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RUFULUS (LICHTENSTEIN, 1823)**

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Observations of Possible Cooperative Foraging Behaviour by the Brown Water Snake, *Lycodonomorphus rufulus* (Lichtenstein, 1823)

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Abstract

Snakes are usually solitary animals except when sheltering under cover, during male-to-male combat, mating and where species use communal dens for hibernation. The usual predation methods used are discussed including a case of cooperative hunting. Observations of possible cases of cooperative foraging by the South African Brown Water Snake, *Lycodonomorphus rufulus* (Lichtenstein, 1823), are provided along with a suggested explanation of the advantages of such cooperation.

Key words

Brown Water Snakes, *Lycodonomorphus rufulus*, Hyperoliidae, reed frogs, possible cooperative foraging.

Introduction

In the words of Henry Disney (1993) “*Central to my experience is a conviction that field data are of inescapable importance, if a taxonomist is to correctly interpret data derived from the study of preserved specimens in the laboratory or museum.*” I believe that his words are equally valid for all zoologists, such as those studying behaviour of living specimens. Observations of feeding behaviour of snakes reveals two basic patterns described respectively by Schoener (1971) as 'active foraging' and 'sit and wait foraging'. This latter behaviour is also described as 'ambush hunting' (Mushinsky, 1987) and may be coupled with tail luring of anuran or lizard prey in some species e.g. *Agkistrodon* spp., *Bothrops bilineatus* (Wied-Neuwied, 1821), *Cerastes vipera* (Linnaeus, 1758) and *Bitis peringueyi* (Boulenger, 1888). The viper *Pseudocerastes urarachnoides* Bostanchi, Anderson, Kami & Papenfuss, 2006 uses tail luring to prey on birds (Fathinia, *et al*, 2009) while snakes of the genus *Thelotornis* slowly extend and retract their black tipped red tongues resulting in groups of birds mobbing the snake and perhaps becoming more vulnerable to predation (Goodman & Goodman, 1976). These behaviours are essentially solitary, as is most snake behaviour other than communal hibernation in some species. Active foraging consists of searching for prey in suitable locations. For example, the egg eating snakes *Dasypeltis* spp. search bird nests for eggs while other species may be observed actively investigating burrows, crevices and other suitable sites normally utilised by their prey.

Dinets (2017) provided the first report on cooperative hunting in snakes when he studied cooperative hunting of bats in cave passages by Cuban Boas *Chilabothrus angulifer* (Cocteau & Bibron, 1840).

Observations

During an investigation into the effects of pesticides on wildlife in sugar cane fields on the North Coast of KwaZulu-Natal, South Africa (Johnson, 1984 & 1987; Johnson & Raw, 1989), the late Philip Johnson and the writer, visited several wetlands (swamps and reedbeds) during the period February 1982 to June 1984 in order to collect

amphibians. Unfortunately Johnson (1984, localities 7, 8, 21 & 37) only recorded the first detection of a species at a locality and not subsequent detections at that locality. During these nocturnal expeditions we occasionally came across foraging snakes. On at least three, possibly four or more, of these occasions we found that, having encountered one active Brown Water Snake in reeds or other waterside vegetation, another snake of the same species was discovered in close proximity to the previous individual. On one occasion it was possible to capture both snakes without the capturer (LRGR) having to move his feet.

Similar observations have been made by others: Angelo J. Lambiris (pers. comm. 2023) wrote “*This reminds me of one or two occasions in Grahamstown, where I saw something probably rather like this, but thought no more of it - most likely just thinking it pure good luck to find two Lycodonomorphus rufulus in such very close proximity while they and I were engaged in hunting frogs!*”

Martin Pickersgill (pers. comm. 2023) commented “*About the Brown water snakes. Yes, now that you mention it I have often found them in relatively close proximity, although I never thought anything of it.*”

Tyrone J. Ping (pers. comm. 2022), when asked if he had made any similar observations of brown water snakes, confirmed that he had seen similar situations on more than one occasion, sometimes with both snakes on a single reed, and once, south of Port St Johns, he saw one eating a *Hyperolius* on a branch overhanging a pond with a smaller snake on the same branch. In some instances, one snake was actively hunting or feeding and the second snake was apparently lying in wait.

The Facebook group: **Predation Records - Reptiles and Frogs (Sub-Saharan Africa)** received a post from Soutpansberg Centre for Biodiversity and Conservation on 7 February 2018 as follows: “*Interesting sighting from last night. We found this Brown Water Snake (Lycodonomorphus rufulus) while it was constricting this Common River Frog (Amietia delalandii). While watching snake we heard a commotion and saw a second Water Snake snake actually catching and constricting another River Frog. I was impressed with the fierceness and power of this gentle snake species.*” (Fig. 1).



Figure 1. Brown water snake constricting river frog. Photograph by Melissa Petford.

Jeanne Tarrant, Manager of the Threatened Amphibian Programme at Endangered Wildlife Trust, in answer to an enquiry, stated “*Yes, I fairly often come across brown water snakes in wetland situations in the vicinity of reed frogs, and if I think about it, often more than one at the same time.*” Jeanne also provided a photograph by Nick Evans (Fig.2) of a one of these snakes swallowing a reed frog (*Hyperolius marmoratus*).



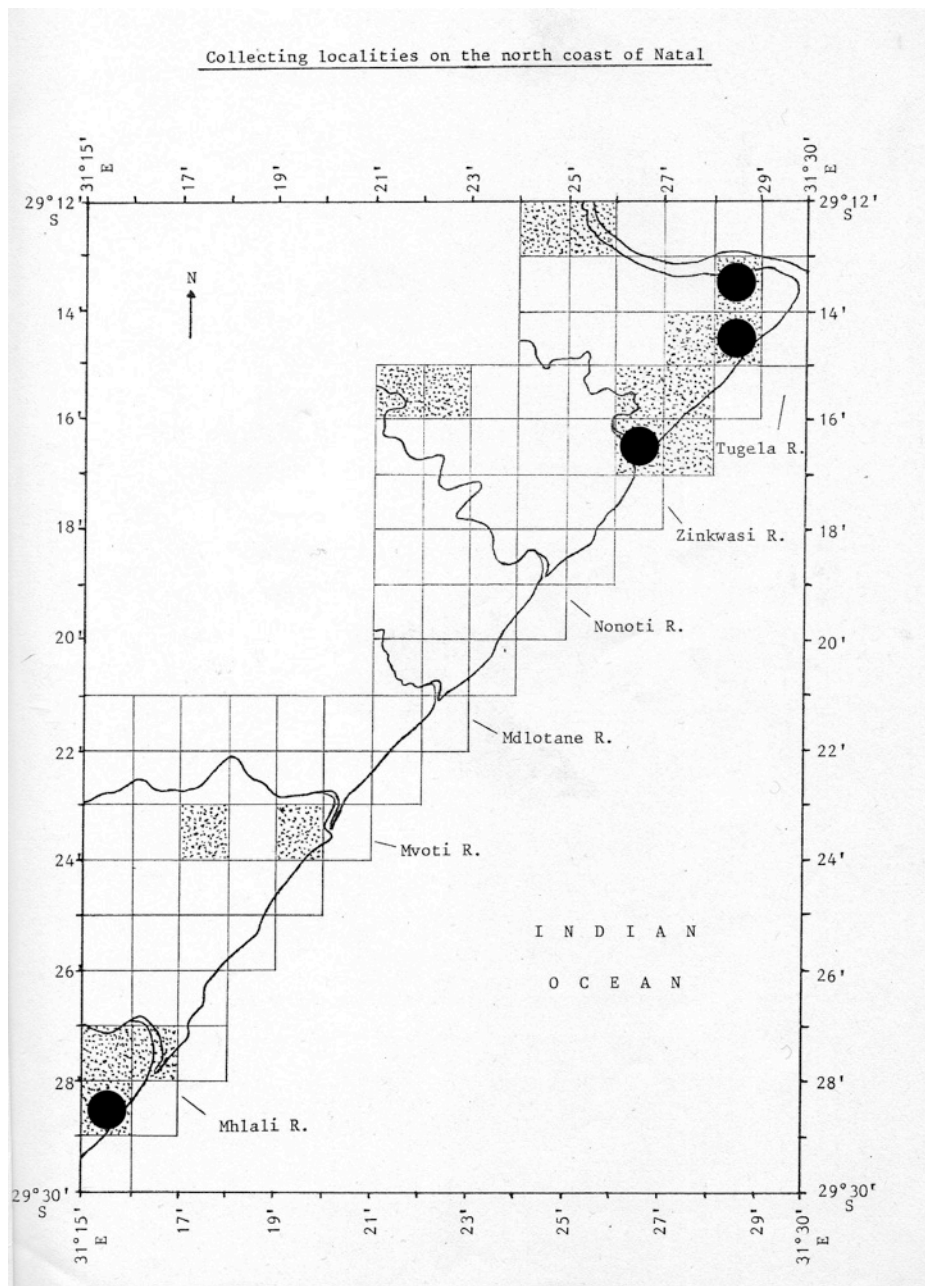
Figure 2. Brown water snake swallowing a marbled reed frog. Photograph by Nick Evans.

In response to my request on the Facebook group **Snakes of Southern Africa**, Craig Van Rensburg wrote “*Many moons ago (1980's) myself and Andrew Martin Holmboe would often walk, with flashlights at night, along a stream in Randburg area. We saw plenty of Brown Water Snakes...often in close proximity to each other.*” Others who responded (see acknowledgements) all reported finding multiple examples sheltering together under cover as would be normally expected when more than one snake is found together.

Discussion

At the time of the initial observations, all these snakes were actively foraging for their prey (reed frogs of the genera *Hyperolius* and *Afrixalus*). Since it is rare to find more than one snake at a time in the open, i.e., not sheltering together, these observations aroused some interest. Although one would expect that finding two or more snakes hunting together would be purely coincidental hunting in the same suitable site with abundant prey without further significance.

Reptiles and amphibians were recorded at 39 sites between Sheffield Beach in the south and the Tugela River in the north. Brown water snakes were not common and were only found at four sites: the Sheffield swamp forest, a wetland surrounded by sugar cane field north of the Zinkwazi River where most observations were made and two sites in the Hlogene Forest on the south bank of the Tugela River mouth (map 1). They were not found at other sites with reed frog populations.



Map. 1. Location of collection sites (stippled squares) and those where brown water snakes were found (black circles) (scanned from Johnson 1984, modified with black circles).

Based on observations of the behaviour of Hyperoliid reed frogs, it seemed to me that it was also possible that these snakes were taking advantage of each other's presence in order to increase their foraging success. Enquiries with others (as listed above), who are or were likely to visit appropriate sites at some time, have shown that this behaviour seems to be more common than expected.

Reed frogs tend to cling to the leaves or stems of reeds or sedges while calling at night. Should a potential predator, human or reptilian, be detected within "flight distance", the frog's usual response is to leap across to another leaf or stem or else to dive into the water. Immediately after landing it usually moves so that the leaf or stem lies between it and the potential predator. In the water it usually swims downward to seek shelter amongst underwater aquatic vegetation or debris.

Brown Water Snakes probably hunt by scent since, like most snakes, they are less likely to detect immobile prey visually than those that are actively moving (personal observations of captive snakes). Unlike rodents that leave a continuous trail of scent on the ground that is relatively easy for a snake to follow, the semi-arboreal leaping locomotion of reed frogs does not allow for easy tracking of their scent by snakes.

It seems that two snakes, climbing through the reeds in close proximity while searching for their prey, would enjoy a competitive advantage over a single snake in that any frog leaping to escape one of the snakes would attract the visual attention of both snakes. Since any lateral escape would have a 50% possibility of being towards the accompanying snake the chances of being captured would be much increased in these circumstances. Once visual contact has been established, the snakes are likely to find tracking their prey much easier and are able to pursue them with improved chances of successful capture. In the case of an escape leap towards the accompanying snake, the habit of the frog of moving to the back of the leaf or stem it lands on would ensure that it remained in sight of the second predator while being hidden from the first. Should it land within striking distance of the second snake there seems little doubt that it would immediately be taken.

It seems likely that the main advantage of cooperative hunting would be through escaping frogs jumping towards the second predator where they are more easily captured. In solitary hunting it is inevitable that the frogs will invariably leap away from the predator. Since both foraging snakes would be equally likely to disturb frogs both would also enjoy the advantages of having their prey jumping, literally, into their coils. While there can be no certainty at this stage that the snakes observed were actually cooperatively foraging, it certainly does seem a possibility that requires further investigation.

The observations noted here may be simply disregarded as opportunistic or coincidental however the possibility of cooperation should not be completely ignored in view of the frequency of independent observations.

While these observations are suggestive of possible cooperation rather than simply coincidence, this kind of hypothesis can only be scientifically tested in an experimental setting or by repeated long-term observations, perhaps an opportunity for those with suitable facilities.

Acknowledgements

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