Herpetological Review, 2013, 44(1), 68–76.

Working with a Full Deck: the Use of Picture Cards in Herpetological Surveys of Timor-Leste

Timor is the 44th largest island in the world and the seventh largest between Asia and Australia (area 29,402 km^2). It occupies an extremely interesting geographical position within the biogeographical sub-region known as Wallacea, at the southeastern edge of the Lesser Sunda Archipelago and separated from Australia by the Timor Sea (ca. 450 km). This gap was considerably lessened during the final 250,000 years of the Pleistocene Epoch (2.588-0.012 MYA), when glaciation lowered sea levels by up to 120 m below present-day shorelines (Voris 2000). The Sahul Shelf of Western Australia extended to within 300 km of the Timorese coast, with stepping-stones present in the vicinity of the Ashmore and Hibernia Reefs, during at least 50% of this time and, as calculated from Voris (2000), was as close as 100–150 km for a much shorter combined period of 15,000 years.

Through the capricious nature of colonialism, Timor is politically divided into two almost equal parts. The western part (14,395 km^2: Monk et al. 1997), formerly part of the Dutch East Indies, now belongs to Indonesia's East Nusa Tenggara Province (in Bahasa: Nusa Tenggara Timur), whereas the formerly Portuguese eastern half, inclusive of the Oecusse District, an exclave surrounded by Indonesian West Timor on the northern coast of the island, and the neighboring islands of Ataúro and Jaco, comprise the 15,007 km^2 Democratic Republic of Timor-Leste (area taken from the website of the Government of Timor-Leste). The eastern part in particular has had a tumultuous and often-violent history, which has resulted in it being one of the least biologically explored islands in the region.

History of Herpetology on Timor

In terms of herpetological surveys, the port of Kupang in the western part of Timor was an important Dutch East Indian reprovisioning stop for some of the great expeditions of the early 19th century (reviewed in Kaiser et al. 2011), and a few specimens from this time exist in European museum collections (most significantly, the Muséum National d'Histoire Naturelle in Paris, France; Naturalis, formerly the Rijksmuseum van Natuurlijke Historie, in Leiden, The Netherlands; and the Zoologisch Museum Amsterdam, now also housed in Leiden). Additional short surveys were conducted there during the early 20th century (e.g., Smith 1927; collections in the Natural History Museum, London, United Kingdom) and in the 1990s (e.g., How et al. 1996a,b; collections in the Western Australian Museum, Perth, Australia). In contrast, the Portuguese eastern half of the island was not a popular shipping destination and, through the centuries, received little attention from biological, let alone herpetological, collectors. Small collections were made by Francisco Newton and co-workers (reported in Bethencourt Ferreira 1897, 1898) and during explorations for the availability of natural resources (Manaças 1956, 1972; Themido 1941). Unfortunately, all but the two specimens housed at the University of Coimbra listed by Themido (1941) were lost in the fire at the Museu Bocage, Lisbon in 1978 (Brandao 1997). Even though some collecting has occurred in Timor-Leste during the early years of independence, by batrachologist Stephen J. Richards (James Cook University, Townsville, Queensland, Australia) and ornithologist Colin J. Trainor (Charles Darwin University, Darwin, Northern Territory, Australia), no further herpetofaunal reports were available until this project was initiated in 2009.

A New Start

As a consequence of the lack of available survey data, published reports, or extant museum collections, we embarked on the first comprehensive herpetofaunal survey of Timor-Leste in 2009 working from an almost blank canvas. In our initial report (Kaiser et al. 2011), we documented the results of our first survey phase (June–July 2009), together with results from Richards and Trainor. Since then we have conducted a further six phases, at a rate of two per year, adding further species and data to our knowledge of the herpetofauna of 'mainland' Timor-Leste (O'Shea et al. 2012 and in prep.), the exclave of Oecusse (Sanchez et al. 2012), and of Ataúro Island (Kaiser et al., *in press*). The known herpetofauna currently stands at almost sixty taxa, approximately one third of them new to science.

The Need for a Tool

Part of the remit of our surveys has been to involve Timorese students from the national university (Universidade Nasional Timór Lorosa'e) in the country's capital, Dili, in the study of

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their own herpetofauna. This process also allows these students to engage and interact with local administrators and Timorese citizens in general. The work includes promoting conservation of the Reticulated Python (*Python*[1] *reticulatus*), learning about the cultural links to the Saltwater Crocodile (*Crocodylus porosus*), and investigating the provenance of Chinese Pond Turtles (*Mauremys reevesii*) sold by the roadside in Dili (see Kaiser et al., in prep). While these types of story-telling opportunities frequently emerge when discussing nature with local residents, and while discussions of local species based on an overall '*bauplan* knowledge' of animals is quite straightforward, we wanted to ensure that we could collect local knowledge that was as detailed as possible. In this regard, researchers elsewhere noticed that the rural peoples in the Highlands language group Kalam (also known as Karam) in northeastern Papua New Guinea were able to differentiate between morphologically similar species of frogs, lizards, and snakes, and could provide separate names and even an ethnobiological classification system (Bulmer and Tyler 1968; Bulmer et al. 1975). Although a number of the frogs served as food species, several of the snakes were of 'medical importance' (see Gopalakrishnakone and Chou 1990; Jena and Sarangi 1993), and some taxa had totemic or other cultural value to local residents, many of the smaller species had no apparent bearing on the lives of the local inhabitants, yet were afforded names in the Kalam language. This level of cognitive awareness of the herpetofauna contrasts with the fact that, in many regions, harmless, inedible species are known only by a 'catch-all' common name. Bulmer and colleagues also noted that people of language groups neighboring the Kalam-speakers were less discerning and did group small reptiles together under umbrella names. The degree of local cognitive awareness relating to natural history cannot, therefore, be either simply assumed or discounted.

In an effort to maximize the exchange of information where different languages are in play, visual aids are a boon because photographs reach across the language barrier. As a consequence, we have long given thought to ways in which best to create visual aids for use during fieldwork. Although there now exist a small number of books on the herpetofauna of the Lesser Sunda Islands containing color photographs (Auliya 2007; de Lang 2011; Iskandar 1998; McKay 2006), these are not ideal as visual aids when interviewing individuals or groups of villagers, as they only permit a single open spread at any one time and often prevent the comparative examination of more than one image. The use of several books is also clumsy from a logistical viewpoint, since having to carry several guidebooks to a remote village can add considerable weight to already full packs. Some titles are also not easily or inexpensively obtained and could become spoiled by their excessive handling during fieldwork in a tropical climate. The titles listed above are also deficient in their coverage: whereas they list frogs, turtles, and snakes, they exclude lizards, which, as a group, account for approximately 66% of the reptile fauna of Timor-Leste (O'Shea et al., unpubl. data). The need for a simple, portable, visual tool, ensuring ease of use and dependability even under field conditions, was the driving force behind the idea for Species Identification Cards (SICs), which one of us (MOS) came up with in late 2011.

[1] We accept the reasoning of Zug (2011) and Kaiser et al. (2013) in retaining the Reticulated Python (*reticulatus*) and the Lesser Sunda Python (*timoriensis*) in the genus *Python*. While the data presented by Rawlings et al. (2008) indicate a split in the genus *Python*, the resulting new genus has not yet been scientifically named.

Species Identification Cards—Design

Images.—Each card displays a high resolution photograph of a reptile or amphibian, showing as much morphological detail as possible. When warranted, such as with the red flanks in sexually mature male four-fingered skinks (*Carlia* spp.) or the orange tail-tips of juvenile bent-toed geckos (*Cyrtodactylus* spp.), we included sexual or ontogenetic dichromatic variation on the same cards. With especially variable species, such as rice-paddy frogs (*Fejervarya* spp.) or Emerald Tree Skinks (*Lamprolepis* cf. *smaragdina*), the latter of which occurs as both a green-and-bronze phase or as a completely bronze phase, more than one card was produced. This approach was also taken with the Lesser Sunda Island Pitviper (*Trimeresurus insularis*); although all the specimens we have seen in Timor-Leste so far have been vivid green, one of our Timorese field colleagues assured us that the bright yellow phase, commonly seen in specimens from Wetar, an island in Indonesia's Maluku Province to the northeast, is also present in eastern Timor-Leste. For this reason a card was produced for each of the known color phases—green, yellow, and cyan—the last being the color of some Komodo Island populations. We also included species rare for Timor, those not recorded since the now lost 19th century collections of Newton were made (e.g., the Little Filesnake, *Acrochordus granulatus*, and Cantor's Watersnake, *Cantoria violacea*), as well as species reported from West Timor by earlier fieldworkers (e.g., the Crab-eating Mangrove Snake, *Fordonia leucobalia*).

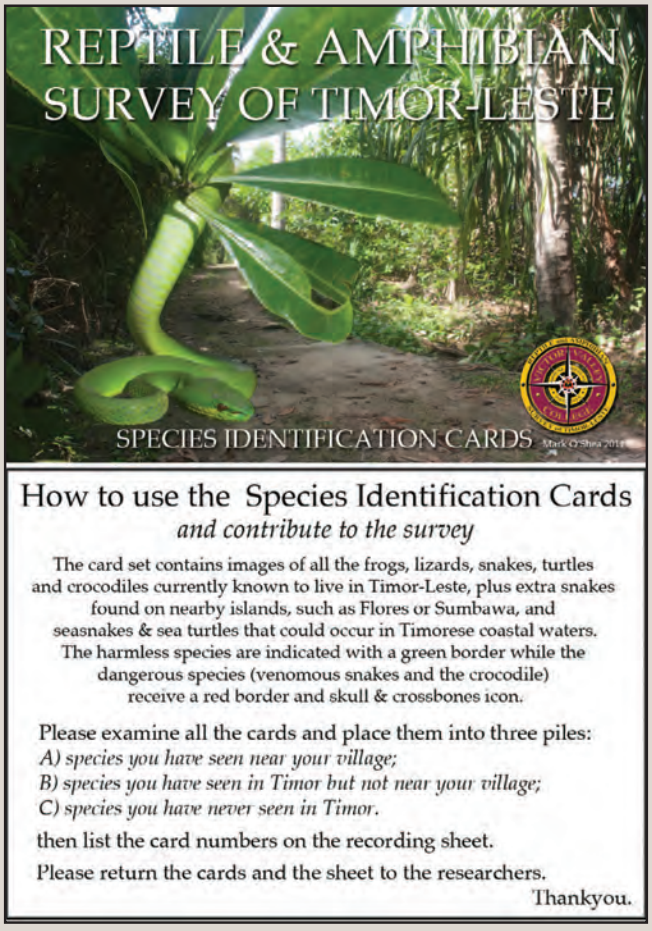

Fig. 1. Title card (top) and instruction card (bottom) of the Species Identification Card deck used in Timor-Leste.

FIG. 2. Four sample cards from the deck of Species Identification Cards developed for Timor-Leste. Images of harmless species (top row) are framed in green, whereas images of dangerous species (bottom row) are framed in red and feature a red skull-and-crossbones symbol.

The SICs were further expanded to include all sea snakes and sea turtles likely to occur within Timorese coastal waters, and also a number of significantly important snake species from elsewhere in the neighboring Indonesian province of East Nusa Tenggara. Some of these species may yet be encountered in Timor-Leste. The reasoning behind these inclusions was that although frogs and lizards are often fairly abundant and an intensive survey will generally locate most of them, snakes are much more solitary and secretive and therefore more easily overlooked, even by experienced field herpetologists visiting an area many times over a prolonged period of time. It was primarily the desire to learn more about the snakes that initiated the SIC idea. Living and working an entire life in a localized area, the rural Timorese hunter, farmer, or fisherman is much more likely to have encountered most species inhabiting the home location than a visiting scientist. Providing a set of snake SICs is not dissimilar to showing a series of 'mug shots' or an identification line-up to a potential witness of crime. The species from outside Timor that were added to the SICs included the Lesser Sunda Catsnake (*Boiga hoeseli*) and the Common Mock Viper (*Psammodynastes pulverulentus*), both found on Flores, Alor, and Sumbawa, as well as the Indonesian Spitting Cobra (*Naja sputatrix*), found on Flores and Alor, and the Eastern Russell's Viper (*Daboia siamensis*), found on Komodo, Lembata and Flores. Also included was the Lesser Sunda Python (*Python timoriensis*), although it is now fairly certain that the type locality of Kupang, West Timor, is in error and this species does not occur on the island of Timor (see Barker and Barker 1996).

Production.—In total, a set of 99 SICs, corresponding to 51 genera and approximately 86 species (and populations that might represent undescribed taxa), was produced to standard playing card size (3.5" × 2.5" or 89 mm × 63 mm). The set of photo cards was accompanied by a title card (Fig. 1 top) and an instruction card (Fig. 1 bottom). Each SIC carries the scientific name of the species concerned (these cards also serve as teaching aids for our students) and their common names in English and, where available, in the languages Bahasa Indonesia and/or Tetun. Common names in Tetun were drawn from names that already existed in the language or, where no such names existed, from those coined by Kaiser et al. (2011), O'Shea et al. (2012), and Sanchez et al. (2012), in collaboration with Timorese colleagues. All amphibians and harmless reptiles received a green border around the photograph (Fig. 2 top), while medically important species (front-fanged venomous snakes and the crocodile) received a red border and a skull-and-crossbones icon in the bottom left corner (Fig. 2 bottom). The top left corner bears the Timor-Leste flag, the top right the project logo, and the bottom right the SIC's number. SICs were numbered sequentially by alphabetical scientific genus and species names from *Acalyptophis* to *Varanus*. This proved to be a valuable addition as it not only sped up the sorting of a used suite of SICs, it also allowed for the species to be easily listed in three columns (see below) rather than merely placed in piles. The cards were printed with the project logo reproduced on the reverse, in the style of genuine playing cards.

Six sets of cards packed in a double compartment plastic case were printed by Ad Magic, Inc. (Netcong, New Jersey, USA; www.

FIG. 3. Zito Afranio Soares (in white shirt at center left) conducting the interview in Anartutu Village on Ataúro Island.

admagic.com). One set was donated to Timor-Leste's Directorate of National Parks, while the remaining sets were distributed to the team, especially to the Timorese students.

Text.—The text of the English instruction card (Fig. 1 bottom) invites the participant by explaining "*How to use the Species Identification Cards and contribute to the survey.*" It further explains the setup of the card: "*The card set contains images of all the frogs, lizards, snakes, turtles and crocodiles currently known to live in Timor-Leste, plus extra snakes found on nearby islands, such as Flores or Sumbawa, and sea snakes & sea turtles that could occur in Timorese coastal waters. The harmless species are indicated with a green border while the dangerous species (venomous snakes and the crocodile) receive a red border and skull & crossbones icon.*" This brief summary sets the stage for the following set of instructions: "*Please examine all the cards and place them into three piles: (A) species you have seen near your village; (B) species you have seen in Timor but not near your village; (C) species you have never seen in Timor. Then list the card numbers on the recording sheet. Please return the cards and the sheet to the researchers. Thank you.*" It is our intention to reproduce additional versions of the introduction card in Bahasa Indonesia and Tetun, the *lingua franca* of Timor-Leste.

Use of the cards.—The basic premise of using SICs is straightforward: give the set to one or more individuals, who can then independently, in their leisure time, sort the cards in the manner requested. It was therefore our initial plan to leave sets of SICs in villages to which we would be returning later in a survey, asking elders and/or interested individuals to examine the cards and place them into three piles. However, our Timorese colleagues advised that it would be more productive if they conducted interviews so that they could firm up identifications with more detailed explanation if the need arose, observe the body language of those being interviewed and listen to their inflections when speaking, thereby extracting a maximum of information about the way in which the species were encountered, and also to ensure that the cards were returned afterwards. Thus, one of our Timorese team members (Zito Afranio Soares) conducted the first SIC survey amongst a group of Timorese villagers in Anartutu village (elevation 560 m), Macadade Suco, Ataúro Subdistrict, Dili District, Timor-Leste, on 29 January 2012 (Fig. 3). This was followed with an interview conducted among his workers by Barry Hinton, proprietor of the lodge Barry's Place in Beloi village (4 m elev.), Beloi Suco, Ataúro Subdistrict, Dili District, Timor-Leste, on 3 February 2012. We further used the cards opportunistically for species identification during discussions (e.g., with expatriates and Australian Army personnel we met on Ataúro Island), and we tested them informally to obtain ideas that might allow us to optimize our methodology. Although we have subsequently conducted a similar survey in a village near Balibo, Bobonaro District, on the mainland, the focus of this paper will be the two specific interviews listed above.

Results and Comments: The Numbers in the Cards

In an accounting simplified by eliminating different color variants, we report on the placement of 57 species into categories (Table 1). In nearly half of the cases (24 of 57, 42%), selections by both sets of villagers agreed with our current understanding of the Ataúro herpetofauna. Furthermore, our own collecting data supported an additional 28% of choices made in Anartutu only and 9% of choices made in Beloi only, for a total of 79% of observations with some level of agreement via the use of SICs. Whereas it is encouraging to learn that there is considerable agreement between scientists and villagers in their respective assessments, there are also signs that great care must be taken in the analysis. For example, is the reason that there is substantially higher agreement between our team and the Anartutu villagers than with the Beloi villagers (70% vs. 51%, respectively) that the people in Anartutu know their fauna better, or is the underlying reason our choice of interviewer (Timorese scientist vs. non-Timorese employer, respectively)? As with any scientific enterprise, beginnings can sometimes be perplexing, but as we gain more experience with this model of involving local residents, we anticipate being able to improve our evaluation methodology.

Results and Comments: The Anartutu Cardgame

Amphibians.—The complete absence of amphibians indicated by our interviewees was not surprising since after three surveys on Ataúro we have yet to record any amphibian species (Table 1; Kaiser et al., *in press*). However, we would have expected at least one of the villagers to have seen rice-paddy frogs (*Fejervarya* sp.) or the Common Asian Toad (*Duttaphrynus melanostictus*) on visits to Timor.

Turtles and the crocodile.—The three Timor freshwater turtles (the introduced *Mauremys reevesii* and *Pelodiscus sinensis,* and the endangered endemic *Chelodina mccordi timorensis*) were unknown to our interviewees, as were all sea turtles with the exception of *Caretta caretta* (Table 1). Curiously, *Crocodylus porosus* was also not recognized as present, even though crocodile attacks are relatively commonplace on Timor and the crocodile is part of the creation myth for mainland Timorese.

Geckos.—Whereas the house geckos *Hemidactylus frenatus, Hemidactylus* cf. *tenkatei,* and *Gehyra mutilata,* all rather similar in appearance, were considered present, the obviously flat-tailed *H. platyurus* was not (Table 1). This reflected our own experience of having collected *H. frenatus* and *G. mutilata* on Ataúro but not *H. platyurus* (Kaiser et al., *in press.*). *Gekko gecko* was listed present, as were *Cyrtodactylus* spp.

Skinks.—Almost all the cards featuring skinks (*Carlia, Eremiascincus, Sphenomorphus* spp.) were placed into Category A (Table 1). As expected, the interviewees included *Eutropis multifasciata* and both color phases of *Lamprolepis* cf. *smaragdina.* We have collected only a single specimen of the Lowland Snake-eyed Skink *Cryptoblepharus leschenault* on Ataúro, and this was the only snake-eyed skink, out of three possible species, the interviewees considered present.

TABLE 1. Results from two interviews conducted using Species Identification Cards on Ataúro Island, Timor-Leste. Responses were tallied using presence/absence categories. Cards with species known from near the interviewees' village were assigned to Category A, species known from elsewhere in Timor but not near the village to B, and species considered absent from Timor to C. In the village of Anartutu, a member of our survey team conducted the interview and all three categories (A–C) were used as intended, whereas in Beloi the interviewer lumped two categories identifying "known" species to save time. A plus sign (+) in the village columns indicates that the species was considered present, with superscripts in the Anartutu column indicating the A or B category. In the Survey Results column, a plus sign indicates that we have confirmed this species on Ataúro Island (Kaiser et al., *in press*). A minus sign (–) indicates absence. The comment section clarifies the choices made, where appropriate.

	Anartutu	Beloi	Survey Results	Comments
Amphibians				no amphibians recorded from Ataúro to date
Duttaphrynus melanostictus	–	+	–	
Fejervarya sp.	–	+	–	
Kaloula cf. *baleata*	–	–	–	
Limnonectes timorensis	–	–	–	
Litoria everetti	–	–	–	
Polypedates cf. *leucomystax*	–	+	–	
Crocodile				
Crocodylus porosus	–	–	–	Ataúro's coastal habitat unsuitable
Turtles				
Caretta caretta	+[B]	–	–	recorded from Timor
Chelodina mccordi timorensis	–	–	–	Timor endemic
Chelonia mydas	–	+	–	recorded from Timor
Dermochelys coriacea	–	+	–	recorded from Timor
Eretmochelys imbricata	--- omitted ---	+	–	recorded from Timor
Mauremys reevesi	–	–	–	introduced on Timor
Pelodiscus sinensis	–	–	–	introduced on Timor
Lizards				
Carlia spp.	+[A]	+	–	expected, not yet recorded
Cryptoblepharus leschenault	+[B]	+	+	a single voucher specimen recorded
Cryptoblepharus spp.	--- omitted ---	+	–	two Timor endemics
Cyrtodactylus spp.	+[A]	+	+	two species recorded
Draco timoriensis	–	–	–	
Eremiascincus spp.	+[A]	+	+	one species recorded
Eutropis cf. *multifasciatus*	+[A]	+	+	
Gehyra cf.*mutilata*	+[A]	+	+	
Gekko gecko	+[A]	+	+	
Hemidactylus cf. *tenkatei*	+[A]	+	–	
Hemidactylus frenatus	+[A]	+	+	
Hemidactylus platyurus	–	+	–	expected, not yet recorded
Lamprolepis cf. *smaragdina*	+[A]	+	+	
Sphenomorphus spp.	+[A]	+	–	expected, not yet recorded
Varanus cf. *salvator*	+[A]	+	+	possibly an undescribed endemic
Varanus timorensis	–	+	–	recorded from Timor
Snakes				
Acalyptophis peronii	+[B]	+	–	open water or coral reef species
Acrochordus granulatus	+[B]	+	–	possible in coastal waters
Astrotia stokesii	+[B]	+	–	open water species
Boiga hoeseli	+[A]	+	–	recorded from Alor
Brachyorrhus albus	+[A]	+	–	restricted to islands in NE Maluku[1]
Cantoria violacea	+[B]	–	–	poorly known on Timor
Cerberus cf. *rynchops*	–	+	–	locally common on Timor in rice-paddies
Coelognathus subradiatus	+[A]	+	+	
Cylindrophis boulengeri	+[A]	–	–	only known from one Timor locality

TABLE 1. Continued.

	Anartutu	Beloi	Survey Results	Comments
Snakes				
Daboia siamensis	+[B]	–	–	believed absent for lack of bites; present on neighboring islands, not Timor
Dendrelaphis inornatus	+A	+	+	observed, escaped
Enhydrina schistosa	+[B]	+	–	turbid estuary habitat not available
Fordonia leucobalia	+[B]	+	–	likely in coastal mangroves
Hydrophis elegans	–	+	–	open water or estuarine
Lapemis hardwickei	–	+	–	open water or estuarine
Laticauda colubrina	–	+	–	coral reef and rocky islets, likely
Laticauda laticaudata	–	+	–	coral reef and rocky islets, possible
Liasis mackloti	+[A]	–	–	expected, not yet recorded
Lycodon capucinus	+[A]	+	+	
Lycodon subcinctus	–	–	–	uncommon on mainland
Naja sputatrix	–	+	–	on neighboring islands, not Timor
Pelamis platura	–	+	–	open water
Psammodyastes pulverulentus	–	–	–	on neighboring islands, not Timor
Python reticulatus	–	–	–	expected, not yet recorded
Python timoriensis	–	+	–	records from Timor in error[2]
Ramphotyphlops spp.	+[A]	+	+	possibly an undescribed endemic
Stegonotus sp.	+[A]	+	–	Timor south coast endemic
Trimeresurus insularis	+[A]	+	+	

[1] Murphy et al. (2012)
[2] Barker and Barker (1996)

Agamas and Monitors.—We have failed to find any *Draco* on Ataúro and have been told previously that they do not exist there, despite the relative abundance of *D. timoriensis* on Timor. Our interviewees confirmed this by listing *Draco* as absent (Table 1). They considered the Common Tree Monitor from the mainland (*Varanus timorensis*) absent, but clearly recognized the much larger *V. salvator* complex monitor from Ataúro's coastal swamps (Table 1). While we doubt that these large lizards inhabit the area surrounding the montane village, they may on occasion be temporarily taken to the villages at higher elevation to function as a totem in conflict resolution (see Kaiser et al., in prep).

Marine snakes.—Sea snakes and sea kraits were included among the SICs with the expectation that they would primarily be identified by residents of coastal villages. However, our mountain village interviewees identified *Acalyptophis, Enhydrina,* and *Astrotia* as seen nearby (Table 1). All other taxa, *Hydrophis, Lapemis, Laticauda,* and *Pelamis,* were unrecognized. Since *Enhydrina* inhabit turbid estuarine environments and *Astrotia* is a rarely encountered, open-water species, these are likely to be errors that stem from a relative unfamiliarity with the species.

Terrestrial snakes.—The interviewees recognized the same species we have recorded from Ataúro (*Coelognathus subradiatus, Lycodon capucinus, Ramphotyphlops* sp.; Table 1). They also included the green and cyan color phases of *Trimeresurus insularis* but not the yellow phase found on neighboring Wetar. One python species, *Liasis mackloti*, was recognized, but neither *Python reticulatus* nor *P. timoriensis* were considered present.

Among the other recognized species were *Cylindrophis boulengeri* and *Brachyorrhus albus*. Whereas the former is known from eight specimens collected on Timor (Forcart 1953), records for the latter from Timor appear to have been in error (Murphy et al. 2012). The bronzeback *Dendrelaphis inornatus timorensis*, which we sighted but failed to capture, the catsnake *Boiga hoeseli*, a species not known from Timor but recorded from Alor, Ataúro's western neighbor, and *Stegonotus*, a genus not recorded from Timor until 2011, were also considered to be present (Table 1).

As seen in Timor but not near the village (Category B), our interviewees selected *Acrochordus granulatus, Cantoria violacea,* and *Fordonia leucobalia*, all mangrove swamp species (Table 1). Aside from a few very small mangrove lagoons along its northeastern shore, Ataúro has no suitable mangrove swamps for these species, but such habitats exist near Dili on the mainland. A fourth and seemingly more common taxon from the same habitat type and also rice-paddy, *Cerberus rynchops*, was not selected.

A worrying inclusion in the "seen but not nearby" category was the highly venomous *Daboia siamensis*, probably the most dangerous snake in the Lesser Sunda Archipelago, which is not known to occur as far east as Timor. However, the occurrence of *Daboia* has been verified from Lembata, an Inner Banda Arc neighbor of Ataúro, three islands removed. Therefore, it is possible that the interviewees did not remember that our question restricted their observations to Timor and that their familiarity extends to a species from a nearby island. Were this species present on Timor, we would have expected to reveal a medical history of serious snakebites, including fatalities.

Apart from the species mentioned above, the rarer wolfsnake *Lycodon subcinctus*, the mock viper *Psammodynastes pulverulentus*, known from Alor and other islands to the east but not Timor, and the spitting cobra, *Naja sputatrix* were also not selected (Table 1). Non-recognition of *N. sputatrix* by people from the higher elevations on Ataúro does not contradict anecdotal evidence we have collected regarding its presence on the island, because spitting cobras are lowland habitat generalists.

Conclusions of the Anartutu interview.—Our interviewees' observations coincided very closely with our own field experience, especially with regards to amphibians, turtles, the crocodile, and lizards, with the possible exception of the inclusion of *Carlia* as present on Ataúro. The exclusion of *Draco timoriensis* and *Varanus timorensis*, but the inclusion of the large *Varanus* was especially in agreement with our own findings. Even among the more elusive and generally feared snakes there was a great deal of agreement between the interviewees and our data, with all the species we had recorded being recognized (Table 1). The inclusion of several seasnakes and *Daboia* were unexpected, as was the exclusion of *Naja* and *Python reticulatus,* whereas the inclusion of *Cylindrophis*, *Brachyorrhus, Boiga,* and *Stegonotus* suggests more fieldwork is required on this rugged island.

Results and Comments: The Beloi Cardgame

The Anartutu village survey can be compared with a similar survey conducted with workers at Barry's Place, an eco-resort on the coast just north of Beloi village, who are more likely to be widely travelled and familiar with species from the mainland. In this survey the interviewer (the employer Barry, a Tetun-speaking Australian) simplified the trial on his own initiative during the interview by combining both categories indicating familiarity (Categories A and B), presumably to encompass Ataúro in a single category.

Amphibians.—The eco-resort workers recognized *Duttaphrynus, Fejervarya,* and *Polypedates* but excluded the three localized mainland amphibians (*Kaloula* cf. *baleata, Limnonectes timorensis, Litoria everetti*; Table 1).

Turtles and the crocodile.—Again *Crocodylus* and the three freshwater turtles were unfamiliar, but sea turtles were sorted in an exact contrast to the previous interview: *Dermochelys, Chelonia,* and *Eretmochelys* were included, *Caretta* was excluded (Table 1).

Geckos.—As in the previous interview, *Cyrtodactylus, Hemidactylus, Gehyra,* and *Gekko* were familiar (Table 1), although a striped *H. frenatus* was omitted. However, the workers also recognized *H. platyurus*, a species we do not yet know from Ataúro.

Skinks.—Every single skink was recognized (*Carlia, Cryptoblepharus, Eremiascincus, Eutropis, Lamprolepis, Sphenomorphus*). The inclusion of the endemic mainland *Cryptoblepharus* spp. was obviously an error but the inclusion, once again, of the unverified *Carlia* was interesting.

Agamas and monitors.—*Draco* was again unrecognized, but *Varanus timorensis* was included, possibly being mistaken for juveniles of the familiar, larger Ataúro swamp monitor (Table 1).

Marine snakes.—Curiously, all the species pictured were listed as present (Table 1) but it is possible the workers included some former net fishermen used to removing seasnakes from their nets and seeing a flattened tail assumed they were all the same.

Terrestrial snakes.—The workers agreed with both ourselves and the previous interviewees by including *Coelognathus subradiatus, Trimeresurus insularis* (with all three color phases), *Lycodon capucinus,* and *Ramphotyphlops* spp., while excluding *Lycodon subcinctus* (Table 1). They agreed with the first interviewees and our suspicions by including *Dendrelaphis inornatus* and *Boiga hoeseli,* but they erred in including *Brachyorrhus* and *Stegonotus.*

Unlike the Anartutu interviewees, the workers included *Acrochordus, Cerberus, Fordonia,* and *Naja* as present but excluded *Cylindrophis, Cantoria, Liasis,* and *Daboia.* They also included *Python timoriensis* but excluded *P. reticulatus.* If *P. timoriensis* is to be found anywhere in Timor-Leste, then Ataúro, being close to its easternmost record of Alor, is the most likely location.

Conclusions of the Beloi interview.—Among the obvious differences in how this interview was conducted is that the person doing the interview was not a native Timorese and that two categories were lumped together. While it may be easy for an employer inspired by a herpetological survey to gather employees for this type of exercise, we are not certain how effectively someone largely unfamiliar with the featured species can conduct the interview. It also occurred to us that employees might try to please their employer by answering in the positive more frequently than warranted. Overall, we again found considerable overlap with our own collections, even though there were some discrepancies such as the inclusion of mainland species as present on Ataúro. It is interesting that our survey has not revealed a single species on Ataúro not already known, and therefore selected, by at least one of the interviewees.

Discussion

Based on our specific test interviews, we find that the use of SICs alongside traditional survey methods shows great promise. Having used SICs in situations where we had some prior knowledge of the existing fauna allowed a reasonably good assessment of how to optimize use of SICs. Furthermore, we were also in a position to determine whether the results could add useful information to our survey efforts. Having completed these initial trials, we recognize the benefits of SICs, but we freely admit that there is room for improvement.

Interview optimization.—Based on the two interviews presented here in detail, as well as on several others conducted in mainland Timor-Leste, there are several ways by which use of SICs and the associated interviews can be improved. Firstly, our Timorese colleagues suggested that it would work best if we, as *malaes* (Tetun: foreigners) kept our distance, because they believed that during an interview villagers open up more to a fellow Timorese when foreigners are absent. The Anartutu interview was conducted in this way, whereas the eco-resort interview was conducted by the workers' Australian employer, a resident but nonetheless a *malae*. This may have led to differences in the interpretation of what was required of both the interviewers and the interviewees, and an increased desire to please by answering in the affirmative. In general, the interview ought to garner the best results if it is conducted by a team member indigenous to the survey area and not by actual or perceived outsiders.

Secondly, for the interview process it is essential that the interviewer have intimate knowledge of the animals surveyed as well as their habits and habitats. This is essential for the interviewee(s) if questions about the card arise, and it is important for the interviewer to ascertain whether positive identifications reflect the reality of a habitat and the probability of the encounter actually having taken place; refining questions can then be asked by the interviewer to eliminate doubts.

Thirdly, while it is certainly possible that interviews of multiple interviewees provide more results (i.e., animals recorded) more quickly, this may create a distracting group dynamic. For example, if one individual in a group is found not to be able to answer the interviewer's request for clarification, this may cause embarrassment and subsequent reluctance on the part of the interviewee to answer further questions (or to speak up at all), and on the part of the interviewer to ask that particular interviewee for further clarification questions in order to avoid further

embarrassment. We would consider individual interviews optimal, although we realize that in the village dynamic this may have to be an area for compromise since the deliberate exclusion of villagers wanting to participate may lead to resentment and future difficulties with fieldwork in the area.

Card optimization.—From a visual perspective, we found the design of the cards to be appropriate and effective overall. In order to provide size information, we had added a scale in the shape of a snake with expected ranges in length to the images of *Ramphotyphlops braminus* and *R. polygrammicus*, since these snakes are fairly uniform in body shape and coloration and difficult to differentiate for non-experts in the absence of size. This may be a useful addition to these cards in general. We also determined that some refinements were needed in the text. For example, the parameters of what constitutes a category need to be more finitely determined. Using Category B on Ataúro in its current incarnation, it could be seen as applying to "elsewhere on Ataúro" or even as "elsewhere on neighboring islands," when it was intended to indicate "elsewhere in Timor-Leste." Furthermore, the addition of cards in Bahasa Indonesia, Tetun, and possibly other local languages might be important so that both the indigenous interviewer and the interviewee(s) are able to refer to it frequently as decisions about card placement are made.

A final thought.—A possible follow-on worth considering for SICs, once a survey is complete and most, if not all, amphibians and reptiles have been documented, is to produce suits of cards as genuine playing cards, allowing both adults and children to use them as a popular form of wildlife and conservation education through entertainment.

Acknowledgments.—Our research in Timor-Leste has greatly benefited from the personal attention of Xanana Gusmão, the Prime Minister, and of José Ramos-Horta, the country's President in office at the time of our visits. We sincerely thank Their Excellencies for this level of support. We could not have carried out our surveys without the efforts of Claudia Abate-Debat, Senior Advisor to the Prime Minister, whose many intercessions on our behalf smoothed out the wrinkles research can throw one's way. Our gratitude for the issuance of research and export permits goes to Manuel Mendes, Director of National Parks. Special thanks to Ruud de Lang, who kindly provided several images of species for which we lacked photographs. We thank our interviewers, Zito Afranio Soares and Barry Hinton, as well as our team of field assistants, including Agivedo Varela Ribeiro, Zachary Brown, Melissa Carrillo, Scott Heacox, Stephanie Hughes, Aaren Marsh, Gloria Morales, Justin Rader, Caitlin Sanchez, and David Taylor. Financial assistance in support of student travel was provided by the Associated Student Body at Victor Valley College and through donations to the Victor Valley College Foundation. This is contribution No. 10 from the Tropical Research Initiative at Victor Valley College.

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