

Conservation education in a post-conflict country: five herpetological case studies in Timor-Leste

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Manuscript received: 11 February 2013

Abstract. As part of an on-going survey of herpetofaunal diversity in Timor-Leste, we documented our observations regarding encounters between local human inhabitants and their reptilian neighbours. Our interest in environmental and conservation education led to the detailed contemplation of five case studies involving reticulated pythons (*Python reticulatus*), a saltwater crocodile (*Crocodylus porosus*), a monitor lizard (*Varanus cf. salvator*), and Chinese pond turtles (*Mauremys reevesii*). In each case, we initiated a conversation about the captive animals in order to identify their social, religious, or cultural significance, which allowed us to place the captive existence of the animals into their proper context. While the rationale for keeping reptiles captive has some roots in animist beliefs, most often ownership of a 'pet' relates to social status. There does not appear to be a serious problem with the exploitation of any one of these species as a diminishing resource, but the casual relationship with wildlife has led to the endangerment of humans in the past and could facilitate initiatives designed to turn a profit from wild-caught reptiles in the future. We here detail five instances of captive reptile ownership and present implications for conservation, case-by-case resolutions, and recommendations for how in such situations public education efforts may be key to developing a deeper, pro-environment stance on the part of the human population in Timor-Leste.

Key words. Timor-Leste, conservation education, *Python reticulatus*, *Crocodylus porosus*, *Varanus cf. salvator*, *Mauremys reevesii*.

Introduction

The simultaneous need for better education and conservation awareness is probably greatest in the tropics, where agricultural practices and the exploitation of natural resources often follow no planned, sustainable pattern. Young nations emerging from conflicts in particular are in extreme danger of creating lasting negative impacts on their environments (DUDLEY et al. 2002, HANSON et al. 2009; for a broader discussion see AUSTIN & BRUCH 2000). Timor-Leste (also known as East Timor) became independent in 2002 after a drawn-out colonial period under Portuguese rule (since the 16th century) and an oppressive and exploitative period of Indonesian annexation (1975–99). This long occupation amounted to five centuries of hardship for the human population, during which only survival (for local residents) and exports (for the foreign powers) had critical relevance in the territory's affairs. As a consequence, on-

going efforts at education and capacity-building are only now, and slowly, reaching the populations of outlying areas, those most likely to be in immediate contact with wildlife.

Encounters with the human populace during biological fieldwork (e.g., Fig. 1, lower left) are generally sought and of universally recognized importance when trying to learn as much as possible about the creatures of one's academic interest (e.g., MARTINS & NOGUEIRA 2012, O'SHEA & KAISER 2013). However, in addition to learning about organisms' natural history from anecdotes, one often is exposed to the misconceptions held about animals in general, and about amphibians and reptiles in particular (e.g., KNIGHT 2008, BALLOUARD et al. 2012). These misconceptions can be an ideal departure point for engaging local residents in conservation education. For example, seeing animals being mistreated, held captive, or killed for no apparent reason are among the issues herpetological fieldworkers can face;

asking questions about them and informing to educate is a small effort, useful not only to provide relief to an ill-treated animal, but also to broaden the understanding of the owner about the environment and how to better live with it. The setting of Timor-Leste may be particularly instructive from a conservation education point of view: the threat to species may be intensifying now that the threat to citizens' lives and livelihoods from occupation forces has been lifted, while extreme poverty and malnourishment remain serious issues (cf. DALTRY et al. 2005).

The fieldwork we have conducted in Timor-Leste since 2009 is a component of the first comprehensive herpetological survey of the country. Participation of students from the Universidade Nacional Timor-Lorosaê (UNTL, the country's national university) has not only been instru-

mental in our ability to communicate with local residents, talking to our students and their social circle has also afforded us the opportunity to gauge what value the natural environment holds in a local context. We have been fortunate to be able to explain our research to national and local political leaders (a former President, the Prime Minister, several government ministers, chefes de suco [village chiefs], chefes de aldeia [village sub-chiefs]) and the scientific process has found understanding in nearly all discussions. Such understanding has even covered our own efforts in the field to collect specimens, which could be seen as contradicting the goal of conservation. Nevertheless, the scientific basis for such discussions is still developing, and creation of a legal framework to regulate the hunting or keeping of species of conservation concern is a low prior-



Figure 1. Upper left: MOS studies the position of two tightly coiled captive reticulated pythons (*Python reticulatus*) in the corner of a bedroom in Dili, Timor-Leste. Each individual exceeded 3.5 m (10 ft) in length, and together they weighed more than 20 kg (44 lbs). Upper right: Timor-Leste's former President JOSÉ RAMOS-HORTA (blue shirt) watches MOS and LLA handling one of the pythons from the young man's bedroom, now rehydrated, cleaned, and ready for release. Lower left: Whenever an opportunity presents itself, we include local residents in our experience. In this case, MOS is seen conducting a spontaneous show-and-tell for villagers in one of whose homes a juvenile reticulated python was being kept. Lower right: This specimen of *P. reticulatus* displays injuries to its snout as well as mouth rot and stunted growth caused by 15 years in poor captive conditions. Photos by H. KAISER.

ity when more pressing issues, such as water supply, food supply, electricity, or land ownership laws remain to be addressed.

We have found that our entry point for discussions about conservation in Timor-Leste, namely reptiles that are held captive, broadly fall into three categories that, in the mind of the keepers, necessitate their temporary or permanent captivity: spiritual beliefs, social status, or profit-making (Table 1). However, it is often difficult to recognize from the mode of captivity which of these three categories the captive falls into. Thus, before any meaningful discussion about the treatment of the animal, let alone the broader issue of conservation, can begin, it is necessary to determine how deeply felt the need for keeping the captive actually is.

In this paper, we present our experiences with conservation-oriented field education, catalysed by five case studies involving captive reptiles, and the resulting opportunities for conservation efforts in Timor-Leste, to portrait some of the diverse concerns and approaches when dealing with a human population that is naïve in terms of conservation knowledge. We do not intend to present our activities as a streamlined format, nor can they be generalized as they present truly unique circumstances, but we hope that our encounters and recommendations may be useful as others have similar experiences. We solicit comments and ideas on how to improve the situations we, and many of our colleagues, are encountering every time we conduct fieldwork.

Methods

The encounters described below occurred serendipitously while we were conducting surveys of amphibians and reptiles in Timor-Leste. We have divided them into five case studies by the topic of the encounter: three reticulated pythons (*Python reticulatus*) in the capital city, Dili (July 2010), a reticulated python in the Oecusse District (July 2010), a captive saltwater crocodile (*Crocodylus porosus*) in Aileu District (July 2009, February 2011), a monitor lizard (*Varanus cf. salvator*) on Ataúro Island (September 2011,

January 2012), and six Chinese pond turtles (*Mauremys reevesii*) in Dili (February 2011). Interviews were conducted in the language(s) most appropriate in each situation, including the native language of Timor-Leste (Tetún), Bahasa Indonesia, and English. In each case, one or more of the authors along with our field assistants would initiate the conversation and move it forward in an education-minded trajectory. It should be noted that the type of methodology employed in these circumstances was not rigid but free of format and even ad lib, in order to retain the spontaneity of the discussion and avoid any possibility the interviewee might feel they were being lectured to, or ordered about.

Results

Case study 1: three reticulated pythons (*Python reticulatus*) in Dili

Background: Since our herpetological survey work contains a significant international education component and involves students from Timor-Leste's national university (see KAISER et al. 2011), our activities had come to the attention of government leaders. At the request of Timor-Leste's then-President, JOSÉ RAMOS-HORTA, we agreed to assist with the release of three sizeable (> 3.5 m) reticulated pythons (*Python reticulatus*: IUCN Red List – not assessed, IUCN 2012; CITES-Appendix II), held captive in two households in the Becora area of Dili, the nation's capital. Whereas one of these pythons had been in captivity for 15 years, housed most of this time in a wire cage with sheet metal walls in the unsecured backyard of a residential housing estate, the two others were allowed to roam freely in the ground-floor, single-room abode of a young man living among families in a residential compound composed of former military barracks. Of the three pythons, those kept by the young man looked relatively healthy and well-fed, but the long-term captive appeared stunted in its growth (based on a crude estimate of head size versus overall body size) and exhibited signs of necrotic ulcerative stomatitis (mouth rot; Fig. 1, lower right). This disease was

Table 1. Observations and localities of captive reptiles in Timor-Leste during five phases of fieldwork (2009–11). The last column lists the putative reasons for their captivity. GPS coordinates were obtained from placement of place marks on GoogleEarth, rounded to two decimal places.

Species	Locality	GPS Coordinates	Reason
<i>Python reticulatus</i>	Pante Macassar, Oecusse District	9.20° S, 124.37° E	Status
	Beaçu, Viqueque District	8.94° S, 126.45° E	Status
	Uma Boot, Viqueque District	8.94° S, 126.20° E	Status
	Fatucahi, Manufahi District	9.04° S, 125.99° E	Profit
	Becora, Dili District	8.57° S, 125.59° E	Belief
<i>Crocodylus porosus</i>	Aileu, Aileu District	8.73° S, 125.57° E	Status
	Uma Boot, Viqueque District	8.94° S, 126.20° E	Profit (?)
	unrecorded south coast location, Manatuto District		Profit (?)

almost certainly brought about through injury from the snake's continual contact with the boundaries of its enclosure, combined with physiological stress (KAPLAN & JEREB 1995). Its fear was apparent in its aggressive defensive behaviour, as it struck repeatedly when we were attempting to remove it from its cage. Mouth rot is frequently seen in captive snakes that are kept in unsuitable enclosures, such as the one made from bare timber and chicken wire in this case. In each case, villagers sought to gift these animals to then-President RAMOS-HORTA, who, perhaps inspired by our presentations to him, had publicly voiced his concern over citizens keeping large 'pet' snakes around children.

Conservation concerns: Whereas the initial concern of the residents in these neighbourhoods revolved around the presence of large snakes in the immediate vicinity of live-stock (goats, pigs, chickens) and small children, we considered two additional, conservation-related issues: transfer of snakes (at unknown frequency, numbers, and body sizes) from the wild into the city, and release of a diseased captive animal into the wild. Whereas the presence of a few captive snakes in secure and properly designed enclosures may not generally be a population-level threat, making the pet-keeping of wildlife fashionable in Dili, the nation's capital and a city with a population of ca. 150,000, is cause for concern.

Dialog: In both cases, our activity was merely supposed to involve the pick-up and subsequent release of the animals. Acting in an official capacity and on instructions from the President, we were led by the Commander of the Presidential Guard, who vouchsafed that the snakes really were destined for release at the President's request. Upon our arrival at the young man's room, it appeared that he had not been informed of the villagers' plan to relieve him of his pet snakes. In order not to exacerbate an uncomfortable standoff by getting the Presidential Guard to confiscate the snakes, we inquired about his reasons for keeping two sizeable pythons in a small bedroom (Fig. 1, upper left). We explained that this was not only a safety issue for children living nearby but especially for the young man himself. The young man revealed that the pythons, both captured in the immediate surroundings of the military complex a couple of years prior, provided a form of spiritual strength to him, and that having them around provided a powerful "energy." To our relief, the young man was understanding of the issue and accepted our offer of some form of compensation to achieve the release of the snakes to us. The arrangement we made also satisfied the Commander of the Presidential Guard and we were able to complete the pick-up after the young man had been compensated (see below).

Since the young man knew of the third, older snake, he took us to see its owner and led the conversation in a manner similar to that which we had demonstrated a few minutes earlier with him. There was considerable back-and-forth, including dropping of the President's name several times, and eventually a similar form of compensation was agreed upon.

Resolution: The compensation to the young man consisted of a rooster, candles, matches, and a promise of a meeting with the President. The owner of the third snake requested and received US\$ 20 to hire a spiritual adviser to conduct a ceremony for the snake, plus a rooster. We purchased the roosters and the items, assuming they would subsequently be used as part of the household routine. Upon returning to the young man's room to retrieve the snakes, he invited us to remain so that he could bid farewell to the snakes. In the dark room, with doors closed and only by the light of a few candles, he unexpectedly celebrated an animist ritual involving the sacrifice of one rooster, whose blood, dripped on the snakes and the floor, would allow the room to retain some of the pythons' power. Needless to say, restraining the rapidly tongue-flicking pythons took some doing until we could safely remove them from the room. We cleaned and rehydrated the snakes in our hotel's shower to ascertain their health. After a publicized show-and-tell in the Presidential Palace (Fig. 1, upper right), all three snakes were released in an uninhabited area distant from the capital.

The subsequent survival of the two healthy pythons is fairly assured (see SNOW et al. 2007 for an account of the success of *Python b. bivittatus* in a non-native habitat upon release from captivity). The situation of the python with mouth rot created a situation requiring an uneasy compromise. The President had publicly stated that these three pythons would be returned to nature, and this clearly negated the option of euthanasia for the sick individual. At the same time, the lack of suitable facilities and care did not allow for a period of convalescence. While the release of an individual in less than perfect health is clearly undesirable, we believe our intervention to remove the infected tissue and disinfect the area rendered the snake able to heal and feed in the wild, and it minimized the chance of a stress-related disease entering the wild population. The release of all three snakes under the President's auspices had great promotional value for the conservation of large snakes, and we believe that our efforts upheld the guidelines of the IUCN/SSC Reintroduction Specialist Group.

Conclusion: We believe that the young man, a student at a local institute of tourism, understood not only the danger his captives posed to the community and himself, but also comprehended that wildlife belongs in nature. It is our hope that in guiding tourists in the future, he will appreciate that wildlife encountered in the wild can in itself be attractive from an income point of view. Gaining publicity for snake conservation via an invitation to the Presidential Palace is, of course, a rare opportunity. This visit was newsworthy and well documented (via local news print media), and the President, who converted to becoming a reptile conservation 'advocate' after learning about our efforts, was captivated by our presentation. While we have no illusions that our attempts at education are instantly successful in changing a set of beliefs involving a strong spiritual component, we expect that public recognition of these snakes as a concern at the highest level of government will lead to reduced persecution and perhaps an enhanced ap-

preciation of these animals. We have since learned that the young man again owns a python, though a much smaller individual than the two that caused concern in the community, and that he has presented it in an educational context while regaining his spiritual asset. We doubt whether education alone helped the conservation understanding of the third snake's owner, who had held the snake captive for 15 years, and we wonder whether he also subsequently obtained a replacement for the snake we rescued. In the latter case, maybe only the President's desire and the crisp 20-\$-bill ultimately brought about the python's release.

Recommendations: We believe that in cases where public safety is a potential concern, there is first the need for the appropriate action by law enforcement, followed by both formal and informal education regarding the place of animals in nature. Such education must be conducted in the context of local culture and socio-economic conditions, as was advocated in the cases of the Philippine crocodile (*Crocodylus mindorensis*) in rural communities of Luzon Island (PLOEG et al. 2011) and the Siamese crocodile

(*C. siamensis*) in Cambodia (DALTRY et al. 2005), where it appears to have met with success. In the specific case we present, external factors that create an economic value for large snakes (such as from the snake skin industry in neighbouring Indonesia; AULIYA & ABEL 2000, AULIYA 2010) do not appear to have materialized yet, even though the illegal snake trade may have an appeal in a situation where many local residents are subsisting on incomes of < US\$ 3 per day.

Case study 2: a reticulated python in Pante Macassar, Oecusse District

Background: During our survey of the herpetofauna in the Oecusse exclave (as reported by SANCHEZ et al. 2012), residents of the main town showed us their captive reticulated python. The python was caged in a mixed-media enclosure, composed of bare hewn timber, sheet metal, and the obligatory chicken wire, a construction that appeared none too safe for the snake as living quarters, let alone for pre-



Figure 2. Upper left: Under the watchful eye of the python's owner and his daughter, co-authors CS, AVR and LLA conduct a careful physical examination of the snake to assess its overall health. Lower left: With LLA (white shirt) demonstrating, the owner reluctantly, but with keen interest, supports the tail end of the python. Right: After some small steps to become more comfortable with his charge, the owner holds the python by himself for the first time. Photos by M. O'SHEA.

venting escape. The snake looked healthy overall but displayed some scars that appeared to have been caused by cuts from the sheet metal or wire. We were told that the python was fed a live chicken periodically, that it was never handled, and that the owners were afraid of the snake.

Conservation concern: As in our first case study, this python again created a concern about public safety. However, given that the Oecusse District is not directly connected by land to Timor-Leste and surrounded by Indonesian territory, we consider this location even more at risk for the emergence of illegal snake trading than the contiguous districts.

Dialog: Because ownership of the snake appeared to involve an extended family of over a dozen individuals ranging in ages from toddlers to the elderly, we realized that this was not a case where the snake was held for sale, and we felt that this extended family would make a good audience for an educational session. After formally and respectfully requesting and receiving permission to measure and photograph the snake, we explained that in order to do so we would need to remove the snake from its cage. This was approved, and we handled and rinsed the snake, took measurements and scale counts, and returned it to the enclosure. This also permitted us to conduct a short health check on the python. During the data gathering (Fig. 2, top left), our Timorese team members explained snake morphology and natural history to the onlookers, and we pointed out that the cage was ill suited for the animal. Our requests to release the snake were rebuffed, because its ownership appeared to be an important status symbol.

Resolution: Before finally placing the python back, we encouraged some of the children to touch it while it was handled by one of us. A little girl was the first person who dared touch it, and her naïveté and daring catalysed the learning experience for the others. The comfort level with the snake increased significantly during the subsequent hour. We instructed some of the family members in how to handle it, and they practiced touching the snake willingly (Fig. 2, bottom left). We were adamant about the need to respect the snake, and suggested that a status symbol deserved an enclosure worthy of its status. By the time we left, a new cage was being constructed, in line with some of the suggestions we made, and the owner himself was able to handle the python (Fig. 2, right).

Conclusions: This case study shows an ideal situation for learning. Firstly, the initial level of education was the same across the 'students,' even though the group consisted of several age groups. Secondly, the family displayed a genuine desire to learn and act on what they were learning. Thirdly, on account of the status of the snake, the learning experience of the children, and the central location of this family's residence in the main town of Oecusse District, we believe that there may be long-term benefits to the population of humans and snakes in the area so that the relation-

ship with wildlife in general will be based on respect and a desire to learn.

Recommendations: We believe that as researchers, we can seize the opportunity for conservation outreach instantly, if we ourselves retain a situational awareness (the 'bigger picture') when dealing with the community. In fact, it is highly likely that consistent efforts in this regard can lead to improved receptiveness by rural communities to conservation efforts (VAN DER PLOEG et al. 2011, BICKFORD et al. 2012). Thus, we encourage anyone involved in fieldwork to engage the local population and promote conservation-oriented thinking.

Case study 3: a saltwater crocodile (*Crocodylus porosus*) in Aileu

Background: During the intervention of international peacekeepers in 1999, in the aftermath of the United Nations-sponsored referendum guaranteeing statehood for Timor-Leste, a diverse set of military groups was posted to key population centres. One such post was the police station in Aileu, the capital of a namesake district in the mountains south of Dili. It appears that Portuguese peacekeepers stationed there encountered a young adult saltwater crocodile (*Crocodylus porosus*: IUCN Red List – Lower Risk/least concern, Crocodile Specialist Group 1996; CITES – Appendix II) in a roadside swamp near Betano, a town in Manufahi District on the south coast. In a display of macho exuberance, the soldiers captured the crocodile and transferred it to an enclosure on the grounds of their post, several hours by road to the north and inland. Successive postings of UN peacekeepers, as well as the reluctant local police detachment, appear to have adequately maintained the crocodile and its enclosure (Fig. 3) over the last decade (based on our observations during visits in 2009 and 2011). While the animal has by now grown into a weighty 3.5-m beast that subsists on rations of innards supplied intermittently from the local abattoir, there is no institution or individual holding an ownership claim. With the end of the UN peacekeeping mandate in late 2012, the Government of Timor-Leste requested that we assist in relocating the crocodile to an at the time unspecified area on the south coast, removed from human populations. During our first visit to the Aileu crocodile in the summer of 2009 (reported on in KAISER et al. 2009, 2011), we were also shown a small *C. porosus* in a wooden rain barrel, secured only by a lid with a rock set on top. The fate of this individual is unknown to us. Since our last visit to this crocodile in mid-2011, the Government of Timor-Leste, headed by the President's Office, has sent personnel to Australia to be trained in proper relocation techniques. Furthermore, it appears that the training includes monitoring and studying of those coastal *C. porosus* populations that may have a possible impact on human settlements.

Conservation concern: Crocodiles are currently perceived as a considerable threat to public safety in Timor-Leste, because, as a population relieved of the yoke of oppression expands its activities, the frequency of fatalities from crocodile attacks has increased to a level unacceptable to the populace (no statistics are available, but reports have certainly increased from single to low double digits). Crocodiles have even been seen along the beaches near Dili, a favourite weekend retreat for locals and foreigners, and warning signs have been posted. The conservation concerns we have are two-fold. Whereas in the current situation of human-crocodile interactions a laissez-faire approach is untenable, relocation alone is not going to provide suitable long-term relief. Culling may then follow a relocation program that is unsuccessful in curbing the threat. In addition, there is an unusual crocodile population in Lake Ira Lalaro, a seasonally variable water catchment in Timor-Leste's easternmost district. In this locality, a fatality was only recently reported (BRANDON SIDELAU, in litt.) as the presumed result of increased fishing activity to create economic growth. Because this small, isolat-

ed population lives in freshwater at an altitude of nearly 500 m above sea level it may be genetically distinct; relocation of individuals or culling would not be suitable management approaches.

Dialog: In speaking to people about the crocodile in Aileu, we encountered pride (among members of the military or the militarily-minded public), concern (among those in government worried about the status quo), and fear (among those who are simply uncomfortable with having their families living only a chain link fence's strength and a simple door-closing wire away from a predator of prehistoric proportions). While there is a tacit consensus that there does not appear to be any immediate danger from the animal, and while the crocodile itself does not appear to be particularly aggressive and prone to escape, the news that someone may actually remove the animal was received warmly. Officials from the Department of the Environment, Ministry of Agriculture and Fisheries, were also quite eager to receiving assistance with this sizeable problem.



Figure 3. The chain-link enclosure in Aileu, Timor-Leste, in which a saltwater crocodile (*Crocodylus porosus*) has been kept for a decade or more. Co-authors CS and DT, and the residences in the background, demonstrate the precarious situation of having a large crocodile in the centre of town. Photo by H. KAISER.

Resolution: While we have not yet been able to relocate the crocodile for logistical reasons, and while our task may be transferred to the newly trained task force, this 'rescue' is something the Government of Timor-Leste appears to be quite keen on completing. The relocation is important for reasons of public safety as well as for the safety and long-term welfare of the crocodile, and transporting it will definitely require permissions from high officials in charge of internal security. However, it is also a project fraught with the potential for complications. Capturing, handling, moving, and releasing a reptile of the dimensions encountered here is difficult at best, even when not compounded by a 5–6-hour drive in tropical heat. Furthermore, the choice of habitat into which the creature will be reintroduced must be made carefully, and its release can follow only after securing the approval of local and national government bodies.

Conclusions: While this particular crocodile is relatively well known in Timor-Leste, its rescue has considerable potential for becoming a focus for wildlife education. As a well-known captive, the rescue will be newsworthy within Timor-Leste but also in Australia. This interest is generated because the last crocodile rescue in the country was conducted by the 'Crocodile Hunter', the late STEVE IRWIN, and accompanied by considerable publicity. There is a broad national appeal to *C. porosus*, which is immortalized in the legend of the origin of Timor Island (KAISER et al. 2009) and featured on the highest-denomination postage stamp of Timor-Leste.

Recommendations: The Government of Timor-Leste is currently treating the issue of crocodile attacks as an internal security problem and sees an immediate solution in the removal of crocodiles. While this is in some instances a suitable response, such as when a rogue individual forays beyond a normal range or displays unusually aggressive behaviour, this approach is not a long-term solution in a situation where humans and crocodiles have not yet learned to coexist. As in other situations, where the conservation concern is more pressing due to a limited crocodile population size (DALTRY et al. 2005, PLOEG et al. 2011), government intervention without education and economic alternatives may not be the optimal approach. We recommend that in addition to the potential activities of the Timorese crocodile task force, the Government of Timor-Leste provide appropriate economic alternatives to remove individuals from the danger posed by crocodiles (e.g., beach fishermen who wade into the water to catch fish, anyone having to obtain river water by hand). Furthermore, we strongly recommend the creation of an elementary school curriculum that deals specifically with crocodiles, reticulated pythons, and pitvipers, the only other potentially deadly reptile in Timor-Leste, along with the creation of a permanent wildlife education task force that can create lectures and visual tools appropriate to the population it serves.

Case study 4: a monitor lizard (*Varanus cf. salvator*¹) on Ataúro Island

Background: Although Ataúro Island is politically part of Dili District, positioned ca. 25 km off the shores of Timor-Leste's capital city, it is geologically part of a group of islands known as the Inner Banda Arc whereas Timor Island is part of the Outer Banda Arc (see HAMILTON 1988, MICHAUX 1994). As a consequence, the presence of faunal elements on Ataúro that are distinct from Timor would not be surprising (KAISER et al. 2012).

During our first visit to Ataúro in early 2010, we had explained our work to local residents and shown them some of our field laboratory (Fig. 4, top). Even before this visit, we had heard about unconfirmed sightings of a monitor lizard and a spitting cobra on the island, and we made diligent inquiries about these species with all who would listen. During a follow-up visit in August 2010, the senior author discovered the decayed carcass of one monitor lizard among the debris washed up on a stretch of beach (Fig. 4, centre). In addition, one local resident had been identified who was keeping one of these lizards as a 'pet.'

Conservation concern: All species of monitor lizard are protected and listed in the Appendices I or II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). The population we discovered on Ataúro is likely quite small and has only a very limited range in coastal habitats. As a consequence of its potentially taxonomic distinctiveness it could easily become a target of collectors for the reptile skin or pet trades, whose offers to purchase these lizards from local collectors would immediately threaten the population. The sale of a single lizard may provide an income worth months of traditional labour.

Dialog: After serendipitously meeting the lizard's owner at Ataúro's ferry landing, AVR explained to him and several bystanders our mission to describe the local herpetofauna in some detail, emphasizing particularly the importance of such work to conservation. The individual appeared to understand this and explained that these types of lizards held some cultural significance among the people living in the island's mountainous centre.

¹ The taxonomic position of this monitor lizard is currently unresolved. Alone by its size and colouration, the Ataúro population cannot belong to either *V. timorensis* or *V. auffenbergi*. Whereas the geographic proximity of *V. salvator bivittatus* on the nearby Lesser Sunda Islands may suggest a close relationship with the Ataúro population, this is not what preliminary morphological and molecular comparisons suggest (André Koch, in litt.). While there is no doubt that the species belongs to the *V. salvator* complex, it is not possible to state whether it is a subspecies of *V. salvator* (IUCN Red List – Least Concern, BENNETT et al. 2010; CITES Appendix II) or a taxon requiring recognition at species or subspecies level.



Figure 4. Top: Timorese students using the field laboratory to gain skills in the preparation of museum specimens (AVR in white shirt, LLA in green shirt). Centre: Specimen of a monitor lizard (*Varanus cf. salvator*) from a pile of flotsam near Ataúro Island's ferry terminal. Bottom: Decaying specimen of an unidentified species of monitor lizard from Ataúro Island. Note the distribution of fly larvae (small rice-like structures) all over the carcass. Photos by H. KAISER.

A belief in Anartutu, a village in the highlands of central Ataúro, apparently holds that the monitor lizards found on the coast are instrumental in conflict resolution. A village leader is said to bring a newly captured lizard into a hut with the feuding individuals (usually husband and wife) who then proceed to air their grievances. Once the talking is done, the lizard is returned to its coastal habitat far from the village, carrying the contentious issues and any ill feelings with it. With an ingrained belief system, such a process is psychologically feasible.

Resolution: The lizard's owner agreed to donate his lizard to science, and AVR and friends went to the owner's home to collect the lizard. Unfortunately, the lizard had died in its unsuitable housing (one of the ubiquitous plastic water barrels, unprotected from the heat) and was in an advanced state of decay (approximate time of death could be determined at ca. 2 days prior by the presence of a large population of second-instar fly larvae; Fig. 4, bottom). Upon realizing the demise of his lizard, the owner appeared suitably embarrassed and chastened.

Conclusions: The owner was embarrassed in front of his friends, and even though the death of the lizard would not have elicited much of a reaction *per se*, having this discovery shared with the owner's social circle and local researchers, against the background of the pungent smell of decomposition, carried considerable gravitas. We explained the importance of species discoveries in terms of biodiversity and conservation, and requested that any of the individuals in the group, including a police officer, contact AVR by phone should lizards be seen or should knowledge of another captive individual surface. When AVR and LLA subsequently collected a voucher specimen of this monitor, they were duly interrogated by police on the ferry and subsequently detained briefly, until they could produce the appropriate permits.

Recommendations: Discovery of a new, highly visible species that belongs to a CITES-listed group is an obvious challenge, particularly when the country of origin is currently not a signatory to the CITES convention. We have held conversations regarding these lizards with several Ataúro residents whose position in the community we consider important, to ensure the awareness that these lizards are special. We have also displayed the single voucher specimen to a wide audience of policy makers, including the Director of National Parks, in order to create a broader awareness of this population. We believe that capture and transport of one of these lizards would now be noted and reported.

In situations such as these, we recommend to promote the animal population to local residents in a manner that makes it culturally, yet not economically, significant. We further recommend that the proper authority on the national level be appraised of the situation, so that suitable conservation management action is taken to safeguard the population.

Case study 5: Chinese pond turtles (*Mauremys reevesii*) in kangkong paddies

Background: We initially confirmed the presence of *Maurmys reevesii* (IUCN Red List – Endangered A2bcd + 4bcd, VAN DIJK 2011; CITES Appendix III for China) serendipitously when staying at the Albergario Planalto in Baucau, Timor-Leste's second largest city and ca. 100 km east of Dili (KAISER et al. 2010). The manager showed us a photograph

of a turtle of unknown species designation that had been captured while attempting to cross the road in front of the hotel and placed into the hotel's small weed-choked fountain.

Our second encounter with these turtles in February 2011 was even more unexpected, when the senior author observed a turtle trade taking place on one of Dili's swankier streets while walking to the Palacio do Governo (the seat of Timor-Leste's government). He saw a bucket with several turtles changing hands and inquired as to the plans the new owner had for them. The ethnic Chinese buyer explained that, as part of her Chinese New Year celebration, she sought to release the turtles and elicit herself good luck. The senior author offered his services in this regard and, proving his status with a business card and his amphibian and reptile survey logo-embossed shirt, took custody of the six turtles in their bucket (Fig. 5, top). He carried the turtles with him to his government meetings, passed with them through the security at the Palacio, and explained their provenance to guards and government leaders.

Conservation concern: Timor-Leste's Lake Ira Lalaro in Lautém District is home to one of the world's 25 most endangered turtles (Turtle Conservation Coalition 2011), the snake-necked turtle *Chelodina mccordi timorensis* (IUCN Red List – Critically Endangered A1d, B1+2e, Asian Turtle Trade Working Group 2000; CITES-Appendix II). Whereas there is no particular conservation problem associated with the in-country trade of the exotic *M. reevesii* or the other introduced turtle species, *Pelodiscus sinensis* (IUCN Red List – Vulnerable A1d+2d, ASIAN TURTLE TRADE WORKING GROUP 2000; CITES – not listed), there is a potentially serious problem should the exotics and the endangered endemic ever be considered at par when it comes to their use in Traditional Chinese Medicine (TCM; see KAISER et al. 2010). Increased demand for the former could result in rapid extirpation of the latter.

Dialog: When attempting to present the turtle from the fountain to us, the manager of the Albergario discovered with chagrin that it had escaped previously, at an indeterminate time. However, he was able to secure a second turtle from a friend and explained that, unlike the fountain specimen, this specimen had been brought to Baucau from a suburb of Dili. We provided the manager with information about turtles in general and requested that he keep an eye out for additional captives.

Both the Chinese buyer and the individuals encountered near the Palacio knew well that there was a turtle population in the Dili area. Specifically, the habitat of these turtles was consistently described as the kangkong (water spinach, *Ipomoea aquatica*) paddies that primarily exist along the southern edge of the city (Fig. 5, bottom). From all accounts by Timorese residents, the population of *M. reevesii* is well established and breeding, and our own sample included a male in black breeding colouration (Fig. 5, centre). These people did not know that the species had been introduced, but the consensus was that turtles like these



Figure 5. Top: Six Chinese pond turtles (*Mauremys reevesii*) obtained for release on the streets of Dili. Centre: *Mauremys reevesii* male in breeding colouration. Bottom: The presumed habitat of *M. reevesii*, kangkong (*Ipomoea aquatica*) beds on the southern outskirts of Dili. HK is seen on the right in the process of releasing the turtles. Top and bottom photo by M. O'SHEA, centre photo by H. KAISER.

had been living in the area for at least a generation. In the interviewed individuals' minds, this type of turtle was not considered bothersome and in no way linked to consumption, either as a source of protein or as an ingredient in treatments of TCM (KAISER et al. 2010). We explained the status of turtles as endangered species, and we specifically

outlined the potential problems with smuggling and sale of these animals, specifically referencing members of the Chinese Diaspora who may arrive with traditional views on turtles as food or medicine (ominously, it appears that the local need for traditional remedies for the ethnically Chinese segment of society is filled by processed imports; HK, pers. obs.). When found, these turtles are occasionally maintained as pets by people with suitable ponds and fountains.

Resolution: After our exhortation of this turtle as an important scientific specimen was relayed to the turtle's owner by the hotel's manager, the owner graciously agreed to allow us to take it with us as a voucher. Regarding the turtles in the bucket, after conferring with colleagues from the IUCN/SSC Tortoise and Freshwater Turtle Specialist Group, we returned them to the kangkong fields in a compassionate release. Despite their journey in a bucket, after cleaning and watering the turtles in our hotel room's shower (Fig. 5, top), they appeared no worse for wear. Since merit releases of wildlife (usually by Buddhists) are a common phenomenon in Southeast Asia, causing problems both in terms of creating demand for the capture of wildlife and simultaneously because of the release of exotic species (or native species) in inappropriate areas, we have informed the wildlife management authority in Timor-Leste about this issue.

At present, there is no resolution to the situation of *M. reevesii* in Timor-Leste. Whereas *M. reevesii* is listed as Endangered in the IUCN Red List (VAN DIJK 2011), the population in the kangkong fields of Dili is probably the result of several introductions (KAISER et al. 2010). As an alien species, the appropriate conservation response may be the removal of these turtles. We have considered this path, perhaps to be accomplished through the distribution of flyers to the Chinese population as well as through posting signs around the kangkong fields, but since environmental legislation in Timor-Leste is pending as of this writing (28 June 2012), such efforts would be premature.

Conclusions: Both the owner of the original specimen from Baucau and those we encountered with a bucketful of turtles heard a mini-lecture on turtles and their conservation status. In addition, we referenced the endangered population of the Lake Ira Lalaro snake-necked turtles (*Chelodina mccordi timorensis*) in eastern Timor-Leste and explained the uniqueness of that species. Turtles appear to hold a certain novelty value in discussions of wildlife, and we believe that those who were exposed to our turtle talk will remember it.

Recommendations: The potential confusion of an undesired exotic with a highly endangered species is probably not a widely encountered phenomenon. As a consequence, it becomes necessary to initiate educational programs covering both types of animals, specifically with the intention of enabling easy identification of the species concerned (such as pictorial information independent of language;

O'SHEA & KAISER 2013). In the case we describe here, this is a fairly simple task because the three species involved are easy to distinguish morphologically. We also recommend the two-tiered approach already mentioned above, which includes educating both the local populations (in this case, the residents of villages along the shore of Lake Ira Lalaro) and government officials.

Discussion

The preceding case studies give examples of the ways in which the Timorese citizenry encounter and deal with certain reptiles, and given the multiple conservation concerns we raise, they show the level of complexity that exists even in a relatively small country when dealing with conservation. Through these experiences, we have come to realize that the only way to ascertain progress in conservation efforts is a holistic approach that includes a partnering of government, researchers, and educators (e.g., DALTRY et al. 2005, PLOEG et al. 2011). However, efforts such as these are not rewarded instantly, as the crocodile examples in Cambodia (4 years; DALTRY et al. 2005) and the Philippines (3 years; PLOEG et al. 2011) have shown. Invariably, the process must enable local residents to understand how the organisms and their attitude towards them fit in the bigger picture of their own cultural and socio-economic landscape, and serious barriers may have to be broken during this process. For example, residents along the shores of Lake Ira Lalaro will not permit boats on the lake for fear that it will cause the rapid demise of their livestock and the death of those using the boat. Boats, however, would be the optimal means by which to conduct crocodile surveys or mark-and-recapture studies on the endangered snake-necked turtle. We hope to achieve this by initiating community-based education programs, beginning in elementary schools, so that learning includes a better understanding of the place of humans in the environment. If successful, early learning could bring about a paradigm shift so that ecosystem management, while ultimately under the control of government, is locally driven by traditional ecological knowledge and environmental history (sensu BERKES 2004).

In our own experience we have begun to take only preliminary steps by including in our work training efforts directed at science education students from Timor-Leste's national university as well as government employees involved in wildlife management. While these efforts need to be continued and expanded, we are beginning to see that a desire for long-term, community-based biodiversity monitoring programs, which help with capacity-building and public outreach (ŞEKERCIOĞLU 2011), is developing at government level. Given the exposure our activities have received through the publication of herpetology-themed postage stamps from our designs, the publicity from our appearance with the country's president, and the release of our reports (KAISER et al. 2011, 2012, O'SHEA et al. 2012, SANCHEZ et al. 2012), we hope that there can be sustained action to-

wards promoting such activities. We have specifically discussed the training of the Forest Guards deployed by the Department of National Parks in basic scientific technique in order to be able to monitor the Nino Konis Santana National Park and the 29 protected areas around the country. As recommended by ŞEKERÇIOĞLU (2011), Forest Guard activities in Timor-Leste can easily be expanded to include broad-based hands-on training and education for villagers and pupils, as well as local decision-makers, whose interest will be raised significantly if some type of income can be generated through their educational efforts.

If efforts in culturally sensitive and inclusive conservation education are successful and it becomes understood that the collecting and export of tokay gecko (*Gekko gecko*) tongues as a cancer remedy for TCM (e.g., BAUER 2009, CAILLABET 2011) or the indiscriminate killing of Macklot's water pythons (*Liasis mackloti*; see O'SHEA et al. 2012) are poor choices in the context of a habitat that needs to provide a healthy home for families, then conservation will no longer be an abstract foreign-born concept but an internal need – as we hope it became for some of the individuals featured in our case studies.

Acknowledgements

Our work in Timor-Leste would not have been possible without the expressed support of Their Excellencies, former President JOSÉ RAMOS-HORTA and Prime Minister XANANA GUSMÃO, as well as the gracious assistance of distinguished Cabinet members ÁGIO PEREIRA and JORGE TÊME. It is with considerable gratitude that we acknowledge their help and friendship. Our very special thanks go to the wind beneath our wings, CLAUDIA ABATE-DEBAT, Senior Advisor to the Prime Minister, who opened many doors, facilitated countless meetings, and who tirelessly jumped to our aid when needed. Our fieldwork has benefited from several groups of motivated students, and we wish to acknowledge their many contributions. Our thanks for assistance in the field go to VENANCIO LOPES CARVALHO, currently at the University of New South Wales, and to ROBERT SEWELL, Naveen Jalota, JESTER CEBALLOS, DOMINIQUE FALLAS, MARY JANE WEIL, MARIANNA TUCCI, MARISSA COX, JOANNA FLORES, KYLE OLSEN, ERIC LEATHAM, PAUL FREED, BARBARA LESTER, CHRISTINE LE DUC, DAN SUZIO, ANNIE SUZIO, and MARGARET ANDREWS from Victor Valley College (VVC). Partial funding for student travel was generously made available by VVC's Associated Student Body, and equipment purchases were subsidized by a Title V grant to the STEM Division at VVC. This paper is Communication # 7 from the Tropical Research Initiative at Victor Valley College.

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