

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



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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/dyscolouration 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/dyscolouration of the upper left jaw – as reported pre-mortem by the owner (Fig. 2) – was observed during dissection, so remains unexplained. The pre-mortem 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 pre-mortem (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 pre-mortem, as seems to be an issue

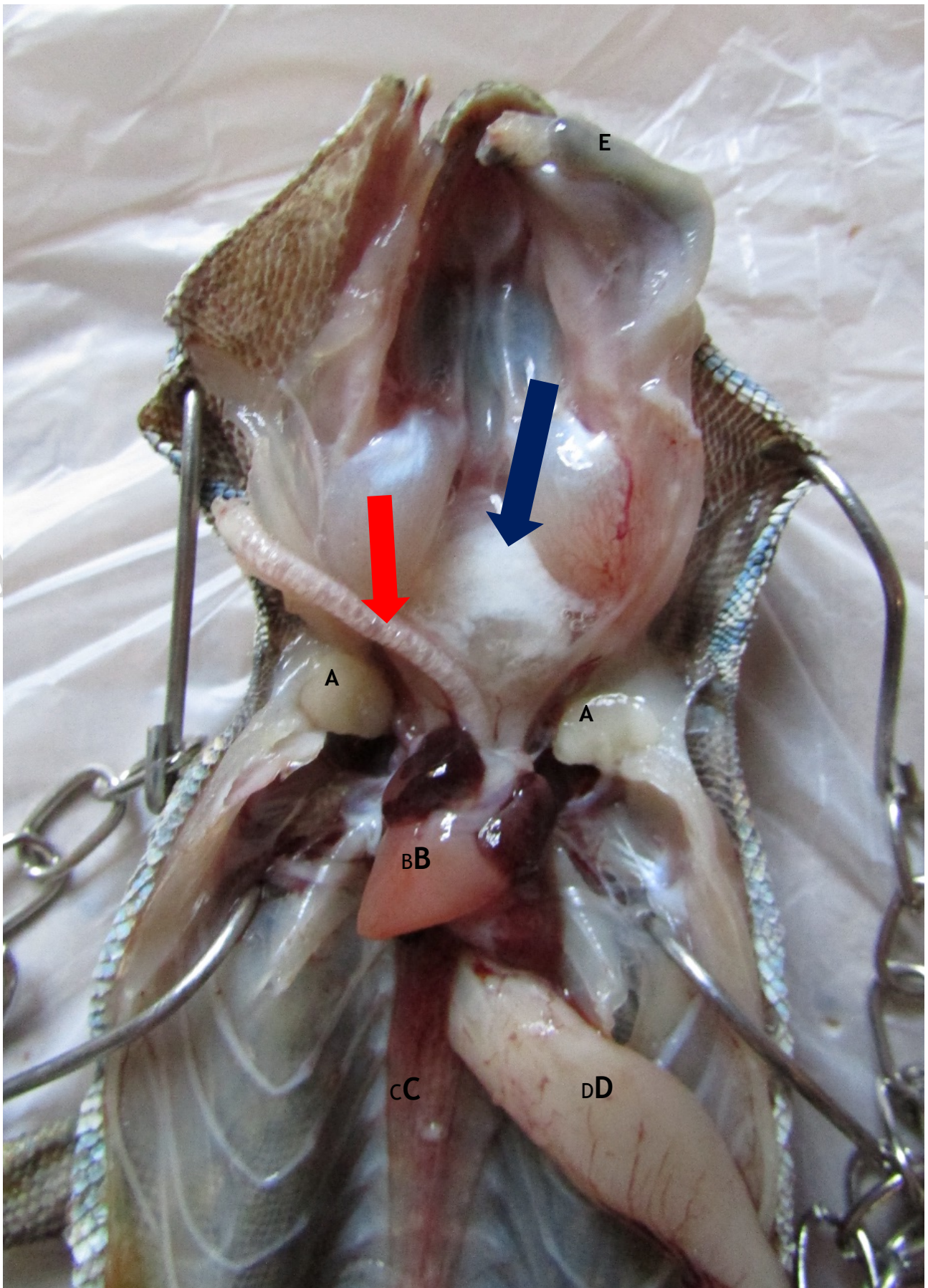


Figure 3. Dissected head and anterior abdominal cavity of *G. grandis*. Large amount of thick, clear-white fluid in oral cavity (blue arrow). Note bubbles of fluid in the trachea (red arrow), which was moved to the side for this image. A = thyroid/parathyroid glands; B = heart; C = lungs; D = stomach;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

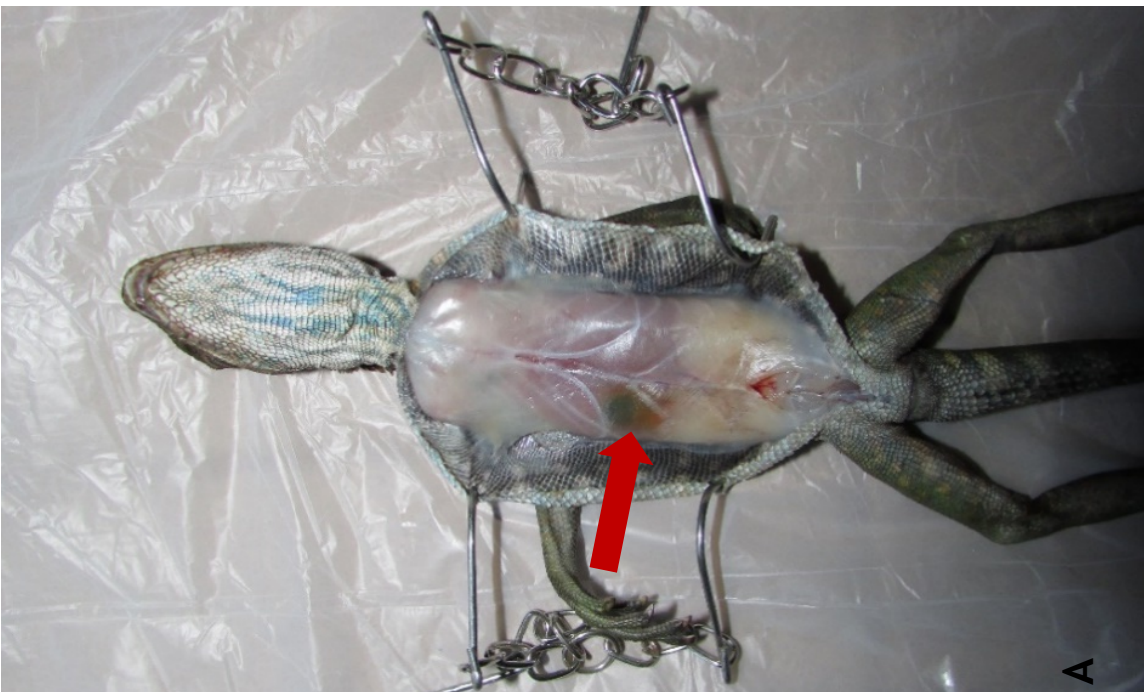


Figure 4. Initial dissection of *G. grandis*. Bile imbibition observed (red arrows) before abdominal cavity is opened (A) and visible on the liver (1) after abdominal cavity exposed (B). Note the 3-chambered heart (2) where two atria (dark) sit anterior to the ventricle (pale).

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

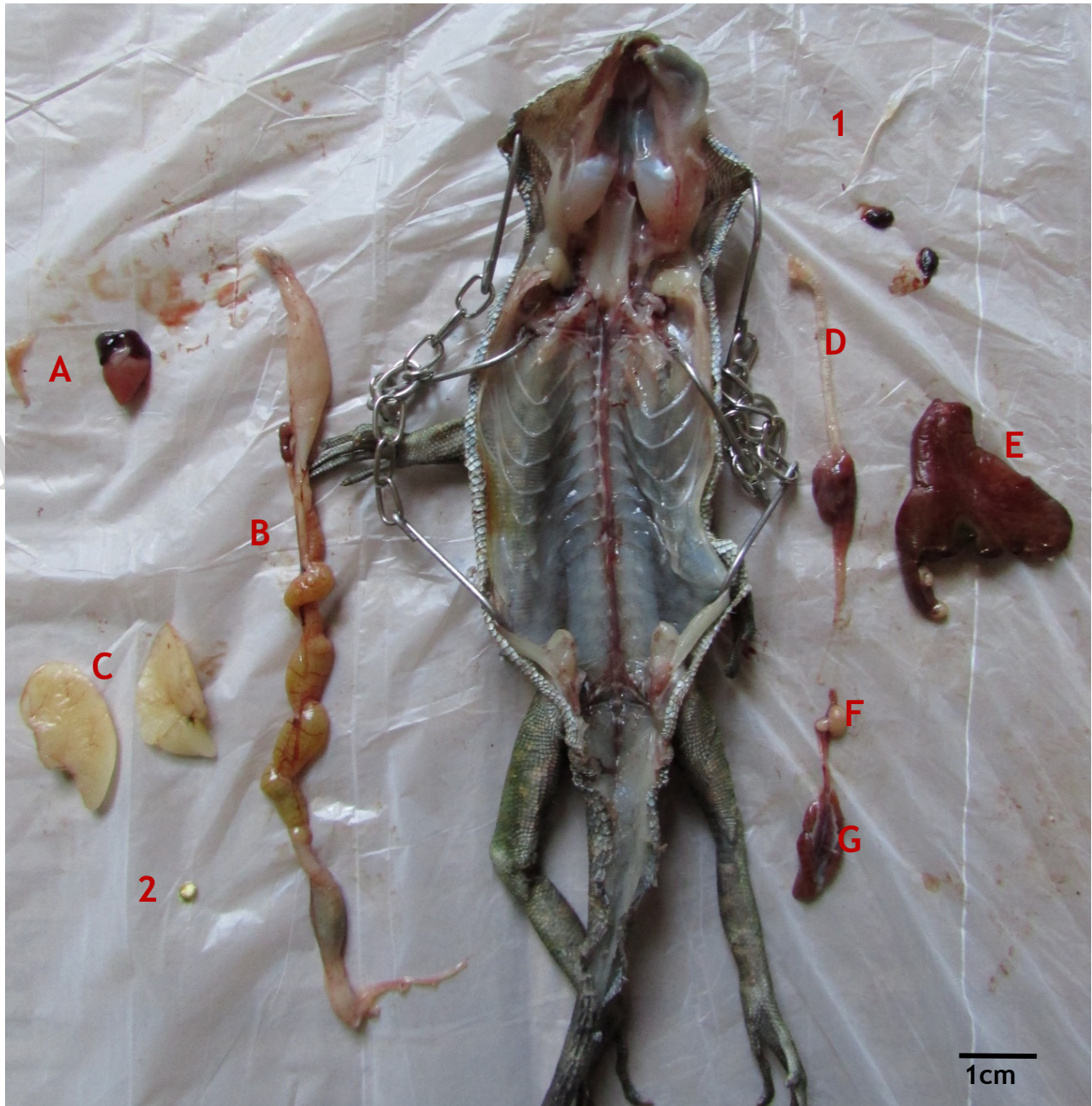


Figure 5. Internal organs and body cavity of *G. grandis* lizard during dissection. A = heart; B = digestive tract; C = abdominal fatty deposits; D = respiratory tract; E = liver; F = gonads; G = kidneys; 1 = hyoid apparatus; 2 = urate removed from rectum.

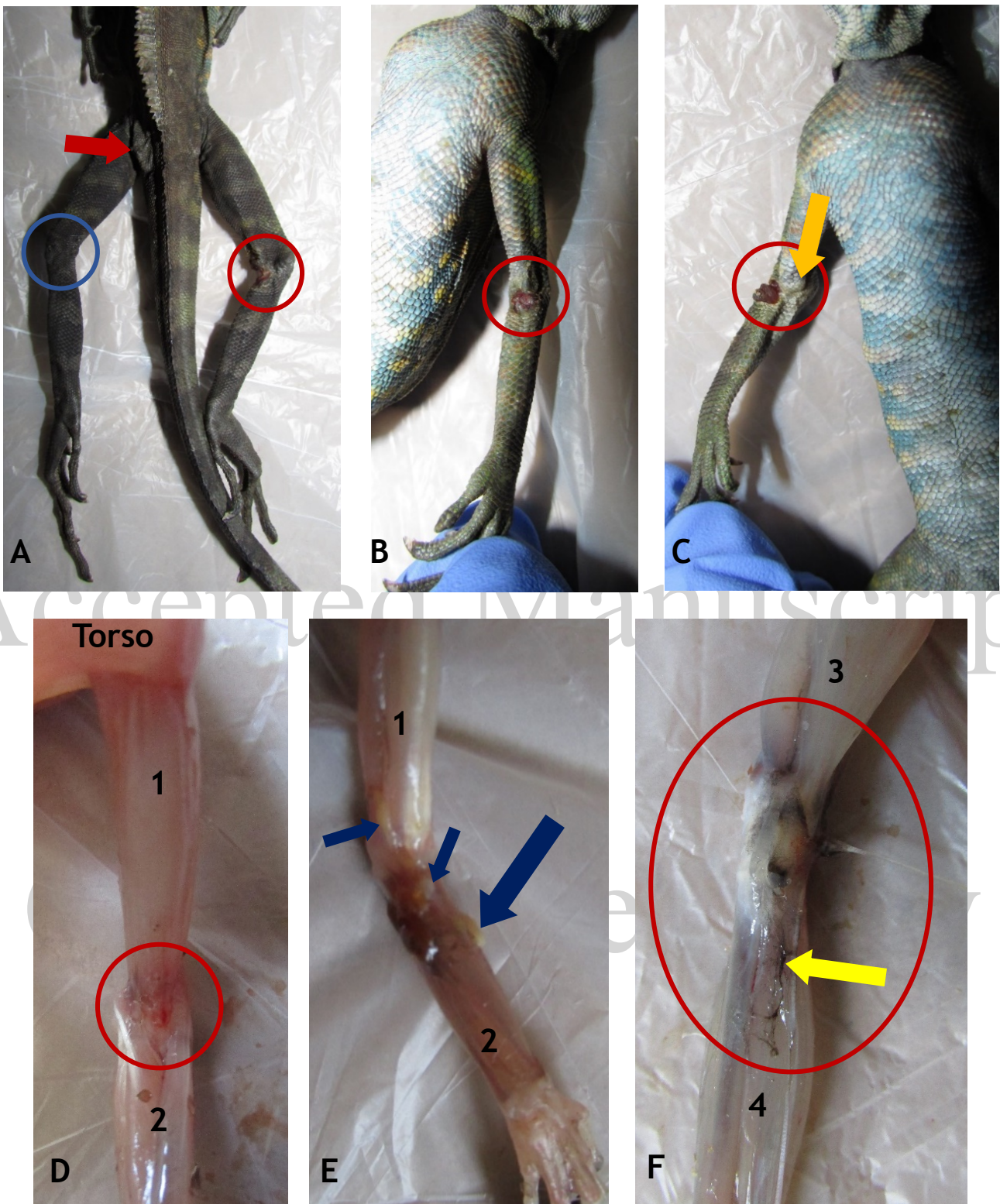


Figure 7. External examination (A-C) and skinned (D-F) limbs of deceased *G. grandis*. **A:** Dorsal posterior profile, showing wound between upper and lower right hindlimb (red circle). Left hindlimb showed no similar wounding (blue circle). A small wound noted at the top of the left hip bone (red arrow). **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 discoloration (not shown).

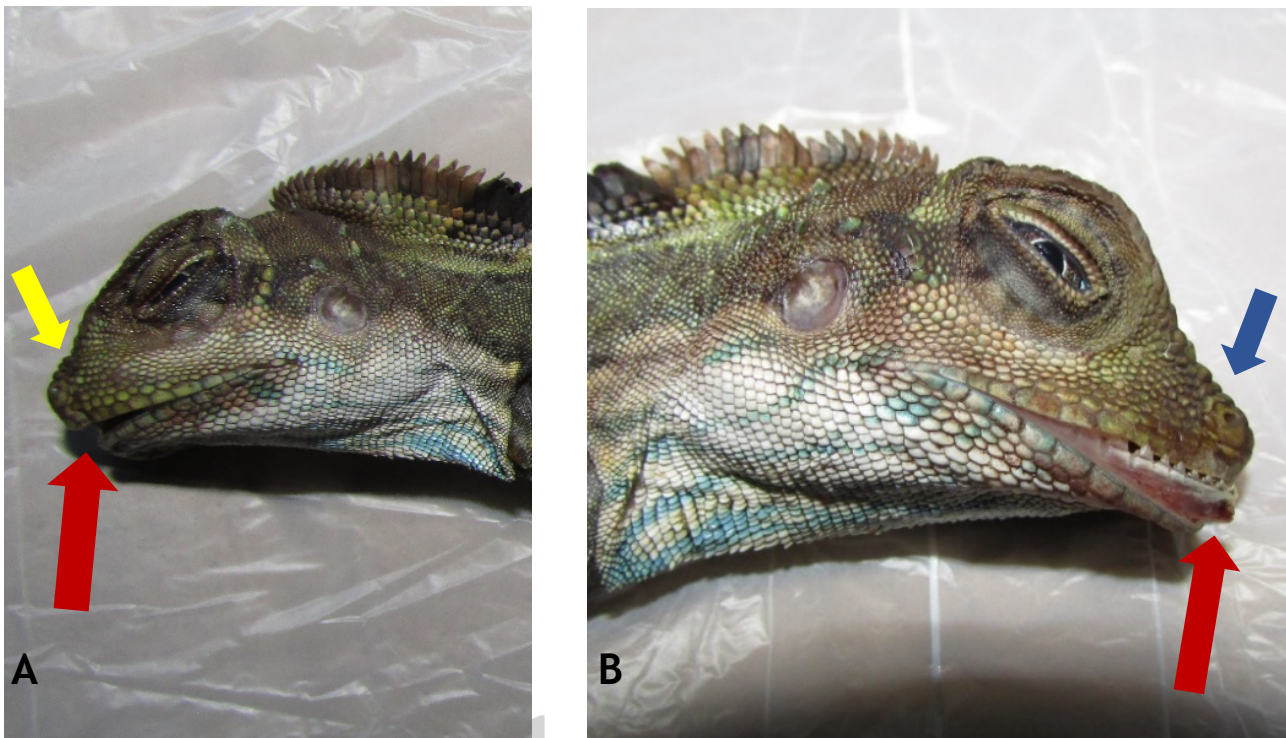


Figure 6. Deceased *G. grandis*, prior to dissection. **A:** Left side of mouth does not close (red arrow) due to malocclusion of left mandible and protrusion of right mandible (B). Note truncated (“squashed”) appearance of left side of nose (yellow arrow). **B:** Right head profile showing detached 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 and subdermal 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.

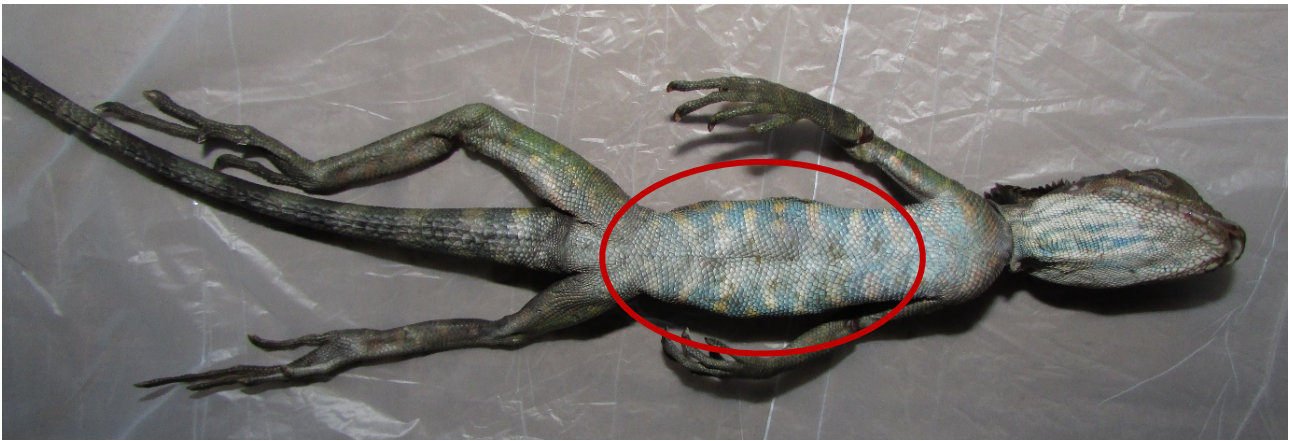


Figure 8. Ventral profile of *G. grandis*, showing numerous patches of browned scales on abdomen (circled). Some minor areas also noted on the chin (not highlighted here) but limbs, tail and dorsal sides seemed unaffected.

Acknowledgements

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