



Examination of the molecular relationships of sand frogs (Anura: Pyxicephalidae: *Tomopterna*) and resurrection of two species from the Horn of Africa

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Abstract

Tomopterna kachowskii and *T. elegans* from Ethiopia and Somalia, both currently synonyms of *T. cryptotis*, are resurrected based on morphological and molecular data. *Tomopterna hieroglyphica* is determined to be conspecific with *T. kachowskii*, with the latter taking precedence. Analysis of mitochondrial 12S rRNA, t-valine, 16S rRNA data reveals that these species differ from each other by 7.7%, differ from other described species of the genus by at least 3.0% and are only distantly related to *T. cryptotis*. A phylogeny of the genus is constructed, and the relationships among species are discussed. Discriminant function analysis was completed using 25 morphological measurements to determine if the seven clades identified in molecular analyses have concordant morphological difference. Translations of the original descriptions are provided, and a detailed redescription of *T. elegans* is included as the original description was made with only juvenile specimens. *Tomopterna kachowskii* and *T. elegans* are distinguished from other species of sand frogs by their visible tympana, presence of an outer metatarsal tubercle and moderate pedal webbing. Slightly more extensive webbing and variable presence of a discontinuous row of small glands beneath the tympanum distinguishes *T. elegans* from *T. kachowskii*.

Key words: Amphibia, Ethiopia, Somalia, systematics, taxonomy

Introduction

Sand frogs of the genus *Tomopterna* Dumeril and Bibron, 1841 are distributed throughout the savanna and arid regions of sub-Saharan Africa. Their stout, toad-like habitus and well-developed flange-like inner metatarsal tubercle used to burrow backwards makes them easily identifiable. They often inhabit extremely dry areas as long as there are at least temporary pools in which the tadpoles can develop. Currently there are eleven species described, many of which are impossible to distinguish or have substantial morphological variation (Frost, 2011). One of these species, *Tomopterna cryptotis*, has a huge geographical range across the savannas of Africa from Senegal and Mauritania in West Africa to Somalia in the Horn of Africa, and it is additionally distributed in the southern countries of Angola, Namibia and South Africa (Channing *et al.*, 2004c). This species is believed to be absent from southern Tanzania, northern Zambia and northern Mozambique due to lack of suitable habitats (Channing *et al.*, 2004c).

The systematic history of those populations currently identified as *T. cryptotis* is quite complex; a number of species were described from the Horn of Africa and subsequently synonymized with *T. cryptotis*. *Chiromantis kachowskii* Nikolskii, 1900 was described using specimens collected in Ferad, Ethiopia (Fig. 1). This species was much later synonymized with *Rana cryptotis* Boulenger, 1907, originally described from Angola (Largen and Borkin, 2000). Although the former was described first, priority was given to *R. (Tomopterna) cryptotis* because it was a widely used name (International Commission on Zoological Nomenclature, 2001). *Rana (Tomopterna) hieroglyphica* Ahl, 1927, was described from “So-Omadu” (Somadu), Somalia, using material previously identified as *Rana (Pyxicephalus) delalandii* (Ahl, 1923). The characters that Ahl (1927) used to identify this new spe-