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A case study of the Ploughshare Tortoise *Astrochelys yniphora* and the role zoos can play in conservation

Roopali Raghavan, Sonja Luz, Chris R. Shepherd, Richard Lewis, Paul Gibbons and Eric Goode

INTRODUCTION

The illegal trade of live animals is a serious problem throughout South-east Asia: as enforcement efforts to combat illegal wildlife trade in the region improve, increasing numbers of live animals are confiscated. This can present a challenge of how to manage them appropriately post-confiscation. Relevant government departments, zoos and conservation/welfare non-governmental organizations (NGOs) commonly care for confiscated wildlife. Suitable handling of these sometimes very large numbers of animals is difficult and the quality of care and facilities varies greatly. Policies and legislations governing the post-seizure handling of such wildlife are also variable. Confiscated specimens often cannot be repatriated and in such cases, providing adequate lifelong care for them becomes an overwhelming burden and in many cases a welfare issue. Of particular conservation concern are those cases that involve threatened species. As a modern zoo, Wildlife Reserves Singapore (WRS) has adequate facilities and expertise to address this problem in Singapore, where the number of animals confiscated is relatively small. Between 2005 and June 2014, WRS received a total of 1406 live animals. These confiscations do not include native wildlife brought into WRS, rescued from conflict situations, which undergo medical examinations and if physically healthy, are reintroduced into appropriate habitat in the wild. Only 4% of the animals confiscated were of native fauna. The authors recognize the urgent need for developing capacity and policies to address the issues of managing confiscated live animals and believe that high end rescue facilities in all countries in South-east Asia are needed to address these issues adequately. Such facilities need to join forces and show transparency and a willingness to adopt modern tools of wildlife management and conservation. In this paper, the authors illustrate a case study for managing confiscated Critically Endangered Ploughshare Tortoises *Astrochelys yniphora*. They present the collaborative approach being taken to ensure these animals remain a valuable part of the efforts being taken to ensure the survival of the species.

BACKGROUND

Wildlife trade involves a diverse range of live animals and plants or their parts and derivatives that provides an income for people and generates considerable revenue nationally (TRAFFIC, 2008). While much is traded



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The Critically Endangered Ploughshare Tortoise *Astrochelys yniphora* continues to be threatened by demand for the illegal pet trade. International co-operation to safeguard this species has never been more urgent.

nationally, there is a large volume of wildlife that is traded internationally (Stoett, 2002; Schlaepfer *et al.*, 2005; Nijman and Shepherd, 2007). International trade in many species is regulated and monitored according to the provisions set out in the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Wildlife trade is a multi-billion dollar business that affects an ever-increasing number of species around the world, and if not properly managed can become a serious conservation concern (Stoett, 2002). Population growth, increasing buyer power, and globalization have led to a rise in demand for wildlife and this has occurred in developed, emerging and developing nations alike (Nijman, 2009). A study that monitored global wildlife trade in CITES-listed species over 10 years (1998–2007) found that over 35 million animals were exported in this period, of which 30 million (~300 species) were wild-caught (Nijman, 2009). These numbers do not include illegal or undeclared international trade nor species not covered by CITES, whose numbers are expected to be significantly larger than levels of reported exports (Sodhi *et al.*, 2004; Blundell and Mascia, 2005). In Asia, the unsustainable trade in wildlife has been identified as one of the main conservation challenges (Nijman, 2009), with more South-east Asian species under greater threat than species in any other part of the world (Rao *et al.*, 2014). South-east Asia is both a centre for the consumption of wildlife products and a key supplier to external markets, with demand being met by both legal and illegal trade (TRAFFIC, 2008).

South-east Asia is typically defined as the area that includes Brunei Darussalam, Cambodia, Indonesia, Lao

People’s Democratic Republic, Malaysia, Myanmar, Philippines, Singapore, Timor Leste, Thailand and Viet Nam. The region has been identified as a region where wildlife trade poses a disproportionately large threat to species (TRAFFIC, 2008; Rao *et al.*, 2014). All South-east Asian nations are signatories of CITES, with the exception of Timor Leste.

It is important to note that most wildlife trade streams pass through a limited range of trade hubs in the region, confined mainly to ports, airports and markets, of which there are a large number in countries such as Indonesia, Malaysia, Singapore, Thailand and Viet Nam (Nijman, 2009). These hubs provide opportunities to maximize conservation efforts.

The number and quality of laws and regulations governing wildlife trade in South-east Asia have increased and improved over recent years, providing stronger mechanisms for controlling illegal and unsustainable trade (TRAFFIC, 2008). As measures to restrict illegal wildlife trade are implemented in the region, the increase in the number of live animal confiscations and the need to manage and sustain them in non-native captive conditions become a frequently occurring reality. Any solution needs to address incentives for better management of the rescued live animals, with special reference to those species most under threat (Grieser-Johns and Thomson, 2005).

Wildlife Reserves Singapore’s efforts to reduce illegal wildlife trade and disposal of confiscated live animals

Singapore is a significant player in the regional and global wildlife trade. In 2012 alone, a gross import of 116 032 live animals and a gross export of 1 339 879 animal skins was reported to CITES (CITES, 2014). During

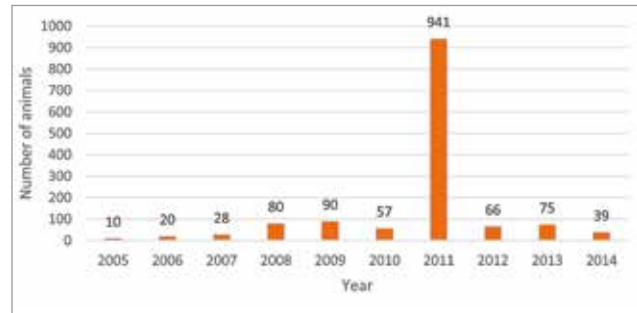


Fig. 1. The number of confiscated animals received by Singapore Zoo between 2005–June 2014.

the financial year 2012–13, the authorities in Singapore intercepted illegal imports of wildlife on 13 occasions, which involved species covered by CITES (AVA, 2013). Wildlife Reserves Singapore (WRS, the parent body of the Singapore Zoo, Night Safari, River Safari and Jurong Bird Park) has been receiving confiscated animals from the Agri-food & Veterinary Authority (AVA), the CITES authority in Singapore, for over two decades.

WRS recognizes the need to work closely with organizations like TRAFFIC, other NGOs, and more importantly, governments, to ensure efficient ways to confiscate wildlife from illegal trade and repatriate confiscated animals, where possible, or to participate in holding assurance colonies of confiscated specimens of threatened species.

Singapore Zoo has received a total of 1406 confiscated animals (123 species) from AVA and the Singapore police from 2005 up until June 2014. Fig. 1 indicates the numbers received per year over this period.

Details on confiscations	All confiscations	Excluding single 2011 confiscation
(a)		
Total number	1406	482
Amphibians	2.63 %	7.68 %
Arachnids	1.49 %	4.36 %
Fish	1.07 %	3.11 %
Mammals	7.40 %	21.58 %
Reptiles	87.41 %	63.28 %
Details of reptile confiscations		
(b)		
Crocodiles	0.24 %	0.98 %
Lizards	9.52 %	38.36 %
Snakes	4.15 %	16.72%
Tortoise and freshwater turtles	86.09 %	43.93%

Table 1. (a) Breakdown of the total number of confiscated animals received based on their taxonomic group; (b) Details of reptiles received based on their taxonomic group.

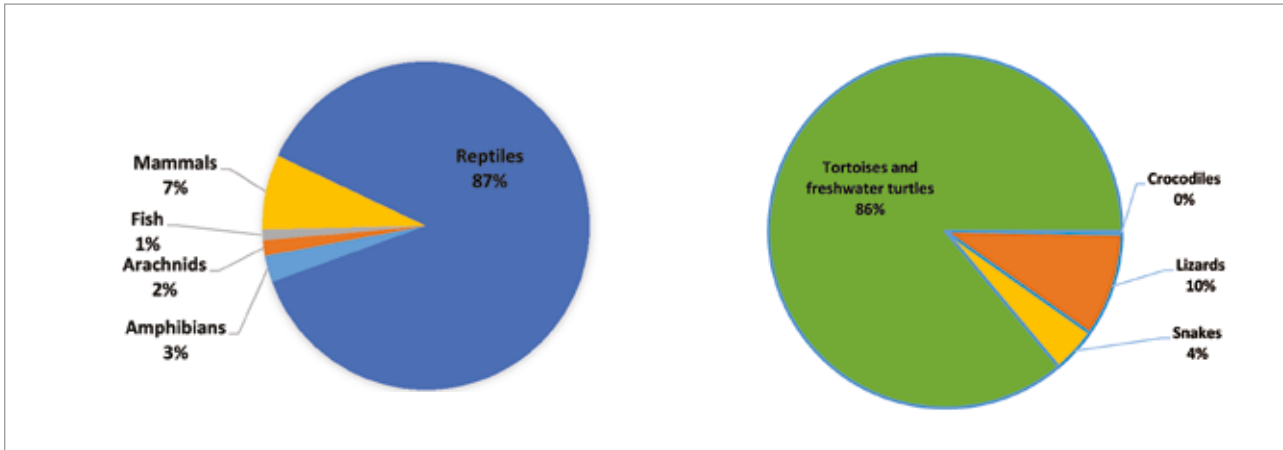


Fig 2. Breakdown of total number of confiscated animals received based on their taxonomic group.

The high number of animals in 2011 compared to other years is due to a large confiscation of 924 Red-eared Sliders *Trachemys scripta* hatchlings.

Discounting the large confiscation of Red-eared Sliders, the authors examined the data over the years (Table 1; Fig. 2) and found that reptiles—principally tortoises and freshwater turtles—consistently formed the majority of the confiscated animals.

The procedure followed for the animals once they are received by Singapore Zoo is similar to quarantine protocols typically followed for wildlife and as per the IUCN Guidelines for the placement of confiscated animals (IUCN, 2000). This includes a thorough check to evaluate their health and condition. The animals are monitored in quarantine until the investigation into their confiscation is completed. Based on whether they are native or not, they are evaluated for suitability for release into the wild. Native animals (around 4% of the confiscations during the study period) deemed capable of survival in the wild are micro-chipped and released in suitable habitats in collaboration with the National Parks Board of Singapore.

The majority of the animals seized are not native to Singapore and in most cases, sending them back to the native range country for safe repatriation is not an option available to the zoo (IUCN, 1998) due to a lack of resources, uncertainty of origin, and a variety of other reasons. Depending on the age, size, species and health, a decision is made on whether the animals will be retained by WRS, or if they need to be euthanized. Euthanasia was performed on 924 Red-eared Sliders due to their poor health. Any animals going to be absorbed into WRS collections in the various parks are microchipped for individual identification and retained. Only around 37% of the animals retained by WRS are exhibited in the parks. The remaining 63% are housed within the parks but not displayed (see Fig. 3).

The authors believe that responsibly managed zoos with good financial standing have a distinct advantage over less well-equipped facilities to serve as functional entities for rescued wildlife. They have trained veterinary specialists who provide the animals—which are often in conditions of extreme stress—with appropriate medical attention. In the long term, the existing infrastructure as well as husbandry knowledge of zoos can be called upon for the safekeeping and management of wild animals. This is also the best solution from a financial perspective. Particularly in the case of highly threatened species, the microchipping of animals for individual identification and the security of being located within a zoo will be advantageous.

Strategies for Critically Endangered species threatened by illegal wildlife trade: the case of the Ploughshare Tortoise

Among the tortoises and freshwater turtles seized, the Ploughshare Tortoise *Astrochelys yniphora* is one of the species of greatest concern. It is assessed as Critically Endangered by the IUCN *Red List of Threatened Species* (IUCN, 2014) and is restricted to a 25 to 60 km² range around Baly Bay in northwestern Madagascar (Durrell *et al.*, 1989). Over the past few decades, populations of this species have been depleted as a result of local/regional consumption and habitat destruction; the illegal pet trade has contributed to a recent sharp decline, with numbers in the wild currently estimated at fewer than 500 mature individuals (Leuteritz and Pedrono, 2008). The species is now restricted to five small subpopulations which are discontinuous from each other, with an estimated area of occupancy of about 12 km² (Leuteritz and Pedrono, 2008). The threat of poaching persists, and studies on population dynamics and threat impacts estimate that the species is almost certain to go extinct within the next generation if current threats continue unabated.

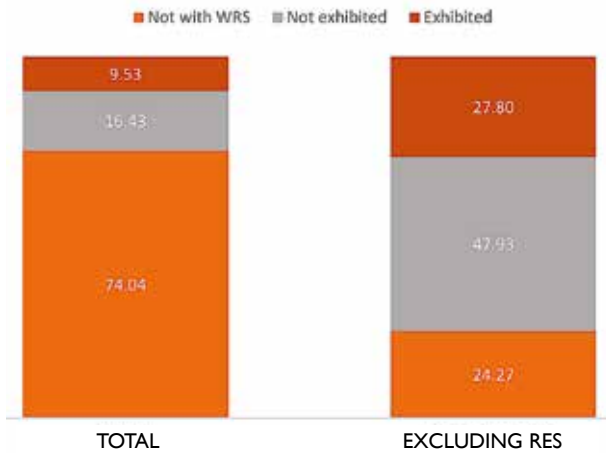


Fig. 3. Details of status of confiscated animals received by WRS between 2005–June 2014, including (and excluding, right) the 294 Red-eared Sliders. “Not with WRS” includes animals that have died, been reintroduced, handed over to another authority or were euthanized.

(Leuteritz and Pedrono, 2008). The species is protected under national law in Madagascar and is also included in CITES Appendix I, trade in specimens of which is permitted only in exceptional circumstances.

There are a large number of affluent wildlife buyers, especially in South-east Asia where controls can be lax, hence there is a market for such exotic pets (i.e. non-indigenous species) (Nijman and Shepherd, 2007). Numerous species of tortoises are traded as pets in major cities in East and South-east Asia and their supply and demand appears to be increasing throughout South-east Asia, with an increase in species diversity on offer and in the number of retail outlets specializing in these species (Shepherd *et al.*, 2004; Shepherd and Nijman, 2007; Nijman and Shepherd, 2011).

The Durrell Wildlife Conservation Trust established a conservation programme for the Ploughshare Tortoise in 1986, working closely with the government of Madagascar and local people to safeguard the species (Durbin *et al.*, 1996). The initial goal of the programme, called Project Angonoka, was the establishment of a captive-breeding project. By December 2004, the project had 224 captive-bred juveniles from 17 founder adults (10 males, seven females) and a reintroduction programme began in 2005. Since the 1990s, the programme also focused on ecological research on the species in the wild, and developing conservation strategies with the surrounding local communities. This included creating firebreaks in the habitat, with the assistance of local communities, as well as the creation of a national park to safeguard this species and the remaining forests (Durbin *et al.*, 1996).

Poaching of the Ploughshare Tortoise for the pet trade has been rampant since the 1980s. The fact that trade is illegal and that the species is listed in CITES Appendix I does not appear to be a deterrent to the poachers. Over 200 live Ploughshare Tortoises have been confiscated globally in recent years (Table 2) of which at least 73 have died or disappeared. Kiester *et al* (2013) also estimated at least 218 Ploughshare Tortoises are held illegally in China, Germany, Indonesia, Italy, the Philippines, Singapore and Thailand, based on insider information and internet and market surveys. Shepherd (pers. obs., 2014) suggests the numbers of Ploughshare Tortoises held illegally in South-east Asia are much higher—perhaps double the number suggested by Kiester.

Singapore Zoo currently holds three Ploughshare Tortoises confiscated by AVA; two sub-adults (less than seven years of age) were received in 2009 and one individual less than two years old, in 2014. These animals are being retained at Singapore Zoo with the objective of establishing an assurance colony for the species in Singapore in the future. Wildlife Reserves Singapore is working in close collaboration with TRAFFIC, Durrell

Country/territory	Entity	Confiscated	Died or Disappeared
Madagascar	DWCT Antananarivo	88	18
Madagascar	Private owner, Antananarivo	12	0
Madagascar	Croc Farm	20	13
Madagascar	Direction de Forêts	5	5
Thailand	Government	76	64
Hong Kong	Kadoorie Farm	40	1
Malaysia	Government	6	2
Singapore	Singapore Zoo	4	1
Germany	Frankfurt Zoo	4	1
Japan	Nogeyama Zoo	4	0
United Arab Emirates	Sharjah Breeding Center	4	0
China	Kunming	3	3
Taiwan	Taipei Zoo	2	2
Taiwan	Ping Tung Rescue Center	2	0
Comoro Islands	Government	1	1
USA	Fish & Wildlife Service	1	0

Table 2. Ploughshare Tortoise confiscations from 2008 to present. Sources: Kiester *et al.*, 2013; Gibbons *pers. com.* 2015.

Institution	Male	Female	Unknown	Total
Asia (2 institutions, 8 individuals)				
Nogeyama Zoological Gardens, Yokohama, Japan	2	1	2	5
Singapore Zoological Gardens, Singapore	0	0	3	3
Middle East (1 institution, 4 individuals)				
Sharjah Breeding Centre for Endangered Arabian Wildlife, United Arab Emirates	0	0	4	4
Islands of the Indian Ocean (1 institution, 12 individuals)				
François Leguat Giant Tortoise Reserve, Rodrigues, Mauritius	4	7	1	12
Europe (4 institutions, 16 individuals)				
Durrell Wildlife Conservation Trust, Jersey	0	0	4	4
North of England Zoological Society, Chester, UK	0	0	4	4
Frankfurt Zoological Garden, Germany	0	2	2	4
Rotterdam Zoo, Netherlands	0	0	4	4
North America (4 institutions, 31 individuals)				
Honolulu Zoo, Hawaii, USA	0	1	0	1
Turtle Conservancy, California, USA	1	2	18	21
Zoo Atlanta, Georgia, USA	0	0	5	5
Knoxville Zoological Gardens, Tennessee, USA	0	0	4	4

Table 3. Holding records for captive Ploughshare Tortoises in professionally managed collections outside Madagascar.¹

¹This table lists only those animals that are included in the ISIS database (ZIMS, 2015) and those held as per the personal knowledge of the authors, there may be a few animals in captivity that are not included here.

Wildlife Conservation Trust, and Turtle Conservancy on Ploughshare Tortoise conservation.

Table 3 provides details of Ploughshare Tortoises held in captivity outside the range country, across the world. Twelve institutions across five regions currently hold 71 individuals, the majority of which are yet to attain sexual maturity. It is pertinent to note that all of these individuals are confiscations from illegal wildlife trade. Owing to their young age, none of these captive populations has been reported breeding over the last 12 months. The individual organizations will be unable to contribute significantly to the conservation of the Ploughshare Tortoise due to the small numbers that they hold, hence regional collaboration is required to house reasonable-sized groups together in order to maximize breeding opportunities. Singapore Zoo will work in collaboration with the other zoos for the subsequent breeding and management of the assurance colony.

Ploughshare Tortoises continue to be traded as pets due in large part to their beautiful high-domed shells and their increasing rarity, despite trade being illegal. As a result, conservation organizations have resorted to a drastic measure to prevent the species from becoming extinct—the engraving of identification codes onto the animals' shells along with internal microchipping in order to reduce their black market value and allow for

quick identification. Engraving a tortoise's shell makes it less desirable to traffickers and easier for enforcement agencies to trace. The carapaces of two juvenile tortoises housed at Singapore Zoo were engraved with codes at a highly visible event in 2013, and are part of the global record of individuals held in captivity, in collaboration with the Turtle Conservancy, Durrell Wildlife Conservation Trust, and TRAFFIC.

Singapore Zoo and relevant partners took advantage of the engraving of identification codes to spread awareness amongst the public on the threats to the Ploughshare Tortoise due to the illegal pet trade and the need for public support to reduce demand for this endangered species (Shepherd, 2013). This outreach event, entitled "Tattoo the Tortoise" was held on 16 December 2013 at Singapore Zoo and included presentations by experts working on the conservation of this species and an exhibition open to the public. These activities provided an opportunity for the public, governments and other relevant bodies to learn about the dire situation facing these animals, and what they can do to help secure more stable Ploughshare Tortoise populations. This also served as a platform to educate zoo visitors on the issues and drivers of illegal wildlife trade, raise awareness of the plight of the Ploughshare Tortoise and build support to tackle the illegal trade in the species.

CONCLUSIONS

The authors recognize the urgency for developing conservation capacity addressing the disposal of confiscated live animals and believe that more well-equipped, and possibly government-funded rescue facilities in the South-east Asian region are urgently needed to improve management of such issues. Such facilities, whether run as NGOs or connected to zoos, need to form closer associations and show transparency and willingness to adopt modern tools of wildlife management and conservation. A direct link to the *in-situ* research community also has to be established to help ensure scientifically monitored approaches to reintroduction programmes.

Zoos across South-east Asia should get more actively involved in conservation capacity-building and contribute to efforts to combat illegal wildlife trade in the region; they can also provide financial or in-kind support to assist regional agencies and NGOs in this endeavour. Zoos must work closely with government bodies and NGOs to repatriate confiscated animals to their country of origin.

Collaborative efforts between various organizations is immediately required for effective conservation. The current information, and in some cases, transparency about the status of Critically Endangered confiscated animals in the South-east Asia region needs to be remedied with immediate effect.

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