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Assessment of the international illicit wildlife trade in the critically endangered Malagasy tortoise species *Astrochelys yniphora* and *Astrochelys radiata*

DENNIS SCHWARZ¹, DAVID NEWTON² & CYNTHIA RATZIMBAZAFY³

¹Hamburg University, Animal Ecology and Conservation, Martin-Luther-King Platz 3, 20146 Hamburg, Germany

²TRAFFIC, East/Southern Africa regional office, c/o IUCN East and Southern Africa Regional Office, PO Box 11536, Hatfield, Pretoria, South Africa

³TRAFFIC, East/Southern Africa regional office, c/o WWF Madagascar Country Office, BP 738, Antananarivo 101, Madagascar.

Corresponding author: DENNIS SCHWARZ, e-mail: d_schwarz1@gmx.de

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Illicit wildlife trade is a main reason for the decline of many species worldwide (BROAD et al. 2003, ENGLER & PARRY-JONES 2007, ROSEN & SMITH 2010). Animals or parts and derivatives of them are traded as food, traditional medicine, skin for the fashion industry, or as pets. Especially for reptiles, the wildlife trade with Asia as a major hub contributes to the population declines of many endangered species (TODD 2011, NIJMAN & SHEPHERD 2015).

In Madagascar, the illicit export of rosewood and palisander (*Dalbergia* spp., *Diospyros* spp.) mainly to China amounted to about US\$ 220 million in 2009 (RANDRIAMALALA & LIU 2010) and the reptile and amphibian trade may also yield substantial sums of money (RASELIMANANA 2003). Among reptiles, the international trade in Madagascar's four endemic tortoises, including the radiated tortoise (*Astrochelys radiata*), ploughshare tortoise (*A. yniphora*), spider tortoise (*Pyxis arachnoides*), and the flat-tailed tortoise (*P. planicauda*), has been identified as a substantial threat to the survival of these species and should therefore receive more attention (e.g., NUSSBAUM & RAXWORTHY 2000, TODD 2011, KIESTER et al. 2013, RAMAHALEO & VIRAH-SAWMY 2013, GANZHORN et al. 2015). All four tortoises have been assessed as 'Critically Endangered' in the IUCN Red List of Threatened Species and listed in Appendix I of CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora), which prohibits commercially trading in them (LEUTERITZ & PEDRONO 2008, LEUTERITZ & RIOUX PAQUETTE 2008, LEUTERITZ et al. 2008, LEUTERITZ & WALKER 2014, www.cites.org). Yet, the actual impact of the international trade remains difficult to evaluate. In order to assess the extent of the global

trade, the present correspondence discusses the international illicit trade in two endemic Malagasy tortoise species, *Astrochelys yniphora* and *A. radiata*. We chose to focus on these two species because *A. yniphora* was declared to be world's rarest tortoise (PEDRONO & SAROVY 2000) with a population estimate of 600 wild individuals remaining and declining (KIESTER et al. 2013), while *A. radiata* faced a population decline of 47% from an estimated 12 million to 6.3 million between 2000 and 2012 (RAFELIARISOA et al. 2013). Furthermore, *A. radiata* was traded in high numbers (320 individuals found during 12 surveys) on Bangkok's Chatuchak weekend market between 2004 and 2014 (NIJMAN & SHEPHERD 2015).

The geographic range of *A. yniphora* is restricted to an area of less than 100 km², divided into subpopulations through habitat fragmentation and degradation (LEUTERITZ & PEDRONO 2008). The 600-individual estimate between 2011 and 2013 included individuals with carapace length > 200 mm (KIESTER et al. 2013). Illegal collection of individuals for the international wildlife trade has become a major threat to the species' survival (LEUTERITZ & PEDRONO 2008). It is estimated that the numbers of individuals kept in captivity illegally are similar to their number in the wild population (KIESTER et al. 2013).

As for *A. radiata*, the population decline results from a combination of habitat loss, collection for local bush meat, and international pet trade (RAFELIARISOA et al. 2013). Approximately 45,000–60,000 individuals are collected annually from their inhabited ecoregion (RAMAHALEO & VIRAH-SAWMY 2013). According to a survey in 2011 (SulaMa 2011), about two pirogues with 50–80 radiated tor-

toises each leave from the coast of a small community west of Tsimanampetsotsa National Park per week. Another investigation on the quantities of *A. radiata* being poached in the area of southern Madagascar documented that more than 8,870 live tortoises were seized between 2001 and 2010 and more than 4.8 tons of meat (RAMAHALEO & VIRAH-SAWMY 2013). WALKER & RAFELIARISOA (2012) suggested that habitat loss and poaching to support the illicit pet trade were insignificant to the decline of the species given the current scale of bush meat poaching, which constitutes the main problem. Their hypothesis is supported by confiscations reported by national media of 222 live tortoises, 8.2 tons of dried meat, and 155 pounds of fresh meat within the Ambovombe area during October 2011, with six villages and potentially hundreds of people thought to be involved.

The complexity of the poaching problem is connected with the social situation in Madagascar. Poverty and several years of drought and diminished agricultural production have led people to collect tortoises and sell them for cash to be able to purchase rice and corn (HUDSON 2013). Furthermore, the laws on protected species are not enforced. Corruption, lack of resources to conduct adequate controls, lack of motivation among law enforcers, and lack of knowledge about new laws hinder conservation actions and the persecution of poachers (RAMAHALEO & VIRAH-SAWMY 2013). Furthermore, detecting smuggling activities is challenging, as traders are well informed which flight routes to choose to avoid luggage checks. A flight route used to smuggle animals to Bangkok is from Mahajanga (Madagascar), because this airport lacks baggage scanners, to Mayotte in the Comoros Islands, then on to Reunion Island, and from there to Bangkok (KIESTER et al. 2013). Once smuggled animals arrive in Thailand, they can be traded openly, because according to Thai legislation (Wild Animal Reservation and Protection Act B.E. 2535, WARPA, of 1992), dealers stocking exotic protected species are not required to prove the origin of specimens unless they are in the process of exporting or importing them (TODD 2011). By manipulating the CITES system, these smuggled animals are then often declared captive-bred with fake documents and so enter the international trade laundered (NIJMAN & SHEPHERD 2009).

Between November and December of 2014, data on confiscations of both species at international airports were collected by searching popular media and press reports on the Internet. We searched the Internet using the search engine Google. Focus was on confiscations that took place on international airports to separate the international pet trade from the local bush meat trade. Results contained in the first five pages of each Google search were examined. Search items were: tortues saisies; tortues confisquées; tortues à soc saisies; tortues saisies Madagascar; tortues confisquées Madagascar; tortue étoilée saisies; *Astrochelys radiata* confiscated; *Astrochelys yniphora* confiscated; Madagascar tortoises; ploughshare tortoise confiscated; radiated tortoise confiscated; trade Malagasy tortoises; traffic Malagasy tortoises; Angonoka seized.

The search yielded a total of 125 confiscated individuals of *A. yniphora* and 3,864 confiscated individuals of *A. radiata* between 2010 and December 2014 (Table 1). The focus on Internet sources also revealed confiscations in six countries: China, France, Madagascar, Malaysia, Thailand, and the Union of the Comoros.

The annual mean of 773 individuals of *A. radiata* seized from of a total of 3,864 individuals that were seized from 2010 to 2014 (five years) represents 1.3% of the estimated 60,000 tortoises collected annually from the region. As it is difficult to assess the complete volume of the illicit international trade, given the fact that it is unlikely that all instances of poaching were detected, these data have to be understood as a fraction of the actual number traded internationally. Considering that there is still so little data available on this topic, this survey contributes to the assessment of the extent of illicit international trade in the species *A. radiata*.

The number of 125 individuals of *A. yniphora* confiscated between 2010 and 2014 illustrates the acute threat to the species by international trafficking. As in the case of *A. radiata*, these confiscations only represent an unknown fraction of the actual extent of trade. Seized animals are usually juveniles (C. SHEPHERD pers. comm.) and therefore not represented in population estimates. These data indicate that illicit wildlife trade in *A. yniphora* takes place in high numbers relative to the remaining wild population estimated. The confiscation of 54 individuals during one check at Suvarnabhumi Airport (Bangkok, Thailand) in 2013 shows that massive numbers of tortoises can be air-shipped in a single trafficking attempt (TRAFFIC 2013, <http://www.traffic.org/home/2013/3/19/largest-seizure-of-critically-endangered-ploughshare-tortoises.html>). If poaching continues at these high rates, the wild population of *A. yniphora* will be under serious pressure, as the animals' generation time is estimated at 42 years, and sexual maturity is reached at a minimum age of 15 years (LEUTERITZ & PEDRONO 2008). Thus, the species' life history traits provide highly unfavourable conditions for any removal of wild individuals.

Establishing and implementing intelligence sharing between Malagasy, Malaysian, and Thai conservation agencies, an increase of penalties handed down for wildlife crimes, establishing checkpoints at smuggling hotspots at the Malaysia/Thailand border, and conducting species-identification training programmes for key enforcement personnel are some of the recommendations made by TRAFFIC to halt the process of laundering smuggled animals into the international trade (NIJMAN & SHEPHERD 2009, TODD 2011). Mainly, a review and amendment of the WARPA is strongly recommended, the text of Section 23 should be amended to include "possession" in the provision for CITES-listed species as to shift the obligation of proving the rightful ownership on the owner rather than the enforcement authorities (CHNG 2014, TODD 2011).

Furthermore, legalisation of a regulated small-scale trade in *A. radiata* has been suggested as one possible conservation measure, potentially providing financial incen-

Table 1. Quantities of internationally seized individuals of the species *A. yniphora* and *A. radiata* between 2010 and 2014. Numbers listed under “Source” represent Internet sources: 1 – <http://www.wildlifeextra.com/go/news/madagascar-tortoise828.html#cr>; 2 – http://wwf.panda.org/wwf_news/?194250/New-law-backs-up-Malaysian-customs-efforts-to-stop-endangered-tortoise-smugglers; 3 – <http://pattayadailynews.com/thai-customs-seize-consignment-of-tortoises-from-africa/>; 4 – <http://www.traffic.org/home/2011/7/27/malagasy-frontier-police-seize-indonesia-bound-shipment-of-w.html>; 5 – <http://www.greenetvert.fr/2012/10/20/900-tortues-endemiques-confisquees-en-une-semaine/67806>; 6 – <http://www.traffic.org/home/2013/3/19/largest-seizure-of-critically-endangered-ploughshare-tortois.html>; 7 – <http://www.traffic.org/home/2013/12/10/rare-malagasy-tortoises-turn-up-in-luggage-seized-in-bangkok.html>; 8 – <http://annamiticus.com/2014/03/04/bangkok-identified-hub-tortoise-trafficking/>; 9 – <http://www.turtlesurvival.org/storage/documents/magazines/TSA-Magazine-2014.pdf>; 10 – <http://www.turtlesurvival.org/blog/1-blog/279-ploughshare-tortoises-among-shipment-of-521-seized-at-ivato-airport-in-madagascar#.VaQX1vntmko>; 11 – <http://www.lexpressmada.com/blog/actualites/huit-valises-de-tortues-saisies-aux-comores-11751>; 12 – http://www.robindesbois.org/english/animal/ON_THE_TRAIL_6.pdf; 13 – <http://www.straitstimes.com/world/europe/france-seizes-170-rare-baby-radiated-tortoises-at-airport>.

Date of confiscation	Species	Quantity	Location of confiscation	Date of publication	Source
14 June 2010	<i>Astrochelys radiata</i>	285	Kuala Lumpur Airport, Malaysia	16 June 2010	1
16 July 2010	<i>A. radiata</i>	369	Kuala Lumpur Airport, Malaysia	21 July 2010	2
11 October 2010	<i>A. radiata</i>	218	Bangkok Suvarnabhumi Airport, Thailand	12 October 2010	3
27 July 2011	<i>A. radiata</i>	169	Ivato Airport, Madagascar	27 July 2011	4
10 October 2012	<i>A. radiata</i>	569	Ivato Airport, Madagascar	20 October 2012	5
15 March 2013	<i>A. radiata</i>	21	Bangkok Suvarnabhumi Airport, Thailand	19 March 2013	6
10 December 2013	<i>A. radiata</i>	62	Bangkok Suvarnabhumi Airport, Thailand	10 December 2013	7
11 February 2014	<i>A. radiata</i>	127	Bangkok Airport, Thailand	4 March 2014	8
March 2014	<i>A. radiata</i>	153	Ivato Airport, Madagascar	2014	9
11 May 2014	<i>A. radiata</i>	512	Ivato Airport, Madagascar	13 May 2014	10
31 May 2014	<i>A. radiata</i>	1014	Moroni-Hahaya Airport, Comoros	3 June 2014	11
27 September 2014	<i>A. radiata</i>	195	Guangzhou Airport, Guangdong, China	3 November 2014	12
14 December 2014	<i>A. radiata</i>	170	Paris Charles de Gaulle Airport, France	29 December 2014	13
June 2010	<i>Astrochelys yniphora</i>	1	Kuala Lumpur Airport, Malaysia	16 June 2010	1
16 July 2010	<i>A. yniphora</i>	5	Kuala Lumpur Airport, Malaysia	21 July 2010	2
27 July 2011	<i>A. yniphora</i>	26	Ivato Airport, Madagascar	27 July 2011	4
15 March 2013	<i>A. yniphora</i>	54	Bangkok Suvarnabhumi Airport, Thailand	19 March 2013	7
11 February 2014	<i>A. yniphora</i>	10	Bangkok Airport, Thailand	4 March 2014	8
March 2014	<i>A. yniphora</i>	19	Ivato Airport, Madagascar	2014	9
11 May 2014	<i>A. yniphora</i>	9	Ivato Airport, Madagascar	13 May 2014	10
31 May 2014	<i>A. yniphora</i>	1	Moroni-Hahaya Airport, Comoros	3 June 2014	11

tives that could reduce non-sustainable trade (LINDGARD et al. 2003, GANZHORN et al. 2015). The conservation organisation Turtle Survival Alliance (TSA) motivates communities in Madagascar to protect their tortoises on their own. In 2011, the TSA provided financial support to build a primary school for the citizens of the village Antsakoamasy, who are very enthusiastic about protecting their tortoises. The school was opened in 2012 with over 1,000 people attending the opening ceremony and inspiring tortoise conservation in other communities by outlining that there is value in protecting tortoises (HUDSON 2013). Public awareness campaigns show success, with Tsiombe village being another example of a community protecting their tortoises by their own initiatives. Almost all poaching attempts in the area have been detected due to intelligence coming from members of the village (RAMAHALEO & VIRAH-SAWMY 2013). The TSA also developed a “confiscation and reintroduction strategy”, with the ultimate goal of reintroducing confiscated tortoises to areas of former abundance in safe and protected habitats. Establishing five temporary

rescue facilities, where confiscated tortoises can be cared for immediately, is planned in five well-known poaching areas in Madagascar. One was built in 2013 at Ambovombe and one at Ampanihy was under construction at the time (HUDSON 2013). In 2005, the Village des Tortues in Mangily-Ifaty, 30 km north of Toliara, was opened to receive confiscated tortoises, providing care and shelter. The ultimate goal was the reintroduction of these confiscated tortoises into the wild, but no tortoise was reintroduced between 2005 and 2013 (RAMAHALEO & VIRAH-SAWMY 2013). Also, establishing educational projects and publicising the dire situation of endangered wildlife worldwide may reduce people’s interest in keeping endangered exotic species and lead to a decline in their illicit trade.

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