ARTICLES

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Monitoring the Trade: Using the CITES Database to Examine the Global Trade in Live Monitor Lizards (*Varanus* spp.).

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Abstract - Previous research has shown particular monitor lizard species to be the subject of intense exploitation for the global trade in reptile skins. However, to date there has not been a review of the CITES - declared trade in live monitor lizards. This paper examines the dynamics of the trade in live monitor lizards between 1975 and 2005, based on CITES import data to determine the countries involved, as both exporters and importers. In addition, the species involved in the trade and their source are explored. The results are then discussed with regards to the conservation implications of this trade.

Introduction

In the early 1990's the global trade in wildlife resources was estimated to exceed US$ 159 billion per year, of which approximately US$ 15 billion was accounted for by the trade in live animals and plants, as well as their constituent products and derivatives (Cowdrey, 2002). Reptiles and their constituent products have and continue to be, heavily exploited in many parts of the globe. Demands for reptile products have included skins (Jenkins and Broad, 1994; Thorbjarnarson, 1999), meat (Klemens and Thorbjarnarson, 1995) and ingredients for traditional folk medicine (Alves et al., 2008). As a result, significant historical over-harvesting has been implicated in the extinction of some reptile species, such as many giant tortoise populations of the Mascarene Islands (Stoddart and Peake, 1979).

A more recent demand has been for live reptiles destined for the exotic pet trade (Hoover, 1998), leading researchers to be concerned about the contribution over-exploitation may have upon the current global decline in reptiles (Gibbons et al., 2000**).** In fact, pressure from the trade in live reptiles has been implicated in the extirpation of both the Chinese cave gecko (*Goniurosaurus luii*) and the Roti Island snake-necked turtle (*Chelodina mccordi*) from their type localities soon after their formal description in the scientific literature (Stuart et al., 2006). Demand for live reptiles within the EU alone has resulted in an almost 400% increase in the number of animals imported from 60,000 animals in 1990 to 225,000 in 1999 (Engler and Parry-Jones, 2007), whilst the United States importation records reveal a trade of several million amphibians and reptiles on an annual basis (Schlaepfer et al., 2005).

Previous studies examining the trade in live reptiles destined for the pet market have been limited (but see Carpenter 2004; Ceballos and Fitzgerald, 2004; Schlaepfer et al. 2005; Turkozan & Kiremit, 2007) and have not included an analysis for the lizards of the varanid genus, despite the EU imposing import restrictions in 1997 of both live animals and their products for four species of monitor lizard (*V. dumerilii*, *V. jobiensis*, *V. beccarii* and *V. salvadorii*) from Indonesia (Engler and Parry-Jones, 2007). Whilst records exist within

the Convention on International Trade in Endangered Species (CITES) trade database there have not been any attempts made to quantify the declared and therefore legal trade in live monitor lizards. As a result, this study was undertaken to examine the dynamics of the declared trade in live monitor lizards conducted over a 30 year period (1975-2005) using CITES import data.

Data Source

Data comprising details of the trade in live specimens of all CITES listed varanids were downloaded from the CITES trade database as a compiled Comparative Tabulation Table from UNEP/WCMC (http://www.cites.org/eng/resources/trade.shtml). The data comprised information on the number of individuals of each varanid species imported and exported by countries involved in the trade between 1975 and 2005. In addition, all records from 1990 onwards contained information regarding the origin of those animals. Data reported by importing countries was used to calculate estimates of the numbers exported by individual countries. Import data was used in preference to export data since it is based on CITES permits that are actually used, whilst export data is typically based on CITES permits that are issued, some of which may not be used (Carpenter et al., 2004).

Results

Species traded

Forty-two different species of monitor lizard were exported as live animals for commercial purposes between 1975 and 2005, totalling 1,347,618 specimens. The number of species involved in the trade increased to peaks of 28 species in both 2002 and 2005 (Fig. 1). Despite the high number of species involved in the trade, 91% of all animals exported during the thirty year period were of just three species (Fig. 2); *Varanus. exanthematicus* (48.1%, $n = 647,600$), *V. niloticus* (23%, $n = 309,759$) and *V. salvator* (19.6%, $n = 263,750$). Only four other species constituted an individual contribution to the trade in excess of one per cent (Table 1).

Countries involved in the live monitor trade

Based on CITES import data a total of 82 countries were recorded as having exported live monitor lizards between 1975 and 2005. This figure includes a number of countries outside the global distribution of wild monitor lizards and included exports of captive-bred individuals as well as re-exports of wild caught animals. Only nine of the 82 countries contributed in excess of

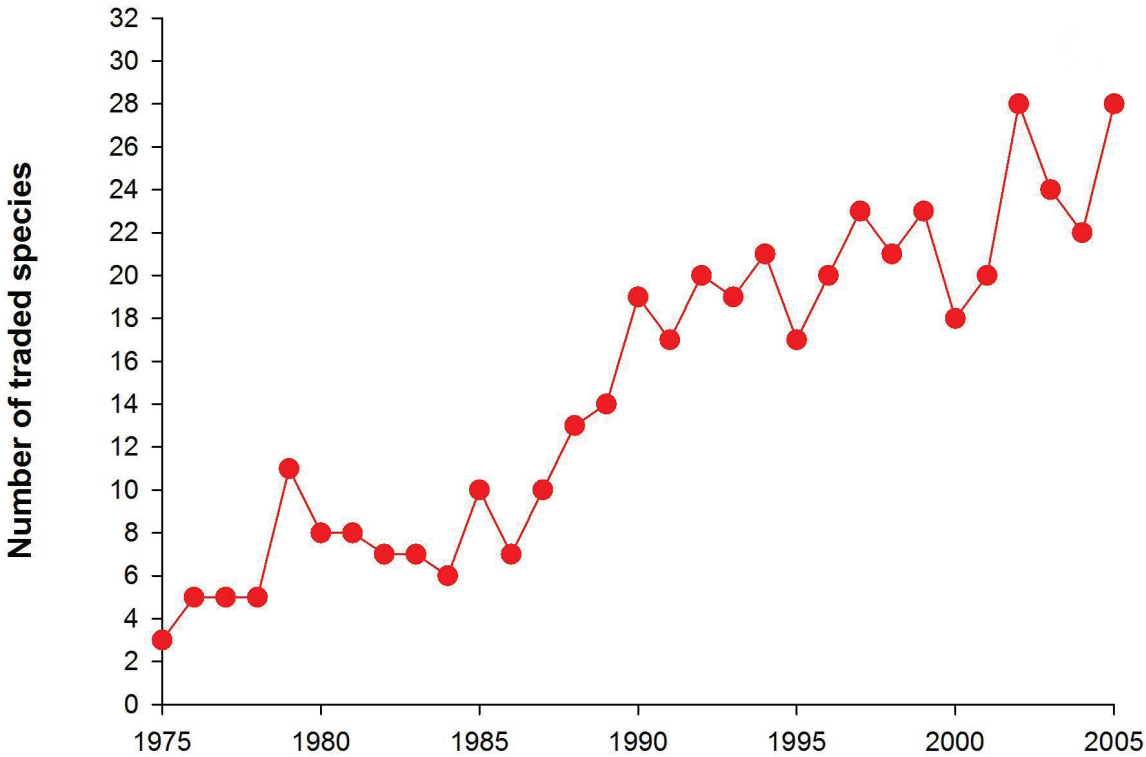

Fig. 1. The number of monitor lizard species exported annually as live animals for commercial purposes between 1975 and 2005.

Table 1. The number of countries involved in the exportation of live monitor lizards between 1975 and 2005 as recorded by CITES trade data.

Species	Number of exporting countries	Total number of exported lizards	Percentage of global trade
Varanus spp.	23	8,962	0.6650%
Varanus acanthurus	11	1,690	0.1254%
Varanus albigularis	14	26,079	1.9352%
Varanus bengalensis	4	148	0.0110%
Varanus bogerti	3	1,211	0.0899%
Varanus caudolineatus	1	22	0.0016%
Varanus doreanus	8	3,907	0.2899%
Varanus dumerilii	15	14,380	1.0671%
Varanus exanthematicus	48	647,600	48.0552%
Varanus gilleni	4	41	0.0030%
Varanus glauerti	2	88	0.0065%
Varanus glebopalma	1	1	0.0001%
Varanus gouldii	6	116	0.0086%
Varanus griseus	2	100	0.0074%
Varanus indicus	15	19,049	1.4135%
Varanus jobiensis	9	5,538	0.4109%
Varanus kingorum	3	33	0.0024%
Varanus komodoensis	1	14	0.0010%
Varanus macraei	2	631	0.0468%
Varanus melinus	2	1,134	0.0841%
Varanus mertensi	2	96	0.0071%
Varanus mitchelli	1	5	0.0004%
Varanus niloticus	46	309,759	22.9857%
Varanus olivaceus	4	19	0.0014%
Varanus ornatus	1	6	0.0004%
Varanus panoptes	4	5,512	0.4090%
Varanus pilbarensis	1	17	0.0013%
Varanus prasinus	14	7,497	0.5563%
Varanus rosenbergi	1	3	0.0002%
Varanus rudicollis	16	16,266	1.2070%
Varanus salvadorii	11	3,376	0.2505%
Varanus salvator	35	263,750	19.5716%
Varanus semiremex	1	35	0.0026%
Varanus similis	5	2,140	0.1588%
Varanus spenceri	1	1	0.0001%
Varanus storri	4	188	0.0140%
Varanus timorensis	9	7,973	0.5916%
Varanus tristis	4	166	0.0123%
Varanus varius	3	4	0.0003%
Varanus yemenensis	3	33	0.0024%
Varanus yuwonoi	1	28	0.0021%
Total	**82***	**1,347,618**	**100%**

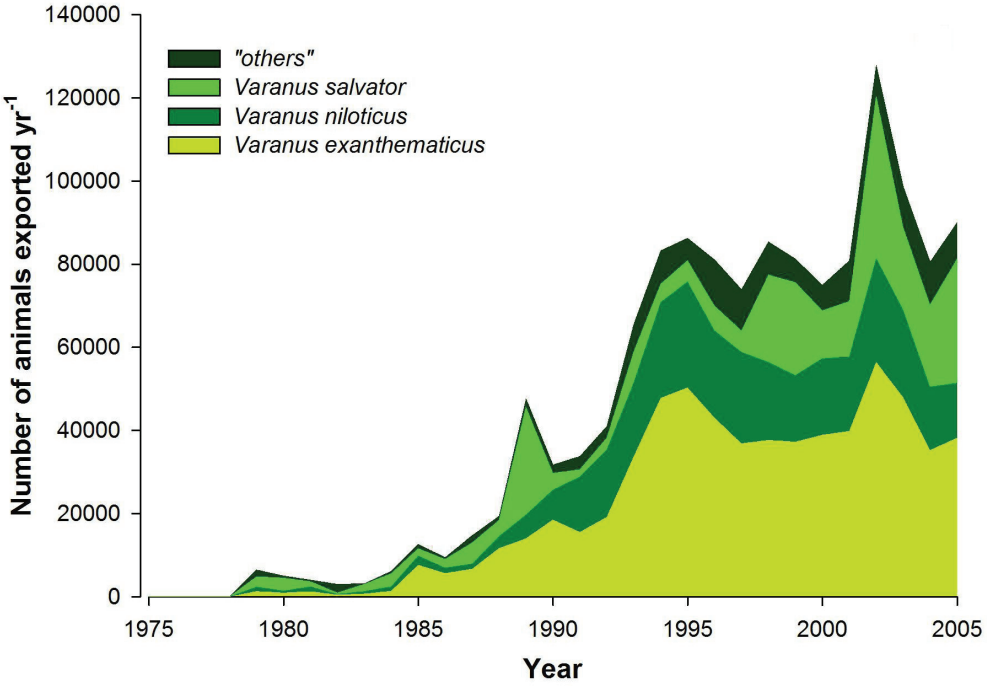

Fig. 2. The number of individuals exported annually as live animals for commercial purposes between 1975 and 2005.

1% of the total number of live animals traded (Fig. 3a). Four African nations, four Asian nations and the United States accounted for 94.3% of all live animals exported (Table 2.). It should be noted that despite accounting for over 1% of the total trade in live monitor lizards each, Thailand and the Philippines have not exported any monitor lizards since 1992 and 1994 respectively.

Between 1975 and 2005 a total of 89 countries submitted records to CITES documenting the importation of monitor lizards. However, imports were dominated by 10 countries, with the greatest number of live monitor lizards entering the United States (68%; n = 915,793 lizards; Fig. 3b). Three Asian countries (Hong Kong 5.8%; Japan 5.3%; China 2.6%), five European countries (Germany 3%; Great Britain 2.6%; Spain 1.7%; France 1.5%; Netherlands 1.1%) and Canada (1.8%) constituted a further 25.4% of the total importations over the 30 year period (Figure 3b).

Sources of monitors in the live trade

Data on the monitor lizards found in the international trade prior to 1990 does not include their origin. However, this data was available from 1990 until the end of 2005 (Table 3). For the two most heavily traded species (*V. exanthematicus* and *V. niloticus*) there has been a steady decline in the proportion of animals exported globally that were declared to be wild caught from 100% in 1990 to lows of 49.5% (2004) and 27.2% (2005) respectively. For both species the proportion of lizards that were reported as farmed or ranched showed a correspondingly steady increase (Fig. 4a and 4b). In contrast, the declared origin of the third most heavily traded live species, *V. salvator*, has remained almost exclusively wild caught, with small amounts of captive bred animals declared in 1996 and 1997 (1.3% and 1% of the annual trade respectively) and in 2005 lizards declared as ranched/farmed (2.7% of the annual trade; Fig. 4c). Additionally there has been a steady decline in the number of animals reported as wild caught for all other *Varanus* spp. to a low of 49% in 2005 with corresponding increases in the number of animals reported as captive bred and ranched (30.5% and 20.5% respectively).

Discussion

Despite a total of 42 *Varanus* spp. being traded, the results of this review show exports of live animals between 1975 and 2005 to clearly be dominated by three species, with the majority of these animals exported by just nine countries. The four major exporting countries in Africa (Benin, Ghana, Togo and Tanzania) involved in the trade in live monitor lizards are also known to be significant contributors to the global trade in Chameleons (Carpenter et al., 2004) suggesting a reliance on wildlife as a significant economic resource (Roe et al., 2002). This

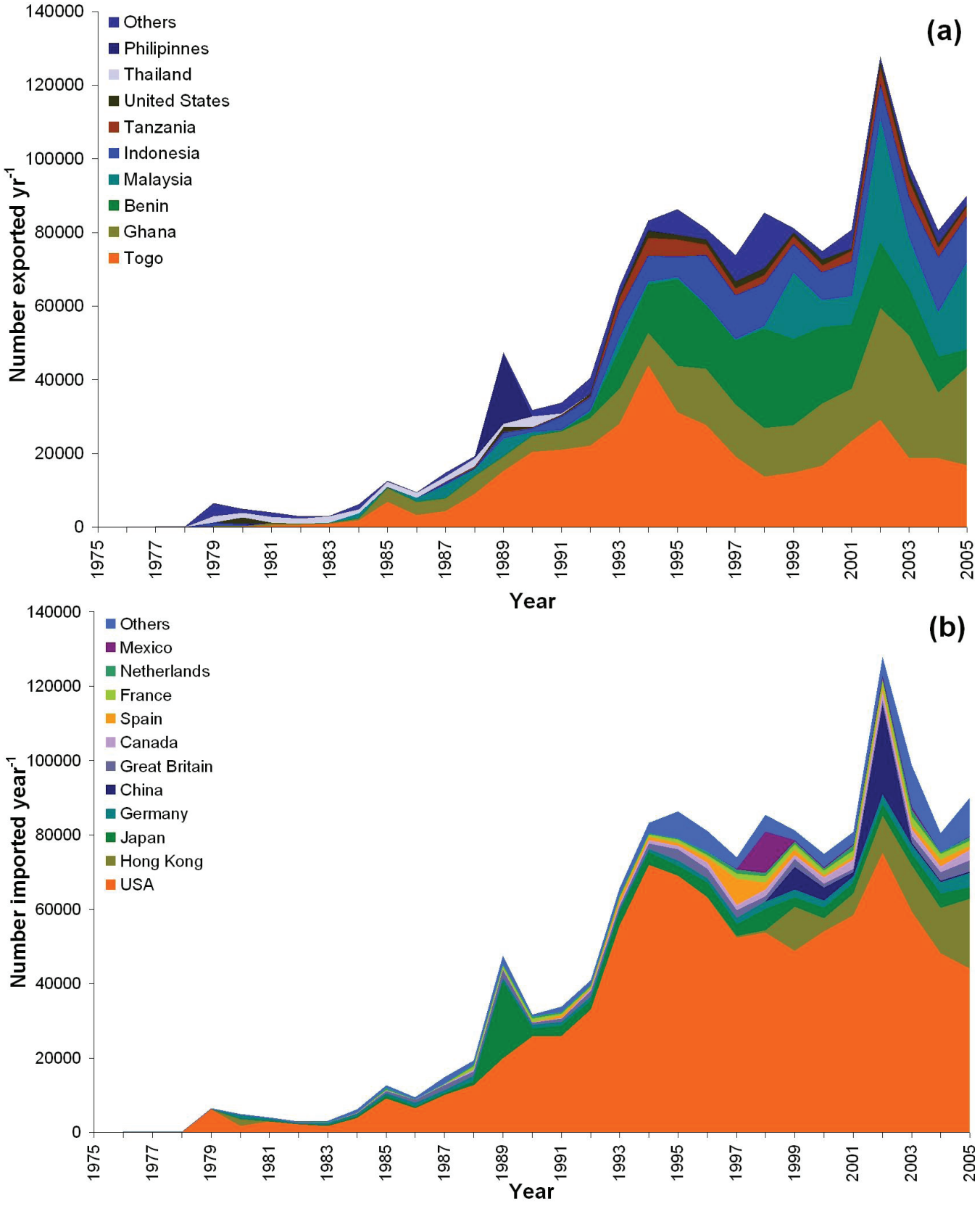

Fig. 3. The number of live monitor lizards exported (a) and imported (b) between 1975 and 2005 by individual countries, as reported in CITES trade data.

Table 2. Exports of live monitor lizards by the nine countries contributing in excess of one percent of animals to the global trade.

	Varanus exanthematicus		*Varanus niloticus*		*Varanus salvator*		*Other Varanus* spp.		
Country	No. lizards exported	Percentage of species' total trade	No. lizards exported	Percentage of species' total trade	No. lizards exported	Percentage of species' total trade	No. other spp. Exported	No. lizards exported	Percentage of species' total trade
Benin	122,800	19	90,812	29.3	-	-	0	-	-
Ghana	254,770	39.3	8,427	2.7	-	-	0	-	-
Togo	243,598	37.6	164,167	53	-	-	0	-	-
Tanzania	5,404	0.8	15,844	5.1	24	0.009	1	19,770	15.8
Indonesia	202	0.03	28	0.009	66,524	25.2	25	73,006	57.8
Malaysia	7	0.001	-	-	138,363	52.4	14	3,310	2.6
Philipines	-	-	3	0.0009	18,719	7.097	6	118	0.1
Thailand	-	-	10	0.003	17,327	6.56	8	2,196	1.7
United States	9,575	1.47	6,326	2.04	4,345	1.65	24	1,825	1.5
Total	**636,356**	**98.201**	**285,617**	**92.1529**	**245,302**	**92.916**		**100,225**	**79.5**

Table 3. Sources of live monitor lizards legally traded between 1990 and 2005 as recorded in the CITES trade database (CB = Captive Bred, R = Ranched or farmed lizards and WC = Wild Caught).

	V. exanthematicus			*V. niloticus*			*V. salvator*			*All other Varanus* spp.		
Year	CB	R	WC	CB	R	WC	CB	R	WC	CB	R	WC
1990	0	0	13,567	1	0	4,309	0	0	3,884	8	0	1,712
1991	0	0	14,389	0	0	7,230	0	0	1,073	17	0	1,881
1992	0	0	16,220	0	0	13,444	0	0	2,232	13	0	2,483
1993	866	0	30,165	67	0	13,629	0	0	5,359	18	0	4,778
1994	1,216	25	44,445	452	0	20,760	0	0	3,685	52	0	5,742
1995	855	115	45,007	609	325	22,754	19	0	4,270	176	0	2,585
1996	2,145	1,195	35,549	1,243	1,564	16,178	40	0	2,960	140	0	4,180
1997	4,191	1,657	24,368	4,001	1,003	8,459	24	0	2,272	232	4	3,514
1998	1,898	1,636	22,468	1,160	997	8,750	25	0	18,331	56	90	4,009
1999	1,250	6,236	19,701	690	4,737	6,454	1	3	14,660	52	136	3,434
2000	415	8,135	18,158	170	6,399	4,937	0	0	9,689	236	2	3,555
2001	253	15,307	21,351	0	7,879	7,366	7	7	9,210	448	87	4,907
2002	6	14,916	31,679	0	8,514	8,597	2	23	37,461	841	368	4,778
2003	131	13,546	24,650	74	14,041	5,988	0	75	14,397	719	472	4,780
2004	20	15,850	15,572	0	8,678	3,991	4	20	11,835	812	479	3,553
2005	0	12,696	15,329	87	6,842	2,595	0	586	21,295	1,712	1,146	2,754

is likely to be a similar story for the two Asian countries (Malaysia and Indonesia) that continue to export large numbers of monitor lizards, as both live animals and their constituent products, which raises questions about the sustainability of this trade.

Intensive collection of animals may have significant impacts on local populations. Selective harvesting of larger male *V. salvator* is known to occur for the skin trade in Sumatra (Shine et al., 1996) and may also occur with the live animal trade, with exporters potentially favouring smaller individuals and juveniles due to reduced transportation costs. Selective harvesting may also have a negative effect on future population recruitment. However, it should be noted that although almost 1.4 million live monitor lizards were traded during the 30 year period reviewed, this number pales when compared to the estimated 2.3 million animals that are killed annually to supply the international leather industry (Jenkins and Broad, 1994). Despite such intensive collection of animals for the skin trade, Shine et al. (1996) argue that a number of characteristics such as ecological flexibility and high reproductive rate of varanid lizards and, in particular *V. salvator*, allow them to withstand such high rates of harvest. Further work examining the ecological traits of monitor lizards destined for the pet trade is required before a definitive answer on the sustainability of collecting can be ascertained (Iskandar and Erdelen, 2006). In particular, naturally rare species that have limited distributions may be significantly impacted by even low levels of harvesting. This is particulary important for monitor lizards known to be endemic to small islands, for example *V. beccarii* and *V. melinus,* whose populations are unlikely to be able to withstand intensive harvesting. Studies of *V.*

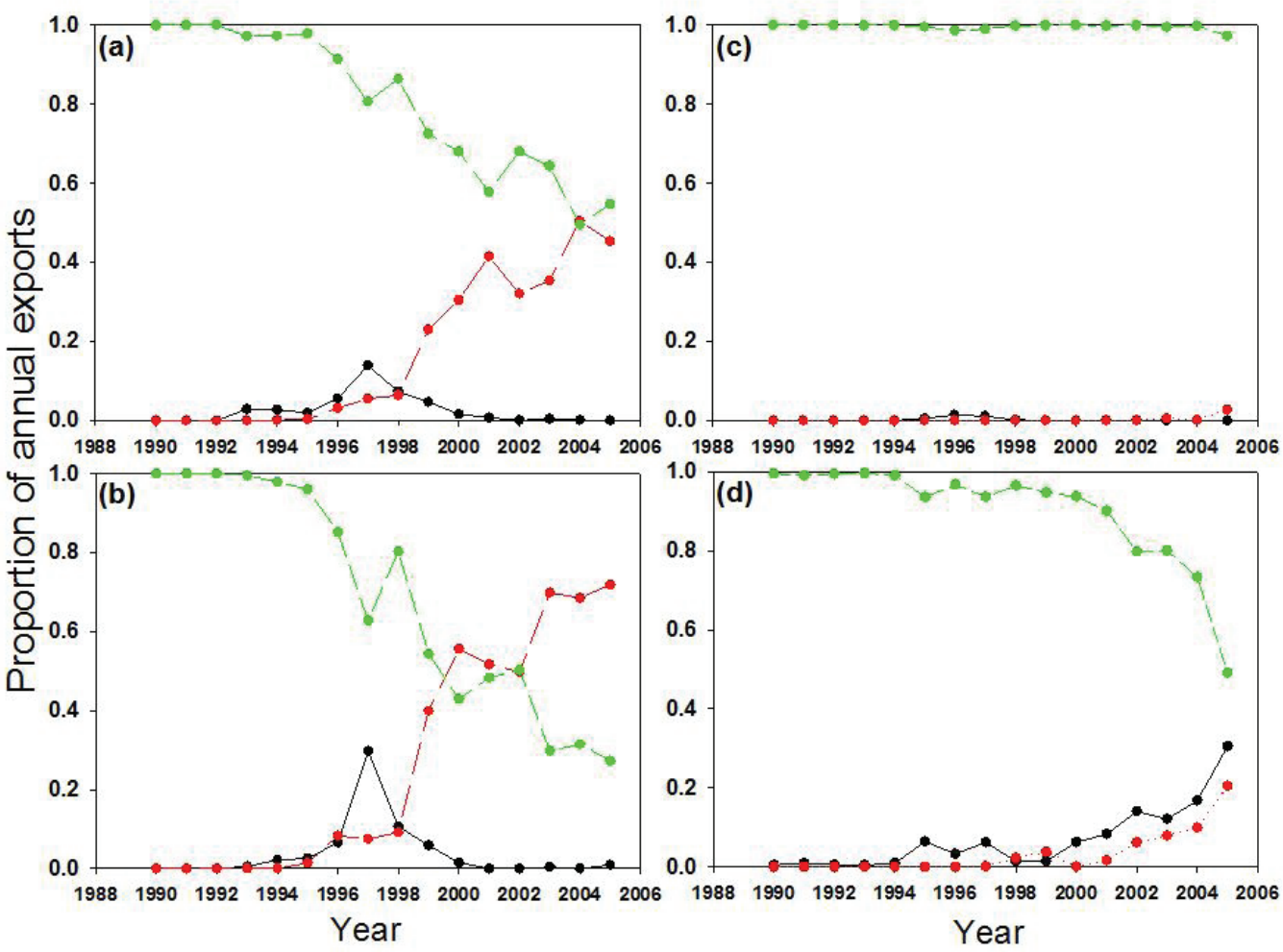

Fig. 4. Trends in the annual proportions of wild caught (green), ranched and farmed (red) and captive bred (black) live monitor lizards in the global commercial trade. Panels refer to; *V. exanthematicus* (a), *V. niloticus* (b), *V. salvator* (c) and all remaining *Varanus spp*. (d)

exanthematicus in the coastal plains of Ghana have shown individual collectors to remove approximately 50% of all juveniles they encounter (Bennett, 2000). If such collecting practices were to be applied to monitor species of small population size known to be endemic to single islands, it could result in their extirpation, as has been seen with other reptile species collected for the pet trade (Stuart et al., 2006).

One important result this review has highlighted is the large increases in the numbers of monitors declared to be ranched/ farmed and captive bred that have entered the trade. Verifying such declarations is not possible, and may be spurious. Such changes in the source of live animals maybe an attempt by exporters to ensure a sustainable supply of animals. However, altering consignment labels is known to occur in attempts to thwart national or international trade controls (Roe et al., 2002) and since governance of the pet trade lags behind that of the leather industry, the extent to which such actions occur remains unknown (Carpenter et al., 2005). The process of ranching/farming monitor lizards also raises other concerns. Typically, this involves the capture of gravid females or the collection of eggs from fresh nests. The eggs are then incubated and the resultant young exported, whilst the females are released en masse, often at a single locality (Bennett, 2001). Clearly this raises questions with regards to the large-scale removal of cohorts from a population, as well as the potential for altering population sex-ratios through the translocation of reproductively active females.

From the data reviewed it may appear that the trade in live monitor lizards for the pet trade may have limited consequences for the conservation of the three most commonly traded species in comparison to the levels of their harvesting for the leather trade. However, there have been further conservation implications raised by the trade in live monitor lizards such as the establishment of feral populations outside their natural range. *Varanus niloticus* is known to have established a breeding feral population in the Cape Coral region of Florida which has the potential to impact numerous native species due to its carnivorous nature (Enge et al., 2004). In addition traded reptiles have the potential to introduce novel parasites such as ticks and their subsequent zoonoses into areas that were previously out with their distribution (González-Acunã et al. 2005). Diseases that are of significance to both animals and human populations have been linked to the trade in wildlife including; SARS and the trade in small mammals (Bell et al., 2004), Chytrid fungus and the trade in *Xenopus spp*. (Weldon et al., 2004) and Avian Influenza (Karesh et al., 2007) Whilst the current trade in live monitor lizards has not been linked with the movement of any infectious diseases, the established routes also have the potential to increase the spread of any potential future outbreak.

In summary, this review has shown that the trade in live monitor lizards is dwarfed by that of the leather industry and suggests that the source of animals is shifting from wild caught populations to captive-bred and ranched/farmed animals. The fact that this study has solely relied on data made available in the CITES trade database suggests that all figures are likely to be under-estimates of the total trade in live animals. Data from countries that are not signatories of the CITES agreement, in addition to data from the illegal trade are unavailable. In addition many mis-matches in reporting of lizards between importing and exporting countries occur (Kenneth McCloud, *pers. comm.*), which suggests further work is required to improve future CITES reporting. Clearly more research is required to examine the ecological characteristics of wild populations that are still being exploited for the trade in live animals. In addition the sustained levels of trade in live animals suggest a need for further research examining the effectiveness and implications of the ranching and farming activities of exporting nations in ensuring a sustainable future for this trade.

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