A spanner in the taxonomic works? A simultaneous spawning irruption of Giant *Pyxicephalus adspersus* and Edible *P. edulis* Bullfrogs

Derek Engelbrecht

Engelbrecht D 2024. A spanner in the taxonomic works? A simultaneous spawning irruption of Giant *Pyxicephalus adspersus* and Edible *P. edulis* Bullfrogs. Biodiversity Observations 14: 50–54.

23 May 2024

DOI: 10.15641/bo.1538

Herpetology

A spanner in the taxonomic works? A simultaneous spawning irruption of Giant *Pyxicephalus adspersus* and Edible *P. edulis* Bullfrogs

Derek Engelbrecht

Department of Biodiversity, University of Limpopo, Sovenga, 0727, South Africa

faunagalore@gmail.com

Observation

The Giant Bullfrog *Pyxicephalus adspersus* and Edible Bullfrog *Pyxicephalus edulis* occur sympatrically or parapatrically in parts of South Africa's Limpopo and North West provinces and parts of Botswana (du Preez 2004). The superficial similarities of the two species, especially of smaller individuals, make it difficult to separate them using traditional morphological characters (du Preez 2004, Scott-Prendini et al. 2012). This has resulted in a complex taxonomic history. Loveridge (1950) regarded *P. edulis* as a subspecies of *P. adspersus*, and Poynton (1964) treated *P. edulis* as a junior synonym of *P. adspersus*. Poynton & Broadley (1985) suggested that in certain areas, considerable overlap exists in some of the taxonomic characters used to separate the two species, making them of limited taxonomic value. It has even been suggested that both *P. adspersus* and *P. edulis* start life as the same species and, depending on climatic conditions, they manifest as different morphs under different climatic conditions, e.g., in wet, Lowveld regions, *P. edulis* is produced, and in drier, harsher Highveld regions, more *P. adspersus* is produced (Pickersgill 2007). Nevertheless, clearly frustrated with his attempts to separate *P. adspersus* and *P. edulis*, Pickersgill concluded: "As for me, without adults or vocal evidence I've no idea if our material is *adspersus*, *edulis* or a combination of taxa and I'm not going to lose any more sleep over it." Fortunately, the calls of the two species are distinct (Channing et al. 1994), but both *Pyxicephalus* spp. are only vocal for a short period around a spawning event, making this character of limited use when they are not spawning (Engelbrecht et al. 2015). Other features that are used to separate the two species include the presence or absence of a prominent white spot on the tympanum (present in *P. edulis* and absent or, at best, indistinct in *P. adspersus*) and the distance between the eye and the tympanum (< diameter of the tympanum in *P. edulis*, and > diameter of the tympanum in *P. adspersus*), but these require good views of the individual (du Preez & Carruthers 2009, Yetman 2012). In addition, tadpole morphology and certain molecular markers may also be used to separate the two species (Yetman 2012). Nevertheless, the difficulty in identifying these two species has implications for accurate distribution modelling and for improving our knowledge of the species' habitat preference and other aspects of its ecology (Yetman 2012).

Given their superficial similarity, great care must be taken when vetting distributional records involving the two species, especially in regions where they are known to overlap (Minter et al. 2004). *Pyxicephalus adspersus* and *P. edulis* are known to occur sympatrically in the Pilanesberg region, North West Province, and at Mookgophong and the Polokwane Plateau in the Limpopo Province (see du Preez 2004, Yetman et al. 2017). However, it is unclear whether the two species are only known from the same general region but occupy different micro-habitats or spawn at different times or if they have been recorded together at the same locality and at the same time. For example, Channing et al. (1994) states: "Based on the presence of calls, both species occur at Naboomspruit."

I have witnessed several spawning irruptions of both *P. adspersus* and *P. edulis* at various localities on the Polokwane Plateau since

2009, all being single-species irruptions. Until 2021, all the *P. adspersus* spawning irruptions in this region occurred in Polokwane Plateau Bushveld, and all the *P. edulis* irruptions were in Makhado Sweet Bushveld (Mucina & Rutherford 2006). On the morning of 15 December 2020, following approximately 90 mm of rainfall overnight, I came upon a simultaneous spawning irruption of *P. adspersus* and *P. edulis* on the farm Uitkoms 864 LS north of Polokwane (23° 41' 30"S, 29° 30' 23"E, QDGC 2329DA; 1192 m a.s.l.; Figure 1). The frogs were calling and spawning over an area of approximately 3 500 m^2 which comprised of a series of several shallow pools of varying degrees of interconnectedness; most of my observations were made at one pool of c. 400 m^2. A sound recording of both species calling can be found at https://www.inaturalist.org/observations/202381661, and a short video clip can be found at https://www.youtube.com/watch?v=rCq-_RPt3DY. The site is in an ecotone between Polokwane Plateau Bushveld and Makhado Sweet Bushveld (Mucina & Rutherford 2006).

The water was mainly 6–10 cm deep, and the deepest point was ~18 cm, although there was little activity in that part of the pool. It was difficult to estimate the numbers of each species since female *P. adspersus* and male *P. edulis* may overlap in size, and sexual dimorphism is also not as pronounced in *P. edulis* as it is in *P. adspersus*. Nevertheless, I would estimate there were about 25–30 male *P. edulis* and approximately 20 male *P. adspersus* in the pool where I made my observations.

There was no apparent niche separation within the pool, and both species were found in all areas of the pool. Callings males were well-spaced, but there was usually at least 30 cm between calling *P. adspersus* and *P. edulis* males (Figure 2). Typical of bullfrog spawning aggregations, both species exhibited aggressive behaviour, both intra - and interspecifically. Males wrestled, knocked and violently tossed one another through the air, and at least one individual had suc-

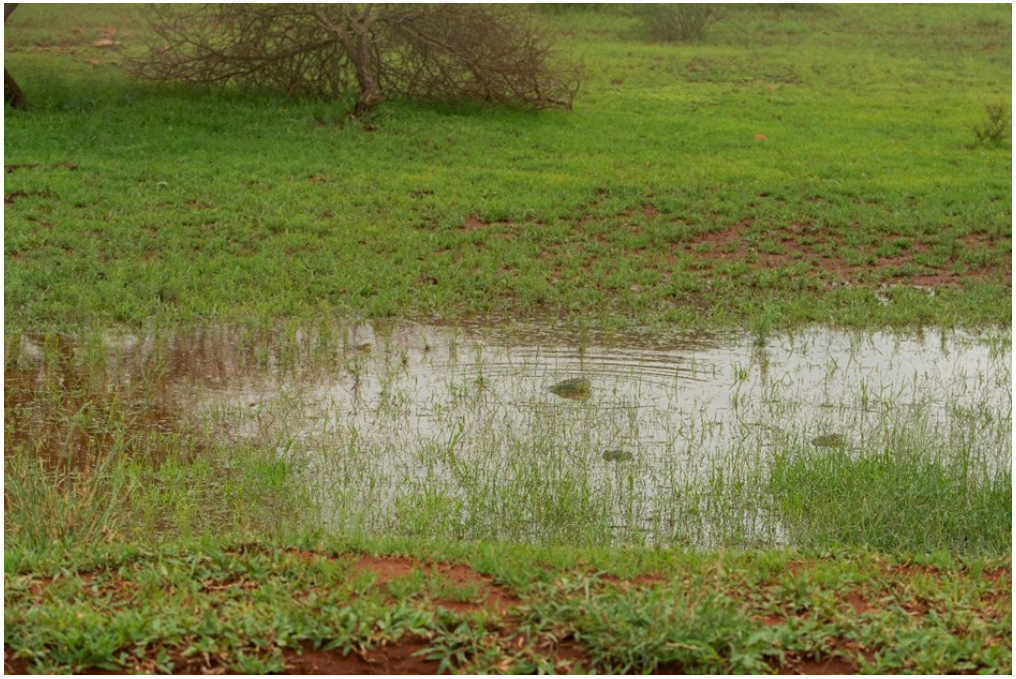

Figure 1: A general view of the temporary pool where the observations of spawning Giant and Edible Bullfrogs were made.

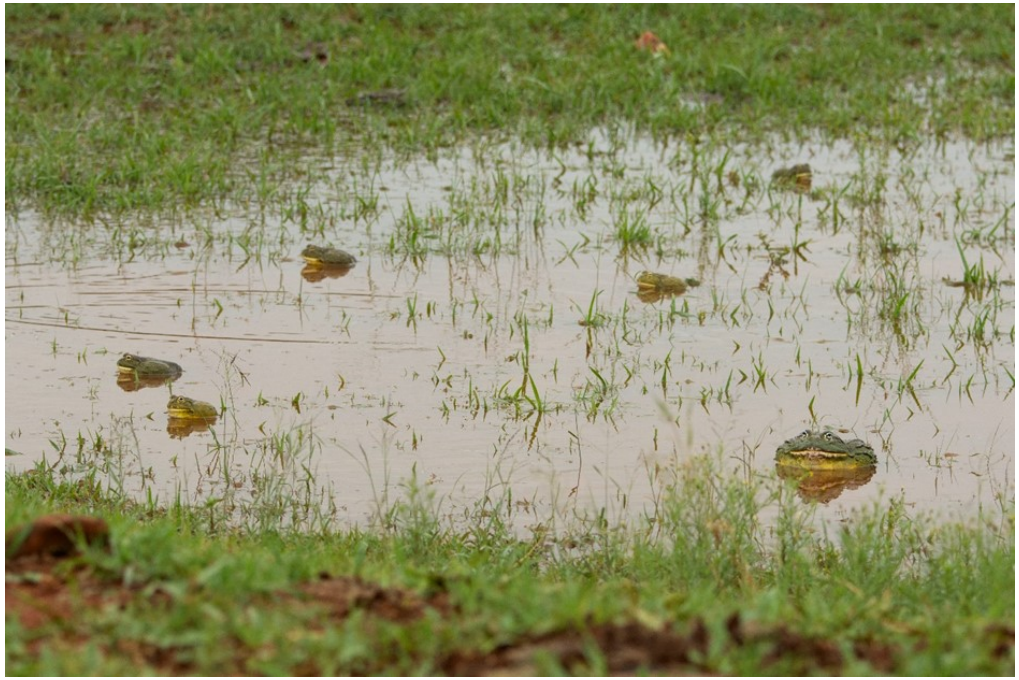

Figure 2: Calling males were usually well-spaced; here, a single Giang Bullfrog male calls amidst a few Edible Bullfrog males.

cumbed from its injuries (Figure 3). Surprisingly, the much smaller *P. edulis* was not intimated by the larger *P. adspersus* males and was seen attacking them on several occasions, but always with the obvious outcome – the *P. edulis* coming off second best or having to make a hasty retreat (Figure 4). Generally, the larger *P. adspersus* males were dominant. The spawning activity of both species had subsided markedly, and by 11h00, calling and fighting were only sporadic. A visit to the pool early the next day failed to locate any bullfrogs.

This record of simultaneous irruptions of *P. adspersus* and *P. edulis* at the same place and time raises interesting questions. If the same conditions trigger spawning irruptions, and there does not appear to be any species-specific habitat requirements for spawning, then why is there not a greater overlap in the distribution of the two species and what are the limiting factors for each spcies? Also, given the similar size ranges of small females of *P. adspersus* and large *P. edulis* females, mistaken identity during amplexus is possible, and hybridisation must also be considered a possibility. Although I looked for it, I couldn't find any unequivocal evidence of cross-breeding as the females were either submerged during amplexus or it was not possible to confirm the presence or absence of a whitish spot on the tympanum, one of the features used to separate the two species. Unfortunately, the pools dried up before the tadpoles completed their metamorphosis, and I could not obtain photos of the *Pyxicephalus* metamorphs at this site. Collecting tissue samples of bullfrogs from this site would be of value in confirming if hybridisation occurred in this population.

Figure 3: Typical of spawning events, males are aggressive, and fighting is common – and violent. a) Wrestling (Giant Bullfrogs), b) crashing into a rival (Giant Bullfrogs), and c) tossing an opponent (Edible Bullfrogs).

References

Channing A, du Preez L, Passmore N 1994. Status, vocalization and breeding biology of two species of African bullfrogs (Ranidae: *Pyxicephalus*). *Journal of Zoology, London* 234: 141–148.

Du Preez L 2004. Genus *Pyxicephalus* Tschudi, 1838 (Family Ranidae). In: Minter LR, Burger M, Harrison JA, Braack HH, Bishop PJ, Kloepfer D (eds). The Atlas and Red Data Book of the Frogs

a b c

Figure 4: a) A male Edible Bullfrog lunging at a male Giant Bullfrog, hitting it on the snout, followed by b) a brief stand-off before c) the Giant Bullfrog retaliates, knocking the Edible Bullfrog back to where it came from.

of South Africa, Lesotho and Swaziland. SI/MAB Series #9. Smithsonian Institution, Washington: 298–299.

Du Preez LK, Carruthers V 2009. A Complete Guide to the Frogs of Southern Africa. Random House Struik, Cape Town.

Engelbrecht D, Mashao M, Halajian A 2015. Notes on the breeding behaviour and ecology of Edible Bullfrogs *Pyxicephalus edulis* Peters, 1854 in the Limpopo Province, South Africa. Herpetology Notes 8: 365–369.

Loveridge A 1950. History and habits of the East African Bullfrog. Journal of the East African Natural History Society 19: 253–255.

Minter LR, Burger M, Harrison JA, Braack HH, Bishop PJ, Kloepfer D (eds) 2004. Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland. SI/MAB Series #9. Smithsonian Institution, Washington, DC.

Mucina L, Rutherford MC (eds) 2006. The Vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

Passmore NI, Carruthers VC 1995. South African Frogs: A Complete Guide. 2nd ed. Southern Book Publishers and University of the Witwatersrand Press, Johannesburg.

Pickersgill M 2007. Frog Search. Results of Expeditions to Southern and Eastern Africa. Frankfurt Contributions to Natural History 28. Frankfurt am Main, Edition Chimaira.

Poynton JC 1964. The amphibia of southern Africa: A faunal study. Annals of the Natal Museum 17: 1–334.

Poynton JC, Broadley DG 1985. Amphibia Zambesiaca 2. Ranidae. Annals of the Natal Museum 27: 115–181.

Scott-Prendini E, Oliver L, Visser J, Lewis A 2012. Morphological variation in African Bullfrogs (Pyxicephalidae: *Pyxicephalus*), assessed from CT scan data and morphometrics. African Herp News 58: 64–65.

Yetman C 2012. Conservation Biology of the Giant Bullfrog, *Pyxicephalus adspersus* (Tschudi, 1838). Unpublished PhD Thesis, University of Pretoria, Pretoria, South Africa.

Yetman CA, Clark T, Dippenaar-Schoeman A 2017. Natural history: Giant Bullfrog *Pyxicephalus adspersus* (Tschudi 1838). African Herp News 65: 19–24.

Paper edited by Megan Loftie-Eaton
Biodiversity and Development Institute