

# 15

---

## Wildlife trade as an impediment to conservation as exemplified by the trade in reptiles in Southeast Asia

VINCENT NIJMAN, MATTHEW TODD AND CHRIS R. SHEPHERD

### 15.1 Introduction

Wildlife trade is at the heart of biodiversity conservation and sustainable development. It includes all sales or exchanges of wild animal and plant resources by people (Broad et al. 2003, Abensperg-Traun 2009). Wildlife trade involves live animals and plants or a diverse range of products derived from them and needed or prized by humans — including luxury goods, medicinal ingredients, food and pets. It generates considerable revenue and may provide or supplement incomes for some of the least economically affluent people (Ng and Tan 1997, Shunichi 2005, TRAFFIC 2008). The principal motivating factor for wildlife traders is economic, ranging from small-scale local income generation to major profit-oriented business. Wildlife can be traded locally (within a village or region) or nationally (that is within the political borders of a country or state) but a large volume of wildlife is traded internationally (Green and Shirley 1999, Wood 2001, Stoett 2002, Auliya 2003, Blundell and Mascia 2005, Schlaepfer et al. 2005, Nijman and Shepherd 2007). Between collectors/harvesters of wildlife and end users, any number of middlemen may be involved in the wildlife trade, including specialists involved in transporting, storage, handling, manufacturing, industrial production, marketing

and the export and retail businesses, and these may operate both domestically and internationally (TRAFFIC 2008). Intrinsically linked to economic growth, the demand for wildlife has increased and, exacerbated by ongoing globalisation, the scale and extent of wildlife trade likewise may have enlarged (Nijman 2010). Human population growth, increasing buyer power and globalisation have led to a rise in demand for exotic wildlife (hence international trade) and this has occurred in developed, emerging and developing nations alike. In the absence of strong regulatory mechanisms, and given large financial gains, these demands are often fulfilled, putting a strain on wildlife populations. In the most extreme cases this may lead to the extinction of populations or even species (e.g. Shepherd and Ibarrondo 2005).

One of the best-known regulatory policy instruments for international wildlife trade is the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) called to life in 1973 and to which 175 Parties are signatories. With the aim of preventing species from becoming (economically and ecologically) extinct as a result of unsustainable trade, thousands of species have been put on one of the three Appendices that preclude (Appendix I) or regulate (II and III) international commercial trade. When CITES laws are passed in a contracting party, the police, customs inspectors, wildlife officials and/or other government officers are empowered to enforce CITES regulations (Nijman and Shepherd 2011).

Although levels of wildlife trade are rarely quantified and specified, it is clear that for many species groups and different areas huge quantities are traded annually (Li and Li 1998, van Dijk et al. 2000, Auliya 2003, Zhou and Jiang 2004, Schlaepfer et al. 2005, Engler and Parry-Jones 2007). Reptiles are traded globally in large volumes to supply the demand especially for skins, food, traditional medicines and pets (Nijman 2010). With other factors, such as habitat loss and degradation (Gibbons et al. 2000, Gardner et al. 2007), anthropogenic disturbance (Garbeer and Burger 1995), climate change (Janzen 1994, Araujo et al. 2006) and pollutants (Guillette et al. 1994), the collection of reptiles from the wild for commercial purposes has been invoked as a contributing factor to the declines or even extinction of individual species (Gibbons et al. 2000, Schlaepfer et al. 2005, Shepherd and Ibarrondo 2005, Stuart et al. 2006). Extant 'reptiles' (as used here) are a paraphyletic group comprising all non-avian and non-mammalian amniotes, with four orders being recognised: Squamata (lizards, snakes ~8000 species), Crocodylia (alligators, crocodiles, gavials ~25 species), Testudines (turtles, tortoises ~300 species) and Sphenodontia (tuataras, 2 species).

Here we provide four case studies of domestic and international trade in reptiles for various purposes in four Southeast Asian countries: Thailand, Vietnam, Malaysia and Indonesia. These four countries differ economically, with Thailand and Malaysia being more affluent than Vietnam and Indonesia; geographically,

with the island-nation Indonesia being somewhat isolated from the remainder of Southeast Asia, and Vietnam and Thailand offering a gateway into China; and culturally, with Malaysia and Thailand appearing to be more internationally orientated than Indonesia and Vietnam.

Combined, the case studies give a representative picture of wildlife trade in Southeast Asia, showing similarities and highlighting some differences among types of trade and countries. Our data are derived from various sources using different methodologies, illustrating the diversity in data collection for monitoring wildlife trade in this respect. Specifically, we report on the sale of exotic tortoises for the pet trade in Thailand, the trade in stuffed marine turtles and *bekko* ('tortoiseshell', i.e. products made out of the carapace of hawksbill turtles used for decorative purposes) in Vietnam, the export of monitor lizard meat from Malaysia, and the commercial 'captive-breeding' of reptiles for the international pet trade in Indonesia. We show that in the first three case studies there is a consistent, open and substantial illegal trade in these protected animals, and that in the latter case study there are clear indications that wild-caught individuals are exported under the disguise of being bred in captivity. These cases demonstrate how wildlife trade acts as an impediment to the conservation of these reptiles.

## 15.2 Methods

### 15.2.1 Data acquisition

Data were collected during surveys by the wildlife trade monitoring network TRAFFIC, and were conducted in the period 2002–2010. Data for the trade in exotic (non-native) tortoises in Thailand were collected during five surveys of Chatuchak market in Bangkok in January and August 2006, April 2007, June 2009 and January 2010. The trade in stuffed marine turtles and *bekko* was assessed during two surveys in May 2002 and April–May 2008; focusing on two major Vietnamese trade hubs, Ho Chi Minh City and Ha Tien. The *bekko* is made exclusively from the carapaces of hawksbill turtles (*Eretmochelys imbricata*) and trade in stuffed marine turtles was restricted to hawksbill turtles and green turtles (*Chelonia mydas*). In both countries surveys typically lasted several days and all shops specialising in reptiles and amphibians (Thailand) or *bekko* (Vietnam) were visited and species composition and numbers were recorded. The recorder in all cases was a westerner with considerable experience with the local wildlife trade and in wildlife trade monitoring, and while showing a clear interest in the wildlife for sale would not make themselves known as a researcher. Where possible, the authenticity of the products for sale or the species identity was checked. Prices were recorded when displayed or otherwise requested from vendors; it should be noted that prices reported here are initial

quotes and that prices will normally go down with bargaining or when more items are purchased at once. All are converted to USD using the exchange rate at the time of the survey.

Data on seizures of clouded monitor lizards (*Varanus nebulosus*) in peninsular Malaysia in the period 2005–09 were compiled from a number of sources, including press releases and information obtained directly from government agencies. The data from 2005 and 2006 were based exclusively on summary statistics provided by the Malaysian Department of Wildlife and National Parks, but documents from other ministries provided conflicting data; we take a conservative approach and report the lowest numbers.

In August and November 2006, a TRAFFIC researcher and a member of the Indonesian Ministry of Forestry (MoF) visited all active reptile captive-breeding facilities in Indonesia and their observations were compared with numbers presented in the monthly breeding reports that these facilities had submitted to the MoF. We focus on five species that are commercially captive-bred for the international pet trade in at least three of these facilities, the pig-nosed turtle (*Carettochelys insculpta*), frillneck lizard (*Chlamydosaurus kingii*), green tree-python (*Chondropython viridis*), emerald monitor lizard (*Varanus prasinus*) and Timor monitor lizard (*V. timorensis*). Together we consider commercial captive breeding of these species as illustrative of the pet reptile trade from Indonesia.

Details of the survey methods can be found in reports by TRAFFIC (2004), van Dijk and Shepherd (2004), Nijman and Shepherd (2007, 2010a), Shepherd and Nijman (2008b), Stiles (2008), Shepherd and John (2010) and Todd (2010).

### 15.2.2 Legality of trade

The trades in our case study species in the different countries vary in the extent to which they are legal. The four countries are all Party to CITES with the Convention entering into force in Malaysia in January 1978, in Indonesia in March 1979, in Thailand in April 1983 and in Vietnam in April 1994. CITES is implemented at the national level through national legislation, and parties must have legislation that allows the implementation and enforcement of the Convention. Although Thailand, Vietnam and Indonesia's national legislation generally meets all the requirements for implementing CITES (but there are some ambiguities, see below), Malaysia's legislation is somewhat deficient (see e.g. CITES 2000).

Thai wildlife laws with respect to non-native species are ambiguous. Species not native to Thailand are covered under Chapter 4 of Wild Animal Reservation and Protection Act B.E. 2535: Importation, Exportation, Transitory Movement of Wild Animals and Wild Animal check point. Importation and exportation of protected and reserved wild animals and carcasses are prohibited (unless these were obtained from captive breeding) but there is no mention of 'possession' or 'domestic trade' of species on the prohibition list, only import and export. Exotic tortoises

that are listed in Appendix I of CITES are not allowed to be traded commercially, and here we restrict our discussion to those species.

Hawksbill and green turtles could be legally exploited in Vietnam prior to April 2002, but subsequently commercial use and exploitation in the wild was prohibited (note that the first survey included here took place in May 2002). Circular 02/2006/TT-BTS of March 2006 provides a list of marine resources that are prohibited from commercial trade, including hawksbill turtles and green turtles. Both species are included in Appendix I of CITES.

The clouded monitor lizard is a Totally Protected Animal in peninsular Malaysia under the Protection of Wild Life Act 1972 (Act No. 76). Totally Protected Animals are species that shall not be killed, taken or be held in anyone's possession. The clouded monitor lizard is listed in CITES Appendix I and therefore international commercial trade is prohibited.

All five species of reptiles we focus on in the Indonesian case study are protected under Indonesian law. It is illegal to keep these animals or to trade in them, but the eight captive-breeding facilities we assessed were given permission by the Indonesian MoF to breed them for commercial purposes. The resultant offspring can be sold internationally but trade in wild-caught specimens of protected species by these facilities is not allowed. Four of the five species are included in Appendix II of CITES, regulating all commercial international trade.

## 15.3 Results

### 15.3.1 Tortoise trade in Thailand

We observed a total of 475 individuals of six species of Appendix I-listed tortoises for sale at Chatuchack market (Table 15.1). These included some of the most endangered species of tortoise in the world, such as the Critically Endangered radiated (*Astrochelys radiata*), ploughshare (*A. yniphora*) and spider (*Pyxis arachnoides*) tortoises, all endemic to Madagascar. Apart from Madagascar, we also observed Appendix I-listed species from the Indo-Burmese region, viz. the Indian roofed turtle (*Kachuga tecta*) and the Burmese eyed turtle (*Morenia ocellata*). The numbers of individuals we observed for each species differed substantially, with hundreds of radiated tortoises and dozens of spider tortoises and spotted pond turtles (*Geoclemys hamiltonii*) but smaller numbers of the other species. Most individuals were openly displayed in the shops although during later surveys some of the rarer species were kept at nearby houses (and were observed upon request). Prices ranged from ~USD 20 for a small Indian roofed turtle to ~USD 2 000 for a medium-sized, unusual yellow radiated tortoise, but individuals of most species could be bought for ~USD 100–300.

**Table 15.1** Appendix-I tortoises observed for sale at Chatuchak market, Bangkok, Thailand in the period 2006–10 showing a consistent supply of some of the world’s rarest tortoises. IUCN Red List classifications abbreviated as follows: CR, Critically Endangered; VU, Vulnerable; LR, Lower Risk/Least Concern.

Species	IUCN	Jan-06	Aug-06	Apr-07	Jun-09	Jan-10
Radiated tortoise <i>Astrochelys radiata</i>	CR	32	187	50	18	106
Spotted pond turtle <i>Geoclemys hamiltonii</i>	VU	0	2	4	28	1
Indian roofed turtle <i>Kachuga tecta</i>	LR	2	0	0	0	3
Burmese eyed-turtle <i>Morenia ocellata</i>	VU	4	0	0	0	0
Spider tortoise <i>Pyxis arachnoides</i>	CR	0	4	0	0	31
Ploughshare tortoise <i>Astrochelys yniphora</i>	CR	0	0	0	0	3

### 15.3.2 Marine turtle and *bekko* trade in Vietnam

Informants in the markets confirmed that hawksbill turtles are rare in Vietnamese waters, more so in the 2008 survey than in the 2002 survey. Raw scutes used in *bekko* manufacture are illegally imported primarily from Malaysia and Indonesia. The number of *bekko* products observed for sale decreased somewhat between the surveys suggesting a decrease in demand and/or availability/supply (Table 15.2), but both in Ha Tien and Ho Chi Minh City *bekko* is still widely and openly available for sale. In total ~12 000 items were recorded, two-thirds of which were in Ho Chi Minh City. The most expensive *bekko* items on sale were handbags with asking prices of USD 300 and USD 450 in Ha Tien and Ho Chi Minh City, respectively. Most items were considerably less expensive, with bangles, bracelets, necklaces and combs typically selling for USD 3–30.

A total of 200 stuffed turtles were observed, ranging from 20–40 cm maximum width and many of them, particularly the hawksbills, were very young individuals. A 56 cm wide hawksbill in Ho Chi Minh City was selling for USD 485, but smaller stuffed green and hawksbill turtles were on offer for USD 20–30 each.

### 15.3.3 Clouded monitor lizard trade in Malaysia

In the 5 years (2005–09) ~38 000 clouded monitor lizards were confiscated in 33 seizures in 8 of the 13 States and Federal Territories of Malaysia (Table 15.3). The

**Table 15.2** *Bekko* ('tortoise shell') and stuffed marine turtles for sale in two Vietnamese cities in 2002 and 2008.

City	Ho Chi Minh City		Ha Tien		Total
	2002 (21)	2008 (22)	2002 (3)	2008 (10)	
Bracelet / bangle	3092	812	939	622	5465
Hair clips, bands, pins	550	135	663	581	1929
Finger ring	443	556	425	316	1740
Necklace	261	34	8	4	307
Spectacle frames	284	120	20	18	442
Earrings (pair)	225	51	32	0	308
Comb	147	76	143	186	552
Cigarette holder/ filter	116	24	8	38	186
Brooches, pendants	103	4	0	86	193
Name seal	102	13	0	0	115
Ornamental box	74	18	5	11	108
Hand fan	59	6	12	6	83
Lighter holder	39	0	2	0	41
Pipe	33	5	0	27	65
Cigarette box	31	7	3	1	42
Purse	22	6	0	3	31
Miscellaneous	94	35	97	39	265
Total <i>bekko</i>	5696	1924	2360	1948	11928
Whole stuffed turtle	24	35	90	58	207

highest numbers came from three of the east-coast States (Terangganu, Johor and Pahang). Individual seizures ranged from single to >7000 individuals, with median seizures ranging from 24 to 2215 individuals in different years. Eight seizures comprised >2000 lizards each. The monitors were seized from dealers in warehouse/cold rooms, in houses, shop lots and at airports and jetties – being transported or awaiting transport. The shipments were apparently destined for China, or, to a lesser extent, to be used in local 'exotic' meat restaurants.

**Table 15.3** Number of clouded monitor lizard individuals in seizures in peninsular Malaysia in the period 2005–09. \*Malaysia’s Ministry of Natural Resources and Environment (2009) reports the confiscation of 9265 clouded monitor lizards for 2006; the data presented here are from the Department of Wildlife and National Parks as reported by CITES (2007).

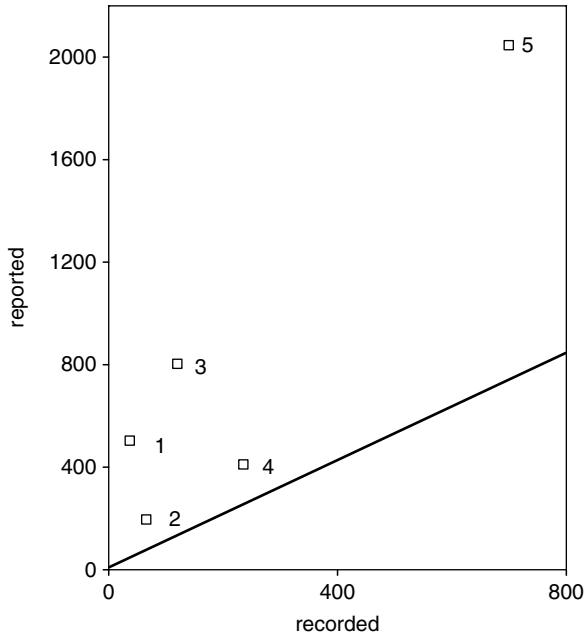
Year	Total monitors	Median seizure (N)	Maximum seizure
2005	5400	–	–
2006	4612*	2215 (3)	2390
2007	9604	433 (10)	2910
2008	14568	222 (11)	7093
2009	3803	24 (8)	2330
2005–2009	37987	181 (32)	

#### 15.3.4 Commercial captive breeding of reptiles in Indonesia

Of the eight operations included in this assessment, only two facilities were run at what we consider a professional level, with knowledgeable staff and adequate facilities to breed at least some species of reptiles in captivity. All other facilities did not appear to be suitable for captive breeding and/or appeared to be rarely used for captive breeding.

For all five species there were large discrepancies between stock/offspring data that the breeding facilities reported on a monthly basis to the Indonesian MoF and what was observed to be present (Fig 15.1). A total of 1200 individuals of the five species were observed whereas the breeding reports indicated that ~4000 individuals should have been present. There were five cases (from three facilities) where a facility reported a stock of some 20–40 animals and regular production of ~100 second-generation offspring, where not a single individual of that species was observed to be present during the inspection. Illustrative is the case of Timor monitor lizards: from the monthly breeding reports it appeared that five facilities were breeding the species. Upon inspection, two of these facilities did not have the species present, one facility owner made it clear that he did not breed the species at all (but housed 19 individuals) and two stated that breeding did take place. The monthly breeding reports of one of these facilities stated that 445 Timor monitor lizards were present but upon inspection only 20 individuals were located and facilities for breeding were absent. The other facility housed five individuals (39 in their breeding report) and was judged to be capable of producing offspring. For the years 2006 and 2007, Indonesia reported the export of 606 and 615 captive-bred Timor monitor lizards, respectively, mainly to the USA.





**Figure 15.1** Captive-breeding of reptiles in Indonesia, showing numbers of individuals reported in monthly breeding reports and numbers recorded during site visits. The line of unity represents the line where reported numbers equal recorded numbers. Key: 1 = Timor monitor lizard *Varanus timorensis*; 2 = pig-nosed turtle *Carettochelys insculpta*; 3 = frillneck lizard *Chlamydosaurus kingii*; 4 = emerald monitor lizard *V. prasinus*, 5 = green tree-python *Morelia viridis*.

### 15.3.5 Wildlife trade links and wildlife trade enforcement

Although we here focus on the trade in reptiles, it is important to note that much of the trade in the above-mentioned species occurs concurrently with (legal and illegal) trade in other wildlife. The Thai traders in Appendix I-listed tortoises traded in a large range of pet reptiles, often from similar range countries. For example, during the 2010 survey at Chatuchak market, more than 400 Madagascar chameleons, geckos, snakes and frogs were also observed. Chatuchak is also known to be a major outlet for mammalian products as diverse as elephant ivory (Stiles 2009) and live slow lorises (Nekaris et al. 2010).

Especially during the 2002 survey, but also to a lesser extent during the 2008 survey, we found a strong link between the trade in *bekko* and ivory in Vietnam. In 2002, of the 36 shops with *bekko* for sale in Ho Chi Minh City, 16 also had elephant ivory for sale. Furthermore, a number of business cards collected from dealers depicted both sea turtles and elephants, suggesting the availability of both ivory and *bekko* (or other marine turtle products). In some cases, clouded monitor

lizards were seized on their own, but more often they were seized with a variety of other vertebrate species also destined for the exotic meat market, including East Asian porcupines (*Hystrix brachyura*), Malayan pangolins (*Manis javanica*), leopards (*Panthera pardus*), barn owls (*Tyto alba*), estuarine crocodiles (*Crocodylus porosus*) and reticulated pythons (*Python reticulatus*). Hence, while the shipments of clouded monitor lizards were substantial, the traders dealing in them were also dealing illegally in other protected wildlife.

The popular international media often link wildlife trade crimes directly to the illicit drugs or arms trade or to trafficking of women and children, but it is worth noting that in the four case studies addressed here we found no such link. Traders in animals and animal parts were, by and large, specialised in various types of wildlife trade and it is our impression that most are indeed only involved in wildlife trade or other legal commercial trade.

## 15.4 Discussion

The trade in live reptiles to supply the demand for the international pet trade involves large numbers (e.g. Hoover 1998, Bridges et al. 2001, Auliya 2003). The curio trade (including *bekko*) affects certain species disproportionately (Heppell and Crowder 1996), as does the trade in reptiles for traditional Chinese medicine (Chen et al. 2009) but numbers of individual animals are dwarfed by the quantities traded in reptile skins (Dodd 1986, Zhou et al. 2004). Increasingly the trade in reptiles to supply the demand for the 'exotic' meat markets is becoming more apparent (van Dijk et al. 2000, Zang et al. 2008) with, for instance, tonnes of turtles being traded into China (Shepherd 2000, Shoppe 2009). The case studies presented here, in our experience, give a fair and illustrative representation of the wildlife trade throughout Southeast Asia. Although the often illicit wildlife trade in Indonesia, Vietnam and Thailand occurs very much in the open (e.g. in large open markets), or in specialised shops, it is somewhat more hidden in Malaysia and other Southeast Asian countries. Increasingly the internet is becoming an important vehicle for buying and selling wildlife, though here we see even larger differences between countries (this may be related to the countries' internet penetration rate, i.e. the percentage of the total population of a given country that uses the internet, which ranges from 12% in Indonesia, 26% in Thailand, 27% in Vietnam to 65% in Malaysia: Anonymous 2010).

Our four case studies all clearly indicate deficiencies in wildlife trade regulation and show that the scale of this international trade in threatened species can be a substantial impediment to conservation. The trade in *bekko* and stuffed marine turtles in Vietnam is currently sourced largely from Indonesian and Malaysian vessels because marine turtles are largely depleted from Vietnamese waters

(Hamann et al. 2005). Globally, hawksbill turtles are Critically Endangered, with trade in *bekko* being identified as one of the main threats to the survival of the species (Mortimer and Donnelly 2008). Likewise, harvesting of green turtles has been identified as the main threat to this species, contributing to its Endangered status (Seminoff 2004). The *bekko* industry in Vietnam supplies demand from other Asian countries and, to a lesser extent, Asian nationals living elsewhere (Stiles 2008).

As with the trade in *bekko*, the trade in pet tortoises in Thailand is truly international, with animals sourced from Madagascar and Indo-Burma (India, Bangladesh, Myanmar) only to be re-exported illegally to countries such as Japan, Malaysia and Singapore (Nijman and Shepherd 2007, Shepherd and Nijman 2008b, Todd 2010). This trade involves some of the world's most endangered tortoises. For the most part, tortoises are openly displayed in shops, suggesting ineffective enforcement.

The data on trade in clouded monitor lizards were obtained from the Malaysian authorities. While it is encouraging to see that these seizures are made, the numbers involved (nearly 40 000 lizards in some 30 confiscations) and the intended destination (with large numbers bound for China) are cause for concern. With limited efforts going into wildlife trade enforcement in Malaysia, and indeed large parts of Southeast Asia, the amounts seized are generally considered the 'tip of the iceberg'. While this leaves unknown how much remains undetected, it indicates that there is a substantial illegal trade in wildlife meat. To have large numbers of a CITES I-listed Totally Protected Animal being captured, killed and packed in Malaysia, and then shipped abroad is hard to view as anything other than an indictment against the law enforcement efforts of the relevant agencies, both in Malaysia, countries along the trade chain and importing countries such as China.

Although commercial captive breeding of reptiles may relieve some pressure on wild populations, this is valid only if the animals exported as captive-bred are indeed bred in controlled captive conditions from parent stock that themselves were bred in similar conditions. When wild-caught individuals are exported labelled as 'captive-bred' this undermines both the rules and the intentions of CITES (Nijman and Shepherd 2010b). Commercial captive breeding has a positive conservation impact only if it is coupled with efficient enforcement in situ, ensuring wild animals are no longer entering the trade.

In recent years 'captive-bred' specimens of species that are clearly unsuitable for commercial captive breeding have been exported from Indonesia. Prime examples are the pig-nosed turtles reported here (females not reaching maturity until ~20 years of age, producing small clutches and generally difficult to keep in captivity; Cann 1998) or spiny turtles (*Heosemys spinosa*, both sexes may attain maturity at the age of ~10 years, producing small clutches; Herman 1993) reported by Nijman and Shepherd (2010a). It is unlikely that these species can be bred commercially in viable quantities and we urge importing parties to be vigilant when accepting

**Table 15.4** Major source countries and end destinations of trade in reptiles and their derivatives. Taiwan PoC, Taiwan, Province of China; Hong Kong SAR, Hong Kong Special Administrative Region.

<b>Taxon</b>	<b>Type</b>	<b>Origin – source</b>	<b>Trader – exporter</b>	<b>Destination</b>
Hawksbill turtles	<i>bekko</i> Stuffed	Indonesia Malaysia	Vietnam	Taiwan, PoC, China, Hong Kong SAR
Tortoises	Pets	Madagascar Indo-Burma	Thailand	Japan, Malaysia, Singapore
Clouded monitor lizard	Meat	Malaysia	Malaysia	China
Reptiles	Pets	Indonesia	Indonesia	USA, EU

difficult-to-breed species. Furthermore, we urge the Indonesian authorities to clamp down on farms wrongly claiming to produce viably captive-bred reptiles.

This research is based on a number of surveys conducted by TRAFFIC in the last decade, and has a bias towards wildlife trade with international aspects (Table 15.4). The illegal flow of legally protected and CITES-listed species from one country to the next often in substantial numbers suggests that enforcement efforts need to be stepped up. Source countries (Madagascar, Myanmar, Indonesia and Malaysia among others) should ensure that protected wildlife is not exported illegally, importing and re-exporting countries in the region (Thailand, Vietnam, China, Singapore) must ensure that imports and exports do not violate existing legislation. End destinations (Japan, USA, EU, among others) must assure that the imports do not violate the rules and intentions of CITES and that imported specimens were acquired in accordance with national legislation in the country of origin. With limited resources being spread out over a vast geographic area and with great monetary gains to be made from the illegal wildlife trade (and generally low risks of detection and prosecution), this is a daunting task. Furthermore, the weight of legal instruments to control the trade is undermined when local harvesters realise that little action is being taken against known traders and observe high-ranking officials trading or consuming wildlife products. Low rates of prosecution, low penalties and imposition of below-maximum fines all act as a limiting factor to enforcement success (Nijman, 2005).

As shown here and elsewhere (Wang et al. 1996, Li and Li 1998, Davies 2005, Karesh et al. 2007, Shepherd and Nijman 2008a), it is important to realise that most wildlife trade streams pass through a limited number of trade hubs (although these vary for different species-groups and may change over time). These trade

streams and trade hubs provide ample opportunities to maximise the effects of regulatory efforts, as demonstrated with domestic animal trading systems (e.g. processing plants and wholesale and retail markets). Only through targeted and well-informed actions will authorities be able to substantially reduce the illegal reptile trade in Asia.

## Acknowledgements

Daniel Stiles, Mark Auyilia and Elizabeth John conducted parts of the TRAFFIC surveys from which we drew our examples: we thank them all. Loretta Ann Shepherd is thanked for information and comments. The TRAFFIC surveys were financially supported by grants from WWF Netherlands, WWF UK and Royal Danish Embassy. We thank the reviewers for constructive comments on our paper and for suggestions for improvement.

## References

- Abensperg-Traun, M. (2009). CITES, sustainable use of wild species and incentive-driven conservation in developing countries, with an emphasis on southern Africa. *Biological Conservation*, **142**, 948–63.
- Anonymous (2010). Internet world stats: usage and population statistics. Available at: <http://www.internetworldstats.com/>, accessed 24 October 2010.
- Auliya, M. (2003). *Hot Trade in Cool Creatures: A Review of the Live Reptile Trade in the European Union in the 1990s*. Brussels: TRAFFIC Europe.
- Araujo, M. B., Thuiller, W. and Pearson, R. G. (2006). Climate warming and the decline of amphibians and reptiles in Europe. *Journal of Biogeography*, **33**, 1712–28.
- Blundell, A. G. and Mascia, M. B. (2005). Discrepancies in reported levels of international wildlife trade. *Conservation Biology*, **19**, 2020–25
- Bridges, V., Koprak, C. and Johnson, R. (2001). *The Reptile and Amphibian Communities in the United States*. Fort Collins, CO: USDA; APHIS; VS Centers for Epidemiology and Animal Health
- Broad, S., Mulliken, T. and Roe, D. (2003). The nature and extent of legal and illegal trade in wildlife. In *The Trade in Wildlife. Regulation for Conservation*, ed. S. Oldfield. London: Flora and Fauna International, Resource Africa and TRAFFIC International, pp. 3–22
- Cann, J. (1998). *Australian Freshwater Turtles*. Singapore: Beauworth Publishing Ltd.
- Chen, T. H., Chang, H. C. and Lue, K. Y. (2009). Unregulated trade in turtle shells for Chinese traditional medicine in East and Southeast Asia: the case of Taiwan. *Chelonian Conservation Biology*, **8**, 11–18.
- CITES (2000). Doc. 11.21.1 Interpretation and implementation of the Convention, National laws for implementation of the Convention, National Legislation

- Project. Available at: [http://www.cites.org/eng/cop/11/doc/21\\_01.pdf](http://www.cites.org/eng/cop/11/doc/21_01.pdf), accessed 27 October 2010.
- CITES (2007). Notification No. 2005/035. Available at: <http://www.cites.org/common/resources/reports/pab/05-06Malaysia.pdf>, accessed 17 March 2009.
- Davies, B. (2005). *Black Market: Inside the Endangered Species Trade in Asia*. San Rafael, CA: Earth Aware Editions.
- van Dijk, P.-P. and Shepherd, C. R. (2004). *Shelled Out? A Snapshot of Bekko Trade in Selected Locations in South-east Asia*. Petaling Jaya, Malaysia: TRAFFIC Southeast Asia.
- van Dijk, P.-P., Stuart, B. L. and Rhodin, A. G. J. (2000). *Asian Turtle Trade: Proceedings of a Workshop on Conservation and Trade of Freshwater Turtles and Tortoises in Asia*. Lunenburg, MA: Chelonian Research Foundation.
- Dodd, C. K. Jr. (1986). Importation of live snakes and snake products into the United States, 1977-1983. *Herpetological Review*, **17**, 76-9.
- Engler, M. and Parry-Jones, R. (2007). *Opportunity or Threat: The Role of the European Union in Global Wildlife Trade*. Brussels: TRAFFIC Europe.
- Garber, S. D. and Burger, J. (1995). A 20-year study documenting the relationship between turtle decline and human recreation. *Ecological Applications*, **5**, 1151-62.
- Gardner, T. A., Barlowa, J. and Peres, C. A. (2007). Paradox, presumption and pitfalls in conservation biology: the importance of habitat change for amphibians and reptiles. *Biological Conservation*, **138**, 166-79.
- Gibbons, J. W., Scott, D. E., Ryan, T. J. et al. (2000). The global decline of reptiles, déjà vu amphibians. *BioScience*, **50**, 653-66.
- Green, E. P. and Shirley, F. (1999). *The Global Trade in Corals*. Cambridge: World Conservation Monitoring Centre.
- Guillette, L. J., Gross, T. S., Masson, G. R. et al. (1994). Developmental abnormalities of the gonad and abnormal sex hormone concentrations in juvenile alligators from contaminated and control lakes in Florida. *Environmental Health Perspectives*, **102**, 680-8.
- Hamann, M., Hien, B. T. T., Cox, N. et al. (2005). Marine turtle conservation in Viet Nam: towards 2010. *Marine Turtle Newsletter*, **107**, 5-6.
- Heppell, S. S. and Crowder, L. B. (1996). Analysis of a fisheries model for harvest of hawksbill sea turtles (*Eretmochelys imbricata*). *Conservation Biology*, **10**, 874-80.
- Herman, D. W. (1993). Reproduction and management of the Southeast Asian spiny turtle (*Heosemys spinosa*) in captivity. *Herpetological Natural History*, **1**, 97-100.
- Hoover, C. (1998). *The US Role in the International Live Reptile Trade: Amazon Tree Boas to Zululand Dwarf Chameleons*. Washington DC: TRAFFIC North America.
- Janzen, F. J. (1994). Climate change and temperature dependent sex determination in reptiles. *Proceedings of the National Academy of Sciences*, **91**, 7487-90.
- Karesh, W. B., Cook, R. A., Gilbert, M. and Newcomb, J. (2007). Implications of wildlife trade on the movement of avian influenza and other infectious diseases. *Journal of Wildlife Diseases*, **43**, 55-9.
- Li, Y. and Li, D. (1998). The dynamics of trade in live wildlife across the

- Guangxi border between China and Vietnam during 1993–1996 and its control strategies. *Biodiversity and Conservation*, **7**, 895–914.
- Ministry of Natural Resources and Environment (2009) *Response to the Article*. Kuala Lumpur: Corporate Communication Unit of the Ministry of Natural Resources and Environment. Available at: <http://www.nre.gov.my/BM/Maklumbalas/RTTA%20Wildlife%2010%2012%2013%20August.pdf>, accessed 17 March 2009.
- Mortimer, J. A. and Donnelly, M. (2008). *Eretmochelys imbricata*. In *IUCN Red List of Threatened Species. Version 2010.2*. Available at: [www.iucnredlist.org](http://www.iucnredlist.org), accessed 27 August 2010.
- Nekaris, K. A. I., Starr, C. R., Shepherd, C. R. and Nijman, V. (2010). Revealing culturally-specific patterns in wildlife trade via an ethnoprimateological approach: a case study of slender and slow lorises (*Loris* and *Nycticebus*) in South and Southeast Asia. *American Journal of Primatology*, **72**, 877–86.
- Ng, P. K. L. and Tan, H. H. (1997). Freshwater fishes of Southeast Asia: potential for the aquarium fish trade and conservation issues. *Journal of Aquarium Science and Conservation*, **1**, 79–90.
- Nijman, V. (2005). *In full swing. An assessment of the Trade in Gibbons and Orangutans on Java and Bali, Indonesia*. Petaling Jaya, Malaysia: TRAFFIC Southeast Asia.
- Nijman, V. (2010). An overview of the international wildlife trade from Southeast Asia. *Biodiversity and Conservation*, **19**, 1101–14.
- Nijman, V. and Shepherd, C. R. (2007). Trade in non-native, CITES-listed, wildlife in Asia, as exemplified by the trade in freshwater turtles and tortoises (Chelonidae) in Thailand. *Contributions to Zoology*, **76**, 207–11.
- Nijman, V. and Shepherd, C. R. (2010a). *Wildlife trade from ASEAN to the EU: Issues with the Trade in Captive-bred Reptiles from Indonesia*. Brussels: TRAFFIC Europe.
- Nijman, V. and Shepherd, C. R. (2010b). The role of Asia in the global trade in CITES II-listed poison arrow frogs: hopping from Kazakhstan to Lebanon to Thailand and beyond. *Biodiversity and Conservation*, **19**, 1963–70.
- Nijman, V. and Shepherd, C. R. (2011). The role of Thailand in the international trade in live CITES-listed reptiles and amphibians. *PLoS One*, **6**(3), e17825.
- Schlaepfer, M. A., Hoover, C. and Dodd, C. K. (2005). Challenges in evaluating the impact of the trade in amphibians and reptiles on wild populations. *BioScience*, **55**, 256–64.
- Schoppe, S. (2009). *Status, Trade Dynamics and Management of the Southeast Asian Box Turtle in Indonesia*. Petaling Jaya, Malaysia: TRAFFIC Southeast Asia.
- Seminoff, J. A. 2004. *Chelonia mydas*. In *IUCN Red List of Threatened Species. Version 2010.2*. Available at: [www.iucnredlist.org](http://www.iucnredlist.org), accessed 27 August 2010.
- Shepherd, C. R. (2000). Export of live freshwater turtles and tortoises from North Sumatra and Riau, Indonesia: a case study. In *Asian Turtle Trade: Proceedings of a Workshop on Conservation and Trade of Freshwater Turtles and Tortoises in Asia*, ed. P. P. van Dijk, B. L. Stuart and A. G. J. Rhodin. Lunenburg, MA: Chelonian Research Foundation, pp. 112–19.
- Shepherd, C. R. and Ibarrondo, B. (2005). *The Trade of the Roti Island Snake-necked Turtle Chelodina mccordi*,

- Indonesia*. Petaling Jaya, Malaysia: TRAFFIC Southeast Asia.
- Shepherd, C. R. and John, E. (2010). Clouded monitor lizard seizures in Peninsula Malaysia. *TRAFFIC Bulletin*, **22**, 102–103.
- Shepherd, C. R. and Nijman, V. (2008a). Trade in bear parts from Myanmar: an illustration of the in-effectiveness of enforcement of international wildlife trade regulations. *Biodiversity and Conservation*, **17**, 35–42.
- Shepherd, C. R. and Nijman, V. (2008b). *An Assessment of Trade in Freshwater Turtles and Tortoises at Chatucak Animal Market, Bangkok, Thailand*. Petaling Jaya, Malaysia: TRAFFIC Southeast Asia.
- Shunichi, T. (2005). *The State of the Environment in Asia 2005–2006*. Tokyo: Springer-Verlag, Japan Environmental Council.
- Stiles, D. (2008). *An Assessment of the Marine Turtle Products Trade in Viet Nam*. Petaling Jaya, Malaysia: TRAFFIC Southeast Asia.
- Stiles, D. (2009). The status of the ivory trade in Thailand and Viet Nam. *TRAFFIC Bulletin*, **22**, 83–91.
- Stoett, P. (2002). The international regulation of trade in wildlife: institutional and normative considerations. *International Environmental Agreements: Politics, Law and Economics*, **2**, 195–210.
- Stuart, B. L., Rhodin, A. G., Grismer, L. L. and Hansel, T. (2006). Scientific description can imperil species. *Science*, **312**, 1137.
- Todd, M. (2010). *Trade in Malagasy Reptiles and Amphibians in Thailand*. Petaling Jaya, Malaysia: TRAFFIC Southeast Asia.
- TRAFFIC (2004). *The Trade in Marine Turtle Products in Viet Nam*. Ha Noi, Vietnam: TRAFFIC Southeast Asia-Indochina.
- TRAFFIC (2008). *What's Driving the Wildlife Trade?* Washington DC: The World Bank.
- Wang, Z., Chen, H. and Wu, D. (1996). The status on live wildlife trade near the port areas in Yunnan. In *Conserving China's Biodiversity*, ed. P. J. Schei, W. Sung and X. Yan. Beijing: China Environmental Science Press, pp. 197–210.
- Wood, E. M. (2001). *Collection of Coral Reef Fish for Aquaria: Global Trade, Conservation Issues and Management Strategies*. Ross-on-Wye, UK: Marine Conservation Society.
- Zhang, L., Ning, H. and Sun, S. (2008). Wildlife trade, consumption and conservation awareness in southwest China. *Biodiversity and Conservation*, **17**, 1493–516.
- Zhou, Z. and Jiang, Z. (2004). International trade status and crisis for snake species in China. *Conservation Biology*, **18**, 1386–94.