

An assessment of the commercial production of CITES-listed snake species in Viet Nam and China

Synopsis (full report annexed)

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Preface

This assessment of the commercial production of CITES-listed snake species in Viet Nam and China is the result of a directive given to the CITES Secretariat to undertake a study of production systems for Asian snakes listed in CITES Appendix II and the use of source codes; and to develop guidance to assist Parties in monitoring and controlling captive-breeding operations and other production systems, including information to assess their biological feasibility and, where possible, their economic viability (i.e. whether it is financially viable for commercial facilities to produce and export specimens as permitted by national authorities) (Decision 16.102a[i]). This initiative comes following a period of concern expressed by conservationists and management authorities regarding the volume, nature and impact of the trade in Asian snake species, and a fundamental lack of the baseline information required to manage the trade in a non-detrimental manner.

Since the drafting of Decision 16.102 in 2011/2012, a number of studies have emerged that address some of the primary directives. These include (a) a draft inspection manual for reptile captive breeding facilities in Southeast Asia (TRAFFIC 2013), (b) a report on python farming in Southeast Asia by IUCN (Natusch and Lyons 2014), (c) a report on differentiating between wild and captive bred snakes (Decision 16.102a[iv]) and (d) draft guidance on the use of CITES source codes for production systems (Decision 15.52 – implementation of the Convention related to Captive Bred and Ranched specimens). Despite these reports being available, they have yet to be formally considered by the CITES Animals Committee and pertinent Working Groups. However, the reports do cover key aspects relating to guidance, production systems and source codes pertaining to Decision 16.102a(i), and as such there was considerable risk of duplication of effort during the structuring and planning for this study. In September 2014, following deliberation with CITES authorities over specific terms of reference, it was decided to focus this study towards improving baseline knowledge of production systems for all species of snakes, since this remained one of the few outstanding prerequisites for informed decision-making regarding the snake trade. As a result of the above, the specific objectives of this report are stated as follows:

- a) To identify the most viable aspects of, and the most important knowledge gaps within, current snake farm management systems, with particular reference to species and geographic range (i.e. identify species, compare feed inputs, growth rates, fertility rates, survival rates and profitability across regions/ecosystems)
- b) To define optimal biological and economic farming inputs and outputs for individual species (i.e. pooling the best available farm practices from across Asia with the latest science based knowhow to improve capacity, transparency, sustainability and compliance with CITES).

Initially the study planned to carry out fieldwork in Cambodia, Thailand, Indonesia, Viet Nam and China, but due to time and resource limitations fieldwork was eventually restricted to two of the important producers - Viet Nam and China.

This report is intended to provide an overview of the management of production systems for all CITES-listed snake species in Viet Nam and China. However, given that the production of some CITES-listed species (i.e. pythons) has been relatively well documented compared to others, the report focuses primarily on the less well studied colubrid and elapid snakes, which are farmed mainly for their meat, and refers the reader to the following publication for comparative information on pythons: Natusch, D.J.D. and Lyons, J.A. (2014). Assessment of python breeding farms supplying the international high-end leather industry. A report under the 'Python Conservation Partnership' programme of research. Occasional Paper of the IUCN Species Survival Commission No. 50. Gland, Switzerland: IUCN. 56pp.

1.0 Introduction

Snakes and snake products are sought after for diverse reasons, including meat, skin, pets, cosmetics and medicines. The demand for snakes, particularly from Asia's growing middle class, is fuelling an increase in international trade and the emergence of commercial production systems.

Little is known about closed-cycle¹ snake production systems, and conservationists and management authorities have expressed concern over their biological and economic viability, and the impact they have on wild populations.

At least 24 species of reptiles from 18 genera and three orders are currently produced in commercial production systems in Asia. The commercial farming of CITES-listed snake species in Viet Nam and China is currently focused on the production of two species of python for their skins (reticulated python [*Python reticulatus*] and Burmese python [*Python bivittatus*]), three species of elapids for their meat and traditional medicine value (Chinese cobra [*Naja atra*], monocled cobra [*Naja kaouthia*] and king cobra [*Ophiophagus hannah*]) and one species of colubrid for its meat (Oriental rat snake [*Ptyas mucosus*]). This report focuses on species farmed for meat and medicinal value only.

The unique biology of snakes related to commercial livestock production techniques and the diverse nature of the snake product industry make production systems a fundamental cornerstone for the regulation and control of the international snake trade. The aim of this report is to examine closed-cycle production systems and make recommendations for their improvement and the future management of CITES-listed snakes entering trade.

A total of 39 interviews were carried out on snake farms in Viet Nam (31) and Southern China (8) to provide an overview of the biological and economic characteristics of closed-cycle production systems. Information on individual species was based on four King cobra entries², 25 cobra entries and 30 oriental rat snake entries.

2.0 Snake farming by country

2.1 Viet Nam

Viet Nam is one of the most important producers of captive-bred snakes in Asia. At least five CITES-listed species are successfully bred and raised in large numbers on several thousand government registered farms. Wild populations of all farmed CITES species are listed as either Critically Endangered or Endangered in the Vietnamese Red Data Book due to habitat degradation, hunting and illegal trade. The farming industry is heavily dependent on export markets to China but CITES trade statistics do not accurately reflect this. This study suggests numbers of legally farmed animals exported from Viet Nam are an order of magnitude greater than CITES trade figures suggest. Closed-cycle snake farming is carried out

¹ The production of snakes within a controlled environment is independent from the introduction of individuals from the wild.

² An entry is a farmer's account of the production of a particular species.

at a scale that largely negates the need for wild sourced snakes, meaning that production is legal but the trade is illegal. A legacy of unregistered and informal trade in wildlife within the region, particularly between Viet Nam and China, could well explain the inadvertent illegal trade in legitimate captive-bred snakes.

2.2 China

In China, at least 20 different snake species have been variously exploited for food, traditional medicine and musical instruments for up to 2,000 years. In 2003, the Chinese government introduced a range of measures to suppress the trade in snakes due to conservation concerns. In 2006, the government revised its policy and introduced a ten year pilot program to explore the feasibility of closed-cycle snake farming. The aim was to develop a more sustainable supply of snakes to meet market demands. Today there are several hundred closed-cycle snake farms across Southern China producing hundreds of thousands of CITES-listed snakes on an annual basis. The majority of trade is carried out at the national level, but China is also involved in the international import of indigenous and non-indigenous CITES-listed snake species and the processing of snake products for export.

3.0 How are snakes farmed?

Farm sizes and models in Viet Nam and China are highly variable and range from smallholder plots raising a few hundred snakes as a side-line activity to large-scale farms breeding and rearing tens of thousands of snakes as their primary business. Most farms are small, independent operations that breed, raise and sell their own stock, mostly to middlemen. In China there are a growing number of large commercial operations that supply a diverse range of markets, including smaller farms that focus solely on buying eggs and rearing animals to market size. Some farms in China run snake schools where they train farmers how to farm snakes for a fee.

Enclosure types vary from individual cages to large outdoor pits. Most of the more progressive snake farms in Viet Nam and all the farms visited in China use purpose built rooms which house several hundred individuals in 'tower blocks' consisting of stacked wooden pallets. The larger scale farms increasingly resemble conventional intensive livestock farms in appearance and functionality.

Supplementary heating (often with the aid of a thermostat) and insulation are used to control temperature. The provision of optimal temperatures increases growth rates and improves hatchling survival rates. Controlled temperature settings in the warmest part of the enclosure range from 28°C to 31°C.

Clean drinking water is provided on a regular basis and humidity levels are managed using a variety of means, ranging from mounds of damp sand to automated sprinkler systems.

Snake enclosures are cleaned on average once per week. Cleaning typically only involves the removal of faeces and rarely involves washing with detergents or sterilizing agents.

Overfeeding and underfeeding lead to increased morbidity and/or decreased fecundity. Feed rates average 10% of body weight per week. Breeding animals are fed less than growers, while hatchlings and juveniles are fed more and more often. Primary feed inputs can be divided into three categories: wild-harvested natural food (e.g. amphibians and rodents), waste protein from existing industries (e.g. poultry and pork) and formulated diets (processed waste protein). Feed is offered in a variety of ways, and presentation is critical. Food is fed dead, either fresh or thawed after being frozen.

Breeding systems are similar for all species. Most farmers keep more females than males to maximise outputs while minimizing management costs. Breeding animals are allowed to hibernate for an average of 2.3 months to stimulate breeding activity. Farmers exchange animals to prevent inbreeding depression, and practice selective breeding to enhance desirable traits. Eggs are typically incubated under semi-natural conditions within confined spaces, usually some form of box or vessel. Humidity levels are elevated through the maintenance of damp incubation mediums (usually sand) but no supplementary heating is provided. Hatchlings receive considerably more care compared to other age groups in terms of

feed and temperature management, and occasionally housing. Egg and hatchling survival rates are both above 80%.

There is a low prevalence of disease in most snake farms. The most commonly cited veterinary issues were respiratory infections in pythons and rat snakes and skin disease in cobras. The use of medication is common in Viet Nam but not in China. High mortality rates are common among younger animals but less so in adults.

Snake farming is a rapidly evolving industry with virtually all aspects of production undergoing constant changes and improvements. Production systems are generally effective, although opportunities for improved efficiency are considerable and widespread (e.g. use of free solar radiation to maintain temperatures).

Snake farming is driven primarily by the demand for snakes as a culinary delicacy. Snake meat is most valuable when it is fresh and complete with intact skin. The main market demand is for whole live snakes averaging between one and two kilograms. Snakes are also valued by traditional Chinese healers as a general health tonic and for the treatment of stiffness, skin diseases and the treatment of convulsions.

4.0 Species accounts

4.1 King cobra (*Ophiophagus hannah*)

- Large venomous elapid found across much of Asia.
- Wild populations are declining, listed by IUCN as Vulnerable.
- Valued predominantly for their meat and traditional Chinese medicine value.
- Farmed predominantly in Northern Viet Nam.
- Fed predominantly appropriate sized snakes, which are mostly harvested from wild.
- Females mature in their third year and produce an average of 27 eggs per year.
- Usually sold shortly after maturity but long before maximum size is reached.
- Sold at an average weight of 2.55kg for an average price of US\$81/kg.
- Viable eggs sell for US\$9 each.
- Demand and prices for king cobras are increasing.

4.2 Cobras (*Naja atra* & *Naja kaouthia*)

- Common venomous elapid found across much of Asia.
- Some populations declining, listed by IUCN as Vulnerable.
- Valued mainly for their meat, but some medicinal value.
- *N. atra* farmed mainly in Northern Viet Nam and China, *N. kaouthia* mainly in Southern Viet Nam.
- Fed wide range of wild sourced small vertebrates and waste protein.
- Females mature in their third year and produce an average of 22 eggs per year.
- Sold at an average weight of 1.7kg for ~US\$27/kg.
- Viable eggs sell for ~ US\$5 each.
- Demand increasing but price stable.

4.3 Oriental rat snake (*Ptyas mucosus*)

- Common harmless colubrid found across much of Asia.
- Valued mainly for their meat.
- Most commonly farmed snake and easiest species to breed and raise.
- Fed wide range of wild sourced small vertebrates and waste protein.
- Females mature in second year and can lay more than 37 eggs per year (three clutches).
- Sold at average weight of 1.6kg for ~US\$27/kg.
- Viable eggs sell for ~US\$5 each.
- Demand increasing but price stable or decreasing due to increasing number of farms.

5.0 The bio-economic feasibility of snake farming

5.1 Biological feasibility

As commercial livestock animals, snakes have many desirable qualities. They have rapid growth rates, mature quickly and have a high reproductive output. They can be farmed on the vertical or horizontal plane and at high stocking rates (63kg/m³ in this study). They display excellent food conversion ratios due to energy efficient biological traits (physiological and behavioural). Limitations include a protein rich diet and specialised feeding behaviour leading to a disproportionately high cost of feed inputs. Considerable potential exists to improve synergy between production systems and snake biology (and thereby improve feasibility). For example, few farmers have explored the opportunities offered by snake basking behavior and solar capture technologies (e.g. greenhouses).

5.2 Economic feasibility

Farming snakes is feasible and profitable for both small and large scale farms. The cost of raising one snake to a meat market weight of 2kg is approximately US\$20, suggesting net profits of approximately US\$30 per snake. Profits per farm range from less than US\$10,000 to over US\$1,000,000 per year. Feed is the most important base cost (>50% of operational costs) followed by labour. Snake farming is considered a cheap and accessible form of farming for most small-scale farmers.

5.3 Ecological feasibility

Snake farming has good ecological credentials. Many snake farmers rely on agricultural pests or locally abundant species as their primary feed input (e.g. rodents, amphibians). Others rely on waste protein from existing food production chains (e.g. poultry and pork mortalities). The ability of snakes to down regulate metabolic processes allows farmers to feed intermittently according to food availability and price. This allows farms to endure (and benefit from) fluctuations in economic and environmental conditions. Snakes are not susceptible to costly and common disease epidemics (e.g. bird and swine flu). Snake farming, and small-scale snake farming in particular, has considerable potential in the fields of environmentally friendly farming and sustainable intensification.

6.0 Snake farming and snake conservation

The harvest of wild snakes (including CITES-listed species) is common throughout much of the region, but overall levels of exploitation are low and probably sustainable, at least at the regional scale. Wild snakes are probably captured for subsistence use and local demands only. Based on survey results and personal observations during the course of this study, the author found **no evidence of significant national or international trade in wild-caught snakes**. Instead, there is good reason to believe that a) since 2003 there has been a dramatic shift in the sourcing of snakes for the Asian snake trade towards closed-cycle production, and b) snake farms actively avoid contaminating captive stock with wild-caught snakes due to a number of biological and economic factors including:

- Selective breeding for biological traits that are compatible with captive conditions which have a direct bearing on profitability.
- Legal frameworks acting as an effective deterrent in Viet Nam and China.
- Wild-caught animals harbouring infectious diseases and parasites.

Do farms reduce the demand for wild caught snakes and help prevent over exploitation? According to this study, yes. The scale and capabilities of snake farms are reducing the demand for wild caught snakes, at least at the formal market level. **Closed-cycle production facilities are capable of meeting all current and future demands for snake meat and snake skin, and are likely to meet remaining demands in the near future** (e.g. production of unusual or hard-to-keep species for specific traditional medicines).

Is there scope to incorporate farms into a market-based conservation model? Yes, but only for high value species traded for more than just meat value (e.g. skin, medicinal value). In this way, commercial snake ranching programs may encourage farmers to conserve wild populations of snakes and their habitats.

The conservation value of farms as genetic repositories for species is limited due to uncertainties surrounding geographic origin of specimens and genetics, although reintroduction programs *per se* may be of value in certain situations.

7.0 Conclusions

7.1 Summary of key findings relating to CITES

- 1) Captive breeding and closed-cycle production systems are a significant and increasingly important source of CITES-listed snake species involved in the Asian snake trade.
- 2) The significance of closed-cycle production systems with regards to CITES is pivotal, and likely to grow exponentially in the coming years due to growing trade volumes, diversification of products and the expansion of trade networks. Rapid improvements in production technology are also increasing the number of snake species farmed, and thereby affected by trade.
- 3) The current regulation and control of the Asian snake trade is inadequate. A lack of transparency and suboptimal trade management systems are inadvertently leading to clandestine and illegal imports and exports.
- 4) The exploitation of wild populations of snakes within China and Viet Nam plays a comparatively insignificant role in the international snake trade, legal or otherwise, but wild harvests are still prevalent on a local scale.
- 5) In its current form closed-cycle production is a viable industry that generates net socioeconomic and environmental benefits. However, considerable improvements in overall capacity are required to achieve the optimal cost/benefit model, which has potential to deliver profound benefits for rural development, biodiversity conservation and food security.

7.2 Recommendations and future research

- 1) **Regulation and trade control:** *A concerted effort to ensure the effective implementation of existing national and CITES regulation and control measures is required, and when possible these should be improved to ensure transparency and legitimacy of the regional snake trade and industry as a whole. This can be accomplished through the following:*
 - *Implementing existing management structures.*
 - *Closer scrutiny of the origin of animals traded between Southeast Asian countries (e.g. verification of source codes for animals exported from Lao to China via Viet Nam).*
 - *Ensuring national permitting procedures for production facilities must guarantee validity of source codes, where necessary through improved quality and performance of permitting systems/protocols.*
 - *Confirming that regulation and trade controls are characterized by adaptive management.*
 - *Coordinating and developing local capacity for multinational trade*
- 2) *Developing guidelines for transport and slaughter would **improve the welfare** of snakes.*
- 3) *An improved and more consistent understanding of **basic snake biology** and how this interfaces with current captive production systems would improve management in the immediate term.*
- 4) **Improved feed management** through research into a) artificial feeds and b) automated food delivery systems, would reduce costs and improve industry 'green' credentials.
- 5) **Caging systems** do not fully exploit the unique biology of reptiles. Multidisciplinary research into synergies between snake biology and agricultural engineering should focus on a) carrying capacity trade-offs with vertical farming systems and b) solar driven production systems based on greenhouse technology (sustainable intensification).
- 6) *Opportunities exist to integrate snake farming with snake conservation through **ranching programs**. Where and under what circumstances this can be applied has yet to be ascertained.*

- 7) **Education through snake schools:** *The technical skills required to farm snakes are often difficult for snake farmers to collate and interpret. Enabling existing snake farming schools in China to reach a wider audience would improve management standards.*
- 8) **Tourism:** *The development of snake farms as tourist attractions would help to educate the general public and bring additional benefits to those farms situated close to large cities or existing tourist destinations.*
- 9) **Small scale traditional vs. modern intensive:** *Small scale traditional snake farms are a valuable but economically vulnerable production model. Ensuring their intrinsic value is taken into consideration during the development of the formal snake farming industry would safeguard against the inevitable loss of less tangible benefits.*