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Regional Focus

Sub-Saharan Africa

Regional updates and latests research.



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Leptopelis barbouri
 photo taken at Udzungwa Mountains,
 Tanzania
 photographer: Michele Menegon



Another "Lost Frog" Found.

Ansonia latidisca found
 in Borneo



ASA

The Amphibian Survival Alliance is launched

FrogLog

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Struggling against domestic exotics at the southern end of Africa

By G. J. Measey & S. J. Davies

Globally, there are relatively few well-known alien amphibian invaders, in comparison with other groups such as mammals and birds. The handful of frogs which have been deliberately moved all over the world (cane toad *Rhinella marina*, American bullfrog *Lithobates catesbeianus*, and African clawed frog *Xenopus laevis*) are relatively easily identified as 'foreign exotics', at least by those familiar with the local fauna. However, recognition of alien frogs by members of the public is problematic as many are unable to distinguish them from native species (Somaweera *et al.*, 2010). There are added complications with 'domestic exotic' fauna which expand their ranges rapidly within their native country. The presence of these species outside their natural ranges is often viewed with curiosity rather than concern. On a practical level, when the American bullfrog was introduced from the eastern United States to California and other western states there was confusion over its status as it appeared in field guides to the indigenous United States fauna.

A recent review found that the number of domestic exotics is generally underestimated as many are regularly considered 'native'. We ignore these species at our peril as we show in these amphibian examples from the Western Cape Province of South Africa. Further, domestic exotics are likely to increase, because the drivers of their introduction and spread are becoming more prominent, among them the pet and cargo/nursery trades (Kraus 2009), extensive landscape change and climate change. While national and international legal instruments such as CITES and biosecurity conventions exist to control or prevent international movements, few regional (within country) mechanisms are available. South Africa's National Environmental Management: Biodiversity Act and provincial ordinances aim to control within country movement of animals and plants, including herpetofauna. However, our findings suggest that there is a gap between legislation and enforcement.

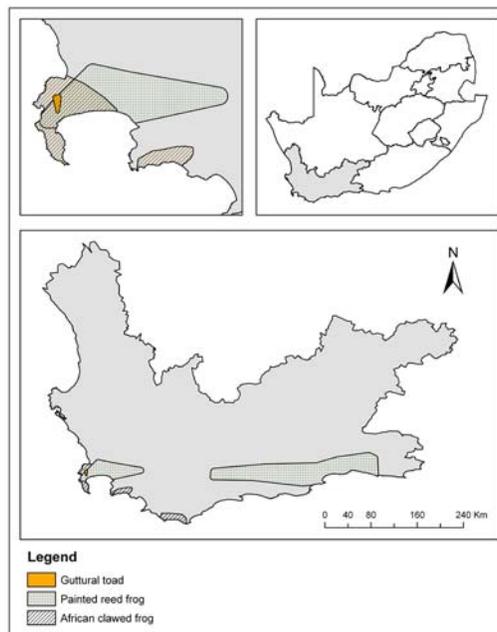


Figure 1: The distribution of domestic exotics (bottom panel, with detail of the Cape Metropolitan Area; top left panel) in South Africa's Western Cape Province (top right panel). The painted reed frog and guttural toad were probably introduced with the horticultural trade, and now have growing extralimital distributions in the Western Cape. The African clawed frog is being introduced and spreading naturally into disturbed water bodies within the range of the Cape platanna (distribution shown) further threatening this Endangered species.

South Africa is one of the world's megadiverse countries (1 221 037 km²), covering five biomes and with three internationally recognised biodiversity hotspots and an endemic floral kingdom. It has no indigenous amphibians in the orders Caudata or Gymnophiona, but a rich and diverse anuran fauna exists with endemic and range-restricted species concentrated in two centres in the north and east (Maputuland-Albany hotspot) and south-west (Fynbos hotspot) of the country. The south-west centre has a particularly high concentration of endemic species, associated with topographic heterogeneity and climatic and hydrological stability of the Cape Fold Mountain system (Poynton 1964), while species richness is highest in the north-east, partly due to the intrusion of tropical species into this part of the country (Alexander *et al.* 2004). Concerns related to invasive amphibians in South Africa include hybridization, trophic cascade effects, competition with indigenous species and transmission of novel or existing pathogens (Van Rensburg *et al.* 2011).

Currently invading the Cape

The painted (or marbled) reed frog *Hyperolius marmoratus*

This small, brightly-coloured reed or tree frog provides an interesting example of within country range expansion. Its expansion into the Western Cape occurred when the South African Frog Atlas Project was in full swing, and thus it was recorded at an early stage (Minter *et al.* 2004). Prior to 1997, there were no records of these handsome, vocal frogs west of 23°E in the province. The single record prior to 1997 was found to be a misidentified arum lily frog (*H. horstockii*) when the museum specimen was examined in 2010 (S.J. Davies and A.A. Turner, unpublished data). The westward travel of the painted reed frog was first detected by A.A. Turner in 2001. By 2006, the species was widespread in the province, and today it is found in farm



Figure 2: South African domestic exotic painted reed frog (*Hyperolius marmoratus*) underwent multiple introductions to the Western Cape and is now in broad sympatry with congener, the arum lily frog (*H. horstockii*) inset.

dams and garden ponds across all but the most mountainous and driest parts of the Western Cape. Choruses of up to 400 males can be heard during the summer breeding season - at about 103 dB, its penetrating whistle is louder than a pneumatic jackhammer two meters away and is therefore easily noticeable.

The painted reed frog is now sympatric with its congener, the arum lily frog (*H. horstockii*), which is endemic to the Fynbos biome (Fig. 2). The impacts of the presence of a closely related species sharing a similar feeding niche are unknown at present.

In 2008, Tolley et al. (2008) reported that the genetic 'signature' of Western Cape painted reed frogs could be traced back to ancestral stamping grounds in northern and central KwaZulu-Natal, the Eastern Cape and the southern Cape. The frogs introduced from these regions could easily have travelled with fresh produce or nursery plants which are known vectors of amphibians (Kraus 2009) or on cars, boats, caravans and building materials. Given its widespread distribution in the Western Cape it is unlikely that control or eradication of the painted reed frog is feasible, except in very localized areas. However, ongoing work will clarify the current species distribution and model the potential future distribution of the species in the Western Cape.

The guttural toad *Amietophrynus gutturalis*

In January 2000, the distinctive call of the male guttural toad was heard by a keen local naturalist coming from a large residence in the Constantia Valley, Cape Town. The toads were of unknown origin, but are presumed to have been accidentally introduced from another part of South Africa (possibly Durban), making this another domestic exotic. The first guttural toad visitors to the Western Cape may have arrived as eggs or tadpoles with a consignment of aquatic plants (de Villiers 2006) ordered by a home owner in Cape Town. This area is within the range of the Endangered western leopard toad (*Amietophrynus pantherinus*), raising concerns about the effects of the invasion on this species. In 2006 the toads were restricted to an area of less than 2 km² around the presumed site of introduction. An attempt was made to eradicate this population in 2003, and 30 adult toads were removed from the site, but the operation floundered due to a lack of resources and sustained effort.

By 2008, the guttural toad population was still spreading and a

decision was made by the CAPE Invasive Alien Animal Working Group (CAPE-IAA) to mount a sustained eradication campaign. By the end of 2009, some 652 guttural toads (plus eggs and tadpoles) had been captured and euthanized. Calls and sightings revealed that the distribution covered approximately 10 km² of the Cape Peninsula (City of Cape Town Biodiversity Management, unpublished data). The CAPE-IAA has secured funding to continue this campaign and to date 1 835 guttural toads, plus eggs and tadpoles, have been collected. The ongoing work is challenging, as almost all of the breeding sites are garden ponds on private property in a low density, high income residential area. Home owners are sometimes unwilling to allow removal of guttural toads from their gardens.

The African clawed frog, *Xenopus laevis*

Unlike the previous examples, in which the original distribution of the species was well-known, we have little idea of the pre-anthropocentric distribution of *Xenopus laevis*. It was described in 1802 by Daudin with no type locality information, but other specimens collected during this period were labelled 'Cape of Good Hope' or simply 'Cape' (see Frost 2011). So why does it deserve to be called a domestic exotic?

The collection of specimens occurred more than 200 years after the colonization of the Cape when there was already extensive farming: vineyards and orchards were established, along with appropriate agricultural infrastructure including irrigation and impoundments such as farm dams. Our knowledge of *X. laevis* today suggests that it is capable of spreading rapidly over land (Lobos & Jaksic 2005, Measey & Tinsley 1998), prefers nutrient-rich or eutrophic waters and is quick to colonise new and disturbed water bodies, where it can rapidly build to high population densities (Measey & Channing 2003, Van Dijk 1977). Therefore it is probable that by the early 19th century, *X. laevis* was already invading farming areas of the Cape.

In contrast, *Xenopus gilli* is endemic to a small area of the southwestern Cape and adapted to the most acidic black water streams and pools (Picker 1993). Its distribution follows acid



Figure 3: The guttural toad (*Amietophrynus gutturalis*) has been rapidly expanding its range after introduction to Cape Town and is within the range of congener the Endangered western leopard toad (*A. pantherinus*; inset).

fynbos vegetation, a habitat that is already highly transformed and is under ongoing threat (Driver *et al.* 2005). Invasion of disturbed *X. gilli* habitat by *X. laevis* is well-documented, and has led to conservation actions to prevent hybridisation between these species (Picker 1985, Picker & De Villiers 1989). Ongoing habitat destruction and hybridisation has meant this species is considered to be Endangered (SA-FRoG & IUCN 2011).

Xenopus gilli and *X. laevis* are thought to have originally occurred in sympatry (Picker & De Villiers 1989), probably separated by different types of water bodies. The introduction of *X. laevis* to the Cape Point section of Table Mountain National Park has been documented at least once (Picker & De Villiers 1989), but has probably occurred repeatedly when ethically misguided individuals 'rescued' animals by placing them in conservation areas. Despite repeated conservation efforts to remove *X. laevis* from this area (Picker & De Villiers 1989), surveys in 2010 revealed high densities within this protected area.

In March 2011, a team from South African National Parks (SANParks) and the South African National Biodiversity Institute (SANBI) seined areas with standing water in Cape Point, removing 848 *X. laevis* (93% of which were juveniles), including gravid females. This exercise has served to underline the importance of the nature of a long-term management commitment toward alien invasive species. Happily, the management authority, SANParks, is committed to sustaining regular trapping and seining events to control the invasion of *X. laevis*.

Perspective

Our examples highlight the problem of domestic exotic amphibians in a megadiverse country, which contains many biomes. Two of the three domestic exotics described here have been moved from a different biome, probably by the nursery trade. The third has been facilitated by a mixture of opportunistic use of anthropogenically altered habitats (with farming), deliberate movement as fishing bait and release by well-meaning individuals. Despite national legislation that covers each of these issues, invasions are ongoing.

Early Detection and Rapid Response (EDRR) is likely to be the most cost effective way to manage domestic exotics, but our examples show that EDRR policy must be supported by sufficient resources and sustained long-term commitment from managing authorities. The wealth of biodiversity in the Western Cape carries with it the cost of removing invasive species that threaten this diversity. Representative committees, such as the CAPE-IAA play a pivotal role in EDRR by bringing multiple stakeholders and their resources together in a collaborative approach to management. The painted reed frog may be beyond the reach of eradication, but ongoing studies will continue to generate insight into the effects of

this invasion. We are hopeful that the spread of the guttural toad and African clawed frog can be managed or halted to preserve South Africa's endemic amphibian fauna.



Figure 4: The African clawed frog (*Xenopus laevis*) is probably native to the South African Cape, but readily invades disturbed water bodies further threatening its cogenitor the Endangered Cape platanna (*X. gilli*).

Acknowledgements

The CAPE-IAA contains representatives from the City of Cape Town, SANParks, CapeNature, SANBI, the Centre for Invasion Biology (C-I-B) and UCT. We acknowledge the importance of the combined efforts of many individuals from each of these organisations in tackling ongoing invasions of domestic exotics in the Western Cape.

Author details; G. J. Measey^{1,2} & S. J. Davies³, ¹Applied Biodiversity Research Division, South African National Biodiversity Institute, Claremont 7735, Cape Town, South Africa. ²Biodiversity and Conservation Ecology, University of the Western Cape, Private Bag X17, Bellville 7535, South Africa. ³Centre for Invasion Biology, Department of Botany & Zoology, University of Stellenbosch, Matieland 7602, South Africa.

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