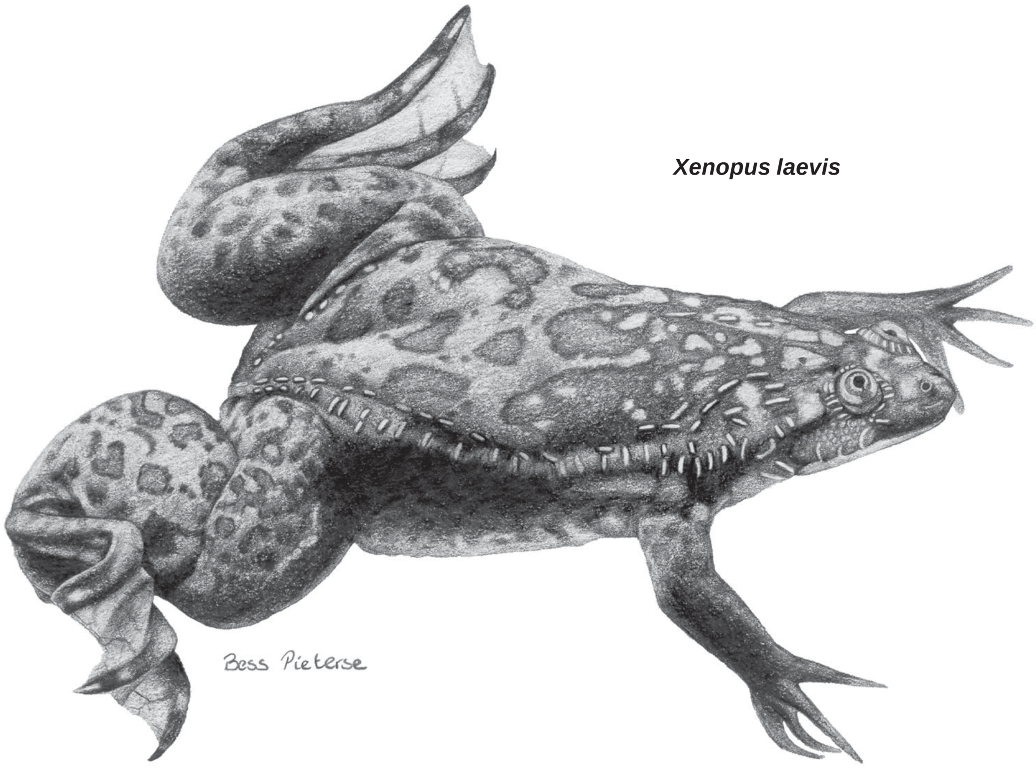
# Genus *Xenopus* Wagler, 1827 (Family Pipidae)

**platannas (A),** clawed toads




***Xenopus laevis***

## Description

The genus name is derived from Greek: *xenos* = strange; *pous* = a foot. This refers to a feature that is unique among frogs, namely the keratinized, clawlike tips of the inner three toes.

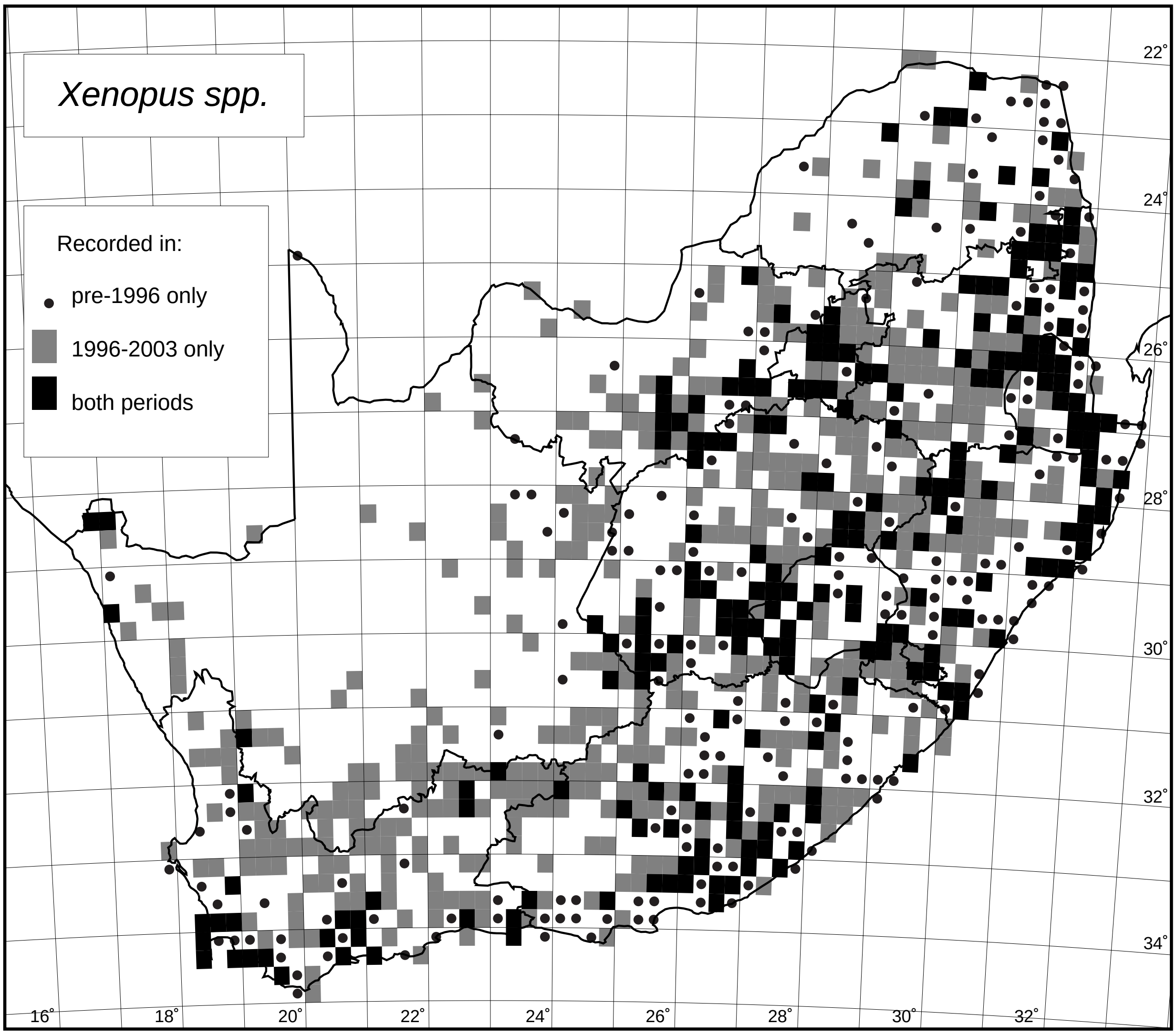
Adults are almost entirely aquatic, emerging only when migrating overland to other water bodies or when capturing prey at the water's edge. They possess several morphological and sensory adaptations to their aquatic habitat. The body is dorsoventrally flattened and streamlined, with laterally projecting limbs. Tympanum, tongue, vocal cords and movable eyelids are lacking. The eyes and nostrils are positioned on top of the head in the same plane, allowing the frogs to suspend themselves with only these structures breaking the surface. The eyes are adapted for vision in air, while receptors in the nasal cavities allow the frogs to sense chemicals in both water and air.

They are powerful swimmers due to their muscular hind limbs and the extensive webbing between their toes. They can even project themselves out of the water to catch insects walking along the edge (Measey 1998a). The skin is smooth, with prominent lateral line organs that resemble rows of stitches along the sides of the body and around the eyes and mouth.

The tadpoles have a distinctive appearance and are sometimes mistaken for fish by the novice. They are translucent with occasional spots of pigment and a pair of long barbels at the sides of the mouth. The tapering tail is constantly in motion, keeping the tadpole suspended in the water column.

## Distribution

Native populations are ubiquitous in and endemic to sub-Saharan Africa. *Xenopus* species occupy every type of freshwater body, seemingly regardless of altitude, pH, and water temperature. Of the 18 currently recognized species, only three occur in the atlas region (Kobel et al. 1996). An endemic species, *X. gilli*, is restricted to acidic, humic waters in the Cape Peninsula and adjoining areas, while *X. laevis* and *X. muelleri* are widely distributed, extending beyond the limits of the atlas region. While these and the other *Xenopus* species may be identified by means of published keys (e.g., Kobel et al. 1996) current taxonomic studies suggest that additional cryptic species may be present within the atlas region.




The presence of *Xenopus* is notoriously difficult to assess by traditional techniques because adults spend most of their time in deep, often turbid, water. Calls may be barely audible out of the water as a dull grating, although surfacing activity of both adults and tadpoles is easily spotted when they occur in high densities. The best method of sampling animals is with a submerged funnel trap containing pungent bait (usually meat). The atlas records consist mainly of visual or specimen records of adults or tadpoles. Adults are often conspicuous in torchlight at night, either at the surface or lying on the bottom of water bodies. In wet weather, adults and juveniles are sometimes seen crossing land.

The distribution maps are reliable and overall coverage is good. Gaps in distribution in arid areas such as Bushmanland and the Kalahari may reflect inadequate sampling rather than true absence. On the other hand, isolated records from arid areas may represent artificial introductions by man.

## Habitat

*Xenopus* may be excluded from certain water bodies by predatory fish, but there seem to be many exceptions to this rule, and animals are commonly found in every type of water body, including rivers, streams, dams, flooded pits, ditches, drinking troughs and wells.

Vegetation does not seem to be a necessary requirement, either in or around aquatic habitats, although the presence of aquatic vegetation may increase the variety of food sources encountered. Certain species have been shown to survive without food for long periods, and this may be typical of the genus as a whole (Merkle 1990). Although *Xenopus* also inhabits streams and rivers, breeding takes place in stagnant or slow-moving water, including temporary pans and ponds. Only the endemic *X. gilli* has special habitat requirements, although *X. muelleri* and *X. laevis* may have different water temperature preferences.

The construction of dams, wells, irrigation channels and watering points for domestic and wild animals has probably allowed *Xenopus* to colonize arid areas from which it was previously excluded. The ability of these frogs to aestivate for long periods in dried mud, also enables them to survive in arid areas.

## Life history

The life histories of indigenous *Xenopus* species are poorly reported and little understood, and the best studies have been based on invasive populations of *X. laevis* (Tinsley and McCoid 1996). However, the following generalizations may apply to the genus as a whole.

*Xenopus* are crepuscular and/or nocturnal in habit, detecting aquatic food items using their lateral line organs (Elepfandt 1996) and sense of smell, or terrestrial food items by sight (Measey 1998a). A wide variety of food sources from all microhabitats in water bodies are utilised, including carrion, which is shredded to size with the claws (Tinsley et al. 1996; Measey 1998b). In the absence of a tongue, the forelimbs assist in the ingestion of food. Adults are notorious cannibals of eggs, tadpoles, recent metamorphs and even small adults.

Laboratory experiments suggest a complex mating behaviour (Kelley 1996; Yager 1996), although most studies have relied heavily on hormonally induced behaviour in artificial environments (e.g., Picker 1980; Tobias et al. 1998). Complex courtship, involving both male and female calls, culminates in a successful inguinal amplexus, after which eggs are deposited singly throughout the water body. Tadpoles hatch after a few days, but remain temporarily attached to the substrate by a buccal mucus thread. Tadpoles are obligatory midwater suspension feeders, adopting a characteristic "head-down" attitude in the water. They exhibit schooling behaviour and often congregate in shady, still areas of pools (Wassersug 1996).

## Conservation

Only one species, *X. gilli*, is known to be threatened throughout its entire range. There are documented cases of displacement, over a period of years, of certain *Xenopus* species from their known habitats by other *Xenopus* species (Tinsley et al. 1996), which indicates that some species in the genus are highly invasive. Also *X. laevis*, a species commonly used in laboratories, has become a feral animal in a number of countries outside of Africa, and may pose a threat to the indigenous species of those countries.

*G.J. Measey*

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# *Xenopus gilli* Rose and Hewitt, 1927

**Photos 76–79**

**Cape Platanna**, Sago-belly Platanna, Sago-tummy, Gill's Platanna, Cape Clawed Toad, Kaapse Platanna (A)

**RED LIST SPECIES**
**Status: Endangered (EN) Criteria: B1ab(i,ii,iii,iv,v)+2ab(i,ii,iii,iv,v)**

## Identification

*X. gilli* is a typical member of the genus. The upper body is light to yellow-brown with elongated, dark brown patches, sometimes paired, that begin between the eyes and extend backwards, breaking up into smaller patches on the lower back and upper surfaces of the hind limbs. The underside usually has clear blackish and yellow mottling, but this may be pale and indistinct in some individuals, especially in populations near Kleinmond (3419AC; J.A. Harrison *in litt*.).

*X. gilli* can be distinguished from *X. laevis* by the following morphological features: its smaller size (<60 mm in body length); a narrower, more acutely pointed head; the absence of a subocular tentacle (present but inconspicuous in laevis); a poorly developed inner metatarsal tubercle (a distinct ridge in laevis); and less conspicuous lateral line sense organs (Poynton 1964; Picker and De Villiers 1988; Passmore and Carruthers, 1995; Kobel et al. 1996; Channing 2001).

The advertisement call consists of a series of short, rapidly pulsed, metallic buzzes emitted under water at a rate of about two per second (for further details of call structure see Passmore and Carruthers 1995; Picker et al. 1996; Channing 2001).

## Distribution

This species is endemic to the winter rainfall region of the Western Cape, generally occurring in relatively lowlying areas (10–140 m a.s.l.) within 10 km of the coastline. Its distribution is correlated with the presence of nearby mountain ranges and an annual rainfall exceeding 500 mm p.a. Confirmed records span a distance of about 160 km, from the Cape Peninsula southeastward towards the Agulhas district (Picker and De Villiers 1988, 1989).

For about 40 years following its description in 1927, the species was known only from the Cape Peninsula and adjoining Cape Flats (3418AB, BA; 3318CD, DC). However, in the late 1960s it was discovered further south on the Cape Peninsula in the Cape of Good Hope Nature Reserve (3418AD), and in the period from 1973 to 1988 it was collected along the coastal forelands to the southeast of the Cape Peninsula and Cape Flats, at Hangklip and Betty's Bay (3418BD), Kleinmond (3419AC), midway between Gansbaai and Agulhas (3419DA), and northwest of Agulhas at the eastern base of Soetanysberg (3419DB, DD).

Two inland records from Nieuwoudtville (3119AC) in 1898 and Citrusdal (3219CA) dating from about 1937 (Rau 1978), have not been subsequently confirmed despite several field trips to these areas. The validity of these records is in doubt and they are excluded from the map.

During the 1980s a study of the distribution and habitat requirements of *X. gilli* was undertaken to assess its future survival prospects. The study showed that, although the species still occurred in at least 24 localities in seven quarter-degree grid cells, habitat destruction and degradation had led to extinction at 60% of its known localities (Picker and De Villiers 1989).

Thus, *X. gilli* has been recorded from a total of 10 quarter-degree grid cells (excluding the two inland localities), but since 1995 it has been found in only five of these cells (3418AB, AD, BD; 3419AC, DA). The atlas data are reliable.

## Habitat

*X. gilli* inhabits blackwater wetlands in low-lying coastal areas. These are permanent and seasonal seepages, marshes, ponds, pans, vleis and coastal lakelets, in a variety of fynbos vegetation types and, in places, a mixture of fynbos and dune thicket. The vegetation types include mostly Mountain Fynbos, Sand Plain Fynbos (on the Cape Flats), or Mountain Fynbos mixed with either Limestone Fynbos or Dune Thicket. The substrate has a predominantly sandy base and varies, depending on the humic content, from white or grey to a dark brown or blackish soil.

The water is humic and dark in colour, low in nutrients, high in dissolved solids, and typically has a low pH (minimum 3.4; Picker 1985). It has been demonstrated that the tadpoles of *X. gilli* can tolerate pH as low as 3.6, whereas *X. laevis* tadpoles have a reduced rate of survival below pH 5–6. This accounts for the observed habitat segregation between these species on the Cape Peninsula where *X. gilli* occurs in acidic blackwater seepages and ponds, while *X. laevis* prefers clear water bodies with elevated pH, for example, artificial impoundments (Picker et al. 1996). Disturbances of *X. gilli* water bodies which alter the humic content and nutrient levels, cause an increase in pH levels and often result in the colonisation of these water bodies by *X. laevis*, providing an opportunity for hybridization between the species (Simmonds 1985; Picker et al. 1996).

While *X. gilli* avoids habitats that have been disturbed by urban development or agriculture, or that contain invasive plants and animals (Picker 1985; Picker and De Villiers 1989), it is interesting to note that healthy populations of this frog inhabit certain seepages that were excavated to form waterholes in the Cape of Good Hope area of the Cape Peninsula National Park (CPNP). However, no other habitat disturbances or threats are evident in these pools, the water quality meets the necessary requirements, and consequently *X. gilli* populations have flourished in them for well over two decades.

## Life history

When its wetland habitat dries up during the summer months, *X. gilli* survives by aestivating below the surface. Rau (1978) found several specimens encapsulated in the mud of dried-up vleis on the Cape Flats, and Rose (1962: 33) found one individual at a depth of 15 cm amongst the roots of a large "weed" growing on the site of a small dried-up vlei. During the rainy season, overland migrations between ponds have been observed in Cape Peninsula National Park (Picker 1985).

Breeding commences during the wet winter months (July), and continues until late October (Rau 1978). Three to four hundred dark brown eggs are laid over a period of a day, each surrounded by a jelly capsule 1.3 mm in diameter (Channing 2001). The nektonic tadpoles feed on phytoplankton in the water and complete their metamorphosis by the end of summer. Rau (1978) recorded spawning activity over a four-month period and found metamorphosis to take about 120 days. The breeding season of *X. gilli* overlaps that of *X. laevis*, which increases the opportunity for hybridization (Rau 1978; Picker et al. 1996).

Adult frogs feed on living and dead animal material in their wetland habitat, including aquatic invertebrates and the eggs, tadpoles and smaller frogs of their own kind and other species (Picker and De Villiers 1988). Predation of the immature stages of *X. gilli* by the larger *X. laevis* is presumably intense in disturbed habitats that have been invaded by the latter. Other predators include herons, cormorants and water mongoose.

## Conservation

### Status

Development and general habitat degradation have severely impacted on the extent of occurrence and area of occupancy of this species, resulting in a loss of more than 50% of its habitat, and severe fragmentation of its populations (Harrison et al. 2001). This is particularly serious on the Cape Flats and adjoining Cape Peninsula where extensive urban development has taken place. By now, *X. gilli* is possibly extinct in both of these areas except for populations in the Cape Peninsula National Park. Similar threats are escalating between Rooiels and Kleinmond on the south coast, leading to further habitat loss and fragmentation.

About 70% of all currently known *X. gilli* habitat is situated in the Cape Peninsula National Park. This is the stronghold of the species with healthy populations in the Cape of Good Hope area. The populations at some sites in this area have been found to vary from 121–591 frogs (Picker and De Villiers 1989; Picker et al. 1996). It is nevertheless of concern that *X. laevis* and/or hybrids have been reported from most of the wetlands in this area, and the situation needs to be monitored. It is also of concern that the only *X. gilli* habitat protected within a conservation area, besides Cape Peninsula National Park and Greater Betty's Bay Nature Reserve, is a small remnant of habitat in Agulhas National Park.

*X. gilli* was included in the first South African Red Data book for amphibians, in the Rare category (McLachlan 1978). In the revision (Branch 1988), it was classified Endangered. Endangered status was retained in Harrison et al. (2001), based on an extent of occurrence <5000 km$^2$, an area of occupancy <500 km$^2$, a severely fragmented habitat, continuing decline in the extent of occurrence, area of occupancy, extent and quality of habitat and the number of locations/subpopulations and mature individuals. The species is legally protected by Nature Conservation Ordinance 19 of 1974, but is not listed by CITES.

### Threats

Loss of habitat and habitat fragmentation pose the most serious threats to the survival of *X. gilli.* In particular, urban development and agriculture have resulted in the filling in and drainage of its wetland habitat or have led to the pollution and eutrophication of breeding sites. Furthermore, the building of artificial reservoirs and irrigation systems has enabled the highly adaptable *X. laevis* to invade areas from which it was previously excluded, including disturbed blackwater wetlands containing populations of *X. gilli*. Predation by *X. laevis* on the eggs, tadpoles and froglets of *X. gilli* represents a further threat to the survival of *X. gilli*.

Urban expansion and human activities also accelerate the spread of invasive alien vegetation. At some localities, indigenous fynbos vegetation has been replaced by stands of exotic trees (Port Jackson Willow *Acacia saligna* and Rooikrans *A. cyclops).* This alters the water chemistry and results in unsuitable habitat for *X. gilli.* Introduced predatory fish may pose an additional threat, particularly in some of the larger, permanent wetlands.

The invasion of disturbed *X. gilli* habitat by *X. laevis*, and the subsequent hybridization of these two species, has been well documented (Rau 1978; Picker 1985; Simmonds 1985; Picker and De Villiers 1989; Picker et al. 1996; Evans et al. 1998). Hybridization threatens the gene pool of the smaller, less numerous *X. gilli*, through potential genetic swamping of populations. This threat is present throughout the distribution area of *X. gilli* (Picker et al. 1996) but appears not to be as serious as was previously thought (Evans et al. 1998).

### Recommended conservation actions

The distribution and conservation status of *X. gilli* is monitored by the Western Cape Nature Conservation Board (WCNCB) as part of a threatened species monitoring programme (De Villiers 1997). Healthy populations in the Cape of Good Hope area were monitored mainly by the Zoology Department of the University of Cape Town, but monitoring ceased in 2000. It will be continued by the CPNP in conjunction with the WCNCB. Besides the monitoring of known localities, additional survey work is to be conducted in surrounding areas, including montane habitats.

Although *X. gilli* populations on the Cape Peninsula are well protected, it is important that other viable populations be included in statutory conservation areas and managed appropriately. This was strongly recommended by Evans et al. (1997), who found that populations to the east of False Bay showed significant genetic differences from the Cape Peninsula populations, although these were not considered to be taxonomically significant. In particular, they indicated that "protective measures within *X. gilli* habitat near Kleinmond would conserve much of the genetic diversity seen in this species".

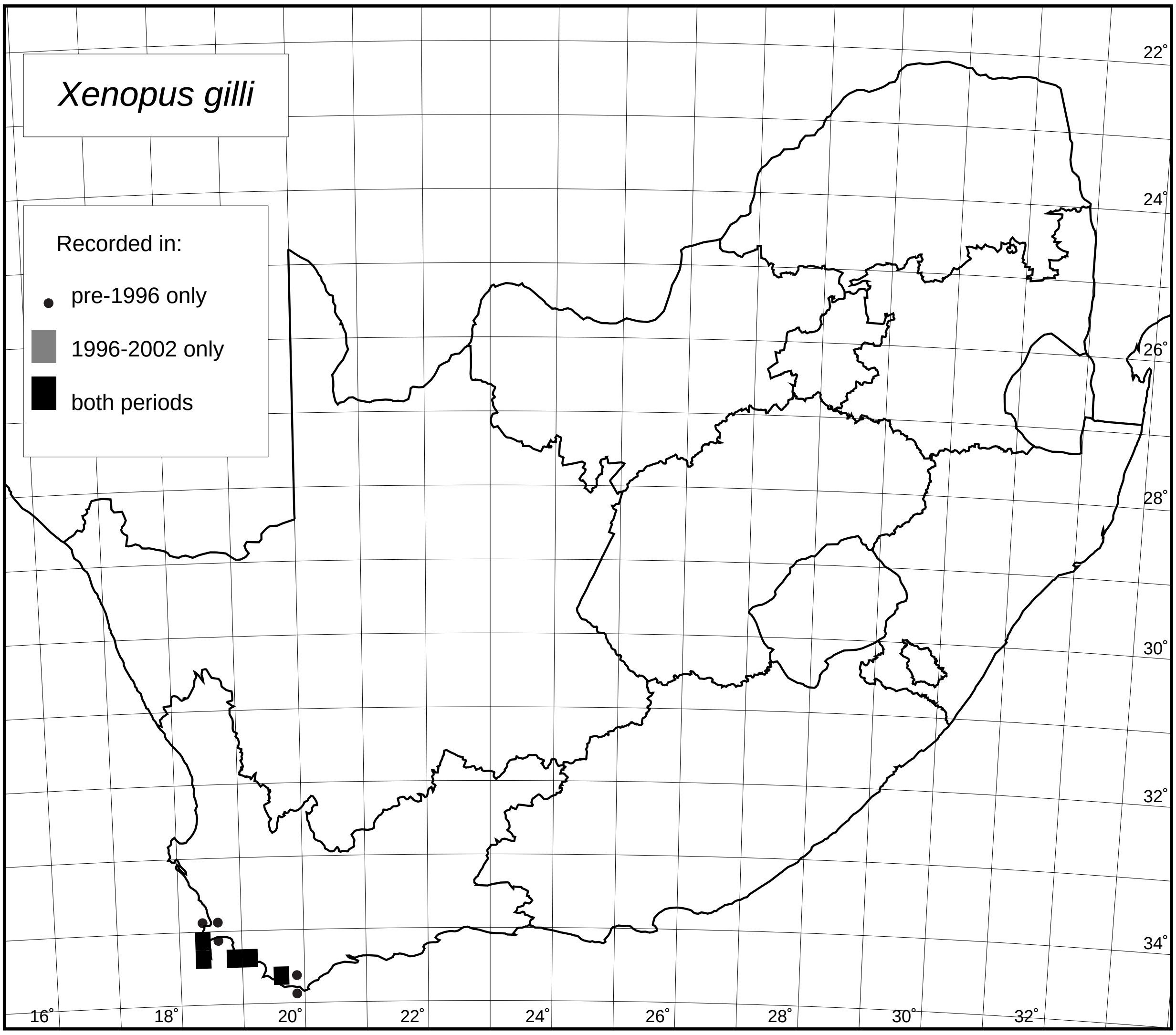
The main management activity is control of alien vegetation. This is undertaken on the Cape Peninsula by CPNP, in the Kleinmond area by the WCNCB, and in the Betty's Bay area by the Overstrand Municipality. Alien vegetation clearing programmes are now underway in the Gansbaai to Agulhas area, but they need to be intensified in *X. gilli* habitat.

In 1985, a Cape Platanna Conservation Committee built a precast wall around Geps Dam, one of the pools in the Cape of Good Hope area, to protect its *X. gilli* population from contamination with *X. laevis* (Picker and De Villiers 1989). After the wall was built, *X. laevis* and hybrids were removed from the water body. Holes were regularly found under the wall, but no *X. laevis* or hybrids were observed in the water body when it was last examined in 2000. In fact, *X. laevis* and hybrids are apparently on the decline in at least this section of the Cape of Good Hope area (M.D. Picker pers. comm.). Although the situation requires continued monitoring, it seems that the wall now serves little purpose and might safely be removed.

In 1988, the Cape Platanna Conservation Committee translocated 154 juvenile *X. gilli* from the Cape of Good Hope area to four blackwater pools in the Silvermine nature area, both areas falling within the present CPNP. Although a survey produced no sign of *X. gilli* in the Silvermine nature area shortly before the translocation, about 16 specimens were collected in 1926 from somewhere in and next to the "Sylvermyn River" which drains this area (Rose and Hewitt 1927). The main reason for the translocation was to establish a separate breeding colony of *X. gilli* on the Cape Peninsula that would perhaps be free of the *X. laevis* threat. It would appear that this experiment has had some success: from one to six adults have been seen in one of the pools on about four occasions during the 10-year period following the translocation. Further recommendations are being formulated in this regard, and monitoring work is to continue.

*A.L. de Villiers*

| | Pre-1996 | Post-1995 | Total |
|---|---|---|---|
| Number of records | 23 | 8 | 31 |
| Number of grid cells | 10 | 5 | 10 |
| % grid cells | 0.5 | 0.3 | 0.5 |
| **Age-class code:** | | | |
| Eggs | 0 | 0 | 0 |
| Tadpoles | 0 | 0 | 0 |
| Juvenile | 0 | 0 | 0 |
| Adult frog | 20 | 8 | 28 |
| **Records per ID category:** | | | |
| Recorded call | 0 | 0 | 0 |
| Call heard only | 0 | 0 | 0 |
| Specimen seen only | 3 | 3 | 6 |
| Voucher/Museum specimen | 12 | 3 | 15 |
| Literature record | 9 | 0 | 9 |
| Other databases | 6 | 0 | 6 |
| Other sources | 1 | 4 | 5 |



# *Xenopus laevis* (Daudin, 1802)

**Common Platanna,** African Clawed Toad, Gewone Platanna (A)

## Distribution

This species is widely distributed in sub-Saharan Africa. Six subspecies are recognised, but parasitological and molecular data indicate that *X. laevis laevis* is the most divergent of these taxa and should be raised to the species level (Kobel et al. 1996; Kobel et al. 1998; Jackson and Tinsley 1997; Measey and Channing 2003). *X. l. laevis* occurs throughout southern Africa south of the Zambezi River, and is the only subspecies currently known to occur within the atlas region. However, winter and summer rainfall areas hold genetically distinct groups that may represent different subspecies of *X. laevis* (Grohovaz et al. 1996; Measey and Channing 2003).

In the atlas region, *X. laevis* is a common and widespread species, occurring from sea level to nearly 3000 m in Lesotho. In the west, it is apparently absent in areas of extreme aridity, including much of the Kalahari and Bushmanland in Northern Cape Province, although this may be due to inadequate sampling. Its distribution extends eastward as far as the Great Escarpment, where it comes into contact with *X. muelleri* in the low-lying parts of Limpopo and Mpumalanga provinces (see *X. muelleri* account).

*X. laevis* is a highly invasive species, as is evidenced by the feral populations that have become established in many parts of the world. Its present distribution in the atlas region may not represent its 'natural range' as this frog is commonly used as live bait by fishermen and may have been inadvertently translocated to areas from which it was previously absent. The proliferation of farm dams and reservoirs over a few hundred years is another factor which may have enabled this species to expand its range.

The atlas data are reliable, but many of the gaps in distribution do not necessarily reflect absence.

| | Pre-1996 | Post-1995 | Total |
|---|---|---|---|
| Number of records | 718 | 948 | 1669 |
| Number of grid cells | 389 | 642 | 837 |
| % grid cells | 19.5 | 32.2 | 42 |
| **Age-class code:** | | | |
| Eggs | 0 | 0 | 0 |
| Tadpoles | 41 | 160 | 201 |
| Juvenile | 10 | 79 | 89 |
| Adult frog | 297 | 671 | 968 |
| **Records per ID category:** | | | |
| Recorded call | 1 | 1 | 2 |
| Call heard only | 0 | 20 | 20 |
| Specimen seen only | 55 | 670 | 725 |
| Voucher/Museum specimen | 635 | 263 | 898 |
| Literature record | 44 | 3 | 47 |
| Other databases | 269 | 32 | 301 |
| Other sources | 25 | 12 | 37 |

## Habitat

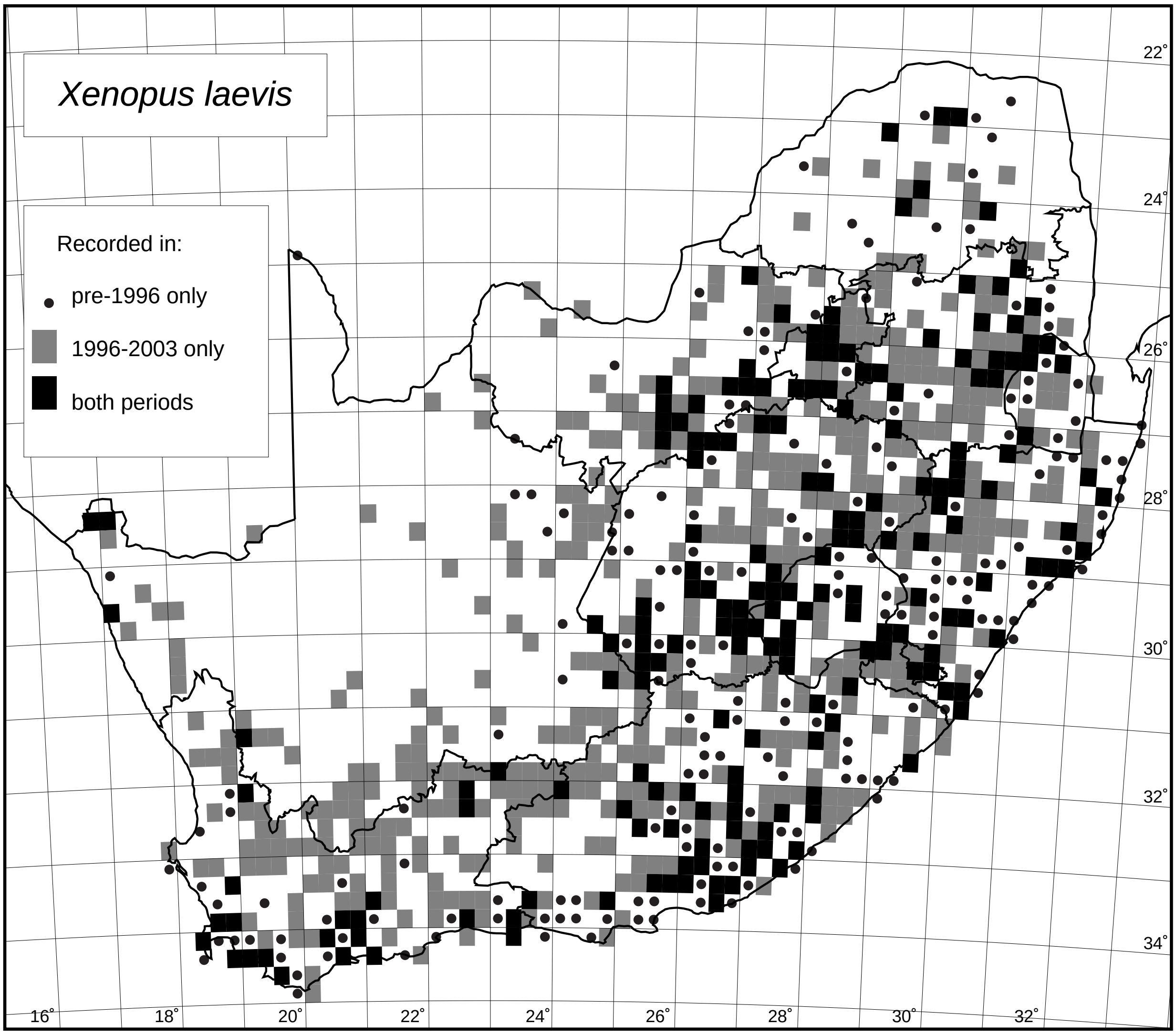
This species inhabits all of the biomes in the atlas region. Prior to the advent of modern agriculture, *X. laevis* probably occurred in low densities in natural water bodies, such as streams, rivers and their pools. Nowadays, however, the species is also found in a variety of man-made water bodies such as farm dams, ponds, sewage purification works and fish farms. Eutrophic waters seem to produce the highest densities.

There are some studies of native populations (Schoonbee et al. 1992), although the best descriptions of habitat are in respect of feral populations (Tinsley and McCoid 1996; Measey 2001). Breeding and non-breeding habitats appear to be the same, although there are no records of breeding in flowing water.

## Life history

After heavy rains, *X. laevis* sometimes leave water bodies *en masse*, and single individuals are also encountered on the surface in damp weather. These appearances may be associated with movement to and from breeding sites (Du Plessis 1966). Breeding begins at the onset of the rains, thus at different times in the summer and winter rainfall areas (Berk 1938; Kalk 1960). There is a prolonged breeding period throughout the rainy season, and both females and males are able to breed more than once per season (Hey 1949).

Many laboratory studies have documented calling in *X. laevis*, describing the advertisement call of the male and acceptance or rejection by females. However, such studies have relied on hormonal induction and may not represent natural behaviours (Picker 1980; Kelley 1996; Tobias et al. 1998). Field studies have suggested that males call around the edges of territories, although this may be density dependent (A. Elepfandt pers. comm.). Spawning takes place during the night when couples, in inguinal amplexus, swim around the pond depositing single eggs on any hard substrate (McCoid 1985).




Larvae hatch within two to three days and, after finishing the yolk supply, begin to feed on algae suspended in the water column. Tadpoles display coordinated schooling behaviour, and maintain their position in the water column by means of a characteristic undulating motion of the tail (Wassersug 1996). Time to metamorphosis varies with temperature and the abundance of food. In optimal conditions, metamorphosis is possible within two months (Tinsley et al. 1996).

Adults may move from water bodies after breeding, reducing the incidence of cannibalism (Hey 1949; McCoid and Fritts 1980; Measey 1998b). Adults are generalist predators and scavengers, and can hold food items in their toothed mouths while breaking it apart with their claws using an overhead kick (Avila and Frye 1978). These behaviours can be detected by other adults in the vicinity and sometimes lead to a feeding frenzy (Frye and Avila 1979). Most food items for post-metamorphic *X. laevis* are benthic macro-invertebrates, such as chironomid larvae. However, a wide variety of food sources are used from all microhabitats in water bodies, including carrion and terrestrial food items (Measey 1998a, b). Even the largest animals take very small prey items, such as zooplankton and ostracods.

Toward the peak of the dry season, *X. laevis* will either move from drying water bodies or burrow into the wet mud to aestivate. Longevity is unknown for native animals, but in feral populations and in captivity, individuals are known to have lived for more than 15 years (Measey and Tinsley 1998).

*X. laevis* plays an important role in the ecology of southern African wetlands because it is widespread and abundant, and it is a voracious predator as well as an important prey item for several mammalian, avian and reptilian predators.

## Conservation

*X. laevis* does not seem to be threatened in any part of its range. Montane populations may be genetically distinct (Measey and Channing 2003; Grohovaz et al. 1996) and may warrant management attention. Hybridisation occurs at the northern and southern ends of its range, with *X. muelleri* and *X. gilli*, respectively.

*X. laevis* seems to present a problem to other species because of its invasive tendencies. This is exacerbated by the fact that thousands of these frogs have been exported from South Africa since the 1930s, and still are, because of the popularity of the species as a laboratory animal. There is concern that this trade may also be contributing to the global spread of chytridiomycosis (Weldon 2002).

*G.J. Measey*

# *Xenopus muelleri* (Peters, 1844)

**Müller's Platanna,** Tropical Platanna, Müller's Clawed Toad, Müller se Platanna (A), Tropiese Platanna (A)

## Distribution

The distribution of *X. muelleri* in sub-Saharan Africa is divided into two distinct areas containing animals that are morphologically similar but probably represent allopatric sibling species (Kobel et al. 1996). One of these forms, *X. muelleri*-East, extends from southeastern Kenya to South Africa, and is the only form in the atlas region. This form includes the type material (from Mozambique), and hence is hereafter referred to as *X. muelleri*.

Within the atlas region, this species is confined to low-lying areas in northern and eastern Limpopo Province, eastern Mpumalanga and Swaziland, and northeastern KwaZulu-Natal, which form the western and southern limits of the Mozambique plain. Although Fischer et al. (2000) recorded mixed populations and hybridization between *X. muelleri* and *laevis* in Mpumalanga (2430BD), the two species are largely allopatric.

The ranges of *X. muelleri* and *laevis* are separated by the 18°C mean July isotherm, with *muelleri* part of a tropical faunal assemblage north and east of this climatic boundary, and *laevis* part of a non-tropical assemblage distributed to the south and west of the isotherm (Poynton 1964; Poynton and Broadley 1991). It is possible that the distribution of the species reflects differences in temperature tolerance: *X. laevis* appears to be able to tolerate a wider range of environmental temperatures than *X. muelleri*, which is more tolerant of high temperatures (Tinsley et al. 1996; see discussion under Habitat).

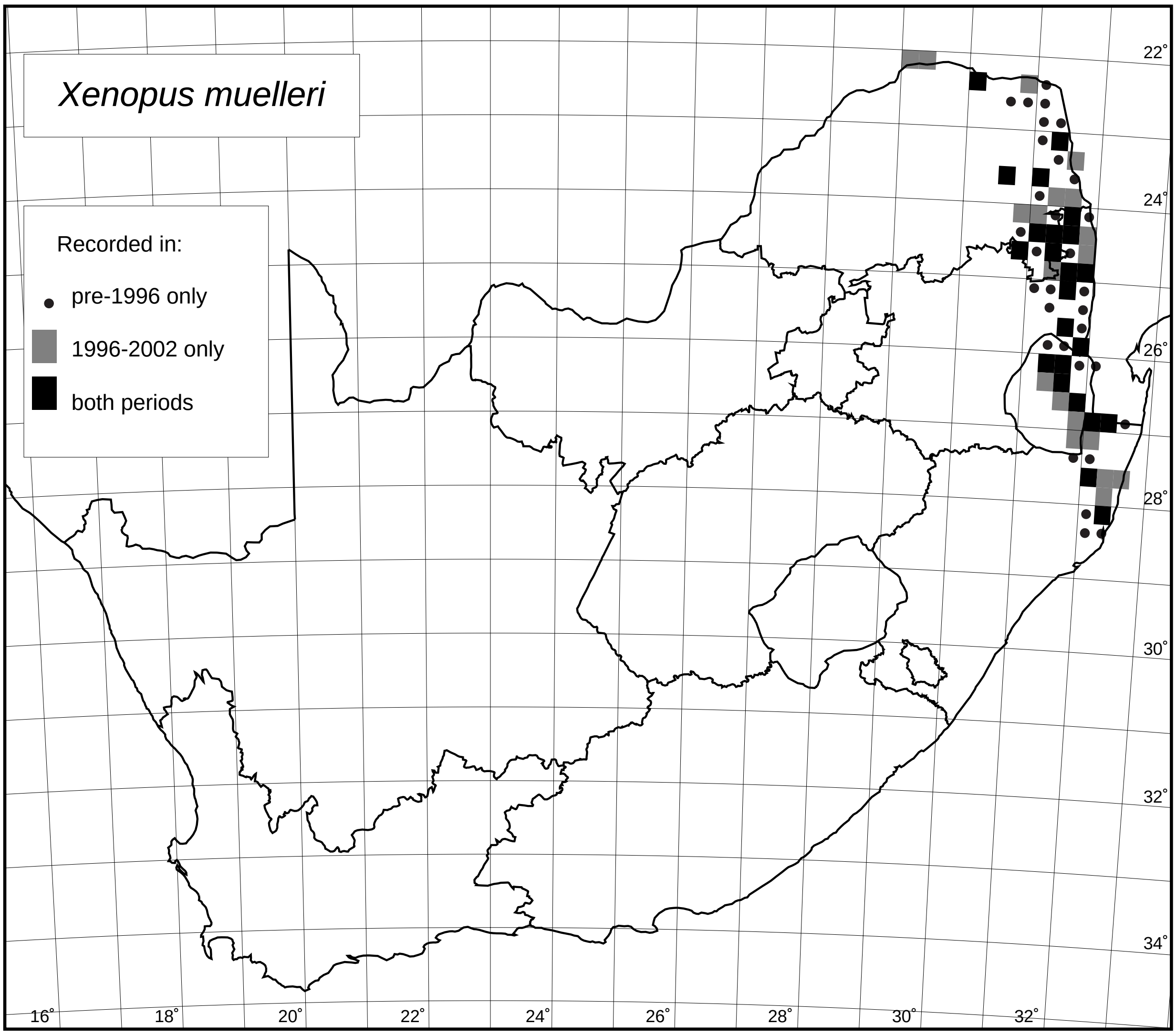
The atlas data can be regarded as reliable as *X. muelleri* can be easily distinguished, morphologically, from *X. laevis*.

| | Pre-1996 | Post-1995 | Total |
|---|---|---|---|
| Number of records | 101 | 77 | 178 |
| Number of grid cells | 54 | 42 | 73 |
| % grid cells | 2.7 | 2.1 | 3.7 |
| **Age-class code:** | | | |
| Eggs | 0 | 0 | 0 |
| Tadpoles | 3 | 3 | 6 |
| Juvenile | 1 | 4 | 5 |
| Adult frog | 57 | 68 | 125 |
| **Records per ID category:** | | | |
| Recorded call | 0 | 0 | 0 |
| Call heard only | 0 | 4 | 4 |
| Specimen seen only | 13 | 56 | 69 |
| Voucher/Museum specimen | 64 | 16 | 80 |
| Literature record | 23 | 2 | 25 |
| Other databases | 6 | 2 | 8 |
| Other sources | 6 | 3 | 9 |

## Habitat

*X. muelleri* inhabits all types of water bodies, including lowland rivers, lagoons, dams and pans (Poynton and Broadley 1985a), mainly in the Grassland and Savanna biomes. It is seldom found in pristine forest habitats, but readily moves into deforested areas (Tinsley et al. 1996).

*X. muelleri* and *X. laevis* do not appear to differ with regard to water-quality preferences or requirements. The apparent difference in temperature tolerance does not seem to apply in southern Namibia, where *X. laevis* occurs at temperatures at least as high as those from which it is apparently excluded in the east (Tinsley et al. 1996). A possible explanation is that *X. laevis* uses cool refugia within high temperature water bodies. This has been observed in extralimital populations of *X. laevis* (pers. obs.). Absence of such refugia from some sites would explain the observations of Lambiris (1989a) and Poynton and Broadley (1985a) that the two species are rarely found at the same site.




## Life history

Little is known specifically about the life history of *X. muelleri*, although much can be inferred from the characteristics of the rest of the genus. Like other *Xenopus*, they are known to move *en masse*, even under dry conditions (Tinsley et al. 1996). Loveridge (1953a) found them aestivating in the mud of a dried pond.

Prey items include beetles, beetle larvae and frogs' eggs (Barbour and Loveridge 1928), while predators include Hammerkop *Scopus umbretta* (Loveridge 1953a), Green Water-snake *Philothamnus irregularis* (Sweeney 1961) and Barbel *Clarias gariepinus*. *X. muelleri* has been observed leaving the water to escape barbel (L.R. Minter pers. comm.)

## Conservation

*X. muelleri* is not threatened, and does not warrant conservation action.

*G.J. Measey*