



Dynamics of the global trade in live reptiles: Shifting trends in production and consequences for sustainability



Janine E. Robinson*, Richard A. Griffiths, Freya A.V. St. John, David L. Roberts

Durrell Institute of Conservation and Ecology, School of Anthropology and Conservation, Marlowe Building, University of Kent, Canterbury, Kent CT2 7NR, UK

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ABSTRACT

Biodiversity-rich countries provide wildlife for the exotic pet trade, but the implications of this for conservation, sustainable use and livelihoods remain poorly understood. CITES Appendix II import data from 1996 to 2012 were used to analyse spatial and temporal trends in live reptiles, a group comprising a substantial component of the commercial wildlife trade. Between 2001 and 2012 the trade declined by a third. The decrease was greatest in wild-caught reptiles (70%), but imports in captive-bred reptiles also decreased (40%), due to reduced trade in green iguanas. Imports originating from captive sources comprised about half of the total trade over the period. In contrast, there was a nearly 50-fold increase in imports of ranched reptiles, dominated by royal pythons from sub-Saharan Africa, but including a recent upsurge of ranched turtles from South America and Asia. Additionally, the proportion of reptiles sourced from 'range countries' (where species naturally occur in the wild) declined. Numbers of reptiles captive-bred within consumer countries to supply domestic markets are difficult to obtain, but may be impacting international trade. Captive breeding may ease collection pressure on wild populations, but might also divert benefit flows, impacting local livelihoods. Ranching may benefit livelihoods and have low impacts on natural populations, but along with captive breeding, could be detrimental if loopholes allow wild animals to be exported as ranched. Given the shift from wild to ranched reptiles, more information is required on the benefits and impacts of commercial ranching operations for traded reptile species.

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1. Introduction

Overexploitation contributes significantly to the extinction risk of threatened species (Rosser and Mainka, 2002). If sustainability is an ultimate conservation goal, it is crucial to understand supply, demand and the temporal and spatial dynamics of resource use. Millions of live animals and plants, as well as their parts and derivatives, are traded each year to supply consumer demand around the world (Broad et al., 2003; Nijman, 2010; Smith et al., 2009). The legal international trade in wildlife, excluding fisheries and timber, was estimated to be worth ~\$24 billion in 2005 (Engler and Parry-Jones, 2007) but domestic and illegal trade is much more difficult to value. Wildlife trade can impact species conservation (O'Brien et al., 2003; Shepherd and Magnus, 2004; van Balen et al., 2000) but also has important social and economic implications (McNeill and Lichtenstein, 2003; Roe, 2002, 2008). The Convention on International Trade in Endangered Species (CITES) was established to help regulate international trade in wild species and ensure it does not threaten their survival. Over 35 000 species

are afforded varying levels of protection through CITES, according to their conservation status and risk from trade, which is regulated through an import–export permitting system.

In some cases, captive breeding may provide a suitable alternative to wild collection (Jepson et al., 2011). It can reduce pressure on wild populations, and captive-bred animals are subject to less stringent CITES controls than wild-sourced animals. Indeed, many commonly kept pets are bred in consumer nations, and this can contribute to research regarding biology, husbandry and disease (Marano et al., 2007). However, captive breeding can also reduce benefit flows to countries where species originate, counter to the Convention on Biological Diversity which recognizes sovereign rights of states over their natural resources and advocates “fair and equitable sharing of benefits arising out of their use” (CBD, 2014). Captive breeding may also disconnect suppliers from source habitats thus limiting opportunities for sustainable use and conservation initiatives. Additionally, captive breeding has been linked to laundering of illegally wild-caught animals (Brooks et al., 2010; Lyons and Natusch, 2011), demonstrating the complex and varied nature of the benefits and impacts of alternative production strategies for supplying the trade.

* Corresponding author. Tel.: +44 (0)1227 827 056x4076.

E-mail address: jr418@kent.ac.uk (J.E. Robinson).

'Ranching', defined within CITES as "rearing in a controlled environment of specimens which have been taken as eggs or juveniles from the wild, where they would have a very low probability of surviving to adulthood" (CITES, 2014a), is another system used for producing reptiles. Ranching relies on harvesting young life stages that regularly experience high mortality in the wild, and is therefore considered a relatively benign method of exploitation (Hutton et al., 2001). In some cases, the harvesting is compensated for by the release of some offspring back into the wild. Ranching is practiced within the country where the species occurs, and if well managed, has potential to benefit both livelihoods and conservation (Gordon and Ajiemba, 2003; Moyle, 2013; Thorbjarnarson, 1999).

A substantial component of the international wildlife trade is made up of reptiles and their products, (Caldwell, 2012; Hoover, 2000; Kasterine et al., 2012). For example, excluding caviar extract, the trade in reptiles accounted for 84% of the value of CITES-listed animals and animal products imported into the EU in 2010, mostly consisting of leather products and skins (UNEP-WCMC, 2012). Additionally, commercial and recreational breeding of reptiles has increased in recent years (Auliya, 2003). The live reptile trade into the EU was valued at \$4.3 million in 2010, accounting for 22% of all live imports by value, superseded only by mammals (UNEP-WCMC, 2012).

Some reptile groups, particularly those associated with freshwater and marine habitats are facing disproportionately high extinction risks (Böhm et al., 2013). These risks are particularly severe amongst turtles, terrapins and tortoises, which in addition to suffering a range of threats (Bugoni et al., 2001; Lewison and Crowder, 2007), are traded extensively as food, curios, pets and use in traditional medicine (Gibbons et al., 2000; Nijman and Shepherd, 2007). Further, there is often limited information about the viability of wild populations (Pough, 2013). Reptiles with small ranges and narrow niche requirements are particularly vulnerable to anthropogenic threats (Böhm et al., 2013). Equally, turtles, snakes and crocodylians that have life histories with prolonged adult survival are vulnerable to commercial exploitation (Pough, 2013).

There is a lack of information regarding the number of live reptiles in trade, where they come from, and the production strategies used to supply them. Using CITES Appendix II trade data we review trends in the production strategies used to supply live reptiles for commercial international trade from 1996 to 2012. In particular, we address the following questions: (1) How has the relative importance of captive-bred, ranched, and wild-sourced animals changed over time? (2) How have changes in production strategies been reflected in global supply routes? (3) What are the consequences of the temporal and spatial dynamics for long term sustainability of the live reptile trade? We focus on the commercial trade in live reptiles, which are predominantly destined for pet trade, but in some cases supply production industries such as farming for meat and skins. Whilst the CITES Trade Database provides substantive data on trade in endangered species at a global scale, we acknowledge that it represents a subset of the entire global trade in reptiles as it does not take into account non-CITES species, illegal or unreported trade, and trade conducted within national borders.

2. Methods

The CITES Trade Database is managed by the United Nations Environment Program and World Conservation Monitoring Centre (UNEP-WCMC) on behalf of the CITES Secretariat with data collated from CITES annual reports submitted by the Parties (CITES signatories). Data on all live reptiles traded globally since 1996

were supplied by UNEP-WCMC [7 April 2014]. Data up to and including 2012 were chosen for analysis based on the completeness of the annual report submission record [dated 4 April 2014].

Ambiguous trade records, such as live specimens traded with units in 'kg' or 'shipments' (representing 0.3% of the data set), rather than as whole units, were excluded. Only data on Appendix II (representing 92.3% of all live reptile trade), commercially traded (coded purpose 'T' in the Trade Database – representing 99.2% of Appendix II reptiles) were analysed. Quantities of reptiles reported by importing countries were analysed rather than quantities reported by exporting countries because some exporting countries report the number of permits issued rather than actual numbers of reptiles exported (UNEP-WCMC, 2013). Only direct trade between exporting and importing countries was analysed, re-export data were excluded. This was because the inclusion of re-export data can lead to double counting and therefore elevated trade records. Re-export data are also unrelated to the country of origin of traded specimens. Because the 27 EU members are not required to report within-EU trade (due to the free trade agreement), rarely reported within-EU trade records were removed.

Comparisons were made between captive-bred (source 'C'), ranched ('R') and wild ('W') reptiles. Remaining sources including first generation ('F'); confiscated or seized ('I'); pre-convention ('O'); unknown ('U') and source unreported ('blank') are incorporated in the 'total trade' figures that are presented.

Genus level records were not included when reporting the number of different species imported over time. However, these records were not excluded for any other analysis. Following CITES standard nomenclature as adopted by the Conference of the Parties (CITES, 2014b), and to avoid duplication, any data reported using synonyms were combined with data reported under the accepted name. Data recorded at subspecies level were combined with species data.

Exporting countries were assigned to geographical regions following the ISO 3166 list of countries maintained by the International Organisation of Standardization and used by the IUCN Red List of Threatened Species. For the top 100 species in trade, exporting countries were categorised as 'range' and 'non-range' according to species range information on the UNEP-WCMC SPECIES+ database and the IUCN Red List. Countries where species were listed as 'introduced' were considered 'non-range'. To compare imports from range versus non-range countries, the percentage of trade coming from range countries in 1996 was compared with 2012, excluding species which were CITES listed post-1996.

Analyses were conducted using IBM SPSS Statistics 20. Pearson's correlations were used to test for relationships between the proportions of imports from different sources (captive-bred, ranched, and wild) over time. A Sign Test was used to test for differences between proportions originating from range versus non-range countries across species.

3. Results

3.1. Global reptile trade

Over 18.8 million live Appendix II reptiles were imported globally for commercial purposes between 1996 and 2012. Most (96.8%) were captive-bred, ranched or sourced from the wild, with remaining sources (D, F, O, I, U and 'blank') accounting for 3.2%.

Following peaks in 1996 and 2001, there has been an overall decline in annual Appendix II reptile imports. Imports decreased by 32.8% from 2001 to 2012 at an average rate of 3.4% per year (Fig. 1a).

Green iguana (*Iguana iguana*) consistently dominated the live reptile trade, with annual imports peaking at nearly one million

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