood glucose levels were checked and blood tests were also run including a blood count and serum chemistry analysis.

This pangolin's physical condition was generally good, especially considering the animal had endured an extended period without food or water. The animal was taken foraging every night for 11 nights, spending up to three hours foraging for prey each night. When not foraging, the pangolin was housed in a custom made sleeping box with a heating pad and water tray. The pangolin maintained weight and was evidently ingesting an adequate quantity of ants and termites. The animal was anaesthetized to facilitate chain of custody sampling process for the BioBank situated at the National Zoological Gardens. This involves taking blood and scale samples, weight and measurements.

In early February 2018, the pangolin was fitted with a telemetry unit and was released into a protected area consisting of typical bushveld habitat. The animal was observed on release and was located on a daily and weekly basis thereafter. After several months, the pangolin had moved approximately 10 km, and remained in a particular area, suggesting that the animal had established a home range.

Sunda pangolin caught in a snare trap

A single, adult female Sunda pangolin was rescued in Lang Son Province, Vietnam and admitted to SVW in October 2018. On arrival, the animal weighed 4 kg and was visually bright, alert and active and did not appear stressed. Physical exam findings included a series of malodorous, deep, mildly necrotic assumed snare-trap wounds slicing diagonally around the ventral aspect of the chest cutting through the muscle layer and reaching around to the lateral aspects of the chest (Fig. 30.3). The wounds varied in depth (0.5–1 cm) and purulent discharge was excreting from the deepest wounds. Upon further examination, the animal was noted to be mildly dehydrated and pale. There was also evidence of diarrhea with loose fecal material observed around the rectum. Several ticks were also removed. The decision

FIGURE 30.3 A female Sunda pangolin (*M. javanica*) presenting snare wounds. *Photo credit: Jess Jimerson.*

was made to anesthetize the animal for further investigation. Subsequent investigation confirmed that necrotic tissue was also present under the lateral scales, and given the depth of infection and limited mobility in the affected region the prognosis was guarded.

The entire wound was flushed with 0.9% saline and dilute iodine to remove organic material, and areas of necrosis were debrided. In total, seven scales were also removed. A small amount of saline soaked gauze was applied to the wound on the lateral aspect of the body topped with thick pads of dry gauze in an attempt to remove any residual contamination within the wounds without drying it out. Tegaderm was applied and wrapped around the body with vetwrap to keep the bandage in place and prevent further contamination (Fig. 30.4). The animal was kept in a wooden box for the remainder of treatment to minimize mobility. The animal was fed on thawed frozen ant eggs (200 g/daily) and treated using a combination of Clavamox, meloxicam, cemitidine and ivermectin.

On changing of the bandages the following day, the pangolin's abdomen was distended and firm and an ultrasound confirmed pregnancy. However, two days later the pangolin was found with dark blood around the vulva and on ultrasound no neonate heartbeat was detected and it was concluded that the animal had a stillbirth.

Four days later, and following two bandage changes under anesthetic, including additional cleaning of the wound due to the presence of purulent discharge, the animal was hydrated and in good condition and its food intake increased to 250 g/daily. However, upon further examination in subsequent days, ulcers

FIGURE 30.4 Female Sunda pangolin (*M. javanica*) under anesthetic following surgery to clean wounds from a snare. *Photo credit: Jess Jimerson.*

were found on the rear footpads measuring 0.2−0.3 cm. They were cleaned with chlorhexidine, rinsed with 0.9% saline, and silver sulfadiazine (SSD) cream was applied.

Within a few days, the pangolin's weight had increased to 4.5 kg and the chest wound was healing well. The animal was anaesthetized when needed in the following week to change the bandages on the chest wound and the footpad ulcers were repeatedly cleaned and treated with SSD cream. By the end of October 2018, the animal had increased in weight to 4.7 kg and all wounds had healed. A minor respiratory problem caused by poor ventilation due to limiting the movement of the animal was resolved within 72 hours by moving the pangolin to larger quarantine enclosure. By early November, the pangolin was listed for release back in to the wild.

Conclusions

Pangolins are seized with regularity in range states in Africa and Asia. Experience gained in the rescue, rehabilitation and release of pangolins in South Africa and Vietnam since the early 2000s means that for animals that are rescued, subject to their health status, there is a chance of rehabilitation and release back in to the wild. The rehabilitation and release of African pangolins in particular, is a relatively new phenomenon and there is little documented knowledge of best practice. The observations and data collected during rehabilitation and release therefore provide new and critical insights to further understanding of these species. Challenges remain to the successful release of pangolins back in to the wild, which in Vietnam include determining the status of resident pangolin populations prior to release and monitoring of animals post-release, given the numbers of pangolins successfully rescued and readied for release. The rescue, rehabilitation and release of pangolins makes an important contribution to the conservation of the species by offering a lifeline to rescued animals. Critical to success is working relationships between stakeholders, including government agencies (e.g., law

enforcement) and rescue centers and veterinary hospitals, such that pangolins that are seized receive the care they need in a timely fashion and have the best chance of survival.

References

Beck, A., 2008. Electric Fence Induced Mortality in South Africa. M.Sc. Thesis, University of the Witwatersrand, Johannesburg, South Africa.

Challender, D., Waterman, C., 2017. Implementation of CITES Decisions 17.239 b) and 17.240 on Pangolins (*Manis* spp.), CITES SC69 Doc. 57 Annex. Available from <https://cites.org/sites/default/files/eng/com/sc/69/E-SC69-57-A.pdf>. [February 2, 2018].

Heinrich, S., Wittmann, T.A., Ross, J.V., Shepherd, C.R., Challender, D.W.S., Cassey, P., 2017. The Global Trafficking of Pangolins: A Comprehensive Summary of Seizures and Trafficking Routes From 2010–2015. TRAFFIC, Southeast Asia Regional Office, Petaling Jaya, Selangor, Malaysia.

IUCN SSC (IUCN Species Survival Commission), 2013. Guidelines for Reintroductions and Other Conservation Translocations. Version 1.0. Gland. IUCN Species Survival Commission, Switzerland.

Nguyen, T.V.A., 2009. ENV wildlife crime unit's efforts to combat illegal wildlife trade in Vietnam. In: Pantel, S., Chin, S.-Y. (Eds.), Proceedings of the Workshop on Trade and Conservation of Pangolins Native to South and Southeast Asia, 30 June – 2 July 2008, Singapore Zoo, Singapore. TRAFFIC Southeast Asia, Petaling Jaya, Selangor, Malaysia, pp. 169–171.

Pietersen, D.W., McKechnie, A.E., Jansen, R., 2014. A review of the anthropogenic threats faced by Temminck's ground pangolin, *Smutsia temminckii* in southern Africa. South Afr. J. Wildlife Res. 44 (2), 167–178.

Pietersen, D.W., Jansen, R., Swart, J., Kotze, A., 2016. A conservation assessment of *Smutsia temminckii*. In: Child, M.F., Roxburgh, L., Do Linh San, E., Raimondo, D., Davies-Mostert, H.T. (Eds.), The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

Richer, R.A., Coulson, I.M., Heath, M.E., 1997. Foraging behavior and ecology of the Cape pangolin (*Manis temminckii*) in north-western Zimbabwe. Afr. J. Ecol. 35 (4), 361–369.

Willcox, D., Nash, H., Trageser, S., Kim, H.J., Hywood, L., Connelly, E., et al., 2019. Evaluating methods for detecting and monitoring pangolin (Pholidota: Manidae) populations. Glob. Ecol. Conserv. 17, e00539.