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Front cover image: Viperine snake (*Natrix maura*), Portugal, John Benjamin Owens

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# Greece Lightning! Herping Athens and Milos

**Kimberley Carter**

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**Herping into the unknown**

Mainland Greece and it's surrounding islands has one of the richest diversity of reptiles and amphibians in Europe with around 90 amphibian and reptile species including many rare and endangered species such as the loggerhead turtle, the Karpathos marsh frog and the Milos viper (Uetz *et al*. 2018).

From 30th September to 7th October a group of Bangor University herpers went to Milos for the wedding of equally reptile-crazy friends, with a detour in Athens and plenty of herping thrown in. Our group had little experience herping in mainland Greece or the island of Milos, but with a list of the species found in our areas and online research at our disposal, we targeted our search primarily for the Milos viper *Macrovipera schweizeri.* With no real plan or field sites in mind we enjoyed the puzzle and reward of testing our "good-habitat" identification skills. We largely relied on identified habitat from satellite images and spotting promising sites from the car. This report consists of day by day accounts and field observation of the places we visited and the amphibians and reptiles found at each.

**30th September - A slow start**

After taking an afternoon flight from Manchester, we didn't arrive into Athens until the evening, where we were welcomed by rain, lots of rain! Greece had been hit by gale-force winds of up to 62mph slamming into the country from the west from a medicane – a combination of the words Mediterranean and hurricane –from the Ionian Sea southwest of mainland Greek. After finding the shuttle bus to deliver us to the hire car office, down built-up streets and then a lane straight from a horror movie, we drove to our hotel in Porto Rafti, on the East side of Greece . All herping for the night was abandoned forced by hunger, pizza and the rain pouring down. Even on the sheltered balcony there was not a gecko in sight!

**1st October - The big climb**

The morning revealed not only the damage and water left over from the storm but also some amazing views and ideal habitat! The weather was still not on our side but we headed off undiscouraged in the drizzly grey, to a rocky hillside on the other side of the bay that looked promising. The rocks being volcanic were rough and jagged, great for getting a good grip underfoot but not great on the hands! The plants didn't help either- nearly every plant had spines. The habitat was typical Mediterranean scrubland; small, low-lying shrubs with small, leathery leaves with thick cuticles, and often needles. A vast array of different lichen covered nearly every surface and the air was filled with the aromatic smell of thyme and oregano.

Although there was plenty of evidence of tortoises from their droppings, it took a long time before we had a sighting of the first herp of the trip - although brief! A small break in the clouds brought out a Dahl's whip snake (*Platyceps najadum*) that quickly disappeared into the vegetation and rocks. After further climbing to reach the top of the hill we were met with stunning views but still no reptiles, although plenty of interesting spiders and small mantids, and so decided to head down to visit the hillside across the valley that was now receiving a good dose of sunlight. Only after risking life and limb (and pride) scaling down the jagged hillside and spiky bushes, did the

**Figures 1a-d.** (Top-bottom left-right) Chalcides ocellatus, Malpolon insignitus, Vipera *ammodytes, Testudo marginata*.

sun break properly on our side, bringing an almost immediate change! In a piece of wasteland at the back of some houses, littered with junk (refugia, yay!), in rapid succession we saw 4 reptiles in the space of around 10 minutes. The first being another Dahl's whip snake, a small juvenile that fled into a rock pile, two Ocellated skinks (*Chalcides ocellatus*) (fig.1a), a juvenile and an adult both found under flipped rocks and a beat-up looking Eastern Montpellier Snake (*Malpolon insignitus*) (fig. 1b) found at the edge of a pile of branches.

After lunch we headed west to a hillside overlooking Athens where previous herp groups had reported horned vipers (*Vipera ammodytes*) (fig. 1c) and marginated tortoises (*Testudo marginata*) (fig. 1d). The habitat rarely altered from the aromatic, low-lying scrubs and lichen covered rocks, although there were a few more trees and more evidence of people, being so close to civilisation and farmland. We quickly found one of the target species, a *T. marginata* found out in the open amongst the vegetation, distinctive with their flared supracauda scutes. Followed by the other target *V. ammodytes*, a

**Figure 2a-d.** (Top-bottom left-right) *Platyceps najadum, Ablepharus kitaibelii, Telescopus fallax, Macrovipera schweizeri*.

juvenile only measuring ≈10cm long, found on a rock with an over-hanging rock giving cover from above. Further searching around the site found more *T. marginata*, either basking in the open or moving along the gravel access road. Of the dozen tortoises we saw, all were adults and only one was a female. Many of the tortoises we found in this area had chips exposing the bone beneath their scutes, a result of old-age and fighting in the males. The female in particular, had lost most of the dark pattern on her scutes. Heading back to the hotel, on the curb of a shopping centre car park, we had our first gecko of the trip (no surprise!) a Turkish Gecko (*Hemidactylus turcicus)*.

**2nd October - Athens to Milos**

Before checking out and heading to the airport for the next leg of our trip in Milos, a quick return to the wasteland site and nearby fields revealed some more interesting finds: two *P. najadum*, one basking on a dry-stone wall and another underneath corrugated roofing sheets,

**Figure 3a-b.** (top-bottom) *Mediodactylus kotschyi*, *Podarcis milensis*

along with 10+ *H. turcicus* and snake eyed skinks (*Ablepharus kitaibelii)* moving amongst the fallen pine needles. The habitat in this area was a more cultivated, and was either farmed land not in use or rocky fields, broken into long rectangle plots down a slope by dry stone walls.

A very short flight to Milos later and exiting the small, propeller plane we immediately saw Milos wall lizards (*Podarcis milensis*), running around the dry grass next to drainage ditches on the runway. Even more were found on the walls of the airport building, but sadly also found by the many stray cats around the building. A few were rescued but unfortunately this was a reoccurring theme during the rest of our stay on Milos. Travelling from the airport to the hotel in Pollonia, we spied some promising looking habitat from the side of the road. The small, charming town of Pollonia, located right on the water is a beautiful place, thoroughly enjoyable for the holiday side of this trip. It has great restaurants, friendly people and excellent natural pools for snorkelling. It was, however, lacking in reptiles apart from *P. milensis.*

**Figure 4a-b.** (top-bottom) *Telescopus fallax, Lacerta trilineata*

With that in mind we headed back to the potential sight spotted earlier in search of cat snakes (*Telescopus fallax*), Leopard snakes (*Zamenis situla*) and the target of the trip, Milos vipers (*M. schweizeri).* The site in question was a rocky valley leading down onto ploughed farmland; the terrain was still just as difficult, with the same rough rocks and sharp plants as before. The valley was a particular interest to the lichen expert of the group; with huge diversity caused by humid air that comes into the valley from the nearby sea. Just as the sun started to set we got our first snake, a juvenile cat snake (*T. fallax*) found under a rock. After photographing and releasing the snake, the group split up and searched both sides of the valley. Driven by tiredness and reluctance to lose more of my blood to the spikey plants, I surveyed the perimeter of the farmland. At the edges of the mud field, dry plants, straw and tubing was thrown in piles. On these and likewise on the rocks up the valley, we found Kotschy's gecko (*Mediodactylus kotschyi*) - distinctive from *H. turcicus* because they lack adhesive pads on their toes. Hope of finding a Milos viper was

**Figure 5.** *Macrovipera schweizeri*

diminishing fast, when a large viper cruised across the path of my torch beam heading from the farmland towards a patch of scrub and tree. With no snake hook and the rest of the group up the valley side, it unfortunately disappeared into the vegetation! We were in luck though because only 15 mins later and the rest of the group also surveying the edge of the farmland, another *M. schweizeri* was found, just off the field moving between the scrubs. Success! Interestingly while heading back up to the car we found *H. turcicus* on exposed rock close to the road, living alongside *M. kotschyi.*

**3rd October – In search of frogs**

In the morning we returned to the previous night's site and didn't see much, more *P. milensis* basking or running on top of the rocks. Taking a picture without a powerful lens (or a lot of patience to sneak up) was difficult as they wouldn't let you within 2m. In the afternoon we met up with more reptile and amphibian enthusiasts and headed to a lake, where there were possible but unconfirmed Milos water frogs (*Pelophylax cf. kurtmuelleri*). The taxonomic status of this species is not fully clear, and it may represent a distinct endemic taxon, so the small, scattered populations on this island are incredibly rare. The site consisted of riparian habitat; a large lake with rocky hills surrounding it from one side, with dried river beds leading down from the hillside. There were more open gravel spaces and larger boulders than the previous sites. Upon arrival, we walked down a path leading past a small church and sparse woodland to the get to the rocky hillside and lake. Sadly, we found a dead *M. schweizeri* exposed in the open, that appeared like it had been hit on the head. Although horrible to see a dead viper, it did confirm they were there.

**Figure 6a-b.** (top-bottom) *Pelophylax cf. kurtmuelleri, Macrovipera schweizeri*

After hours of searching the only reptiles we saw were *M. kotschyi* which are mainly nocturnal but at cooler times of year they are often active in the day. Some of the group

**4th October - Friends in high places**

Eager to return to the riparian site we set off straight after breakfast; our aim was to walk up the dried river bed to check the small groupings of trees dotted along it for *M. schweizeri,* which are known to wait in trees in ambush for birds during their autumn migration (Adamopoulou *et al*., 1997; Nilson *et al*., 1999). On our way up the riverbed we found the usual suspects of *M. kotschyi* and *P. milensis*, a common site on the rocks. On a slightly flatter part of the riverbed further up the hillside a large *T. fallax* was spotted; spread-out basking on the bordering dry stone walls. Although usually nocturnal this individual was found mid-morning in broad sunlight. It wasn't long before we had our next snake, a *M. schweizeri* found curled in a small hollow along the riverbed, positioned immediately next to a small puddle left over from the medicane. It was a perfect ambush spot to prey on birds landing for a drink! One the way down the riverbed a Balkan Green lizard (*Lacerta trilineata*) was found cryptically basking within a scrub – a nice brightly coloured, big lizard to even get the snake-lovers interested. A return to the site in the evening proved unsuccessful for herps (just the usual *M. kotschyi),* and almost disastrous

**7th October - Flying home**

The time had come to say goodbye to this fantastic island. Before heading to the airport and our onward journey to Athens and Manchester, we made one last stop to see the *P. cf. kurtmuelleri* (only 5 adults this time) and the *M. schweizeri,* which hadn't moved from the crack in the mud under the plastic sheet. A further search around the farmland and its piles of sheeting and junk found more *M. kotschyi*

heard frog calls but the source could not be found. A stop at a patch of salt farms near the airport in search of the elusive *P. cf. kurtmuelleri* found nothing either.

for us, negotiating down the big boulders and dried up waterfalls in the dark!

**5th October – When in Greece**

This was a long-needed "tourist" day spent enjoying the sun, amazing food, snorkelling in the sea and visiting Tripiti and its catacombs.

**6th October – The main event**

The day had come for the big event - the wedding! But being herpers of course there was a last ditch effort in search of the rare *P. cf. kurtmuelleri* and any other herps we could find. The other group of herpers had discovered a site the night before that had a small population of the water frogs. We finally found them! What we didn't expect was to find a *M. schweizeri* under some plastic sheet in a sunken hollow near farmland, not far from the

small drainage ditch the frogs were found in. Seven frogs were counted in the small patch of water and surrounding clay bank - which could well be the entire adult population on the island!

and *P. milensis* but unfortunately no more snakes.

Although finding a modest number of species in total we found our targets for the trip and saw a few interesting behaviours. Our research before the trip suggested that *M. schweizeri* were most common in the West of the island, undisturbed by tourists due to the poor roads and infrastructure (Nilson *et al*., 1999). From our observations I believe Milos vipers, although rare, are a lot more widespread and adaptable than previously thought, seeming to

favour habitats, either rural or near agriculture that provide a source of water and in turn prey. Athens and Milos are both beautiful locations with friendly people, tasty food and great herps. It was a great trip with great people! I would like to thank everybody involved and to thoroughly recommend these destinations!

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# Dissection of a *Gonocephalus grandis* (Gray, 1845): identifying cause of death in a rare captive lizard.

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The Giant Forest Dragon, *Gonocephalus grandis* (Gray, 1845), is a locally abundant, but poorly studied, arboreal Agamid lizard (Fig. 1) found across southeast Asia (IUCN, 2018). As it is rarely encountered in the pet trade, most individuals are likely wild-caught, increasing risks of health issues in captive specimens.

This report outlines observations of a dissection of a wild-caught, immature, male *G.grandis*, estimated 24 months old, held in captivity for approximately 8.5 months before its death on 25th July 2018. A dissection performed the following morning aimed to visually identify any obvious indications of the cause/s of death, with the intention to contribute to captive knowledge of this species.

## BACKGROUND

Appropriate husbandry was reported for the latter period of the lizard's known time in captivity, though prior pet-shop conditions are unverifiable. Multiple females of the species were also kept, none of which showed any signs of ill health. The male appeared healthy but rejected food approximately 10 days before death and was assist-fed circa. five days premortem. Hours before death the upper left jaw appeared swollen (Fig. 2) and immediately prior to death, its throat turned pink. The lizard was administered fluid


**Figure 1.** Adult male *Gonocephalus grandis* photographed in its natural habitat in rainforests of Malaysia. At night the lizards perch on thin, terminal ends of branches to avoid predators while asleep. Note the well-developed nuchal and dorsal crests of the mature male and pointed rostrum as typical for the species. Photo © James Hicks, used with permission.

**Figure 2.** Left side profile of *G.grandis* pre-dissection – circled area (red) indicates location noted by owner as swollen on the day the lizard died, before the lizard was removed from its enclosure for iodine bath and electrolyte administration. No swelling/discolouration was noted in this area during dissection, so swelling remains unexplained.

electrolytes orally, and an iodine bath, prior to death. The owner identified protruding teeth on the right jaw, had observed the male nose-rubbing in its enclosure and suggested stomatitis (mouth rot) was present. The deceased lizard was refrigerated until received by the author and dissected immediately upon receipt.

## DISSECTION

Snout-vent-length: 11.71cm, snout-tail-length: 32.97cm, though tail-tip absent but well-healed. There was an unusually high volume of saliva-like fluid in/around the mouth. Thick, white fluid blocked the buccal cavity and was present in respiratory tract (Fig.3), though absent in digestive tract.

Localised green-yellow staining of subdermal abdominal muscle and liver (Fig. 4), indicated typical post-mortem bile imbibition (McGavin and Zachary, 2011). Muscle and organs showed no obvious indications of organ distension, disease or internal parasites, though appeared pale (Fig. 3-5). Major observations are recorded in Table 1.

## INTERPRETATION

Respiratory fluid (Table 1, Fig. 3) suggests infection or may indicate presence of electrolytes in respiratory tract. Electrolytes may have entered the trachea pre- or post-mortem, particularly if “vomiting” reflexes occurred prior to death. No swelling/discoloration of the upper left jaw – as reported premortem by the owner (Fig. 2) - was observed during dissection, so remains unexplained. The premortem pink throat flush may suggest asphyxiation, particularly if the lizard was in shock when electrolytes/food were administered, however I could identify no literature to clarify this phenomenon.

Rostral damage (Table 1, Fig. 6) appeared severe but localised, likely the result of nose-rub as reported by the owner. Rostrum damage/truncation (Fig. 6A) is also a symptom of advanced calcium deficiency or metabolic bone disease, MBD, both of which are common in captive herpetofauna (Ackermann, 1998). However, no other symptoms of advanced MBD were observed - bones did not possess a rubbery appearance/texture and feet showed no swelling (as per Ackermann, 1998; Cooper and Jackson, 1981), and the owner observed no limb trembling at any stage premortem (pers. comm.).

Limb wounds (Table 1, Fig. 7) may have been caused by injury, though dermal damage may also be a symptom of vitamin deficiencies, also a common condition of captive reptiles (Ackermann, 1998; Mutschmann, 2008). Right limb joints appeared necrotic with evidence of spread (Fig. 7), possibly resulting in septicaemia and/or sepsis, though no laboratory analyses were performed to confirm this.

Possible fungal infection (mycosis) on external ventral surfaces (Fig. 8) may be indicative of high humidity/low ventilation conditions premortem, as seems to be an issue

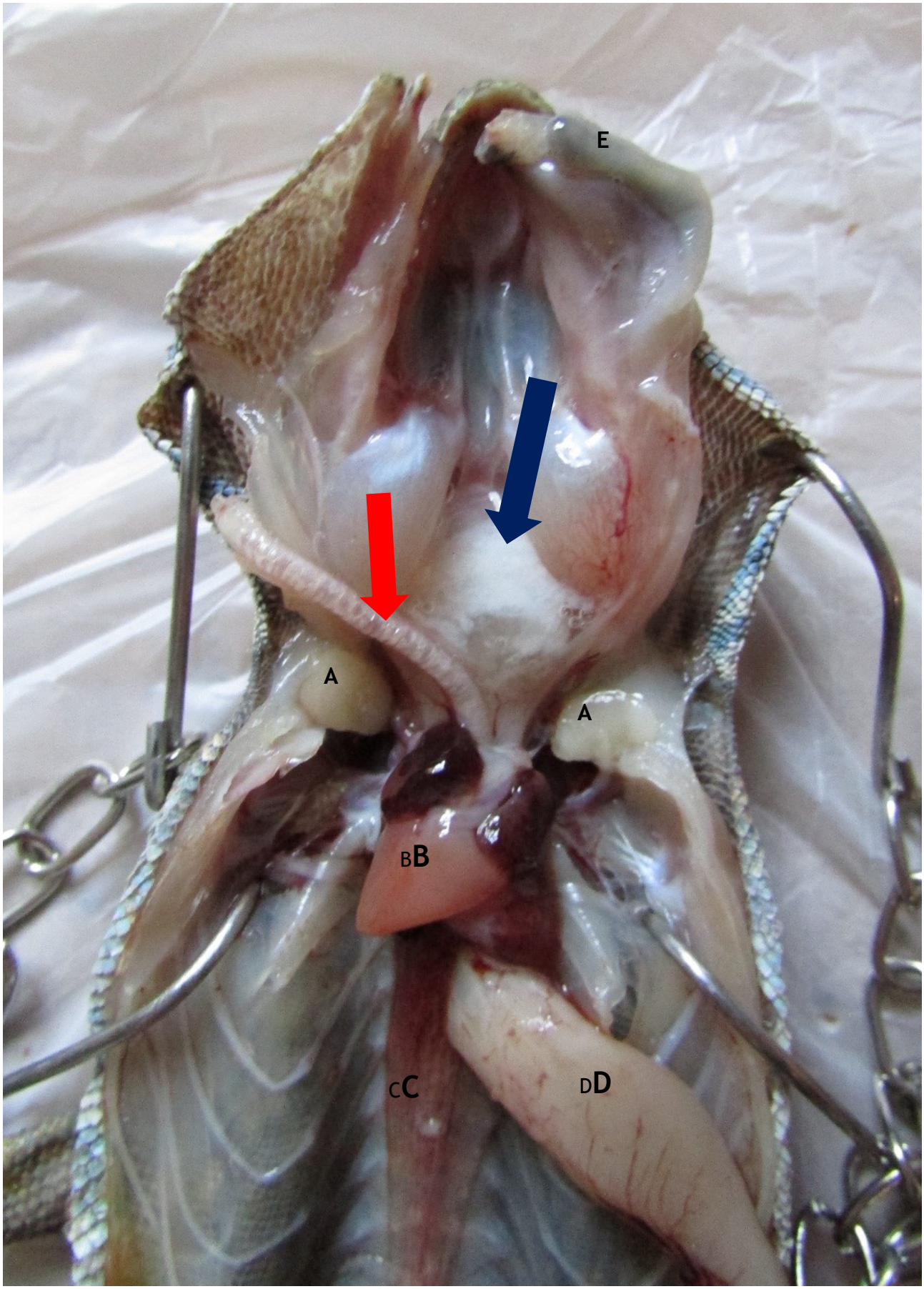


**Figure 3.** Dissected head and anterior abdominal cavity of *G. grandis*. Large amount of thick, clear-white fluid in oral cavity (blue arrow). Note bubbles of fluid in the trachea (red arrow), which was moved to the side for this image. A = thyroid/parathyroid glands; B = heart; C = lungs; D = stomach; E = tongue.

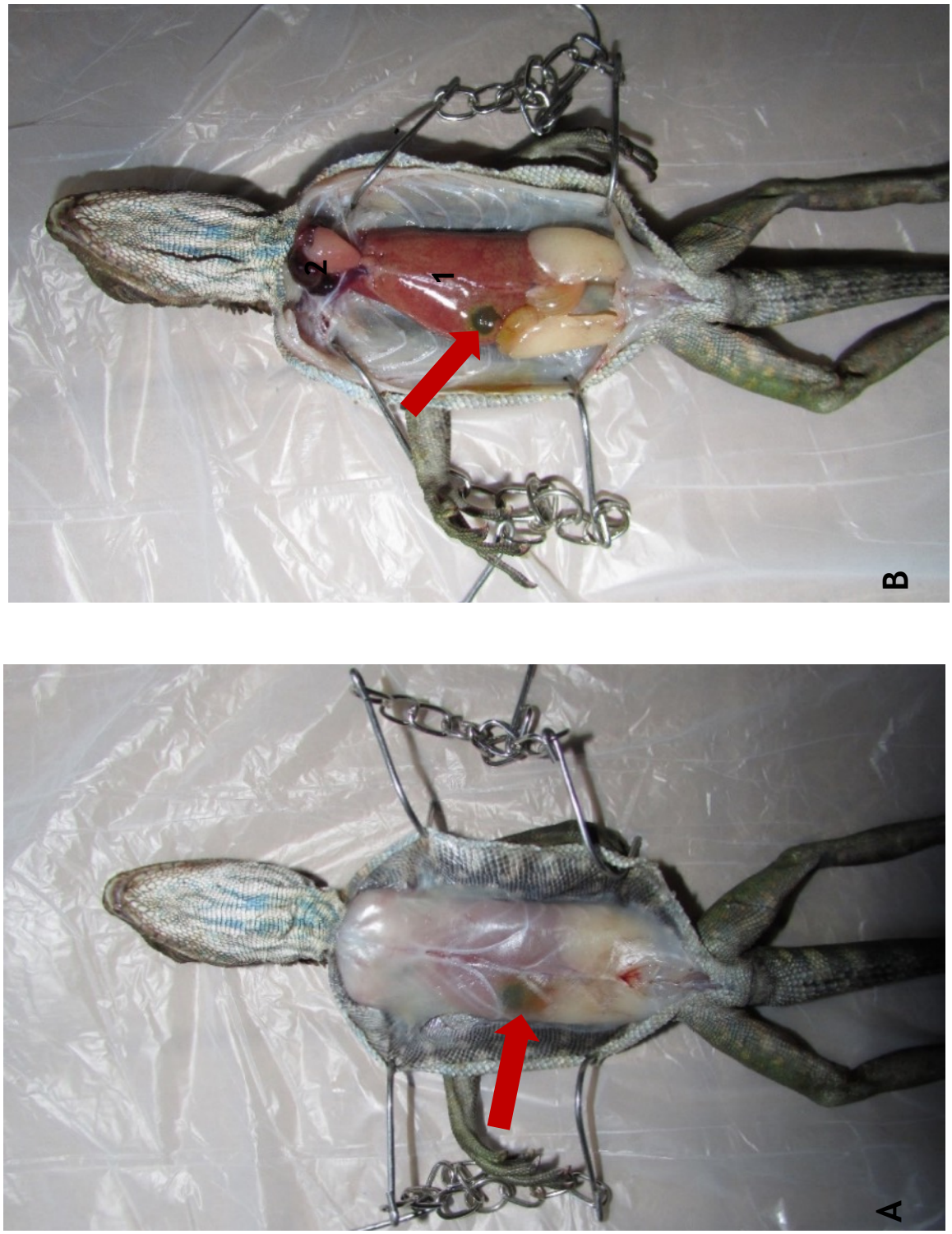


**Figure 4.** Initial dissection of *G. grandis*. Bile imbibition observed (red arrows) before abdominal cavity is opened (**A**) and visible on the liver (1) after abdominal cavity exposed (**B**). Note the 3-chambered heart (2) where two atria (dark) sit anterior to the ventricle (pale).

**Table 1.** Major observations from dissection of recently deceased *Gonocephalus grandis*.

| Body Part | Observation/Condition |
|---|---|
| Buccal cavity | Blocked by thick, white fluid |
| Trachea | Contained bubbles of fluid |
| Skin | Numerous ventral (abdominal, throat) scales discoloured (brown) with rough texture; small wound over left hip bone |
| Rostrum | Malformed, truncated; premaxilla absent |
| Left mandible | Maloccluded |
| Right mandible | Severely protruded from mouth; red discoloration in surrounding muscle |
| Right forelimb | One large, solid, fleshy mass present on the skin surface, hard to remove; two masses apparent as lumps under the skin before dissection, yellow in colour, soft, removed and crushed easily; red discoloration of muscle in immediate area and extending distally |
| Left Forelimb | Open dermal wound on inner elbow joint; no sign of necrosis in subdermal muscle |
| Right hindlimb | Open dermal wound on inner knee joint; discoloured (black) muscle in the immediate area and extending distally |

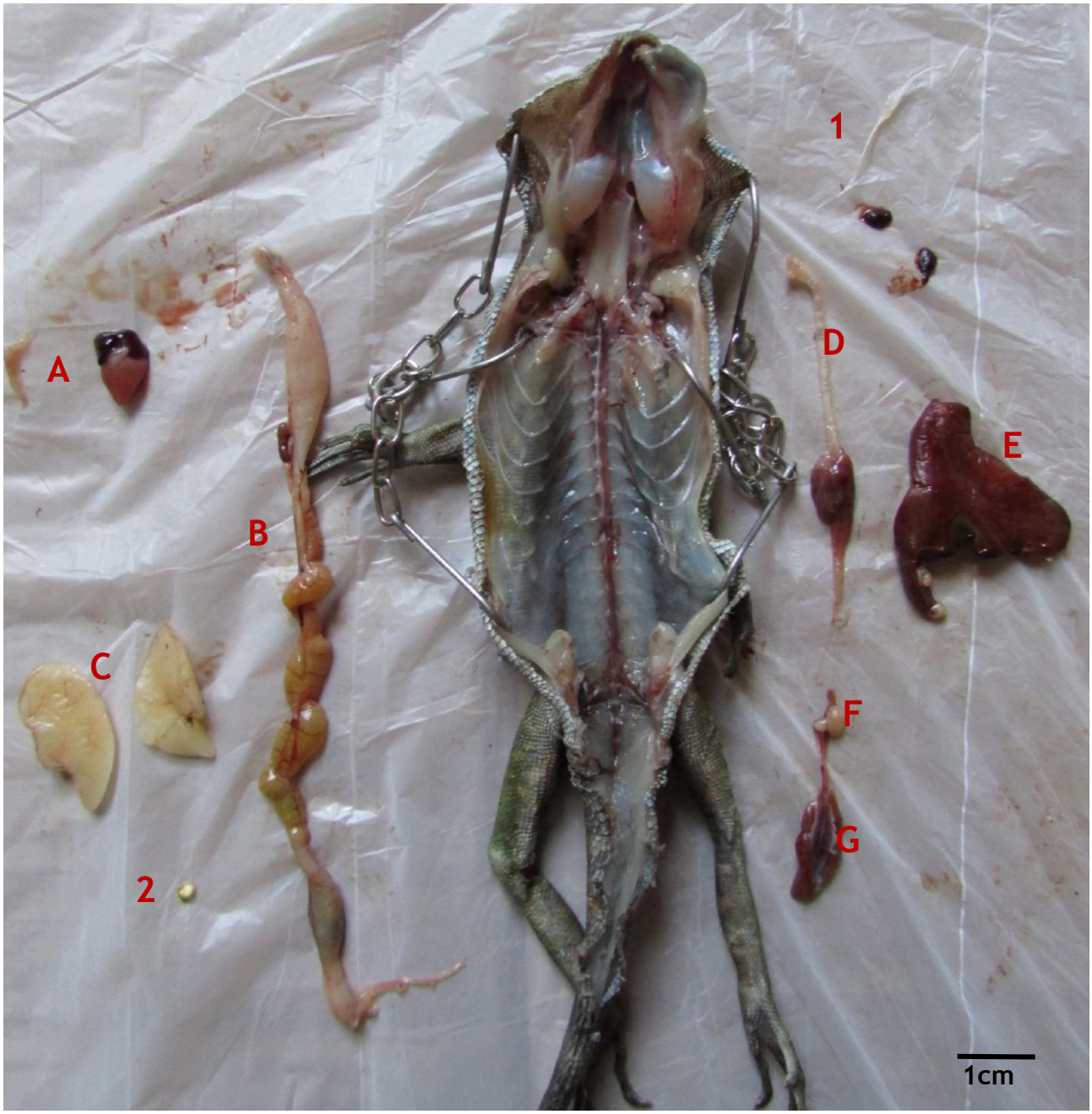


**Figure 5.** Internal organs and body cavity of *G. grandis* lizard during dissection. A = heart; B = digestive tract; C = abdominal fatty deposits; D = respiratory tract; E = liver; F = gonads; G = kidneys; 1 = hyoid apparatus; 2 = urate removed from rectum.

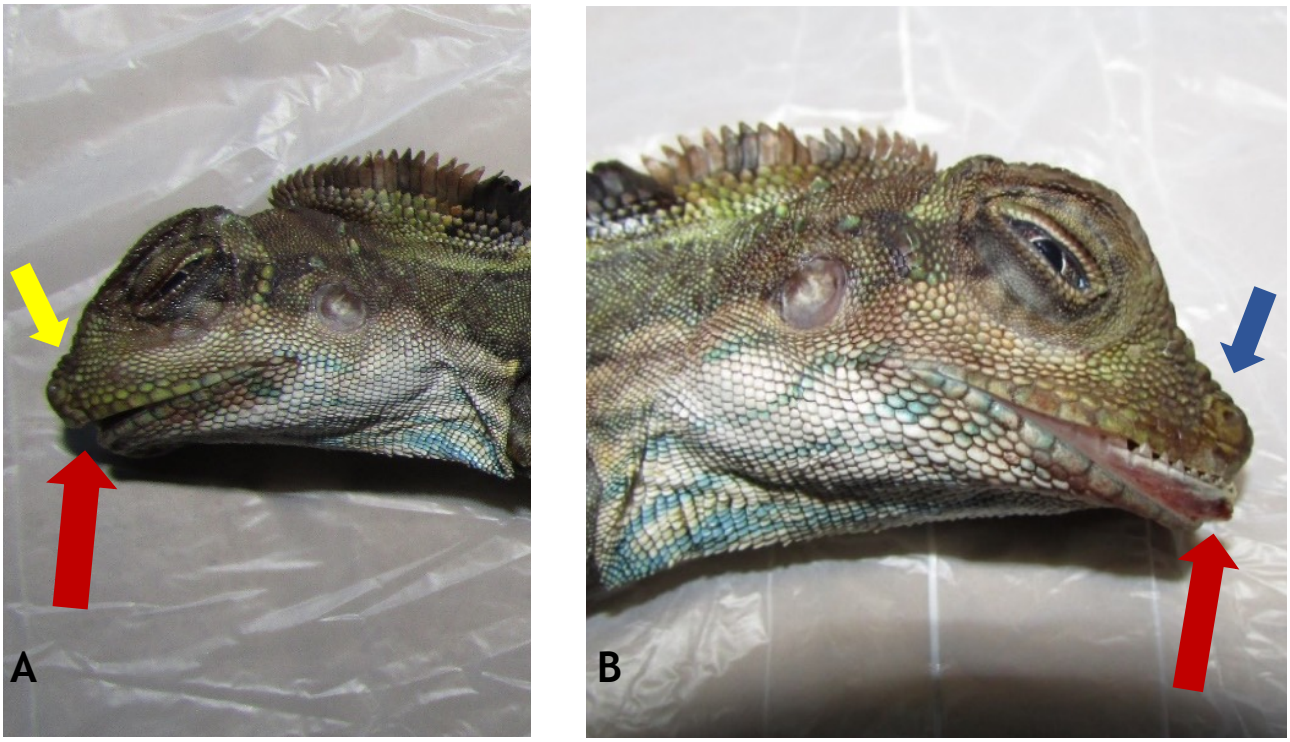


**Figure 6.** Deceased *G. grandis*, prior to dissection. **A**: Left side of mouth does not close (red arrow) due to malocclusion of left mandible and protrusion of right mandible (B). Note truncated ("squashed") appearance of left side of nose (yellow arrow). **B**: Right head profile showing detached right mandible protruding from mouth (red arrow) with pink discoloration on dental bone. Note the more natural nose shape (blue arrow, also comparable to Fig. 1) in comparison to left side (A).

in captive herpetofauna (Cooper and Jackson, 1981). Although mycosis appeared minor, Cooper and Jackson (1981) identified five mycoses in lizards resulting in dermal andsubdermal lesions, tumours and/ hyperkeratosis, most of which occurred near damaged skin (ibid.), possibly explaining the cysts-like masses on the right forearm (Fig. 7C,E).

## CONCLUSION

Secondary infections can occur through stress in wild-caught specimens in captive environments (Cooper and Jackson, 1981). The lizard's wild-caught history likely instigated such stress, contributing to any potential infection from observed limb and/or oral wounds. While the wounds may have resulted from injury, deficiency or a combination of both, infection may have spread leading to shock. Respiratory complications in the final moments may have added to the lizard's deterioration.

However, as I performed a visual analysis only, parasitic infection, infectious disease and other health issues cannot be ruled out and any observations/suggestions recorded here cannot be conclusively implicated in the cause/s of death or attributed to husbandry issues. As such, laboratory studies and veterinary expertise are recommended in any future scenarios, and more thorough background knowledge of the species and individual specimen is needed to improve captive knowledge of this rare lizard.

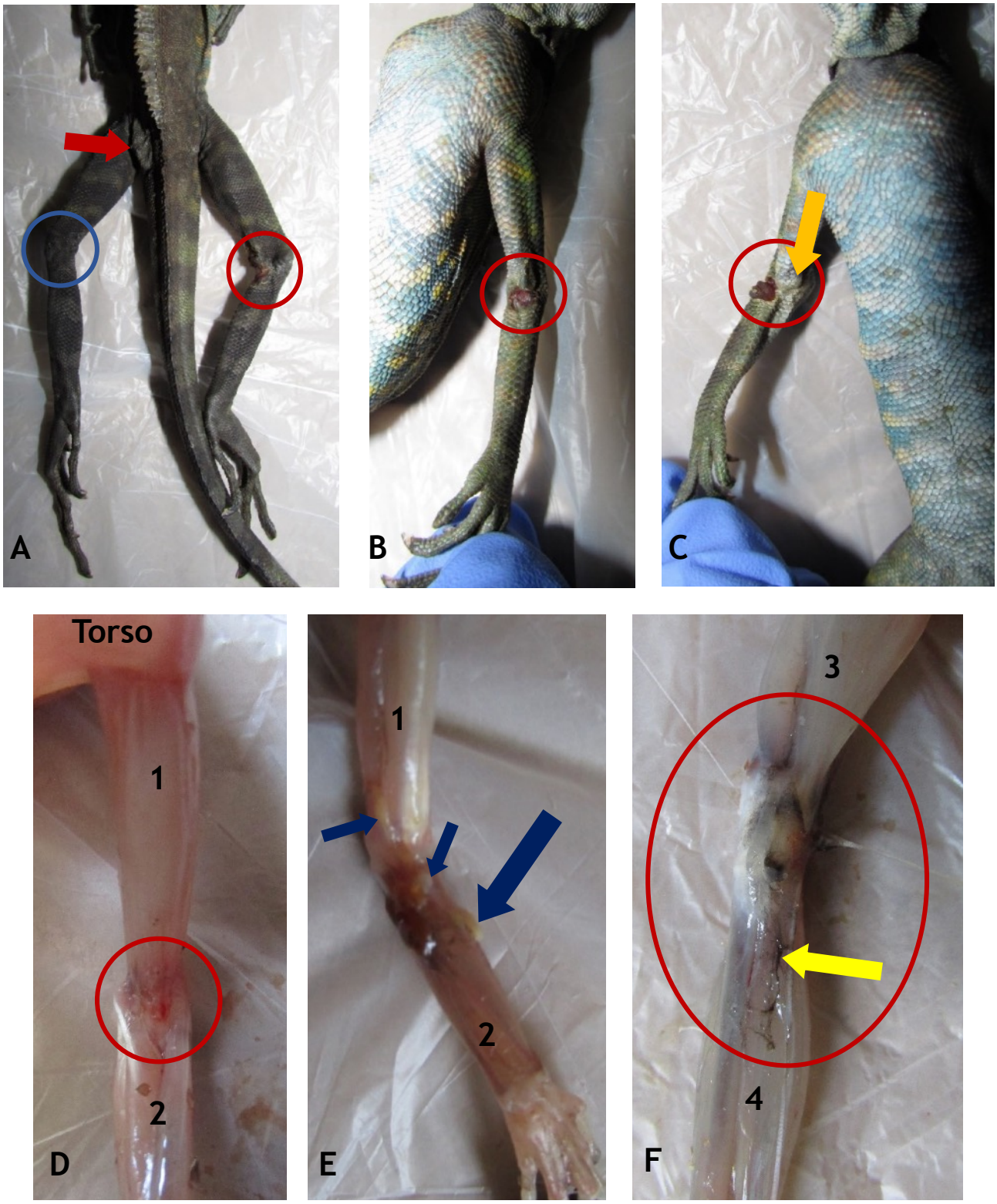


**Figure 7.** External examination (A-C) and skinned (D-F) limbs of deceased *G. grandis*. **A**: Dorsal posterior profile, showing wound between upper and lower right hindlimb (red circle). Left hindlimb showed no similar wounding (blue circle). A small wound noted at the top of the left hip bone (red arrow). **B & C**: Forelimbs showing wound of inner elbow joint of left limb (**B**, red circle), and protruding mass at similar site on right forelimb (**C**, red circle). Right forelimb also presented subdermal masses in the area (**C**, yellow arrow). **D**: Left forelimb showed only minor muscular redness in the inner elbow joint (circled red) between upper limb (1) and forelimb (2). **E**: Numerous solid masses noted in right forelimb (B, blue arrows) with soft consistency of solidified cysts. The largest of these (largest blue arrow) was evident before skinning as a lump under the skin. **F**: Right hindlimb demonstrated areas of muscular discoloration (circled) between upper (3) and lower (4) limb. Signs of necrotic spread (yellow arrow) extending distally from the wound. Left hindlimb showed no such discolouration (not shown).

**Figure 8.** Ventral profile of *G.grandis*, showing numerous patches of browned scales on abdomen (circled). Some minor areas also noted on the chin (not highlighted here) but limbs, tail and dorsal sides seemed unaffected.

## ACKNOWLEDGMENTS

I wish to thank the owner for their co-operation, and James Hicks for his advice and expertise regarding the species.

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# First Record of Intraspecific Oophagy in the common Leaf-tailed Gecko *Uroplatus fimbriatus* (SCHNEIDER, 1797)

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Oophagy is a specific behaviour that occurs in a large variety of predatory and opportunistic species in the animal kingdom (Denoël & Demars, 2008). Oophagy is the act of consuming the eggs or the undeveloped foetuses of a prey species. This behaviour can be broken down into two more specific types of which both can be observed readily within reptiles. The first of these is interspecific oophagy which is defined as the predation of eggs of another species (Michell & Groves, 1993). Examples of this within reptiles are snakes of the genus *Dasypeltis*, which have evolved to feed exclusively on the eggs of birds (Gartner & Greene, 2008). The second branch is intraspecific oophagy and is described as the consumption of the eggs and embryos from the same species, including a female's own eggs and embryos (Michell & Groves, 1993). Intraspecific oophagy is technically cannibalism (Miaud, 1993) with the behaviour being recorded in a number of species within Gekkonidae but not yet within the genus *Uroplatus*. We present the first evidence for this behaviour which was observed in a captive female during the June of 2015.

The female *Uroplatus fimbriatus* (SCHNEIDER, 1797) was approximately 4 years of age at the time of the incident being reported. At the time of observation she was housed with her mate, of a similar age. The geckos were fed twice a week during November-February and five times a week at other times of the year. This was a staple diet of gut-loaded 5th instar locusts and brown crickets, dusted with Vetark Nutrabol with the diet being supplemented with extra calcium (a pinch or two) during the summer months. The vivarium was a clear acrylic set-up designed for arboreal species with a cork bark panel on the back, with minimal ventilation to maintain a high level of humidity. The vivarium itself was approximately 76 cm by 76cm being 122 cm tall. Internally the décor consisted of 5 cm deep coarse orchid bark and sphagnum moss substrate, used to help maintain humidity. Vertical, diagonal and horizontal cork branches with varying diameters were fixed in place as climbing apparatus. Artificial foliage was also added to increase the surface area for activity and provided cover to minimise stress, when walking past.

There was no water bowl; instead geckos were misted every morning and evening with lukewarm water allowing them to drink naturally from surfaces within the vivarium. To maintain the abiotic environmental conditions a 'Reptile radiator' was mounted on the enclosure ceiling which was controlled with a 'Habistat pulse proportional thermostat'. The basking spot (at the top of the vivarium) was maintained at 86-88 °F and the cold spot (in line with the lowest perch) maintained at 75 °F were both monitored with digital thermometers. Finally, a 2% UVB tube light was used and controlled during a defined

photoperiod set on a 12 hour light cycle. A night time drop in temperature was to 65 °F Fahrenheit for 4 months between November and February. During this period humidity was reduced by misting geckos only once in the evening, skipping the morning routine. The 12 hour light cycle was maintained but overall there was a reduction in ambient light through the reptile room windows.

The pair has successfully bred in the past with 2-3 clutches of viable eggs being obtained for 3 years before the incident, although none of these eggs made it through the incubation period. The pair failed to successfully breed again after the clutch mentioned in this report was laid. The female unexpectedly dropped a pair of eggs whilst a Zoo Med Reptibator Egg Incubator was being prepared as it was not known that the female was due to lay imminently. The eggs were dropped away from the nesting area that had been specifically added to the enclosure for the female's use. The nesting area was made from a medium sized Tupperware container (30 cm long, 30 cm wide and 20 cm deep) with hole cut into lid, acting as an entry point. This was positioned at the back of the vivarium to give the female some security when it came time to laying. The container was filled 15 cm deep with damp vermiculate with a thin layer of moss on top. The moss was used as an indicator that the egg laying medium had been disturbed, alerting the breeder that eggs may have been laid at a glance. This set-up had been used on numerous previous occasions and the female readily deposited her eggs within the nesting container.

It took between 30 and 45 minutes for the first of the eggs to disappear, after they had been laid. After returning to collect the eggs, the second of the eggs was in the mouth of the female. The two eggs of which the female consumed were likely to be fertile as both were bright in colour and not misshapen, indicating that they were not 'slugs'. There were no changes in the husbandry of the geckos between any of the times that the female successfully laid eggs; the pair also had minimal levels of disturbance. The act of ingesting infertile eggs has commonly been reported within reptiles (Michell & Groves, 1993). The infertile eggs of *U. fimbriatus* are often attached to a tree or simply dropped to the ground (Svatek & van Duin, 2001), which is the behaviour expected if the eggs were indeed infertile.

In the all-female gecko species *Lepidodactylus lugubris*, individuals have been observed consuming their own eggs after they have been disturbed (Michell & Groves, 1993). This is unlikely to be the case in this incident as the animals were not disturbed until after the Zoo Med Reptibator Egg Incubator had been assembled. In other species of gecko, females consume their infertile eggs in order to provide themselves with energy and minerals (Perry & Brandeis, 1992). Again, this is unlikely to have been the contributing factor which led to the unusual observation as the female was well fed and calcium was supplemented within the diet. Intraspecific oophagy can take place as an unusual form of parental care when performed by females on their own eggs (Michell & Groves, 1993).

There are multiple hypotheses attempting to explain intraspecific oophagy, each helping to explain different circumstances (Michell & Groves, 1993). Some of these have stood up to scrutiny, for example, captive females of several species of *Phelsuma* ingested their own eggs after they were damaged experimentally (Osadnik, 1984). Interestingly, brooding

captive females of the prairie skink (*Eumeces septentrionalis*) have been observed ingesting introduced rotten eggs or eggs that have been swabbed with the contents of a rotten egg (Somma, 1989). These observations may suggest that the behaviour is driven by the need of the brooding females to avoid predation by removing the rotten eggs so the scent does not encourage predators to the female, or to help keep nesting sites clean and free from disease. In other species, however, the behaviour may be linked to a dietary deficiency of calcium or other nutrients that females are able to reabsorb by consuming eggs she has laid. There is the possibility of interplay between these factors which may cause the behaviour to be exhibited in other species (Michell & Groves, 1993).

It may never be known why the *U. fimbriatus* female mentioned in this report consumed her own eggs, but maybe future reports will help to shed light on the mechanisms of the behaviour.

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# An Instance of Dermatophagy in Captive Floodplain Death Adders *Acanthophis hawkei* (Wells & Wellington, 1985)

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It is well known that some species of squamates eat their own slough (Weigel, 1988) it was however mainly thought to be practised largely by the geckos (Greer,1989). It has also been recorded in skinks (Eipper, 2006). This may represent first case of its kind recorded in snakes.

On the 16-11-2016, while tending to enclosures a thirteen month old *Acanthophis hawkei* (Wells & Wellington, 1985) was observed in the act of dermatophagy (figures 1&2). The skin had dried somewhat after being shed and was torn during the act of consumption. Once completed the snake was observed to then find and consume the remaining section of skin. The snake has not

since consumed its shed skin. The instance while unusual, may be explained due to the unusually strong feeding response this individual snake has and that the act of cage maintenance in surrounding enclosures elicited the act.

**Figure 1.** *Acanthophis hawkei* mid consumption of cast off shed skin, the skin was attempted to be removed with forceps and tore.

**Figure 2.** *Acanthophis hawkei* completing consumption of shed skin, the skin was digested and subsequent faeces was within the normal characteristics of the species.

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# Aggregation Behaviour in the Common Blunt-headed Tree Snake (*Imantodes cenchoa*; Linnaeus, 1758)

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The common blunt-headed tree snake (*Imantodes cenchoa*; Linnaeus, 1758) is a small-medium sized, extremely slender arboreal snake species in the Dipsadidae family. *Imantodes cenchoa* has a wide geographic range in the Americas from southern Mexico to Argentina and individuals are regularly encountered at night time in the Ecuadorean Amazon (Bartlett & Bartlett, 2003). Here I present an observation of aggregation behaviour of this species (presumably for breeding purposes). This behaviour was encountered while out on the night of the 19/07/2018 with a group of students on a visual encounter survey. The survey was taking place on one of the trails in the Sani reserve, North of the river Napo, in Ecuador (GPS coordinates: 0.4389°S, 76.3114°W, 238m a.s.l).

The habitat type of this trail is, for the most part, Tierra firme (unflooded forest). There is, however, Varzea swamp, characterised by regular flooding during times of rain and exhibiting more palmy vegetation, within 50m of the trail down a slope. It was a clear night with a half-moon, wet and humid from rain earlier in the day. At 21:27 a pair of *I. cenchoa* were encountered at the edge of the trail in a small shrub around 1.5 m above the ground. Basic data were collected such as species, GPS, weather and a brief habitat description. At 22:16, while returning along the trail after the survey, there were five individual animals within close proximity of each other (<1 m) in the same area. The group composed of two pairs with one other individual close to one of the pairs (Figs. 1 & 2).

Upon returning alone after the survey, there were now only four snakes in the vicinity. The snakes remained motionless for prolonged periods before one of the snakes in one of the pairs would move towards the other, while tongue flicking, and gently tap the other snake at midbody with its head (Fig. 2). The two would then quickly move away from each other.

Similar behaviour has been observed in the past whereby a male individual overlooked a male and female mating, and after mating, engaged in pushing and shoving of the other male snake repetitively until one of the interactors left (Dos Santos-Costa & da costa Prudente, 2005). Communal nesting behavior is another potential explanation for this aggregation behavior as this has been recorded in the goo-eating snake (*Sibynomorphus mikanii*), another Neotropical member of Dipsadidae (Braz & Franco, 2008). There is not a huge amount known about the nesting ecology of *I. cenchoa*, highlighting that there is still much to learn about even the most common species.

The observation lasted for approximately 15 minutes after which time the snakes all moved away to different parts of the trees, perhaps because of my presence, although disturbance was kept to a minimum (red head-torch, remained approximately 3 m from snakes). Despite there being sexual dimorphism in the snout to vent length (SVL) of sexually mature males and females (de Sousa *et al*. 2014; Zug *et al*. 1979), the snakes were not examined closely enough (avoiding interruption of the behaviour) to measure this, so it is unclear if this was a single sex or mixed group. This is

**Figure 1**. One of the pairs of interacting snakes. Red circles show the heads of the snakes.

**Figure 2.** The other pair of interactors, shortly before the pushing behaviour.

the first recorded occurrence of aggregation in *I. cenchoa*, where this crude fighting behaviour was observed among multiple potential pairs (mating was not observed) in close proximity.

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# Length Record and Regurgitation Contents of a Sunbeam Snake (*Xenopeltis unicolor*; Reinwardt, 1827) in Northeastern Thailand

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## INTRODUCTION

*Xenopeltis unicolor* (Reinwardt, 1827) is a primitive snake species characterized by highly iridescent scales and a dorsoventrally flattened skull (Smith, 1943; Frazetta, 1999). This non-venomous, nocturnal, subfossorial snake occurs in South and Southeast Asia, including Indonesia and the Philippines, occupying agricultural areas and lowland forests up to approximately 1000 m (Chan-Ard, 2010). It has unusual morphomechanical jaw apparatus attributes, including flexibly mounted teeth that allow for hinging or rotation (Savitzky, 1983).

The first documented case of predation was of a captive specimen taking a frog, and subsequently eating a frog, lizard or mouse approximately once per week (Mertens, 1943). Other captive sunbeam snakes were reported to consume a meal every 11.5 days on average, never exceeding 18% of their total body mass (Cox, 1993). Wild sunbeam snakes are known to eat reptiles, amphibians, rodents, snakes and birds (Wall, 1921; Smith, 1943; Chan-Ard, 2010; Martins, 2012).

## OBSERVATION AND DISCUSSION

On the night of May 17th, 2018, a reptile survey was being conducted in the vicinity of a small reservoir in the dry evergreen forest of Sakaerat Biosphere Reserve in Nakhon Ratchasima Province, Thailand. On this night, a large breeding aggregation of anurans in the reservoir and its banks was observed, which likely increased the activity of their predators such as *X. unicolor*. At 21:20, a sunbeam snake (**Figure 1A**) was encountered approximately 1.5 m from the edge of the reservoir. Upon capture, it regurgitated two intact common tree frogs (*Polypedates leucomystax)* (**Figure 1B**) that appeared to have been recently consumed. Just before measurement, the specimen ejected a large mass of partially digested meals, including two *P. leucomystax,* and at least two unidentifiable anurans (**Figure 1C**). The total content expelled was at least six anurans, however this number is likely closer to ten due to the sheer quantity of partially digested material.

After regurgitation, the snake was measured. It weighed 1.05 kg and had a total length of 1.25 m. This is longer than any *X. unicolor* reported in literature. Previous maximum total lengths for wild caught specimens are reported as 1.00 m (De Rooij, 1917), 1.145 m (Smith, 1943) and 1.194 m (Bergman, 1955).

Their unique dentary features maxillae and a premaxilla that are fused by bone-to-bone connection, rather than by ligaments (Frazetta, 1999). This may prevent the possibility of taking large prey, thus necessitating predation on many small prey items rather than one large one (Cox, 1993; Frazzetta, 1999). While predation on anurans has been previously recorded in *X. unicolor*, feeding on such a large scale has not. Prior literature had suggested that this species consumes one meal item at a time, however, here we show that this is not always the case (Mertens, 1943; Cox, 1993). Large anuran breeding aggregations likely prompt mass feeding by predators. The sunbeam snake may use these events to “stock up” while prey is abundant and distracted by the other sex. Perhaps this particular specimen was able to


**Figure 1**. Sunbeam snake and regurgitation contents. **A**) Specimen after two regurgitation events. **B**) Upon capture, the snake immediately ejected two frogs. **C**) Regurgitation contents before measurement includes additional frogs, as well as other unidentifiable digested material.

reach a record length by taking advantage of mass feeding opportunities. The sunbeam snake's anatomy coupled with the behavior of their prey may encourage the binging activity that is observed in this paper. More work on the natural history and predator-prey interactions of *X.unicolor* is needed to fully understand their feeding habits.

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# Notes on *Phyllodactylus palmeus* (Dixon, 1968) (Squamata; Gekkonidae); A Case of Diurnal Refuge Co-inhabitancy with *Centruroides gracilis* (Latreille, 1804) (Scorpiones: Buthidae) on Utila Island, Honduras.

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## INTRODUCTION

The Honduran Leaf-toed Palm Gecko (*Phyllodactylus palmeus;* Dixon, 1968) is a medium-sized (maximum male SVL = 82 mm, maximum female SVL = 73 mm) species endemic to Utila, Roatan and the Cayos Cochinos archipelago (McCranie and Hedges, 2013); islands which constitute part of the Bay Island group on the Caribbean coast of Honduras. The species is not currently evaluated by the IUCN Redlist, though Johnson *et al* (2015) calculated an Environmental Vulnerability Score (EVS) of 16 out of 20 for this species, placing *P. palmeus* in the lower portion of the high vulnerability category. To date, little information has been published on the natural history of *P. palmeus*, with much of its ecology and behaviour remaining unknown. *Phyllodactylus palmeus* is found active nocturnally on the bases of tree trunks, on branches, palms and foraging in leaf-litter; during the day, individuals can be observed hiding in cracks, beneath loose peeling bark, on the underside of palm fronds, on shaded hidden segments of trunk, and in porous volcanic coralline rocky outcrops (Köhler, 2008; Brown *et al*., 2018).

Previously on Utila, this species was known to inhabit buildings, and human settlements in high densities, although in recent years, populations have dramatically declined, being extirpated from these urban environments due to the invasion of highly competitive Asian House Gecko (*Hemidactylus frenatus*) (Wilson and Cruz Diaz, 1993: McCranie *et al*., 2005). Over seventeen years following the *Hemidactylus* invasion of Utila (Kohler, 2001), our current observations spanning from 2016 -2018 support those of McCranie & Hedges (2013) in that *P. palmeus* is now primarily restricted to undisturbed forested areas, and that *H. frenatus* is now unequivocally the most commonly observed gecko species across Utila. We report that *H. frenatus* has subjugated all habitat types on Utila Island, having a practically all encompassing distribution occupying urban and agricultural areas, hardwood, swamp, mangrove and coastal forest habitats and even areas of neo-tropical savannah (T. Brown pers. observ). On the other hand, populations of *P. palmeus* are left increasingly fragmented and out-competed in their natural habitats.

As an additional pressure, it should be noted that the site of the following observations was being actively deforested in preparation for sale and development. Furthermore, it is located <500 m to a locality known as Pumpkin Hill (16.12003°N, -86.88223°W), previously identified as a biodiversity hotspot for endemic lizards on the island (Brown *et al*., 2017[b, c]), as well as the site of previously reported observations regarding *P. palmeus* communal nesting behavior at Kanahau Utila Research & Conservation Facility (16.119383°N, 86.884989°W; WGS84) (Brown *et al*., 2018).

## OBSERVATION


**Figure 1. A)** Cryptic *Phyllodactylus palmeus* seeking refuge beneath bark peel. **B)** Female *Centruroides gracilis* with offspring found co-inhabiting the same bark refuge. (Photo Credit: Tom W. Brown)

On April 4 2018, at 10:30 h, we encountered seven individuals of *P. palmeus* occurring within an area of hardwood forest on the eastern side of Utila. The composition of the forest was a diverse mixture of flowering broad-leaf trees (composed in part by the identifiable 'Gumbo-limbo' tree (*Bursera simaruba*), 'Encino' Oak (*Quercus oleoides)*, Yellow Hog Plum (*Spondias mombin)* and Fig trees (*Ficus* sp.). The understory was dominated by Paurotis palms (*Acoelorrhaphe wrightii)* as well as developing saplings and mature vines. Here, we found geckos seeking diurnal retreat beneath bark peels on the trunks of mature trees. On one trunk (Girth measurement – 285 cm), we counted > 10 bark peels with suitable space to provide refuge from heights of 0.5 – ca. >10 m. Whilst we were only able to search the suitable sites from 0.5 – 2.5 m (owing to accessibility), we encountered seven individuals sharing four such refuges. At one of these refuges, (1.6 m above ground), a single adult *P. palmeus* was observed occurring alongside an adult scorpion within a cavity created by a bark peel ca. 8 cm wide x 15 cm depth. When first encountered, the gecko and scorpion were resting adjacent to one another in close proximity, neither interacting; but then owing to disruption by the flash light, both sought to retreat out of sight before a photograph could be taken. To confirm the observation and the identification of both species, we proceeded to carefully extract the scorpion and gecko from the refuge. At this point, the female gecko (*P. palmeus)* was captured and measured to provide morphometric data (SVL – 65 mm, Tail – 63 mm, Weight – 7.5 g), then promptly released on the trunk where it retreated to a similar alternative refuge (Fig 1a). The scorpion was also then identified to be an adult female Bark Scorpion, *Centruroides gracilis* (Latreille, 1804) (body length ca. 43 mm) (S. Longhorn *pers. comm*., see also Teruel & Myers, 2017), additionally found to be tending to her litter of second instar young (Fig. 1b).

**REMARKS**

Previous literature has reported co-inhabitancy of refuge sites between scorpions of the genus *Centruroides* and anurans (Escalante-Pasos, 2017), and between scorpions (Buthidae) and lizards (Agamidae) (Al-Johany & Al-Saleh, 2000). To the best of our knowledge, no such interactions have been previously recorded in the infra-order Gekkota, nor concerning female scorpions with young. In contrast, scorpions are acknowledged to predate on lizards and other small squamates (Bauer, 1990), and some geckos (e.g. *H. frenatus;* Brown *et al*., 2017[a]) have been found to predate on other arachnids. Fundamentally, there have been multiple records where geckos, other lizards and scorpions have preyed upon each other (Castilla, 1995; Zlotkin *et al*., 2003; Pérez *et al*., 2010).

The presented observation is also interesting when considering the degree of maternal care exhibited by scorpions. Using a closely related species, Shaffer & Formanowicz (1996) found that 65% of female Centruroides vittatus carrying young could not be induced to run, instead assuming a defensive posture. These authors also suggested that the cost of viviparity and parental care may cause females to explore alternative defensive strategies. In support, Miller *et al*. (2016) later found females to be more likely to stand and fight off predators, being more aggressive when compared to the males, which would usually prefer to run. Likewise, the female *C. gracilis* in our observations made no attempt to flee when disturbed; though most intriguingly, it did not consider *P. palmeus* as a threat or potential predator. Instead, the reported interaction may of facilitated mutual defensive benefits, being the first potential example of protocooperation between a gecko and scorpion species.

While not much can be said on the relations of *P. palmeus* with *C. gracilis*, the co-inhabitancy of these unlikely neighbors may not be infrequent, considering both are found in relative abundance within hardwood forest habitats, and appear to share the same primary

resources such as invertebrate prey and dark diurnal refuges.

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# An Annotated Checklist of the Herpetofauna of Cikananga Wildlife Center, Sukabumi, West Java, Indonesia

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## ABSTRACT

The herpetofauna diversity of Cikananga Wildlife Center, West Java, Indonesia, was studied using a rapid assessment survey conducted on 10–19 May 2018, as well as incidental observation from staff and volunteers. All amphibians and reptiles observed were identified and recorded during the nine-day survey in the rescue facility, office complex, surrounding forest, and paddy fields. The results showed that 11 species of amphibians from 5 families inhabit the area, 9 species of lizards and 21 species of snakes were also present in the area. This report constitutes a preliminary checklist and first record of amphibians and reptiles in Cikananga Wildlife Center, West Java, Indonesia. The number of specimens was fewer than expected because of the very short survey period, but we hope to record more species in future studies.

**Keywords:** Cikananga, Sukabumi, West Java, Indonesia, Amphibians, Reptiles

## INTRODUCTION

Despite being one of the most biodiverse regions in terms of amphibian and reptile species, herpetological research in Indonesia has not significantly progressed compared to neighboring countries (Iskandar and Erdelen, 2006). Since 2004 to 2010, numerous numbers of new amphibians were recorded but restricted in the Papua region.


**Figure 1a.** Location of Cikananga Wildlife Center, Sukabumi, West Java, Indonesia. ©PPSC


**Figure 1b.** Aerial view of Cikananga Wildlife Center and surrounding areas in Sukabumi, West Java, Indonesia. ©Google Earth

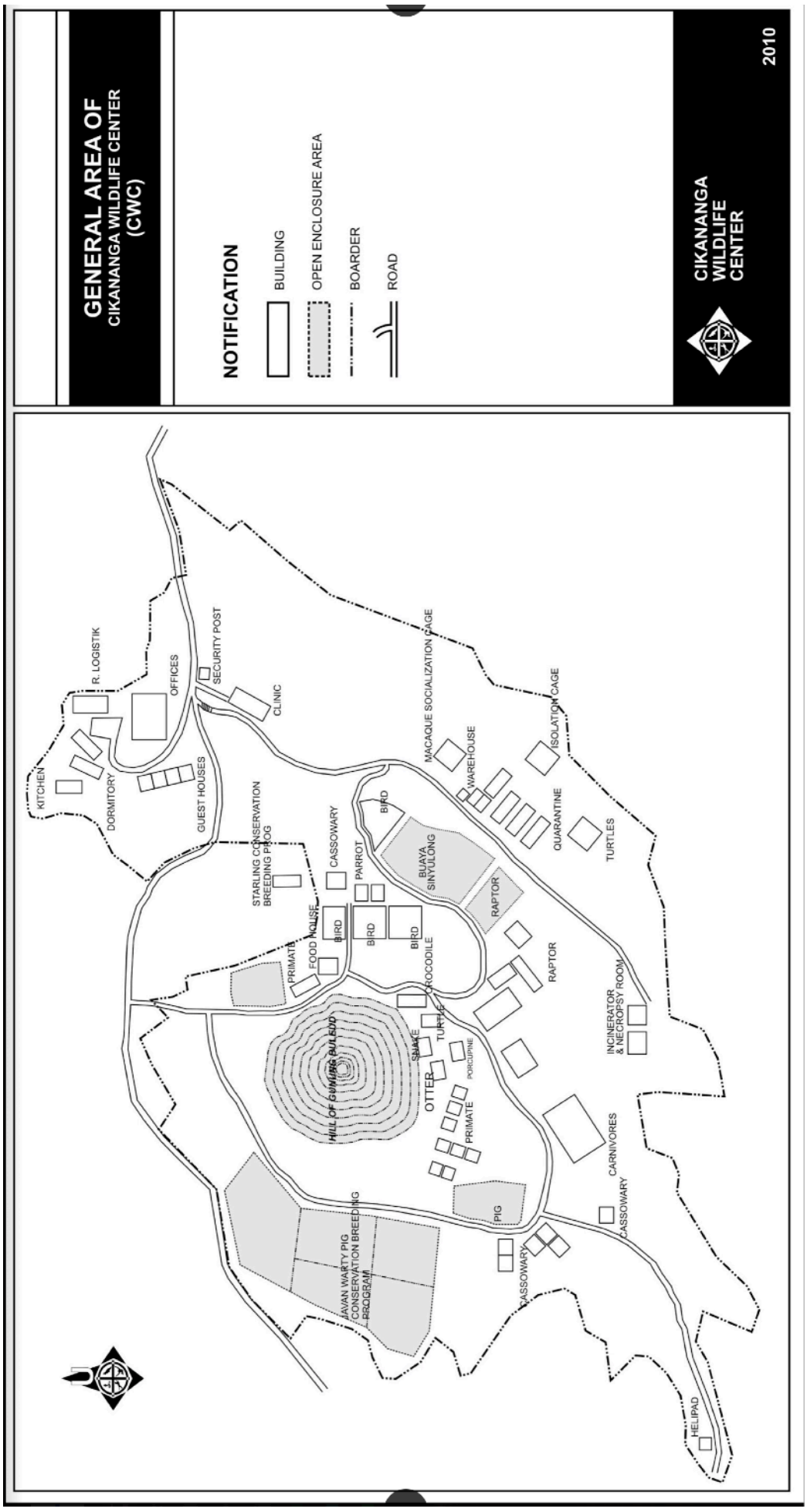


**Figure 2:** Floor plan of Cikananga Wildlife Center, Sukabumi, West Java, Indonesia. ©PPSC

Since 2011, new amphibian records were expanded to Java, Borneo, Sulawesi, and Sumatra region. Over the last ten years, 53 species of amphibians were newly described, and within 2001-2010, several new species of reptiles were discovered, the majority of them in the Eastern region of Indonesia. In last ten years, seven new species of reptiles were discovered in the Moluccas, Sumatra, and Java. On Java, new species of amphibians and reptiles have been recently discovered, such as the description of *Leptophryne javanica* (Hamidy *et. al*, 2018), and *Cyrtodactylus klakahensis* (Hartmann *et. al,* 2016).

The varied habitats of West Java are home to a wide range of amphibian and reptile species. Based on the data from Amphibiaweb (2018) and Reptile Database (2018), 108 species of amphibians and 208 species of reptiles inhabit the island of Java. Herpetofauna inhabit various habitats, from primary and disturbed lowland forest, montane and submontane forest, streams, rivers, caves, to disturbed habitats such as plantations, villages and cities.

West Java is the second largest province in Java with the highest human population (Badan Pusat Statistik, 2010), hence putting its biodiversity at high risk. However, some amphibians and reptiles are still present in naturally vegetated areas and human-dominated areas. Current herpetological studies, particularly in West Java are limited to natural protected and non-protected areas (Riyanto, 2008; Kusrini, 2013; Huda, 2017), while the human-dominated landscapes yet remain unstudied.

We recorded the diversity of amphibians and reptiles that occur in human-dominated landscape at the Cikananga Wildlife Center and its surrounding area in West Java. This study will provide an overview of herpetological diversity in the southern part of Sukabumi, where no similar studies have been published. Our study is a preliminary list, and we hope to record more species in future studies.

## MATERIALS & METHODS

The diversity of amphibians and reptiles of Cikananga Wildlife Center, West Java, Indonesia (07° 03.390 S 106° 54.695 E, ca. 812m asl.) (Fig. 1), was investigated during an expedition for a period of 9 days from 10–19 May 2018. The Cikananga Wildlife Center is located in the district of Sukabumi in the province of West Java, and it is one of the largest animal rescue centers dedicated to the conservation of wildlife in Indonesia. The area is located in Kampung Cikananga, Desa Cisitu, Kecamatan Nyalindung, Kabupaten Sukabumi, West Java, Indonesia. Covering an area of 14 hectares, Cikananga Wildlife Center is divided into rescue center/ park area and office area (Fig 2). Both areas consist of re-growing forest which is dominated by umbrella trees and *Calliandra* sp. Cikananga Wildlife Center is surrounded by cultivated land that dominated by paddy fields, mixed plantation woodland (teak, *Tectona grandis*; umbrella tree, *Maesopsis eminii*; and white *Albizia, Albizia* sp.), and agriculture plantation (tea and vegetables). Patches of mixed pine forest and some unmanaged land formed by open understory grassland and bushes are also still present.

The frogs, lizards and snakes were collected around the office complex, rescue center, along the roadside ditches, forest, rice paddies and a lake in the Cikananga Wildlife Center area and also in the surrounding forest, plantations and rice paddy fields in the area. Most surveys were conducted at night using visual encounter survey with a head torch, as it is the standard method for surveying herpetofauna in tropical regions (Crump and Scott, 1994; Doan, 2009). All non-venomous species were captured by hand, while snake tongs and hooks were used for venomous species. The observation and/or collection of diurnal lizards, and carcasses were performed during the daytime. All deceased specimens found were fixed in 10% formalin, preserved in 70% ethanol and later deposited at the CWC Office for future reference. To photograph the specimens, we

used a digital camera and macro lens. The main references used to identify the specimens were Kusrini (2013), de Lang (2017), Rusli (2016), Das (2010), and Somaweera (2017). All the amphibians and reptiles from incidental observation by staff and volunteers were also confirmed and recorded.

**Table 1.** List of amphibians and reptiles in Cikananga Wildlife Center

| No | Species | Location | | | | | |
|---|---|---|---|---|---|---|---|
| | | Roadside | Office Building | Forested area | Paddy Field | Lake | Park |
| **A. Amphibians** | | | | | | | |
| **I. Bufonidae** | | | | | | | |
| 1 | *Duttaphrynus melanostictus* | X | X | | | | |
| 2 | *Phrynoidis asper* | | X | X | | | |
| **II. Dicroglossidae** | | | | | | | |
| 1 | *Fejevarya limnocharis* | | | | X | | |
| 2 | *Limnonectes macrodon* | | | | X | X | X |
| 3 | *Limnonectes microdiscus* | | | | X | | X |
| 4 | *Occidozyga sumatrana* | | | | X | | X |
| **III. Ranidae** | | | | | | | |
| 1 | *Amnirana nicobariensis* | | X | | | | X |
| 2 | *Chalcorana chalconata* | | | | | | X |
| **IV Microhylidae** | | | | | | | |
| 1 | *Microhyla achatina* | X | X | X | X | X | |
| **V Rhacophoridae** | | | | | | | |
| 1 | *Polypedates leucomystax* | X | X | X | X | | X |
| 2 | *Rhacophorus reinwardtii* | | | | | | X |
| **B. Reptilia** | | | | | | | |
| **I. Gekkonidae** | | | | | | | |
| 1 | *Hemidactylus frenatus* | | X | | | | |
| 2 | *Gehyra mutilata* | | X | | | | |
| 3 | *Gekko gecko* | | X | | | | |
| **II. Agamidae** | | | | | | | |
| 1 | *Bronchocela jubata* | X | X | X | X | X | X |
| 2 | *Gonocephalus chamaeleontinus* | | X | | | | X |
| 3 | *Draco volans* | | X | | | | X |
| **III. Scincidae** | | | | | | | |
| 1 | *Dasia olivacea* | | X | | | | |
| 2 | *Eutropis multifasciata* | X | X | X | X | X | X |
| **IV. Varanidae** | | | | | | | |
| 1 | *Varanus salvator* | | | | X | | |
| **V. Colubridae** | | | | | | | |
| 1 | *Ahaetulla prasina* | | | X | X | X | X |
| 2 | *Dendrelaphis formosus* | | | | | | X |
| 3 | *Dendrelaphis pictus* | | | | X | | X |
| 4 | *Dendrelaphis subocularis* | | X | | | | |
| 5 | *Calamaria linnaei* | | X | | | | |
| 6 | *Calamaria schlegeli cuvieri* | X | | | | | X |
| 7 | *Coelognathus flavolineatus* | | | | X | | X |
| 8 | *Coelognathus radiata* | | | | X | | X |
| 9 | *Gongylosoma baliodeurus* | | | | | | X |
| 10 | *Lycodon subcinctus* | | | | | | X |
| 11 | *Oligodon purpurascens* | X | | | | | |
| 12 | *Oligodon bitorquatus* | | | | | | X |
| 13 | *Ramphotyphlops lineatus* | | X | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 14 | *Sibynophis geminatus* | | | | | | X |
| **VI.Natricidae** | | | | | | | |
| 1 | *Rhabdophis subminiatus* | | | X | | | X |
| 2 | *Xenochrophis trianguligerus* | | | | X | X | |
| **VII. Pareidae** | | | | | | | |
| 1 | *Parea scarinatus* | | X | | | | X |
| **VIII.Elapidae** | | | | | | | |
| 1 | *Bungaru scandidus* | | | | | | X |
| 2 | *Bungaru sfasciatus* | | X | | | | X |
| 3 | *Naja sputatrix* | | X | | X | | X |
| **IX. Viperidae** | | | | | | | |
| 1 | *Trimeresurus albolabris* | | | | X | | |
| | | | | | | | |
| **Total species per habitat** | | 7 | 19 | 7 | 16 | 6 | 27 |

## RESULTS

A total of 11 species of anurans from 3 families, 7 species of lizards from 3 families and 16 species of snakes from 5 families were recorded to inhabit the Cikananga Wildlife Center area (Table 1).

## SPECIES ACCOUNTS

### Amphibians

#### *Bufonidae*

Two bufonid species, *Duttaphrynus melanostictus,* and *Phrynoidis asper,* represent this family.

*Duttaphrynus melanostictus*

This is a widespread and common species; it is adaptable and often occurs in disturbed habitats (Kusrini, 2013; AmphibiaWeb, 2016). Several individuals were observed each night crossing the road or on roadsides, and one individual was found in the office building. This species is one of the most commonly observed amphibians by staff and volunteers.

*Phrynoidis asper*

Several adult specimens were found under the dormitory, and also in the forest near the pig enclosure. This species is usually associated with flowing water such as rivers and streams (Kusrini, 2013). There is a small ditch/ irrigation canal in the paddy fields (about 70 cm in width) with flowing water, however no individuals of this species were recorded there. All individuals were found quite far away from any source of water.

#### *Dicroglossidae*

We observed four species of frogs from this family: *Fejervarya limnocharis*, *Limnonectes macrodon, Limnonectes microdiscus* and *Occidozyga sumatrana*.

*Fejervarya limnocharis*

A very common species, highly concentrated in rice paddies. An estimation of roughly over 100 specimens were observed each night in the rice paddies. On several occasions there were pairs in amplexus. We identified these amphibians by looking at the morphological characters of 5 individuals randomly captured each night, as well as from clear photographs of incidental observation by staff and volunteers. This species is very similar to *Fejervarya cancrivora*, and inhabits the same habitat type. However, they can be distinguished based on the webbing of the hind feet. *F. limnocharis* is not fully webbed; its web only touches the second subarticular tubercle on the fourth toe, while in *F. cancrivora*, the web touches the outermost subarticular tubercle on the fourth toe. An outer metatarsal present in *F. limnocharis* is absent in *F. cancrivora*. This species is occurs in lowland habitats, rarely above 700 m asl. (Kusrini, 2013).

**Figure 3.** *Limnonectes macrodon* predating a smaller frog on 4th December 2018. ©Arfah Nasution

*Limnonectes macrodon*

A rough estimation of over 30 specimens were observed each night on the banks of the lake. This species was also abundant in the rice paddies, an average of 15 specimens were observed each night in the rice paddy fields. This species also occurs in both small and large turtle and crocodile enclosures. One single specimen was observed predating (presumably *C. chalconata*) on 4th December 2018 (Fig. 3).

*Limnonectes microdiscus*

Three specimens were captured on different occasions. One was found in a puddle on a path near a lake, the other two were found in rice paddies. They are found in lowland forest up to an elevation of 1400 masl. (Kusrini, 2013).

*Occidozyga sumatrana*

An average of roughly 10 specimens were observed each night. The majority of specimens were found in rice paddies. One was found on a rainy night with a missing hind leg, in a puddle located on a path near a lake. They were distinguished from the similar species *Occidozyga lima* based on morphological characters of the ventral. *O. sumatrana* has a smooth ventral, while *O. lima* will have tubercles dotted around its belly.

***Ranidae***

In Cikananga Wildlife Center, we found two species of ranids: *Amnirana nicobariensis* and *Chalcorana chalconota.*

*Amnirana nicobariensis*

Several individuals were observed each night, most often on soil slopes covered with various plant species. One individual was observed inside the office building. Some individuals were observed in or around the turtles and small crocodile enclosures.

*Chalcorana chalconota*

Several individuals were observed each night, most often on soil slopes covered with various plant species. This species is also commonly observed perching on branches or foliage, below 2 metres from ground level. Some individuals were observed in or around the turtles and small crocodile enclosures. A pair in amplexus was observed by the pig-nosed turtle tank in the evening.

***Microhylidae***

One species of microhylid, *Microhyla achatina,* was found on Cikananga Wildlife Center grounds.

*Microhyla achatina*

Calls from this species were heard in most areas of Cikananga Wildlife Center grounds, except in the rice paddies. Several individuals were found in leaf litter in various places of CWC grounds. 2-3 individuals were observed every night in the office building, as well as the leaf litter and forested area surrounding the building. This small frog is endemic to Java, and can be distinguished from a similar species, *Microhylapalmipes* based on morphological characters. Webs are absent on the hind feet of *M. achatina*, while on *M. palmipes*, 2/3 of the foot is webbed (Kusrini, 2013).

***Rhacophoridae***

The rhacophorid family is represented here by two species, *Polypedates leucomystax* and

*Rhacophorus reinwardtii*.

*Polypedates leucomystax*

This arboreal frog is perhaps the most common species of Rhacophoridae on Java. It is adaptable and often found in disturbed habitats and in human habitations. One individual was found in the toilet of the office building, and another in the toilet near the crocodiles; both perched on the wall. Several other individuals were seen on the fence of the crocodile and turtle enclosures, and in foliage all around the area.

*Rhacophorus reinwardtii*

One pair in amplexus was observed on a fence of the small crocodile enclosure on 24th April 2018 (Fig. 4). The frogs were observed at around 20:00 at night, with a light shower of rain.

**Figure 4.** A pair of *Rhacophorus reinwardtii* in amplexus. ©Nathan Rusli

**Reptilia (Lizards)**

***Gekkonidae***

*Hemidactylus frenatus*

Several individuals were observed on trees and on walls of buildings. This species is associated with human habitations (Das, 2010).

*Gehyra mutilata*

Several individuals were observed on walls of buildings. This species is found both in primary forest and human habitations (Das, 2010)

*Gekko gecko*

We did not find any specimens during the survey, however occasionally the distinctive sound of these lizards were heard in the evenings. Staff and volunteers have reported frequent sightings of this species and provided photographs. There is one individual that is seen almost every night in the male dormitory, one living in the office building tower, and several individuals on the walls behind the garage (Ferns, Pers. Comm., 20th December 2018).

***Agamidae***

*Bronchocela jubata*

Abundant species found sleeping in trees at night and basking during the day. Both adult and juveniles were observed during every survey, roughly 10 specimens were recorded each night. It is common around disturbed and urban habitats, however in most urban areas of West Java such as Jakarta, they have been outcompeted and replaced by *Calotes versicolor*, which is an introduced species (Risdiana, Pers. Comm., 20th December 2018). *C. versicolor* was not present during this survey, which is a positive sign for this species.

*Gonocephalus chamaeleontinus*

Two colour variations were observed; a green form and a reddish-brown form. Most often seen basking on vertical trees during the day, and occasionally observed sleeping in the foliage at night. According to reports from staff, they have been observed laying eggs under the dormitory.This is a highland species, found in montane forest above 600m asl (Yuwono, Pers. Comm., 19th December 2018; Risdiana, Pers. Comm., 20th December 2018). The specimens were distinguished from *Gonocephalus kuhlii*, a similar species, based on their large nuchal crest and smooth ventral scales (Das, 2010).

**Figure 5.** A gravid female specimen of *Draco volans* killed by a domestic cat. We performed an incision to reveal the four eggs contained inside it. ©Nathan Rusli

*Draco volans*

One male was observed roughly 3-4 metres above the ground, in a tree near the turtle ponds during the day, on 28th April 2018. A female found dead after being attacked by a domestic cat was collected during the day on 16 May 2018. It was gravid with four eggs (Fig. 5).

***Scincidae***

*Dasia olivacea*

A single specimen was recorded in a tree in front of the office building based on a photograph taken in May 2018. The animal was seen basking during the day, roughly 2 metres above the ground.

*Eutropis multifasciata*

Most often observed basking on the ground or on a tree trunk during the day. One individual was observed at night under a pile of leaves near the garage on 12 May 2018, and another two individuals were observed in leaf litter by the path near the bear enclosures at night on 15th May 2018. A juvenile was observed under a rock by the office building during the day on 22nd April 2018.

***Varanidae***

*Varanus salvator*

One individual was observed during the rainy season in 2012, basking next to the lake. Another specimen was observed in 2018 running towards a bird cage, around 16:00 during the afternoon (Tielen Pers. Comm., 21th Decemeber 2018). *V. salvator* was observed swimming in a small stream passing through the paddy fields twice, on 16th and 18th November 2018.

**Reptilia (Snakes)**

***Colubridae***

*Ahaetulla prasina*

*Ahaetulla prasina* is a diurnal arboreal snake. A common species, often found resting in trees at night. An average of 2-3 individuals were found each night. They prefer lowland habitats and are commonly found around human habitations as well as agricultural areas (de Lang, 2017)

*Dendrelaphis formosus*

Two individuals were observed. A juvenile was found resting on foliage, roughly one meter above the ground near the cage shed on the evening of 13th May 2018. An adult was found on 18th May resting in a bamboo tree roughly 4 meters above the ground across the clinic, near the gate of the rescue center. They can be distinguished from other *Dendrelaphis* species based on the very large eyes and the presence of three black stripes on the posterior (de Lang, 2017).

*Dendrelaphis pictus*

This is the most commonly encountered *Dendrelaphis* species, identified by the presence of a light ventro lateral stripe (de Lang, 2017). Several individuals were found resting in trees in the rescue center and rice paddies. Both males and females were observed; a high concentration of this species was found in trees in or near the small crocodile enclosures. One single juvenile specimen was observed eating on frog at paddy field (15th August 2017) and at the park (15th February 2018). A juvenile was observed in the

rice paddies, sleeping in a tree on 18th May 2018.

*Dendrelaphis subocularis*

A single specimen collected in 2007 by Drh. Munawar Kholis was preserved in the office building (Fig 6). It was then identified as *Dendrelaphis subocularis* on 14th May 2018 based on morphological characters. *D. subocularis* can be distinguished from other *Dendrelaphis* species based on the supralabial scales; the 5th supralabial scale is enlarged and located under the eye. It is also the only one touching the eye, therefore at the same time it is the subocular scale, hence the species epithet "*subocularis*". Another morphological feature which distinguishes this species from other members of its genus is the presence of black sutures on its lips. Morphological characters used to identify this species were based on information provided in de Lang, 2017.

**Figure 6.** A specimen of *Dendrelaphis subocularis* collected in 2007. Lateral view of the headwhich clearly shows the 5thsupralabial scale and black sutures. ©Nathan Rusli

*Calamaria linnaei*

A single specimen was found during the day on 28th April 2018 in a ditch next to the office building being attacked by ants (Fig 7). The specimen was identified by pholidosis; it had six scales surrounding the paraparietal, one preocular scale, and mental touching anterior chin shields. Other morphological features which can add to certainty of identification are the abruptly ending tail and ventral with dark

**Figure 7.** *Calamaria linnaei* found in a ditch on 28th April 2018. ©Nathan Rusli

markings. Morphological characters used to identify this species were based on information provided in de Lang, 2017.

*Calamaria schlegeli cuvieri*

Two individuals were observed and collected (Fig. 8). One individual was found at night on 11th May 2018, slithering on a soil slope by the road outside the fence of the complex area. Another individual was found dead in front of the food house on 16th May 2018. They were both identified by pholidosis; five scales surrounding the paraparietal, preocular scale absent, and mental not touching anterior chin shields. Other morphological features which can add to certainty of identification are the gradually tapering tail and immaculate yellow ventral. Morphological characters used to identify this species were based on information provided in de Lang, 2017.

**Figure 8.** *Calamaria schlegeli cuvieri* found slithering on a soil slope on 11th May 2018. ©Nathan Rusli

*Coelognathus flavolineatus*

One dead juvenile specimen was found on the road in front of the crocodile enclosures on 19th May 2017. One adult specimen was observed on 10th August 2018. It was dead and had been half eaten by a predatory animal, possibly a mongoose, which often feed on snakes (Figure 9)

**Figure 9.** A carcass of *Coelognathus flavolineatus* found on 10th August 2018. ©Arfah Nasution

*Coelognathus radiata*

An adult specimen was observed on 6th May 2018, presumably foraging for prey animals on a vegetable orchard that was covered by thick grasses. A juvenile specimen was found dead and flattened on the road near the security post on 30th July 2018. We assume it was run over by a vehichle (Figure 10).

*Gongylosoma balioderus*

One specimen was observed and photographed on the road in front of clinic on a drizzly morning in 2016 (Tielen Pers. Comm., 21st December 2018). It was identified as *Gongylosoma balioderus* based on the following morphological features from de Lang, 2017; large eyes with round pupil, lips yellowish with black sutures. It is presumably female, as females tend to be more vivid in colour than males, and the white ocelli are more contrasting. It bears no longitudinal lines on the body, which distinguishes it from *Gongylosoma longicauda*, in which longitudinal lines are present.

*Lycodon subcinctus*

A single adult specimen was recorded in the park area based on a photograph that was taken on 14th December 2012. It was distinguished from the venomous *Bungarus candidus* based on the supralabial scales (Das, 2010; de Lang, 2017). This specimen had 8 supralabials; the third, fourth and fifth touching the eye.

*Oligodon bitorquatus*

A dead specimen was found at the park gate on 25th May 2018. A juvenile was observed on the stairs near the crocodile enclosure on 08th September 2018, and another during the day crossing the road near the clinic on 11th May

**Figure 10.** A juvenile specimen of *Coelognathus radiata* found dead on road. ©Nathan Rusli

2018. Specimens were identified based on the dorsal pattern. Dorsal colour varies from black to brown, with many oblique rows of small reddish spots.

*Ptyas korros*

Several individuals were found each night, usually resting in the trees surrounding the paddy fields. They have also been observed resting in trees in the park area near the lake. The animals were found resting at a range of roughly 1-2 metres above the ground, in trees which grew on a steep slope. During the day, they have been observed several times in unmanaged grassland with large bushes, as well as in agricultural areas.

*Ramphotyphlops lineatus*

One specimen was observed during the midday on the stair to the office building on 10th January 2018.This is the largest of blind snakes on Java, and could be easily identified based on the yellowish head and lower parts, and 12-15 fine zigzag lines on dorsum (de Lang, 2017).

*Sibynophis geminatus*

A single specimen was recorded in the park area based on a photograph that was taken on 15th April 2018 (Fig. 11). The animal was found slithering near the path to the CCBC entrance on a pile of rocks at 14:00 during the day (Beilby, Pers. Comm., 19th December 2018). It was identified based on its distinctive orange coloration on the nape, as well as two dorsolateral stripes running along the body from behind the neck.

**Figure 11.** *Sibynophis geminatus* observed on 15th April 2018. ©Jonathan Beilby

***Natricidae***

*Rhabdophis subminiatus*

This species was commonly found both during the day and at night (Pers. Obs.). Staff and volunteers often observe them near the clinic, in various locations around the rescue center and complex, basking or slithering on the ground. One was seen hiding inside a pipe during the day. At night, they are observed sleeping in foliage.

*Xenochrophis trianguligerus*

A range of 1-3 individuals were observed every night resting on protruding branches in the lake. One individual was found slithering in the rice paddies on 18th May 2018 in the evening.

***Pareidae***

*Pareas carinatus*

**Figure 12.** A juvenile specimen of *Pareas carinatus* with lighter markings on dorsolateral. ©Nathan Rusli

Both adults and juveniles were observed. Commonly seen at night in various locations around the rescue center (Pers. Obs.). One adult was found in a tree at night next to the garage on 15th May 2018. A juvenile specimen with an unusual pattern was found resting in a bush, roughly 1 metre above the ground on 23rd April 2018 (Fig 12).

**Figure 13.** Naja sputatrix exhibiting arboreal behaviour, climbing on the bushes near vegetable orchard. ©Arfah Nasution

***Elapidae***

*Bungarus candidus*

Two individuals were observed. One individual was observed slithering in the otter cage area at night on 24th April 2018. Another was observed on the same night near the warty pig enclosures. Staff and volunteers have also observed this species in the past.

*Bungarus fasciatus*

An adult individual was observed on 25th April 2018 on the side of the road. One juvenile was found crossing the path near the dormitory in the morning on 26th April 2018, and another slithering on the wall of the slow loris enclosure in the evening of 11th May 2018. One dead specimen was found on the roadside near to the CWC park gate on 12th September 2018.

*Calliophis intestinalis*

A single specimen was found during the day in 2016 in a ditch next to the office building. Another specimen was found at the pig enclosure in August 2018. (Tielen Pers. Comm., 21st December 2018).

*Naja sputatrix*

Adult individuals were often observed basking in the afternoon in front of Mess 1 in the complex area. One single specimen was observed exhibiting arboreal behaviour, climbing on bushes near a vegetable orchard on 10th November 2018 (Fig. 13). One individual was found at night in the rice paddies on 26th April 2018, and another on 10th May 2018. In the past, staff and volunteers have observed this species near the office area, in rice paddies and various places in the rescue center.

***Viperidae***

*Trimeresurus albolabris*

Two individuals were observed, both at night in trees on steep ledges surrounding the rice paddies. One was found on 26th April 2018, and the other on 13th May 2018. This is generally a lowland species, often found in primary and secondary forest.

## DISCUSSION

For the nine-day survey at the Cikananga Wildlife Center area, Sukabumi, West Java, we covered 10.2% of amphibians and 13.5% of reptiles across Java. These are new records of the herpetofauna of Cikananga Wildlife Center, as it is the first time this area has been surveyed. The number of species is less than expected because of the short observation period and climatic factors. Due to the limited survey period, we could not explore and record all the amphibians and reptiles present in the area.

We assumed that combination of urbanization and elevation are also significantly influenced our result. Cikananga Wildlife Center is characterized as a disturbed area, and we could easily find several species of herpetofauna commonly found in disturbed habitat, such as *D. melanostictus, F. limnocharis, H. erythraea, P. leucomystax, H. frenatus, G. mutilata,* and *B. jubata*. It is believed that urbanization, which converts the natural habitats into agriculture, human settlements, and roads are major contributors to the decline of amphibian and reptile diversity at some locations (Lajmanovich *et al.,* 2003; Storfer, 2003;

Gardner *et al.*, 2007; Rais *et al.*, 2015).

Urbanization leads to habitat fragmentation which restrict the dispersal of herpetofauna (Cushman, 2006; Parris, 2006) as well as road kill impacted of vehicular traffic which results in herpetofauna mortality, jeopardizing the survival of endemic, globally, and locally, threatened species (Amarakoon *et al.,* 2010; Baskaran and Boominathan, 2010; Selvan, 2011; Arijit *et al.*, 2012; Karunarathna *et al.*, 2013). We noted several road kills on *C. radiata*, *D. melanotictus*, *A. prasina*, *C. flavolineatus*, and *B. jubata* (fig x). The disturbance of habitat fragmentation also contributed to the habitat alteration which push the amphibians and reptiles inhabit the building area, such as frogs and snakes that commonly found in the building as well as in the ditch.

Cikananga is on high elevation (>800m a.s.l.) where less species commonly occurred. The trend of species richness showed a decrease in richness with increasing elevation (Watkins *et al.*, 2006). More species of herpetofauna occur at low and middle elevations, while few exist at high elevations which consistent with expected optimum water and energy variables (Malonza, 2015). We highlighted a unique occurrence of herpetofauna in Cikananga where both highland and lowland species are occupied this area. Some highland species found is: *R. reinwardtii* and *C.schlegeli*, while the majority of species found were lowland species.

For the baseline data, we only focused on herpetofauna checklist, yet we found some interesting findings relate to the herpetofauna ecology, such as: the population of house gecko that not really common inhabit the area *P. aspera* that contradict from its common habit (we found this species is more common in area which far from flowing water, whilst the species usually associated with flowing water such as rivers and streams (Kusrini, 2013)).

There are several species of herpetofauna which have been introduced to Java, such as *Trachemys scripta* and *Calotes versicolor* (Das, 2010). During this survey, we did not encounter any non-native species of amphibians and reptiles, which is a positive sign as there is no competition for native species. In some areas, the non-native *Calotes versicolor* has outcompeted and replaced the native *Bronchocela jubata* (Yuwono, Pers. Comm., 19th December 2018; Risdiana, Pers. Comm., 20th December 2018). However, we did observe a domestic cat kill a flying lizard, *Draco volans*, which was gravid with four eggs. This is an invasive species which is common in the area and poses the threat of predation towards herpetofauna and other wildlife such as small birds and invertebrates.

More species were found in the park area (26 species), which provide a re-growth secondary forest with man-made lake, animal pools, and puddles. These bodies of water function as breeding grounds for amphibians. In and around the wildlife center there are rice paddy fields, small streams, and ditches, which are also important for amphibians and reptiles as they provide varied microhabitats to live and breed in. The office complex also accommodates a significant number of amphibians and reptiles (19 species), perhaps because the office building area still has some forested area and is adjacent to the paddy field area.

This study aims to create a checklist of herpetofauna in the area, however there have been observations that raise some interesting questions related to their ecology, such as very low density of *Hemidactylus frenatus*, and the behaviour of *P. aspera* that contradicts from its common habits. We also recorded interaction between herpetofauna and other animals, such as the predation of *C. flavolineatus* by a mongoose, *B. jubata* and an unidentified colubrid snake predated by Crested-serpent Eagle, frogs and lizards predated by snakes, such as *Ahaetulla prasina* and *Dendrelaphis* species, and *Limnonectes macrodon* predating on smaller frogs. Further studies on their

ecology would be interesting to conduct in the future.

Surveying herpetofauna in tropical regions is difficult because of their cold-blooded nature. Many species are cryptic, secretive, and somewhat unpredictable, which making it difficult to obtain specimens (Jehle Pers. Comm., 23rd October 2017). A long-term study is needed to increase the list number of herpetofauna, thus we will involve all Cikananga staff and volunteers to help us collect the data from incidental observations.

This checklist is not final, and we expect to find more species during future observations. We will use a longer and wider survey period and area so that we can cover a wider range of habitat types.

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# Behavioral Ecology of the Indian flapshell turtle *Lissemys punctata andersonii* (Webb, 1980) in West Bengal, India.

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## ABSTRACT

A study on the ecology of the Indian flapshell turtle *Lissemys punctata andersonii* (Webb, 1980) was conducted during the period of July 2015 to July 2017. In this study we observed behaviour, food preference, and breeding and nesting habitat preference. For the study we mainly selected the Saraswati and Kananadi river banks in the Hooghly district. Both rivers are shallow in depth (≤4 m) and well vegetated.

**Keywords:** Indian flapshell turtle**,** Ecology, Behavior, Habit, Habitat, Breeding.

## INTRODUCTION

The Indian flapshell turtle is one of the 22 species of turtles found in India. Three subspecies of the Indian flapshell turtle, *Lissemys punctate*, are currently recognized: *L. p. punctata, L. p. vittata, and L. p. andersonii* (Bhupathy *et al.* 2014). We focused our study on the subspecies *Lissemys punctata andersonii*; WLPA status: Schedule-I. IUCN status: low risk, near threatened (Hanfee, 1999). The Bengali name for the species is Til Kachim. This subspecies is morphologically different than the other two; it has an olive-green carapace and soft body parts, with yellow blotches and hieroglyphs on the carapace and head and neck (Smith, 1931, Webb, 1982). Freshwater turtles, such as the target species, perform a valuable service in the aquatic ecosystem as scavengers in the ponds, rivers and stagnant water and thus keep the aquatic systems free from pollution (Rao, 1985; Hossain and Sarker, 1993).

This study was undertaken to determine the habitat, food preferences, feeding behavior, and breeding behavior of the Indian flapshell turtle, *L. p. andersonii,* along a subsection of the Saraswati and Kananadi river banks in the Hooghly district, West Bengal. Both rivers are shallow in depth (≤4 m) and provide lots of vegetation cover.

## MATERIALS & METHODS

**Figure 1.** Body details of *Lissemys punctate andersonii*

During the study period July 2015 – July 2017, we observed feeding behavior, food preference, and made observations on the preferred breeding and nesting habitats of *L. p. andersonii.*

According to The Wildlife Protection Act, 1972 of India, this species is under Schedule-I; removal from the wild, harming or killing this species is a punishable offence. No turtles were observed in captivity and gut content analysis and gonadal development analysis via dissections were prohibited. All research was conducted by visual observations in situ.

During the study period, we visited our study sites in the early morning and afternoon, when this species could be spotted more easily while basking. If individuals were observed in other time periods, we visually monitored their activities and recorded habitat preferences and behaviours. Most nests we found on or very near to agriculture fields. Nests were found by local farmers and villagers and the locations were forwarded to us. We collected data about nest and clutch, including nest temperature and humidity, and conducted daily monitoring.

Ecological study in captivity: We selected two locations for captive study: Chandannagar Rabindra Bhavan, which housed turtles kept in a concrete fountain tank (Subhro Niyogi, 2009) and Jain Swetamber Dadaji's Temple and Garden, Kolkata, where some turtles are kept in the artificial ponds.

Ecological study in nature: Geographically the natural study region is located at the Hooghly district of West Bengal. The area is situated in between Latitude and longitude 22.8859° N, 88.3919° E to 22.9662° N, 88.0650° E. For the study we mainly selected the banks of the Saraswati River and the Kananadi river in Hooghly district. Both rivers are shallow in depth (≤4 m), and are vegetation rich. We also studied in local swamps, ponds, agriculture fields and gardens.

## DISCUSSION

Habitat: In this study we found that Indian flapshell turtle *L. p. andersonii* preferred different types of habitat across their life cycles. They occur in a variety of aquatic habitats, ranging from rivers and streams to reservoirs, marshes, ponds and lakes. We found this species lived under aquatic weeds, floating and semi-submerged vegetation and paddy fields. This turtle has the ability to adapt to a variety of environmental conditions including puddles, drainage ditches and polluted, water-retaining areas. Generally, they prefer to stay at the bottom level of water bodies, but intermittently browse on the surface of the water near the bank. At night they migrate between aquatic habitats, across land, in search of food or mating partner. Bennett *et. al* (1970) stated that this species travel overland during summer in search of suitable aestivation sites when water bodies are dried up. In the dry

**Figure 2.** *Lissemys punctate andersonii* on its terrestrial habitat

season (December- May) the turtle was found in burrowing condition in moist, dry soil (but avoided sticky, damp soil).

Basking Behavior: In this study we found that *L. p. andersonii* basked for a period of time every day. Generally we found this occurred most frequently in the early morning and afternoon, but will also bask midday following period of cloudy weather. Turtles were found basking on submerged logs, sand bars on the bank of water bodies, rocky surface near water bodies and also concrete staircases of the domestic ponds. We conclude that L. *p. andersonii* use four different types of habitat: 1. Aquatic habitat 2. Basking habitat 3. Browsing habitat and 4. Burrowing habitat.

Feeding Behavior: Turtle species are important in the control of larval and adult stages of aquatic insects, aquatic vertebrates, trash fish (low economic value fish), mollusk, other detritus and beneficial organisms (Fugler, 1984). As per previous studies, the Indian flapshell turtle *Lissemys punctata* is carnivorous in nature (Auffenberg, 1981; Vijaya, 1981; Hossain and Sarker, 1993). However, in our study we found that *L. p. andersonii* is an opportunistic omnivore. The turtle was found browsing in the bottom layer of the shallow water bodies and extending its neck in search of prey. We observed in our study that *L. p. andersonii* consumed adult frogs, tadpoles, fish, crustaceans, mollusks, earthworms, insects, water plants, carrion and fragments thereof. In our captive study region, the turtles were fed rice, bread, biscuit, sweets and flowers thrown by the visitors.

Breeding Behavior: The reproductive cycle of *L. punctata* differs according to geographic region and it seems that it is closely correlated with monsoon seasons and heavy rains (Gramentz, 2011). In our study, we found that *L. p. andersonii* mate from May to July. Their mating is aquatic; males swim circularly around the female while also extending his head and limbs and bobbing its head. We occasionally observed the males gently bite or stroke on the anterior edge of the female's carapace. The females would reciprocate by bobbing her head in return.

In this study, we observed that *L. p. andersonii* build their nests from June to August. Generally, the female turtles made their nests in moist sandy soil by digging with their sharp claws and neck. They selected the riverbanks (20-25m higher than the water line) for their nesting sites. During our study period, we found five nests made in September. The nests were positioned entirely on the sandy riverbank; the hatchlings emerged in May after an incubation period of approximately 235-250 days. The average clutch size was 12-17 eggs. One of the five clutches was rescued from poachers and reburied in the nest but, unfortunately, no hatchlings were born. We suspect the eggs were internally damaged due to change of axis.

## CONCLUSION

According to the Wildlife Protection Act, 1972 of India, *L. p. andersonii* is under Schedule-I. IUCN status: low risk, near threatened. However, this species is still very much affected by illegal poaching and hunting. Turtles are consumed by some people as a source of protein and as a delicacy (Rao, 1986). Still now, in many markets of India, turtle is covertly sold as food. In market a kilogram of turtle meat can be sold for a minimum of $6.24 USD (400 INR). In addition, this species is threatened by various types of pollution and urbanisation creating

pressure on the species; through habitat loss, nest destruction through unethical human activities, people illegally occupying bank of rivers and streams for agriculture purpose and the bleaching of the water bodies to increase fish production. In conclusion, the freshwater turtle population is declining due to over-exploitation, habitat destruction and from hunting for their consumption as food. This study is a small step towards the conservation of this species by helping develop our understanding of their behavior and ecology.

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# Fowl Play: A Failed Predation Attempt of an Adult Turkey *Meleagris gallopavo* (Linneaus, 1758) (Chordata; Phasianidae) by *Boa imperator* (Daudin, 1803) (Squamata; Boidae) in Cayo District, Belize.

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## INTRODUCTION

The Mesoamerican boa constrictor (*Boa imperator;* Daudin, 1803) is a distinct species occurring from Northern Mexico to north-eastern South America (Hynková *et al*. 2009), native to ten countries including Belize and all of Central America (Montgomery & da Cunha, 2018). Numerous subspecies populations are recognised within this range (reviewed by Reynolds and Henderson, 2018), regarding substantial variance in colouration, morphology (maximum size) and behaviour (especially in island populations – see Reed *et al*. 2007). *Boa imperator* occupies a diverse range of habitats up to 1500m asl (Savage, 2002). Throughout the lowlands of Central America, *B. imperator* is often the largest and most common snake you could encounter; females are longer and heavier than males, generally growing up to 3 meters' total length (Reed and Rodda, 2009). Owing to the popularity of this species in the exotic pet trade, comprehensive information is available on their natural history and behaviour.

The diet of Boa Constrictors is known to be extremely diverse; consisting of almost any animal they can successfully overpower, kill and swallow; exclusively vertebrates, which includes both volant and non-volant mammals, lizards, frogs and birds (Solórzano, 2004; Reed & Rodda, 2009). Primarily these snakes are generalist 'sit and wait' predators, which rely on camouflage to ambush unsuspecting prey which passes by in strike vicinity. A study by Boback (2005) stated that "of 54 diet items reported in the literature for mainland Boas (Greene, 1983; Smith, 1994; Sironi *et al*., 2000), only 18% (10) were birds". Despite birds (mainly passerines) being a widely documented prey source of Boidae (Pizzatto *et al*. 2009), in-situ observations remain relatively rare (Pavón-Vazquez *et al*. 2016). The following note documents an aborted predation attempt of an adult domestic turkey (*Meleagris gallopavo;* Linneaus, 1758) by *B. imperator,* and discusses the potential implications of livestock predation on the human-snake conflict in Belize.

## OBSERVATION

On 24 August 2018 at ca. 14:30, Lower Dover Field Station & Jungle Lodge, Unitedville, Cayo District, Belize (while opportunistically documenting herpetofauna i.e. Brown, 2018); a large *B. imperator* (ca. total length > 2.5 meter) was encountered attempting to prey on an adult turkey (*M. gallopavo*) in the forest outskirts surrounding the property. While the exact time of capture is unknown, a struggle had been persisting for some time, as both animals seemed exhausted and were bearing injuries consistent with a lengthy skirmish. The adult male turkey lay restrained and incapacitated,

**Figure 1**. Taken at the time of encounter; this photograph depicts the unsuccessful predation attempt of an adult male Turkey (*Meleagris gallopavo)* by a large female *Boa imperator.* © Tom W. Brown

bleeding from bite marks on the legs and unable to free itself from the coils of the snake firmly round the underneath of the wing and its body. The snake (presumably a female owing to its great size and relatively small tail) had also sustained wounds, i.e. broken skin to the top of the head and body; undoubtedly a result of the turkey pecking and clawing in its attempts to be freed. Less than 1 minute after my arrival, the snake began to release and abandon the catch; likely triggered by my approach and presence in the vicinity. Whether or not the snake would have continued to constrict/kill its prey in the absence of an observer, remains unknown; though it is assumed the snake would have naturally arrived at the conclusion to abandon the catch owing the turkeys size.

Wild/domestic turkeys (*M. gallopavo*) are the heaviest of all the Galliforme family, with adult males having a body size from 3.6-3.8ft, wingspan of 4.2 – 4.8ft and weight from 5.5 – 18.8lbs (Dunning, 2008). Additionally, adult male turkeys are known to be especially aggressive in self-defence, capable of fending off predators using their beaks, large bodies/ wings and spurs on the back legs as weapons. While Boa Constrictors are certainly capable of succumbing larger prey (Reed & Rodda, 2009), in this instance, it appears the capture circumstance, large size and continued tenacity of the turkey proved too ambitious. Upon

abandonment, the snake was captured and relocated immediately ca. 150m into the forest, sufficiently away from potential future conflict with humans and domestic livestock. After an initial period of shock, the turkey returned to full health and showed no prolonged ill-effect from its encounter (besides being wary of the forest edges thereon).

## DISCUSSION

The conflict between humans and snakes is an ever growing problem worldwide (Shine & Fitzgerald, 1996; Longkumer *et al* 2016); an issue which continues to surge with on-going encroachment and overlap of urban agricultural lands with natural habitats. Intensive agriculture and urbanisation often results in the rapid decline of local snake populations (especially larger species - see Dodd, 1993). Primarily, the conflict between humans and snakes is driven by concerns for 'human safety in work and living environments' and economic interests such as reducing hunting pressures on domestic livestock (Nonga & Haruna, 2015; Chippaux, 2017). However, despite considerable evidence demonstrating that snakes in urban and agricultural environments actually provide significant economic benefits and services to local people (Cann 1986; e.g. snakes effectively control rodent populations which can be otherwise detrimental to crops/livestock and infrastructure); throughout Central America (and indeed globally), it is still common practice for snakes (as an entire group) to be targeted and 'killed on sight' by humans, usually with a complete disregard to differentiating between a beneficial species or those which pose an actual risk to human life (pers.observ.). Miranda *et al* (2016) reviewed the conflicts between humans and large constrictors (Anacondas), suggesting that most snake killings were not economic or evidence based retaliations, but considered preventative by humans who perceive the snakes as life-threatening. Likewise, despite being harmless to humans, the large size of *B. imperator* generates the same fear and receives a similar level of persecution in Central America.

While reviewing the diet of some Belizean snakes, Platt *et al*. (2016) reported numerous birds as prey items for *B. imperator* in Belize, as well as four separate records of successful predation on domestic fowl, including chicken, quails and ducks. Observations reporting domestic fowl/livestock in the diet of snakes are considered valuable, as they not only illustrate a snake's opportunistic predatory nature, but importantly they highlight the frequency of human-snake interactions and a chief motive for current conflict or retaliation. To the best of my knowledge, this is the first example of a predation attempt on a domestic adult turkey (*M. gallopavo*) in Belize and throughout *B. imperator's* wider range. With hope, it is intended that this publication will help spread and encourage a wider tolerance, understanding and appreciation for snakes inadvertently sharing their habitats with humans.

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# Ingestion of a Discarded Foam Ear Plug by a Wild Lesser Black Whip Snake (*Demansia vestigiata;* De Vis, 1884*)* in Central Province, Papua New Guinea

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The lesser black whip snake, *Demansia vestigiata* (De Vis, 1884) is a small (<1.2m) member of the elapid family, native to Australia (Western Australia, Northern Territory and Queensland) and South-Eastern Papua New Guinea (Central Province, Western Province and National Capital District). This fast-moving diurnal species of snake is common in lowland areas of dry open grassland, heath and woodland, and can frequently be encountered in and around human settlements. It typically feeds on lizards and frogs. Bites from the lesser black whip snake can result in localised pain and swelling, though serious envenomation is considered unlikely (O'shea 1996). Here I report an unusual case of the ingestion of a discarded foam ear plug by *D.vestigiata* in Central Province, Papua New Guinea.

**Figure 1.** Adult male *Demasia vestigiata* showing injuries caused by grass cutting machinery

On 26th July 2018 at 15:40 h I was called out to collect an adult male lesser black whip snake (SVL 755 mm, TL 1022 mm, weight 76 g) that had been injured by a local grass cutter working along a road verge within the vicinity of Lea Lea, Central Province, Papua New Guinea. The surrounding habitats consisted of open grassland, isolated pandanus groves and saltmarsh, interspersed with several blocks of commercial warehouse buildings. The snake was retrieved from within a small patch of vegetation on a road verge where it had taken refuge after being struck by grass cutting machinery, and was situated approximately two metres from the road edge. Injury to the head of the snake was visible along with a large open laceration on its flank (Figure 1). Despite being alive at the time of capture, the individual died shortly after being brought back to our facility. A dissection of the deceased snake revealed that it had consumed a discarded foam ear plug measuring 32 mm (Figure 2). No evidence of prey was found amongst the stomach contents.

Although in this instance it can be determined that death was the result of extensive injuries sustained from grass cutting machinery, the ingestion of discarded waste products is known to cause mortality in snakes (Strine *et al.* 2014). Disposable foam ear plugs are frequently used for hearing protection by local contractors and workers, and various other forms of waste pollution is a common sight around local habitats. The unusual case

**Figure 2.** The discarded foam ear plug retrieved from the stomach of the adult male *Demansia vestigiata*

reported here highlights the importance of proper disposal of all waste products following use in order to prevent potential harm to wildlife, including snakes.

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# Book review – King Cobra: Natural History and Captive Management

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*King Cobra: Natural History and Captive Management.* Tom Charlton (2018). Natural History Publications (Borneo), A913, 9th Floor, Wisma Merdeka Phase 1, PO Box 15566, 88864 Kota Kinabalu, Sabah, Malaysia. 151 pp. ISBN 978-983-812-183-5. UK £35.00 (hardback).

Among snakes, the king cobra (*Ophiophagus hannah*) is in a class by itself in many ways. It is the longest venomous snake in the world; it is the only species in its genus (barring any new species identification from future taxonomical work); and it is the only snake known to build a nest for its eggs. It preys almost exclusively on other snakes: even other venomous species are fair game. Within its range, it is greatly feared for its size and venom, rather unfairly as it causes far fewer human fatalities than many of its elapid cousins. Such a unique and fascinating species thoroughly deserves a book to itself, and British herpetologist and photographer Tom Charlton has provided an excellent example.

As indicated by the title, the book is split into two main parts. The first explores the king cobra's natural history, covering its original scientific description, distinguishing features, distribution, behaviour, and of course, its uneasy relationship with humans and the research being done to conserve it. In the second part, Charlton applies his extensive experience to describe how best to manage this species in captivity, including proper housing and handling, captive breeding, and how a king cobra may be gradually persuaded to eat rodents rather than more expensive and less easily obtained feeder snakes.

It is difficult to think of any detail regarding king cobras that Charlton overlooks. The first part delves into such information as how to distinguish a king from similar Asiatic species, what species it is known to feed upon, how geography impacts its distribution, the effects and treatment of a bite, and whether the existence of the largest recorded individual – allegedly owned by London Zoo in the late 1930s – can be verified. Wherever possible, there is plenty of precision in the facts presented, down to the typical size of a nest. The book also makes note of where solid information is currently lacking, particularly with regards to young king cobras, which are especially elusive.

The opening of the second part makes it clear that a reptile keeper looking to own a king cobra should already have several years' worth of experience with venomous snakes. However, the author still maintains the same level of detail in explaining what he considers to be best practice, presenting information so that every facet is considered and any reader can understand, whilst also highlighting the challenges involved, and that personal safety and the wellbeing of the animal are priority. Charlton also takes care to note that "opinions…vary from keeper to keeper, and a balanced viewpoint should be considered at all times."

Charlton writes in a straightforward style that is easy to follow, and illustrates the book with a wide range of clear and relevant photographs. Most of the points made in the text have at least one excellent accompanying photograph to visually demonstrate them to the reader. This aids in fully appreciating both parts of the book: the variability and complexity of the king cobra's morphology, habitat and behaviour in the first part, and of its captive management in the second.

In conclusion, *King Cobra: Natural History and Captive Management* is a book to be recommended to anyone with an interest in snakes; even those who are not currently intending to keep a king cobra will still gain a full appreciation of this exceptional animal.