Observations of aquatic behaviour in Malagasy ground boas *Acrantophis madagascariensis* (Duméril & Bibron, 1844) and *A. dumerili* Jan, 1860

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Madagascar possesses a diverse snake fauna comprising over 90 species in four families (Jenkins et al. 2014; Nagy et al. 2015). However, while recent years have seen the description of several new taxa (e.g. Vieites et al. 2010; Glaw et al. 2013) and important advances in our understandings of snake systematics (e.g. Nagy et al. 2012, 2015), our knowledge of Malagasy snake ecology and behaviour remains patchy, and entirely lacking for many species (Rosa et al. 2016). This is the case even for charismatic, widespread and economically important species such as the boas, family Boidae (Vences & Glaw 2003).

Madagascar's boas consist of three or four species in two genera, *Acrantophis* (ground boas) and *Sanzinia* (tree boas) (Raxworthy 2003; Vences & Glaw 2003; Reynolds et al. 2014). Both species of ground boa are widespread, with the Madagascar ground boa (*Acrantophis madagascariensis*) occurring through much of northern Madagascar and Dumeril's ground boa (*A. dumerili*) restricted to southern regions (Vences & Glaw 2003). Both species occur in a range of forest and open habitats and share similarities in known behaviour and diet: they are ground-dwelling and active nocturnally and diurnally (Raxworthy 2003), and predate mammals including rodents, tenrecs and lemurs (Brygoo 1982; Sommer 2000; Goodman 2003; Gardner et al. 2015). *Acrantophis madagascariensis* also takes birds in captivity (Branch & Erasmus 1976). Here, we present the first observations of aquatic behaviour in both *Acrantophis* species, providing further insights into their behaviour and ecology.

On 29th December 2013 CJG and LDJ visited Grotte Mitoho (24°02'51"S, 43°45'13"E), a shallow cave on the western edge of the limestone Mahafaly Plateau in Tsimanampesotse National Park (southwest Madagascar). The cave is permanently flooded, and one of the few areas in the region where freshwater is available (Goodman and Jungers 2014): as a result it is regularly visited by ring-tailed lemurs *Lemur catta* (Sauther et al. 2013) and birds such as Madagascar turtle dove *Nesoenas picturata* (CJG and LDJ pers. obs.) that come to drink at the water's edge. National Park guides also state that the cave is permanently inhabited by an adult *Acrantophis dumerili* (Francisco pers. comm., Julien Anselme pers. comm.). At 06.38 we entered the cave and found the boa lying in the open along the water's edge, with most of its body submerged (Fig. 1). We left after a few minutes but returned at 16.53 to find that the snake had moved along the water's edge and was now almost fully submerged, and hidden behind the submerged roots of a fig tree, with only the nostrils and top of the head above water. We accidentally disturbed the snake as we approached, at which point it withdrew its head

underwater and behind the roots, so that it was completely submerged. We did not wait for it to re-emerge.

[Figure 1]

On 21st July 2014 NM and CE were conducting a herpetological survey in the vicinity of Lake Matsedroy (15°29'18"S, 46°38'57"E), a permanent lake approximately 5 ha in area (though highly variable in size seasonally), which is part of the Matsedroy forest fragment of Mariarano Classified Forest (northwest Madagascar). At approximately 20:00 (about 2.5 hours after sunset) we encountered an adult *A. madagascariensis* stationary in the water, less than 0.5 m from the lake edge (Fig. 2). The snake was fully submerged apart from the head. The boa was captured and measured before being released at the same location: it measured 1.7 m in length and weighed 2.5 kg, and was noticeably thin.

[Figure 2]

Few Malagasy snakes are known to forage in or otherwise use aquatic habitats: *Liopholidophis sexlineatus* is semiaquatic and *Thamnosophis lateralis* is often found in water (Cadle 2003; Glaw & Vences 2007), while *Madagascarophis meridionalis* appears to hunt aquatic frogs in streams of Isalo National Park (Rosa et al. 2016). However, although *Acrantophis madagascariensis* frequently occurs near rivers and streams (Raxworthy 2003), we are not aware of any published observations of aquatic behaviour in Malagasy boas (C. Raxworthy pers. comm., F. Glaw pers. comm.). C. Raxworthy (pers. comm.) has observed *A. dumerili* crossing a shallow stream, but in both the cases that we report here the boas were stationary in non-flowing bodies of water. Since they were not traversing the water bodies, the animals may have been submerged either for thermoregulation or foraging purposes. However, we do not believe that thermoregulation is a likely explanation due to the different thermal conditions in which the two observations were made: the *A. dumerili* was observed during the day in the hot season (though in a cave significantly cooler than the surrounding landscape), while the *A. madagascariensis* was observed at night in mid-winter.

Little is known about the foraging mode of Malagasy ground boas but, unlike many aquatic snakes which actively hunt prey such as fish and amphibians (e.g. Bilcke et al. 2006), the boas we observed were stationary. We therefore believe that they were engaged in ‘sit-and-wait’

ambush predation. Ambush predators select microhabitats in order to maximise encounters with prey (Eskew et al. 2009), and in this respect it is notable that both observations were made in semi-arid areas lacking abundant surface water: in such contexts, diverse animal species may visit watercourses to drink and thus occur at higher densities than in the surrounding landscape, increasing the probability of prey encounters. Since both water bodies lacked surrounding vegetation, lying within the water may have offered the snakes the only opportunities to conceal themselves from potential prey animals.

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Figures

Fig.1A Dumeril's ground boa, *Acrantophis dumerili*, lying partially submerged at the edge of a pool in Grotte Mitoho, Tsimanampesotse National Park, southwest Madagascar. The snake is submerged from just behind the head. 1B Wider view of Grotte Mitoho (boa not present). Photos: Louise Jasper.

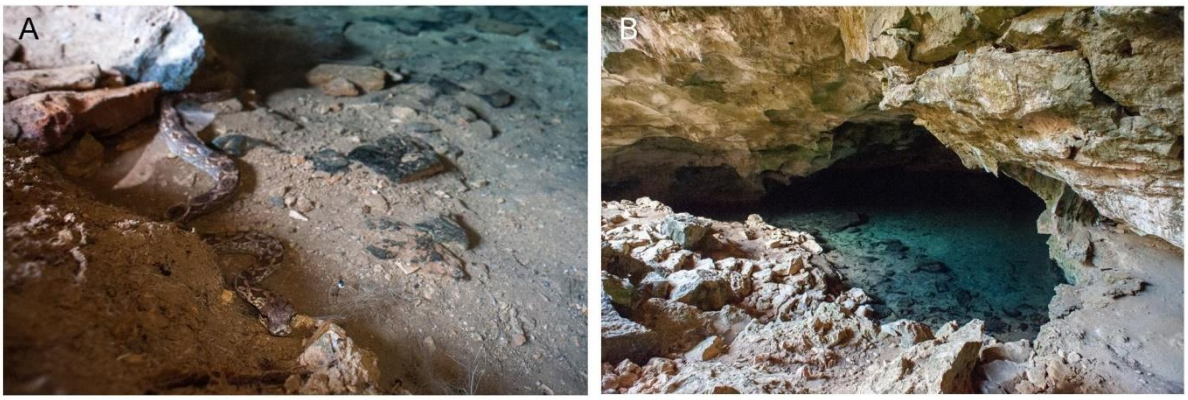

Fig.2A Madagascar ground boa *Acrantophis madagascariensis* submerged at the edge of Lake Matsedroy, northwest Madagascar. 2B Wider view of Lake Matsedroy. Photos: Naidi McDonnell.