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SHORT COMMUNICATION

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Diet of the Galam white-lipped frog *Amnirana galamensis* in southern Nigeria deduced from faecal samples

NIOKING AMADI[1], GODFREY C. AKANI[1], GIFTSON MINAPAKATE SOKARI[1], CHIKANKA FAVOUR WAKOHU[1], ALAWA GRACE NYIMALE[1], DANIELE DENDI[1,2,3] & LUCA LUISELLI[1,2,3*]

[1]Department of Animal and Environmental Biology, Rivers State University, Nkpolu-Oroworukwo Port Harcourt, Rivers State, Nigeria
[2]Institute for Development, Ecology, Conservation and Co-operation, via G. Tomasi di Lampedusa 33 - 00144 Rome, Italy
[3]Département de Zoologie et Biologie Animale, Faculté des Sciences, Université de Lomé, B.P. 1515, Lomé, Togo

[*]Corresponding author e-mails: l.luiselli@ideccngo.org; lucamaria.luiselli@uniroma3.it

Anurans are generalist foragers that feed not only on insects but also on a wide diversity of active invertebrates and vertebrates (e.g. Anderson et al., 1999; Hirschfeld & Rodel, 2011; Vignoli & Luiselli, 2012; Farina et al., 2023). Understanding the variability of their dietary habits across habitats and geographic regions is of natural history interest and of relevance to conservation. In the past, studies of anuran stomach contents have commonly entailed killing and dissecting many specimens (e.g. Onadeko, 2011; Jamdar & Shinde, 2013) but techniques can be used that are safer for the anurans and inexpensive for researchers, such as examination of faecal material or stomach flushing (Sole et al., 2005; Mahan & Johnson, 2007; Hirschfeld & Rodel, 2011). We report here an evaluation of the dietary composition of *Amnirana galamensis* (Fig. 1) in a forest-plantation area of southern Nigeria, using a harmless field technique.

The Galam white-lipped frog *Amnirana galamensis* is a widespread species inhabiting a variety of habitats, including freshwater swamps, wetlands, rural and urban gardens, ponds, ditches, rivers, shrublands and moist savannahs (Rodel et al., 2004; Oussou et al., 2022). Despite this, it appears that there is only a single report giving quantitative data of its diet, based on the stomach contents of dissected frogs (Onadeko, 2011).

During June and July 2023 (wet season) a field study was undertaken in a plantation area close to a poultry farm in Rumuagholu Town (040 53′ 02′′N, 060 58′ 11′′ E), Obio/Akpor Local Government Area, Rivers State (Nigeria) (Fig. 2). The study area was suburban/residential with no surface water flooding but with a small irrigation channel, plantain suckers, fruit trees, oil palms and grassy spots. More specifically, the study site was at about 200 m from an annually inundated swamp forest, and 321 m from the Rumuagholu road. The axis was a forested area with a rich variety of plant flora but in places was cleared and converted into settlements and subsistence farming plots. The main plant species were banana and plantain (*Musa* spp), *Carica papaya*, *Citrus sinensis*, *Citrus tangerina*, *Syzygium malaccense*, *Pachylobus edulis*, *Annona muricata*, *Vernonia amygdalina*, *Occimum gratissimum* as well as grasses that are always cleared from the ground. The rainfall pattern of the area is characteristic of the Niger Delta zone, with an extended rainy season from April to September and a dry season from October to March. At night time (20:00 h to 01:00 h) and with the aid of a flashlight, we captured frogs by hand while wearing latex gloves for the frog's protection. The frogs were safely placed in transparent, perforated plastic containers where they were kept for nine hours in order to collect faeces. After defecating, the frogs were gently transferred into another empty container from where they were released unharmed at their precise point of capture. The faeces were allowed to air dry for two hours and then gently placed in labelled Petri dishes. The stored faeces were then transferred to the Animal and Environmental Biology Departmental Wildlife Laboratory (Rivers State University of Science and Technology, Port Harcourt) for analysis. They were examined under a dissection microscope and the fragments of the various prey categories were identified to the lowest taxon possible. Since it was impossible to count the exact number of prey ingested by each frog, we recorded only the presence/absence of each category of prey in the faeces. Thus we report the number of frogs that have consumed a specific prey item, not the number of prey items actually consumed.

Figure 1. *Amnirana galamensis* from the study area in southern Nigeria

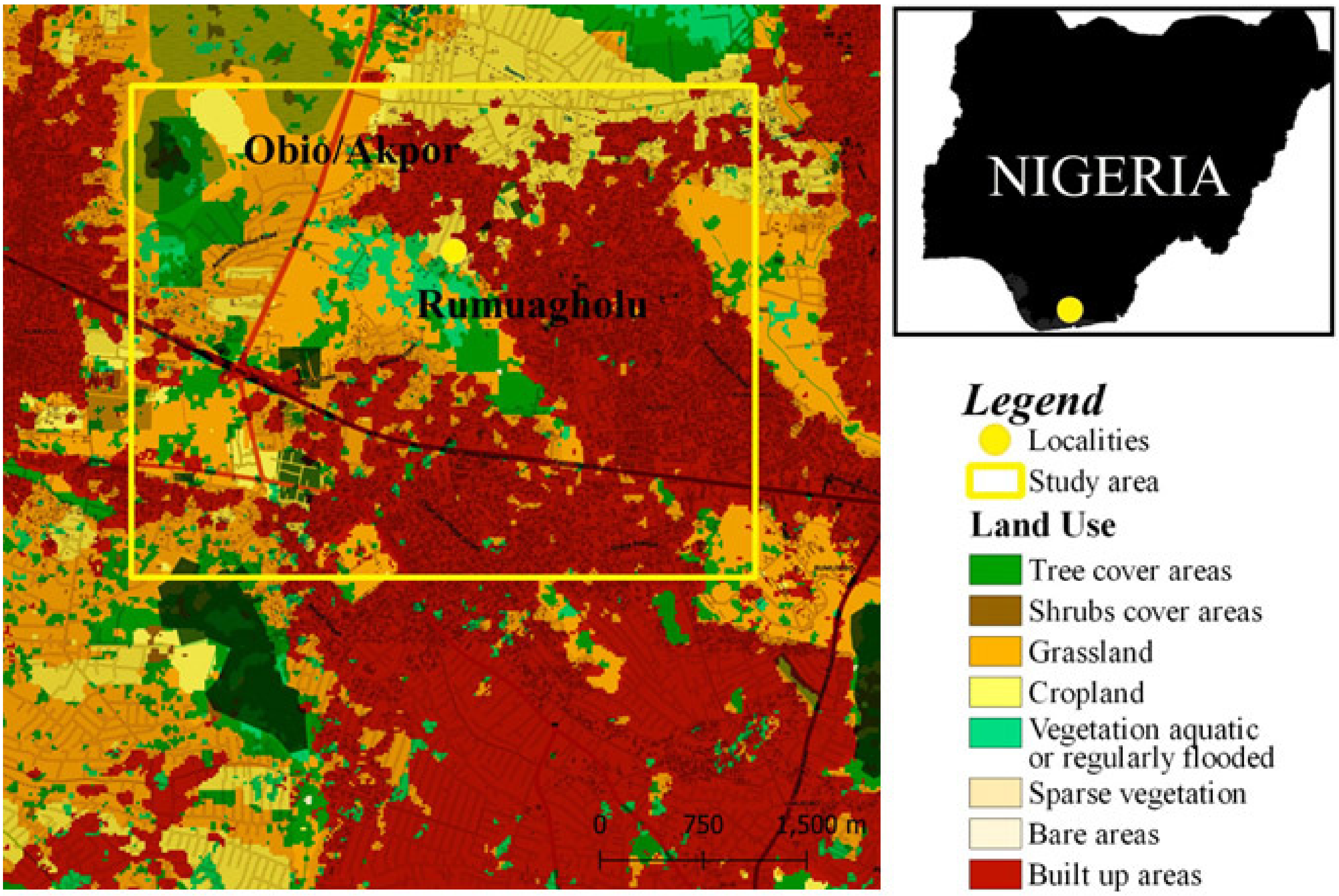

Figure 2. Map of southern Nigeria showing the land-use of the study area, in the Port Harcourt metropolitan territory

Table 1. Taxonomic listing of ingested animal-material observed in the faeces of *Amnirana galamensis* (N = 19)

Prey type	No. frogs	% of frogs
Insecta		
Blattodea	13	68.4
Diptera (larvae)	1	5.3
Hymenoptera (Formicoidea)	19	100.0
Orthoptera	4	21.1
Lepidoptera	3	15.8
Coleoptera	3	15.8
Arachnida		
Araneae	2	10.5
Annelida		
Opistophora	2	10.5
Aves		
Unidentified feather	1	5.3

We obtained identifiable prey items from 19 frog individuals (Table 1). The frogs appeared to be mostly insectivorous, as the remains of at least one insect was observed in all frogs, whereas arachnids and earthworms occurred in just 10.5% of frogs (Table 1). The study species appeared to be a dietary generalist, as (i) both very small (ants) and relatively large (earthworms) species, and (ii) both terrestrial (e.g. Blattodea) and flying (e.g. Lepidoptera) species were found in its faeces. However, there was a clear preponderance of terrestrial prey (Formicoidea, Blattodea, etc.) rather than flying prey, and a preponderance of small prey (especially ants).

Overall, our data are qualitatively similar to those of Onadeko (2011), who also found insects to be dominant in the diet of 15 dissected specimens from south-western Nigeria. However, Onadeko 's (2011) data differed from our own as he found that the proportion of frogs with Hymenoptera and Coleoptera in their diet was the same but that Coleoptera were numerically a much more frequent prey item. The quantitative differences between the present study and Onadeko (2011) may be due to the fact that these frogs, being dietary generalists, tend to prey on the most abundant appropriate insects, and this suggests that ants are the most readily available prey at our study area and perhaps beetles were at Onadeko's site. However the differences might have arisen also from different seasonalities in the two studies. In fact, Onadeko (2011) appears to have worked across the wet and dry seasons but it is not clear whether he did actually study *A. galamensis* in both wet and dry seasons, and so we could not exclude that beetles were especially eaten in dry season, which was not sampled by us. Interestingly, we recorded an avian feather in one individual, this was likely ingested accidentally by the frog without being a case of predation. In *A. galamensis*, Onadeko (2011) also recorded plants in several individuals, also clearly secondarily ingested by these frogs. Most of the individuals examined had many prey items in the faeces, as already observed in many other anurans (e.g. Petrozzi et al., 2021). From a qualitative point of view, the preference of our frogs for small bodied terrestrial prey is similar to that of closely-related species, such as *Amnirana nicobariensis* (Matsui, 2016).

As our study was conducted during the wet season, we cannot exclude the possibility that there may be a dietary shift in the dry season. Indeed, diet compositions are known to differ significantly between seasons in other anurans (*Sclerophrys regularis* and *Sclerophrys maculata*) from the West African coastal region, with Oligochaeta, Gastropoda and Coleoptera being eaten significantly more often during the wet season whereas Formicoidea more often in the dry season (Petrozzi et al., 2021). Further studies should focus on seasonal variations in diet composition of *A. galamensis.*

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