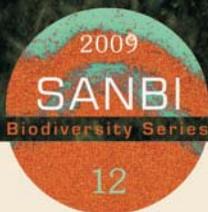


G.J. Measey,  
P.K. Malonza  
and V. Muchai

# AMPHIBIANS

of the Taita Hills



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# Symbol key

<b>habitat</b>	pond	
	puddle	
	river	
	stream	
	underground	
<b>day / night</b>	day	
	night	
<b>altitude</b>	high	
	low	
<b>vegetation types</b>	shamba	
	forest	
	plantation	





**SANBI Biodiversity Series**

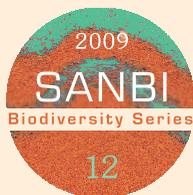
# Amphibians of the Taita Hills

by

G.J. Measey, P.K. Malonza and V. Muchai



2009



## SANBI Biodiversity Series

The South African National Biodiversity Institute (SANBI) was established on 1 September 2004 through the signing into force of the National Environmental Management: Biodiversity Act (NEMBA) No. 10 of 2004 by President Thabo Mbeki. The Act expands the mandate of the former National Botanical Institute to include responsibilities relating to the full diversity of South Africa's fauna and flora, and builds on the internationally respected programmes in conservation, research, education and visitor services developed by the National Botanical Institute and its predecessors over the past century.

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## Contents

Foreword . . . . .	iv
Explanatory notes . . . . .	v
Acknowledgements . . . . .	vi
Biodiversity . . . . .	1
Climate in Taita . . . . .	4
Amphibians . . . . .	8
Metamorphosis . . . . .	8
Amplexus . . . . .	8
Direct development . . . . .	10
<i>Xenopus borealis</i> . . . . . northern clawed frog . . . . .	12
<i>Hemisus marmoratus</i> . . . . . pig-nosed frog . . . . .	16
<i>Callulina davida</i> . . . . . Taita warty frog . . . . .	20
<i>Arthroleptis xenodactyloides</i> . . . . . eastern dwarf squeaker . . . . .	24
<i>Amietophrynus gutturalis</i> . . . . . guttural toad . . . . .	28
<i>Mertensophryne taitana</i> . . . . . Taita dwarf toad . . . . .	32
<i>Leptopelis concolor</i> . . . . . pale-coloured tree frog . . . . .	36
<i>Ptychadena mascareniensis</i> . . . . . Mascarene ridged frog . . . . .	38
<i>Ptychadena anchietae</i> . . . . . Anchieta's ridged frog . . . . .	42
<i>Phrynobatrachus scheffleri</i> . . . . . Scheffler's puddle frog . . . . .	46
<i>Amietia angolensis</i> . . . . . Angola river frog . . . . .	48
<i>Hyperolius glandicolor</i> . . . . . Peters reed frog . . . . .	50
<i>Kassina senegalensis</i> . . . . . common bubbling kassina . . . . .	54
<i>Cbiromantis petersii</i> . . . . . Peter's foam-nest tree frog . . . . .	56
<i>Boulengerula taitana</i> . . . . . Taita Hills caecilian . . . . .	60
<i>Boulengerula niedeni</i> . . . . . Sagalla caecilian . . . . .	64
Further reading . . . . .	69
Clubs and Societies . . . . .	70
About the authors . . . . .	71
Index . . . . .	74

## *Foreword*

This book documents amphibians found in the Taita Hills. Amphibians are some of the least known animals and also not very much liked due to their slimy bodies. They are also among some of the most threatened animals due to human activities. This book will help demystify what amphibians are and their importance in conservation. I hope this will help the readers start appreciating these animals and the importance of conserving their environment and especially the indigenous forests on which most of them depend. I want to believe that you will develop pride (as I did) in the knowledge that some of these only occur in Taita and nowhere else in the WHOLE WORLD.

We live in a rich and beautiful place that must have been even richer and more beautiful before we cleared much of the indigenous forest cover. The Taita Hills has lost over 98% of its forest cover over the last 200 years, according to scientists. It is our onus to see that no more loss occurs and instead try to restore this beautiful place as much as we can. This will benefit us in several ways such as increased watershed services, improved food security and also conserve the unique biodiversity (*Uhaimai*) we have.

The hard work and dedication of the authors has resulted in a work of such comprehensiveness that is sure to impart valuable knowledge to the readers.

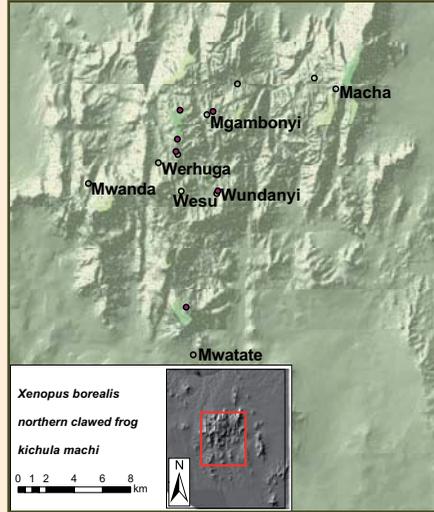
**James Mwang'ombe**

Project Coordinator

The East African Wild Life Society

10 October 2008

# Explanatory notes



The calendar shows relative monthly changes in rainfall and temperature as shades of blue and red. The following bars indicate when males are calling, when eggs and tadpoles can be found, and lastly when adults can be found.

Average sizes of males and females are given relative to a human hand size. Individuals that you find may be smaller or larger than these average sizes.

The maps indicate places where we have found each species of amphibian. It may be possible to find them in other places, and we encourage you to look!



## Acknowledgements

We thank the Critical Ecosystem Partnership Fund for supporting research on amphibians in the Taita Hills and the production of this guide.



Swahili translation by Ahmed Omar (National Museums of Kenya).  
We are extremely grateful to Muthama Muasya (University of Cape Town) for his assistance with the Swahili text.

Photo credits: All photographs by the first author except:

Page 3:	Mwangi Githuru:	<i>Turdus belleri</i>
Page 8:	César Barrio:	<i>Salamandra algira</i>
Page 23:	Anthony Herrel:	<i>Callulina dawida</i> tag
Page 49:	Alan Channing:	<i>Amietia angolensis</i>
Page 54:	Alan Channing:	<i>Kassina senegalensis</i>
Page 71:	Krystal Tolley:	Homo sapiens JM

## *Biodiversity*

Biodiversity is an expression of the biological diversity within a particular area: diversity can be measured from genes to ecosystems, although the most common unit is the number of species. In temperate areas, the number of species is well known as biologists have been working there for a long time, but many areas of the world have not been investigated well and contain unknown levels of biodiversity. In 1999 some scientists investigated the patterns of biodiversity on Earth and concluded that some areas were very special as they contained high numbers of species in well-defined areas that were also under threat. These places they called 'biodiversity hotspots'. Of the 12 biodiversity hotspots that they described, one was called 'Eastern-Arc Mountains and Coastal Forests' in East Africa.

The Eastern-Arc Mountains stretch from the Udzungwas in the far south of Tanzania to the Taita Hills in southeastern Kenya. The mountains in this area are all of the same age (around 200 million years) and have consistently trapped rain clouds coming from the Indian Ocean. This has meant that these mountains have maintained the hot and wet climate which supports natural forests for many millions of years and long before humans inhabited the area.

During this very long period the climate in the area was not stable but went through many wet and dry phases, each lasting many thousands of years. The consequence was that the lowlands became forested (during wet periods) and then turned into savanna (during dry periods). The tops of the mountains of the Eastern-Arc stayed forested the whole time, so that these forests were occasionally connected together in wet periods and separated in dry periods. This gave a chance for the animals and plants that live in the forests to move and spread between mountains, and become separated and isolated into the mountain refuges during dry times. Imagine that if the whole area was once forested and now all those species of plants and animals are concentrated into the forests on the tops of the mountains!

Now, we live in a dry period of this region's history and the savannas form a barrier for most forest animals or plants which cannot move between the mountains of the Eastern-Arc. It is believed that the many changes between connectedness and isolation of the Eastern-Arc Mountains are responsible for the high number of species found in this biodiversity hotspot. At this time (and during dry periods before), the Eastern-Arc



Areas that were once covered in forest are now bare with only small patches of trees which are mostly exotic.



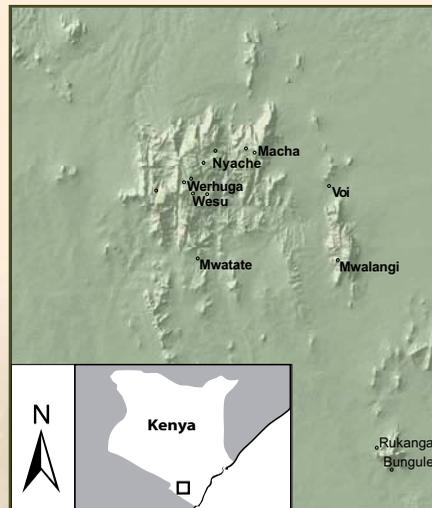
In the lowlands, between the Eastern-Arc Mountains, rainfall is low.

Mountains act as a refuge for many thousands of species which cannot live in the dry savanna. It is possible to think of the mountains as islands of forest surrounded by a sea of savanna. As the species which live in these forests have been isolated for many thousands of years, they have become unique and many exist only on top of individual mountains. We call these species 'endemic' to the particular area they come from. The Eastern-Arc Mountains contain many endemic species which occur nowhere else in the world, and of all the vertebrate animals, the amphibians have the highest total number of species, probably highest in all of Africa.



Endemic species in the Taita Hills include a, Taita imprezia (*Impatiens taitana*); b, the Taita chameleon (*Kinyongia boehmei*); c, the Taita Thrush (*Turdus helleri*); and d, the Taita Cymothoe butterfly (*Cymothoe taita*).

It should come as no surprise that the Taita Hills has a number of endemic animals and plants, species which occur nowhere else in the world. These include the Taita thrush, the Taita African violet, as well as butterflies, millipedes and snails to name but a few. This book is about all of the amphibians in the Taita Hills, whether or not they occur outside, but we will pay special attention to the endemic species of the Taita Hills, where they live and how to identify them. It is our hope that when you know what they look like you will help to preserve and protect these unique and special animals.



The Taita Hills lie in the southeast of Kenya, 160 km northwest of the Indian Ocean.

## Climate in Taita

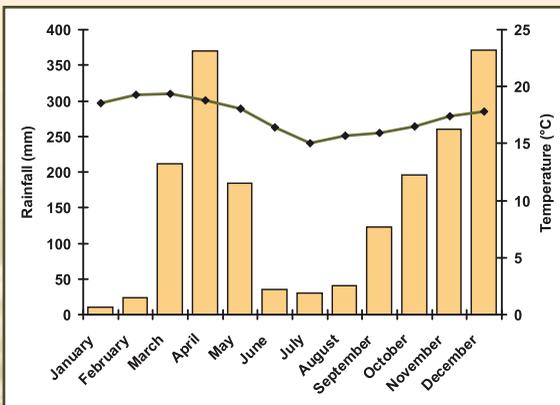
All of this area of Eastern Africa has two distinct rainy periods in every year, the 'Masika', which are long heavy rains from March to May, and the shorter lighter 'Vuli' from October to December. During the dry season a little rain occasionally falls so that no month is completely dry. Unlike the rain, the temperature has a single cold period (in July) and the hottest time in February.

### Rainfall

Some places in Taita are wetter and others drier. In general, higher places are wetter as they catch more of the rain clouds that are passing (for example Mghange and Vuria). But some places are in the 'rain shadow' of mountains which take most of

the rain from the clouds. The rain comes from the Indian Ocean in the southeast, so places which are in the northwest of Taita and behind mountains receive less rain. A good example is the area of Irizi. This is a very dry area although it is at the same altitude as Wundanyi, which is very wet. Irizi is in the 'rain shadow' of Ngangao which takes most of the rain from the clouds before it reaches Irizi.

Different years also have different amounts of rain, and this can include rainstorms during dry periods. A good example was in 2007 when two unseasonal showers deposited nearly 100 mm of rain over much of Taita. However, the dry seasons are never completely dry as any cloud cover brings water in fog to the highest places. Natural forests are particularly good at trapping this



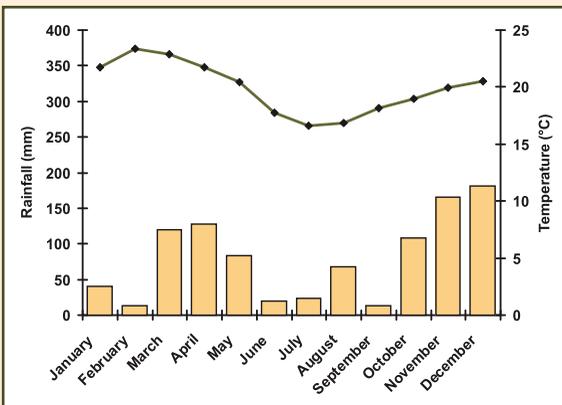
Rainfall and average temperature at Mwachora in 2006 (collected by Oliver Mwakio). Mwachora is a relatively high area (1 630 m asl) and receives much rain.



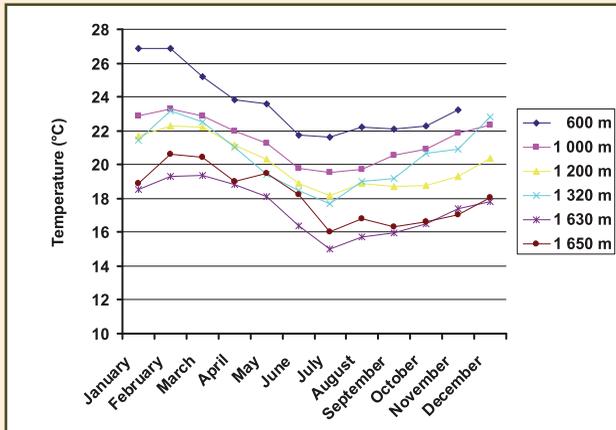
In the rain shadow. Although this area is at 1 400 m asl, the area is dry with candelabra trees and relatively few amphibians.

‘horizontal precipitation’ and direct the water down to the roots. This means that in natural forests the soil is always moist and streams are able

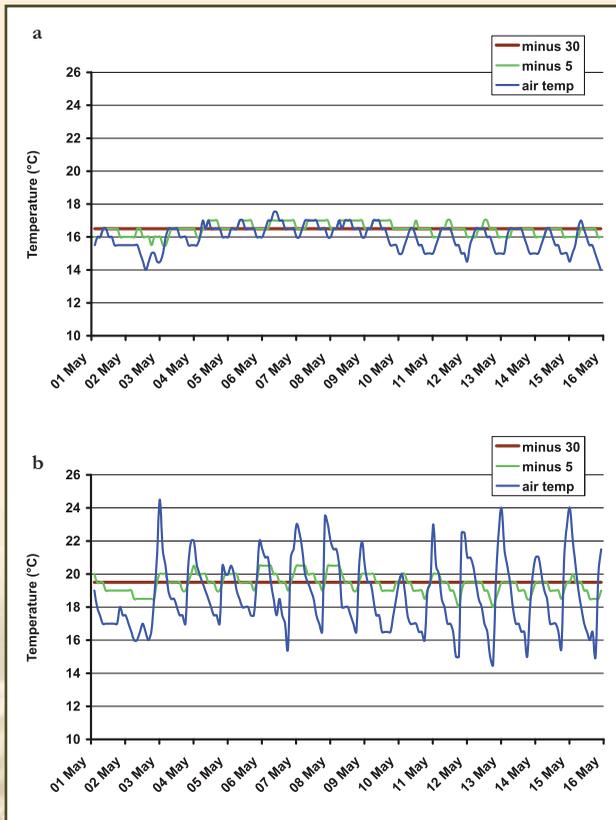
to flow year-round providing much needed drinking water to people living around them. Plantations of eucalyptus are especially bad at this



Rainfall and temperature data for Chawia in 2007 (collected by Christopher Ngeti). At 1 604 m asl, Chawia is almost as high as Mwachora but receives much less rain as it is in the ‘rain shadow’ of Iyale.



Average monthly temperature data from Jora (600 m asl), Piringa (1 000 m asl), Sagalla (1 200 m asl), Mbololo (1 320 m asl), Mwachora (1 630 m asl) and Ngangao (1 650 m asl) in 2006. The higher the site, the cooler the average temperature, but all sites have the same pattern with highest temperatures in February and lowest in July.



Temperature data from (a) Ngangao Forest and (b) a Wundanyi shamba for the first 15 days of May 2006. Notice how the air temperature (blue) varies a lot, while the soil temperature (green) has even less variation, while deep in the soil (brown) the temperature is constant. The forest temperatures are buffered by the deep shade of the trees while on the shamba the air temperature undergoes large peaks and troughs.

Note that 9 May was a cloudy day (with heavy rain!), but on 10, 11 and 12 May it was hot and sunny.

as they soak up all the water deep into the ground. Streams that used to flow in some areas dried up once eucalyptus was planted. The situation is so bad in Sagalla that no water can be dug from the ground in the dry season.

### *Temperature*

The average temperature is directly related to altitude so that the hottest areas are in the lowlands, whereas the coolest are high in the mountains. Daily temperatures are very variable and can change depending on the presence of clouds (cooler in the day and warmer at night) or clear skies (hotter in the day and colder at night). They can also change depending on the vegetation. Forests often feel cool to walk in but at night they are warmer than shambas as they trap the warmth of the day.

As you might expect, soil temperatures are almost constant deep down, and as you approach the surface it is possible to experience daily changes in temperature. There is also a difference between shamba and forest. The deep shade of the forest insulates the air inside so that forests always feel cool on the hottest of days. At night, the air in the forest does not get as cold as that outside so that the forest feels warmer.

Amphibians get their body heat from the environment around them, as

do reptiles and invertebrates. The name for this is 'ectotherm' meaning outside (ecto-) and temperature (-therm). Amphibians do best in a warm, moist environment, so the abundant rain and warm weather in the Taita Hills is very good for them. However, the habitat in which they occur can mean a big difference in temperature and humidity. Natural forests are places with very constant temperature and are always moist. Shambas can vary greatly in temperature and get very dry and very wet. Therefore, different species of amphibians occur in the forests and shambas, while some occur in both.



Rain falls inside the dark forest where the temperature is quite stable.

## *Amphibians*

Amphibians are vertebrates (animals with a back-bone) which have a special moist skin which they can use to breathe oxygen, as well as a set of lungs like us. They lay eggs which have no shell but are coated in jelly. These attributes of amphibians mean that they are commonly associated with water.

The Earth has three groups of amphibians known as frogs, salamanders and caecilians. Sub-Saharan Africa has only frogs and caecilians and both groups occur in the Taita Hills.

### *Metamorphosis*

In school we usually learn about the classic life cycle of an amphibian: jelly-coated eggs are laid in water, these hatch into tadpoles, tadpoles grow bigger, sprout legs and finally go through a metamorphosis when the tail shortens and the legs lengthen to become the juvenile frog which then grows into an adult.

### *Amplexus*

In most frogs, the male grasps the female around her waist or behind her fore-limbs prior to egg laying and fertilisation. This pair of frogs

is said to be ‘in amplexus’ (Latin for embrace), inguinal or axillary, respectively. This is not ‘mating’ as the eggs are not fertilised until the animals go to the laying site, and the



Photographic examples of each order—a, caecilian; b, frog and c, salamander.



Diagram of life-cycle and photographs of stages—a, eggs; b, small tadpoles; c, big tadpoles; d, metamorph and e, adults in amplexus.

position may change for them to do this. Also, not every male which grasps a female will fertilise her eggs as females may reject males, or grasping males may be displaced by other males.

In the Taita Hills it is not hard to see this classic amphibian life cycle of metamorphosis. Try looking in any pond or ditch of water during the wetter months. From June to September many of these dry up which means that these species have a seasonal reproduction tied to the availability of water.

Male frogs call to advertise their presence to females and each species has a distinct and different call. Most

people are very familiar with these sounds even if they do not know that it is a frog that is making it! At the onset of the rainy season (October–November) the calls are very noisy and seem to come from any area where water accumulates. Some species only breed at this time, while others continue calling and breeding throughout the short and long rains.

Female frogs attracted to the calls of males are able to choose an individual from the sound of his call. Once chosen the female's back is grasped by the male (usually smaller), and the pair go to lay eggs. Some species deposit them directly into water in strings, clumps or floating mats. Others lay them on leaves



*Hyperolius glandicolor* male calling.

just above the water so that when the tadpoles hatch they drop into the water and immediately begin to swim.

The tadpoles have a diet very different from the adults. Most eat green plant material called algae that grows abundantly in fresh water, often giving it a green appearance or coating submerged objects in a green slime. The tadpoles graze this food with special teeth. Each species has a unique set of teeth and these can be used to identify which tadpole turns into which frog.

### Direct development

But not all amphibians have a free living ‘tadpole’ stage. Several species in the Taita Hills do not lay eggs in



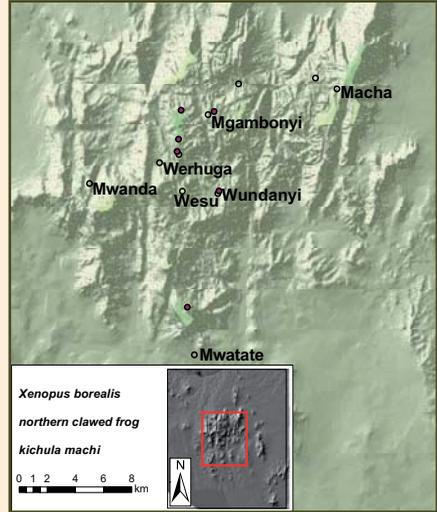
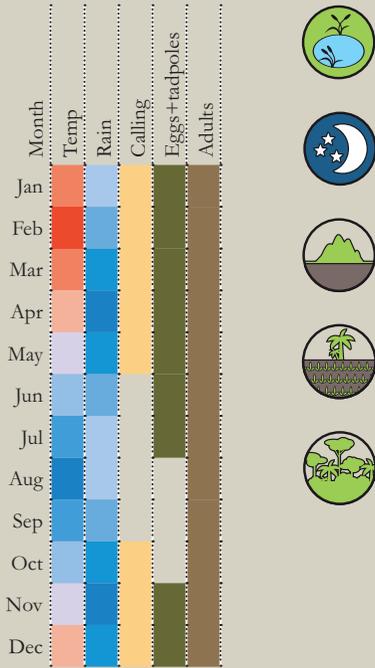
Eggs of the caecilian *Boulengerula taitana* show embryos already developing curled around the yolk.

water instead they are laid within the leaf litter of forests or in the moist soil underground. These species have the advantage that they do not have to return to water in order to breed. They do not even have to wait until it rains to lay their eggs. This independence from water means that they can occur anywhere, often far from water. Their eggs have the same sort of jelly coating as described above; this can dry out

so they must still find somewhere moist to lay their eggs. These frogs and caecilians are perhaps the most fascinating amphibians of the Taita Hills. They include all of the endemic species (see page 3) and much of their natural history was unknown before we made this study. We hope that you enjoy reading about them as much as we have enjoyed studying their fascinating way of life.



# *Xenopus borealis*



Out of water this looks like a very strange frog that moves with difficulty. Note black tips to claws on the feet.

## northern clawed frog



A northern clawed frog breaks through the surface of a typically muddy puddle. Note stitch-like appearance of lateral line organs in lines over the body and around the eyes.

**M**ost frogs are very good at moving on land as well as in water, and either jump or walk very quickly out of the way. Clawed frogs are poor movers on land but they can be found there, during heavy rainstorms, as they seem to flop uncertainly about, or when their pond dries and they move to occupy another. Although not good at moving on land, these frogs are very good at swimming. It is easiest to see them at night shining a torch into the ponds or water-filled ditches

where they live. If you startle them, they disappear very quickly into the mud. Sometimes they appear to hang motionless from the surface while at others they are very active eating insects from the water surface or even launching themselves out of the water to snatch a passing insect.

Once in the hand, this species is very distinctive and hard to confuse with any other in Taita. The hind feet are very large and fully webbed with prominent black claws on the tips of the first four toes (hence the

## *Xenopus borealis* (cont.)



These frogs often sit in water at night with their fingers outstretched feeling for movement of a potential prey item.

name 'clawed frog'). They appear to be covered in 'stitches' which are sensory organs which can detect movement in the water around them. In fact, they use these organs to locate their food which consists of almost everything in the water, including insects, fish, and tadpoles; even their own! They are also very smooth and slippery, quite hard to keep hold of, and can scratch hard using their claws.

During and after heavy rains you might be able to hear the males



Tadpoles of this species look rather like small fish.

## northern clawed frog

calling a 'brrrrr brrrrr brrrrr' sound if you get close to the water surface. Males grasp the females at the top of the back legs and the couple swim in tandem around the pond depositing single eggs on vegetation, rocks or stones. The tadpoles are also unlike any other species in Taita as they are almost transparent, hang in the water with their tails flickering, and filter algae from the water. Two long barbs come from the corners of their mouths giving them the appearance of a catfish, but the eventual growth of legs will betray their amphibious nature.

This species occurs in the highlands of Kenya and Tanzania, and probably in Uganda too.



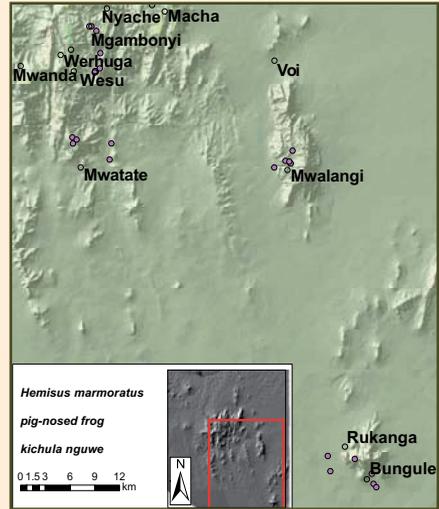
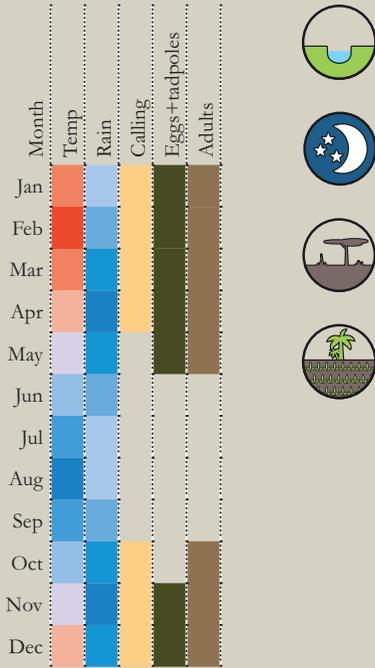
The underside of the northern clawed frog is speckled with orange on legs and arms.

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*Notes*


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# *Hemisus marmoratus*



The pig-nosed frog has a narrow snout and marbled coloration.

## pig-nosed frog



The female is much bigger than the male which digs his hands into her sides to maintain his position during mating.

**I**t would be hard to confuse this species with other frogs in Taita. It uses its small pig-like head to burrow head first into the soil in very wet and sandy places near streams and rivers where it spends the day. This is one of the frogs that are commonly unearthed when digging in shambas, especially in sandy soils. At night, especially after rains, they come out of the soil and move

around shambas eating small insects which they catch by shooting out their sticky tongue. In certain areas, like in the Mwatate or Sagalla valleys this is a very abundant species, but in other areas, at high altitudes or on the steep slopes of the Taita Hills, it is rarely seen.

These frogs have a narrow snout from which they 'shoot' (different

## *Hemisis marmoratus* (cont.)

from all other frogs which ‘flip’) a very special small tongue. The tongue has two lobes which surround the ant or termite as soon as it hits it. As termites and ants move around quite fast, the frog is able to adjust its aim to hit its prey. The size of the snout is so small, these frogs can’t eat bigger prey, instead they specialise on termites and ants.

Calls of the pig-nosed frog can be heard in both rainy seasons with males producing a distinctive ‘quwack’ from areas right next to the breeding habitat. The legs of this species are quite short, so they dig them into the sides of the female when holding her. Together, they lay eggs in a clutch in a hole up to 500 m from still water. The tadpoles hatch inside the hole and move across



Pig-nosed frogs can be found moving around in sandy areas after heavy rains

the intermediate ground when the area is flooded. The tadpoles have a distinctively large tail fin.

This species occurs in a large area outside of the Taita Hills, from South Africa all the way to Egypt and West Africa.

pig-nosed frog

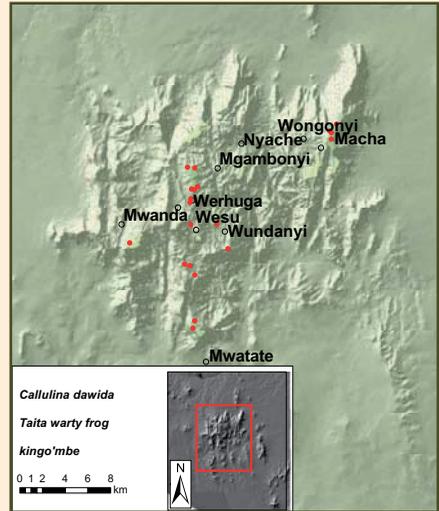
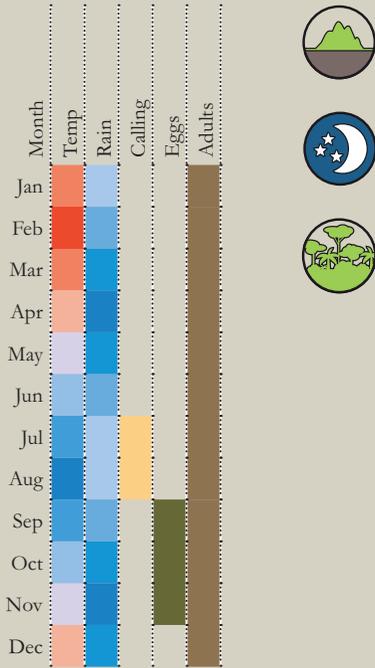
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*Notes*

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# *Callulina dawida*



This frog moves slowly in the leaf litter, giving it the local name *kingo'mbe*.

## Taita warty frog

Critically Endangered

Taita endemic



Many animals have bright blue eyes, and the pattern of their skin can be brown/yellow resembling the dead leaves of the forest floor.

**A**lthough we are familiar with most frogs jumping, this species walks much like a cow across the leaf litter in the indigenous forests of Dawida and Mbololo. Its short legs and long fingers seem best adapted to climbing small trees and vines. During the day animals hide in the leaf litter, but during the night they climb into the low branches of small trees in the forest from where males call in short pulses 'kru kru kru'. It has a warty skin which produces a very sticky substance if picked up.

When disturbed it inflates its body to make it appear larger.

This species only occurs in the indigenous forests of Taita. As there is so little habitat left and the distances between populations are large (fragmented), this species is considered to be Critically Endangered. This means that active conservation measures are needed in order to keep this frog from going extinct. Individuals have been found to occur in small patches of

## *Callulina dawida* (cont.)



A newly hatched frog is so small that it sits comfortably on a finger tip.

indigenous trees on shambas, and these places may be very important for these frogs to move between one forest fragment and the next. By keeping these small patches undisturbed on your shamba, you can help protect this species from extinction.

Our study of this animal in the Taita forests has revealed some of the strange reproductive behaviour. Around 40 eggs are deposited on a large leaf in the leaf litter of an indigenous forest in August or September during the long dry season. This species reproduces by direct development (see page 10) so

there is no tadpole living in water. The female then sits on top of the eggs protecting them from would-be predators, like insects or birds. But only a small number of the eggs are actually fertile, the rest form a kind of moist nest for these fertile eggs to rest in so that they don't dry out.

The female sits on the eggs for 3 months until they are ready to hatch as small frogs. Toward the end of this period, once the rains have started, the female may eat the infertile eggs, ensuring she has enough energy to survive their incubation. The very small (around 10 mm long) frogs that hatch at the

## Taita warty frog



Numbered tags can be seen as an orange rectangle under the skin of the frog. Can you read the numbers of this individual?

beginning of December grow very quickly, doubling their size in four months, by eating small insects in the leaf litter. They can also climb to

escape predators such as Safari ants. In another year they have almost reached the size of an adult and prepare to breed for the first time.

There is still a lot more that we need to learn about this species in order to help with its conservation. More than 100 frogs have been marked individually with small tags (see left/across) on their inner thigh. If you should come across one of these animals with a tag then please write down the tag number, leave the frog in the forest and contact James Mwang'ombe at the East African Wildlife Society office in Wundanyi.

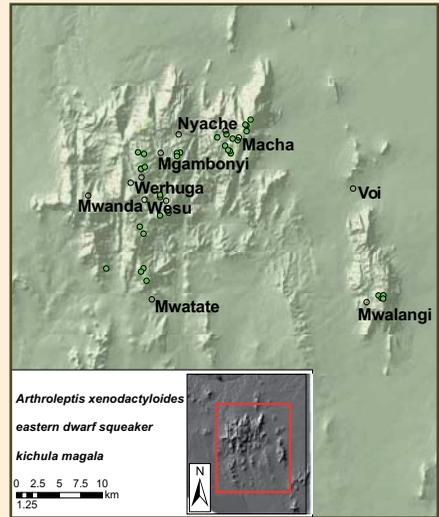
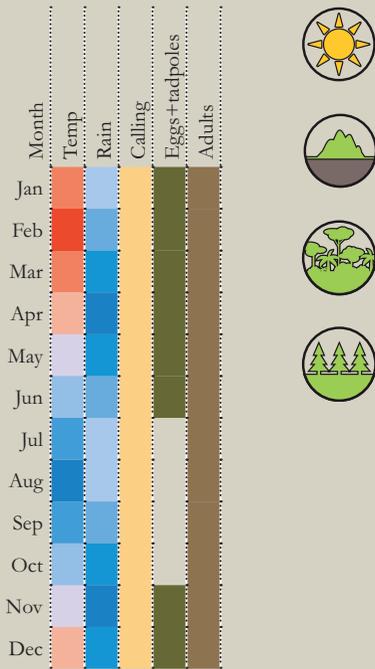
This species occurs in the Taita Hills and nowhere else in the world.

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### *Notes*

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# *Arthroleptis xenodactyloides*



Females (a) are larger than males (b) and are often swollen with eggs making them much fatter.

## eastern dwarf squeaker



The size of a newly hatched juvenile is less than half of an adult, even though the adults are small. Many of these frogs have a characteristic hourglass pattern on their backs.

**T**he dwarf squeaker is abundant in Taita and can be found in any of the forests or plantations. It lives in and on the leaf litter of the forest where it hunts for small insects amongst the leaves. The frogs are very small with females reaching 20 mm long and males only 17 mm long; small enough to sit on your thumbnail. They are the same colour as dead leaves varying between beige, brown to black, often with an hourglass-shape pattern on their backs. The male's call is a tiny cricket-like squeak, that can be heard coming from the forest all year round, especially after rain. The frogs

occur in patches, so you can find them easily just by walking in a forest toward the calling and watching closely at your feet. They are only just a little bigger than crickets and after jumping, disappear under the leaves.

When mating, the males stick to the backs of the females, and the pair then deposits about 25 eggs in the leaf litter. The males stay in the same area and may guard the eggs. This is a direct-developing species (see page 10) and so around 30 days after laying, they hatch directly as small frogs, only 5 mm long. They grow

## *Arthroleptis xenodactyloides* (cont.)

quickly reaching adult size in less than six months.

Genetic studies on these frogs in Taita have suggested that they get displaced during storms and that adults may move long distances of several kilometres to reach another forest. For example, frogs caught in the north of Ngangao Forest were found to be closely related to those in Mbololo.

Outside of the Taita Hills, this species occurs over a large area of East, southern and Central Africa. It is predated upon by birds, snakes and even insects. In Taita it has been



The eastern dwarf squeaker is often a very similar colour to dead leaves.

observed to be eaten by the White-starred Robin which also feeds them to its chicks.

eastern dwarf squeaker

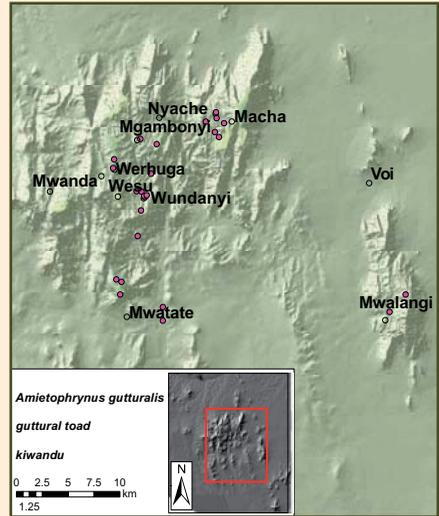
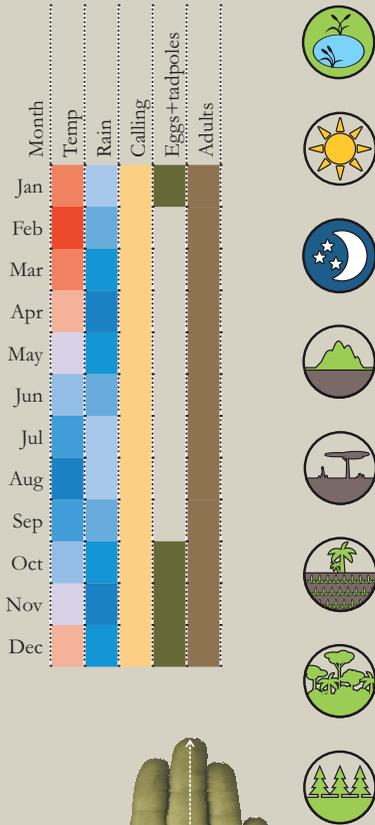
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*Notes*

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# *Amietophrynus gutturalis*



A pair of toads swim in a water-filled ditch selecting a site to lay their eggs.

## guttural toad



Once males have grasped a female they will hold on very tight to ensure that they fertilise her eggs.

**T**his is one of the most familiar species of frogs to Taita people. It is commonly found around homes, in shambas, plantations as well as on forests edges. This explains its Kitaita name as the people's frog, kiwandu. This toad can be found in areas from the base at Mwatate to the heights of Vuria. One of the most spectacular sights is watching these animals come to lights at night to catch insects which are attracted there. On nights

when termites fly this frog can be found gorging itself. Adults will eat just about anything that moves and will fit into their mouths, although most of their diet consists of insects, slugs and snails. On shambas they are a most welcome guest as they eat pests common on many crops.

Males call throughout the year, but are especially loud after the first rains in October and November. Their call is like a sawing noise 'rrrrrrr rrrrrrr'

## *Amietophrynus gutturalis* (cont.)



Eggs are laid in strings amongst vegetation.

and large choruses can be heard over long distances. Males call from inside breeding habitats, both permanent and temporary pools. Females are attracted to the calls and when approaching the chorus they are quickly grasped by males. Many males may try to grasp one female forming large balls of animals. Eggs are laid in long strings (bead-like) that have many thousands of eggs. The tadpoles hatch after a week and mass together as small, very black, forms. They have toxins which make them unpalatable to birds and mammals but are eaten by clawed frogs and aquatic insects.

After two months, small metamorphs begin to leave the water and move into the surrounding habitat. These can be so numerous that they carpet the ground in some areas and it is difficult to avoid stepping on them. Many fall prey to predators and their numbers reduce sharply over the following months as they disperse into the environment. At this small size they can be confused with *Arthroleptis xenodactyloides* (page 24) and *Phrynobatrachus scheffleri* (page 46). In addition, the lowland areas (Tsavo plains) surrounding the

## guttural toad



Individuals can often be seen around houses, especially if there is plenty of food available.



The tadpoles appear as very black forms with rounded bodies.

Taita Hills have two similarly sized toads *Amietophrynus garmani* and *A. xeros*. *Amietophrynus gutturalis* can be distinguished by the prominent cross on its head between the eyes. In Sagalla Hill this species co-occurs

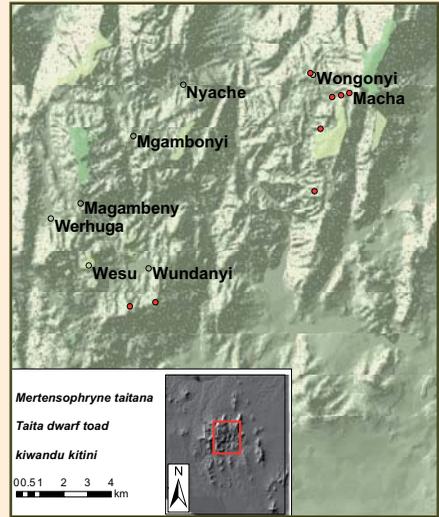
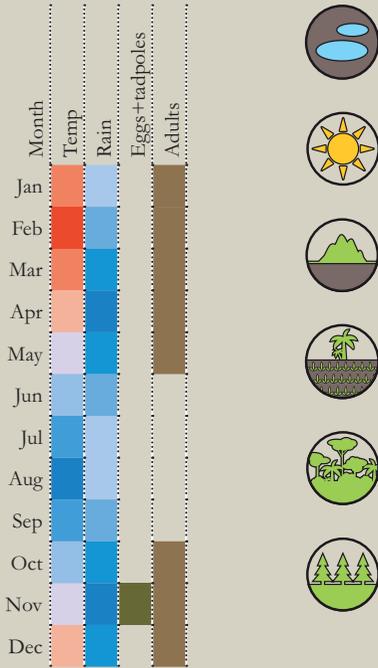
with *A. garmani* but this species has an unmarked face. *A. gutturalis* occurs from the Taita Hills and other highland areas of East Africa all the way south to Durban in South Africa and West to Angola.

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*Notes*


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# *Mertensophryne taitana*



## Taita dwarf toad



A pair of dwarf toads on their way to a road puddle to lay eggs.

The Taita dwarf toad was originally described from specimens caught on Mount Mbololo by Arthur Loveridge in the 1930s, who gave it the species name *taitana*. Since that time, the same species has been found in parts of Tanzania, Congo, Zambia and Malawi. This species is very curious as, unlike most other frogs, males do not have an advertisement call. Recent work in the Taita Hills has found that if disturbed they will emit a small distress call (like many

frogs), but no advertisement call has been heard. Instead both males and females congregate in puddles in the road during November, some weeks into the short rains (Vuli). These small toads (25 to 35 mm long) seem to congregate on a daily basis with eggs being laid in long strings (about 300 eggs per string).

The tadpoles hatch from the eggs very fast and bury into the mud at the sides of the puddle to feed there.

## *Mertensophryne taitana* (cont.)



Strings of eggs are laid in the shallow water where they hatch into tadpoles and develop into frogs in around two weeks.



The road puddles often dry up leaving the tadpoles stranded to become food for scavengers such as these ants.

Each tadpole has a crown of tissue on its head that helps with the low concentration of oxygen in these puddles. The tadpoles transform into metamorphs in a very short period of time, around two weeks which is amongst the fastest recorded for any frog. Once they have bred, the small toads disappear into the surrounding area and are rarely seen again until the time they breed again in November. Some animals have been found on shambas, but little is known about this species away from its breeding site. The adults have a curious habit of sometimes walking on the tips of their toes. It is not known why!

Most individuals have been found on Mbololo, and breeding has only been observed in puddles on roads. Outside of Mbololo there are a few records of this species in the Macha area. Otherwise, it seems to be absent from much of the Taita Hills.

Taita dwarf toad

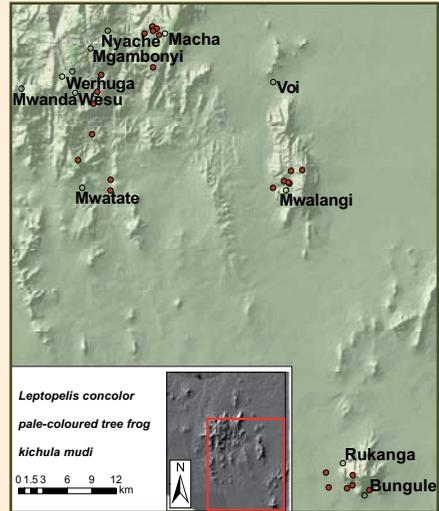
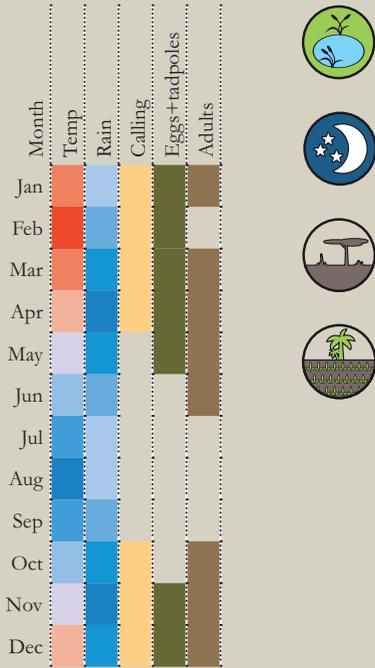
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*Notes*

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# *Leptopelis concolor*



Large eyes are able to see in dim light and prominent discs on the toes are used to hold onto vegetation.

## pale-coloured tree frog



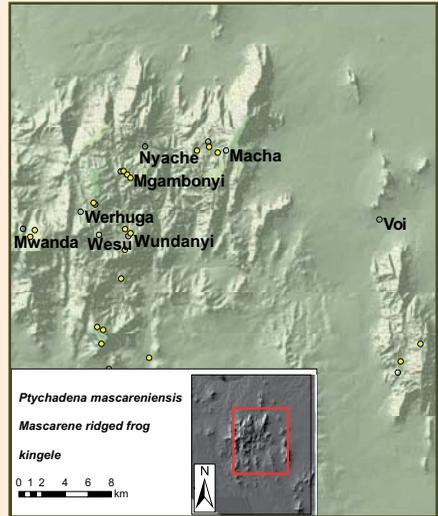
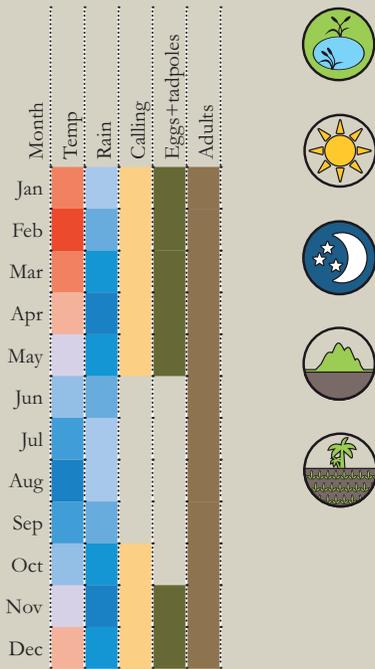
Males sit in vegetation at night to give their distinctive call.

**K**nown mostly from the lower areas of Taita, the pale-coloured tree frog is a common sight on most shambas with some water on them. Sitting at a height of around 1.5 m, males call from October to April on warm, wet nights. The call is made up of two components, first a loud ‘quack’ followed by three quieter, diminishing whistles. Eggs are laid close to, but outside of the water, usually directly above on vegetation. The small tadpoles then develop inside the egg and hatch falling directly into the water as free-swimming tadpoles.

The adults are brown with a distinctive ‘hourglass’ pattern on their backs (like the dwarf squeaker, *Arthroleptis xenodactyloides*). They have very prominent eyes that appear to bulge out of their heads. They use these to search for prey in the low light levels of morning and evening.

Although this species has a similar appearance to the reed frog, *Hyperolius glandicolor* (e.g. discs on toes, sitting posture), they are not closely related. The pale-coloured tree frog belongs to the same group of frogs as the dwarf squeaker.

# *Ptychadena mascareniensis*



Ridged frogs can often be found next to irrigation ditches where they quickly jump into the water if disturbed.

## Mascarene ridged frog



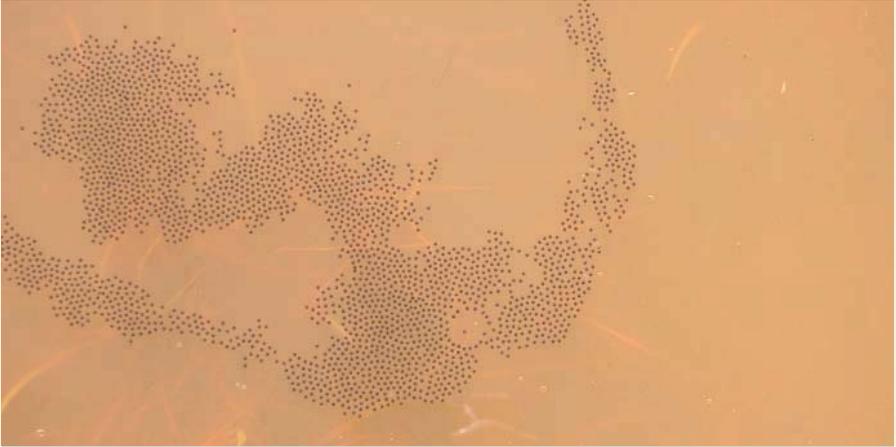
Ridged frog males have prominent eardrums behind their eyes. Beneath the ear is a slit where the vocal sacs emerge when they call.

**W**hile the ridged frog is very common it is often only seen briefly as it jumps out of vegetation into the water and swims away. If you can catch one, you will see quickly that it has a number of folds in the skin (or ridges) running along its back, giving this group of frogs their name: ridged frogs. During the day these frogs hunt at the edge of ponds or slow-moving streams and rivers, looking for small invertebrates to eat, which they catch with a flick of their tongue. If disturbed, they

will immediately jump forwards directly into the water (if it is close enough). They are very good jumpers, capable of covering several metres in one jump.

Ridged frogs breed in the Taita Hills at all times except the dry months of June to September. Males have paired vocal sacs which inflate on either side of their heads, emitting a characteristic 'chrrr chrrr chrrr' that can be heard at a great distance. Females lay eggs which form a floating raft on the surface of pools

## *Ptychadena mascareniensis* (cont.)



Eggs appear as a floating raft for up to a week before the tadpoles hatch and disperse into the water.

and develop into tadpoles which can be found even in roadside puddles. The tadpoles take two months to develop into small frogs which take another nine months to become adult size.

This frog is a great friend of farmers as it is abundant and eats many pests within the shamba. It is very similar to the Anchieta's ridged frog (see page 42) but differs in the Taita Hills by commonly having a stripe (cream-coloured, green or brown) running the length of their back to the tip of their nose. Males are smaller than females and can be recognised by the characteristic slits on either side of the head where the vocal sacs are stored.



The tadpoles of ridged frogs grow their back legs first and can be found in a variety of colours.

This species occurs widely outside of the Taita Hills in most of Central and southern Africa. However,

## Mascarene ridged frog

genetic studies have shown that it is a complex of several different species, so the scientific name may change in the future. It is even found on some islands in the Indian Ocean and Madagascar. Although it has been

introduced by humans to some of these places (including the Mascarene Islands from where it was described) it has arrived at others—probably by floating on large rafts of vegetation carried down rivers and into the sea.

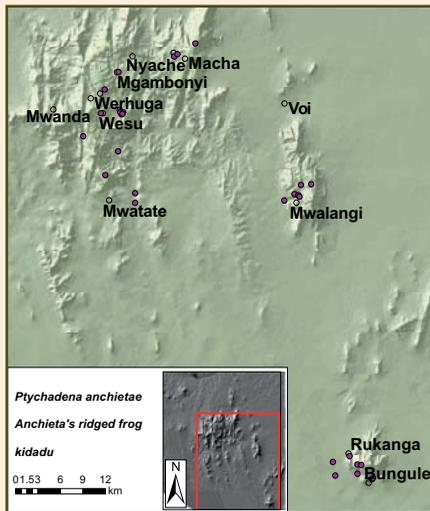
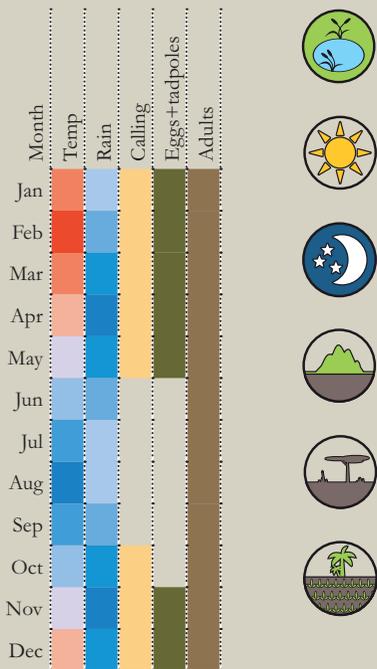
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### *Notes*

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# *Ptychadena anchietae*



Anchieta's ridged frogs have a clear triangle with the base between their eyes running to the tip of the nose.

## Anchieta's ridged frog



Anchieta's ridged frogs can be found sitting together at the edge of water at night.

**T**his ridged frog is found in much the same kinds of places as the Mascarene ridged frog (page 38). However, this frog appears to prefer the lowland areas, whereas the Mascarene ridged frog occurs in greater numbers within the mountains. This frog is also a keen jumper which will jump out of the way as soon as it is disturbed. If it doesn't make it to the water on the first jump, it will either jump again, or disappear into the bottom of the

grass and wriggle through the stems, making it very hard to find if you try to catch it.

This ridged frog breeds during all but the driest months (June to September) and in the same places as the Mascarene ridged frog; in ponds, pools and puddles at the side of the road. The calls that the males produce come from the same kinds of lateral vocal sacs either side of the head. The call they produce sounds very different and can help you

## *Ptychadena anchietae* (cont.)



Males have paired vocal sacs which extend from slits in the sides of their heads.

identify them as it sounds like a ‘wah wah wah’.

Widely distributed in East Africa, adults of this ridged frog can be distinguished from the Mascarene ridged frog by the characteristic triangle of paler skin that lies between the eyes to the tip of the nose. This species is also a friend to Taita farmers as during the day it eats small invertebrates which may damage crops.



The embryos of ridged frogs develop inside the jelly capsule which floats on the water.

**Anchieta's ridged frog**

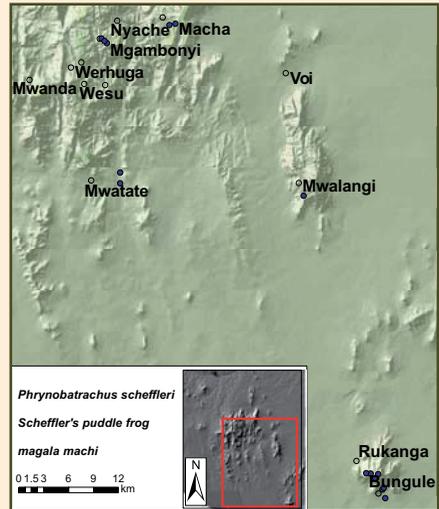
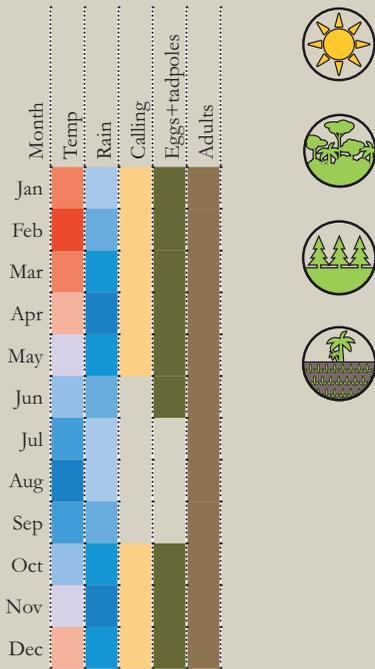
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*Notes*

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# *Phrynobatrachus scheffleri*



Scheffler's puddle frogs are very small and usually found next to streams in shady areas.

## Scheffler's puddle frog



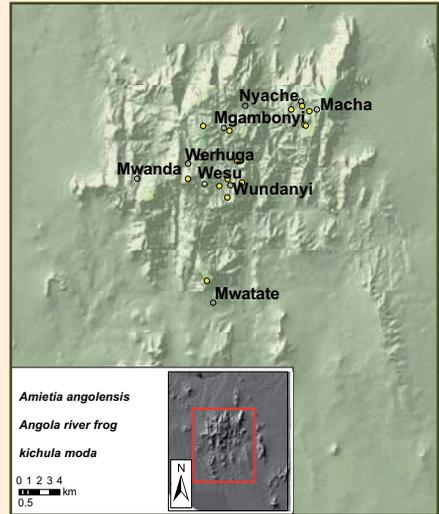
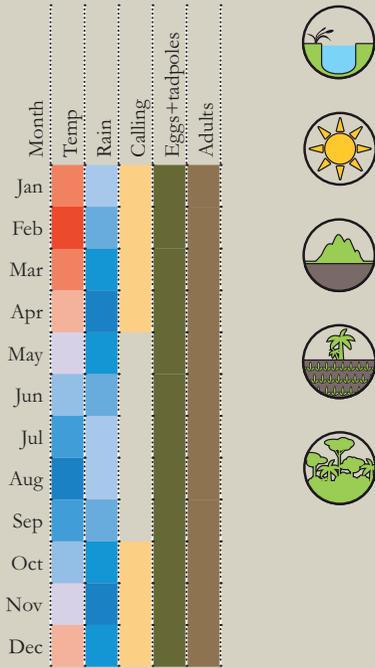
Scheffler's puddle frogs have a distinctive pair of elongated bumps arranged in a V on their back.

**T**hese are one of the smallest species of frogs that occur in Taita, the largest adults are only 22 mm long. They can be most easily found next to small streams and seepages in grassy streams, wooded areas and forest. They hop quickly about in the mud or sand at the side of the stream catching any flies or other small insects that might land there. This species can be confused with *Arthroleptis xenodactyloides* (page 24), except that it has distinctive raised marks forming a V pattern on its back.

Males call from concealed positions close to breeding sites with a series of short buzzes, 'bzzz bzzz bzzz'. This species lays eggs singly floating in small puddles at the edges of streams, especially those that have formed during spates of rain. The tadpoles grow within the puddles and metamorphose into juveniles which can also be found at the side of the stream.

This species occurs in much of East and southern Africa, but it is believed that there may be more species than are currently recognized.

# *Amietia angolensis*



Males can be found sitting at the edges of rivers in prominent places.

## Angola river frog



These are large frogs which have powerful back legs for swimming against the current of streams and rivers.

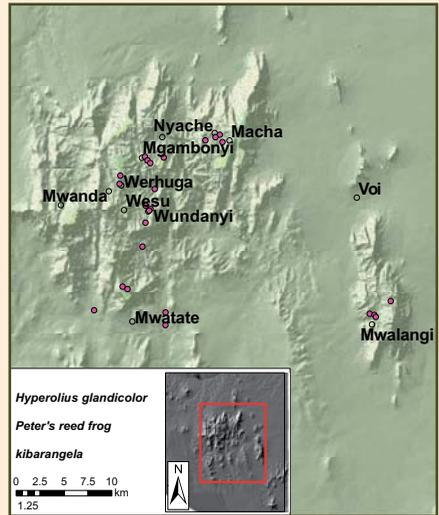
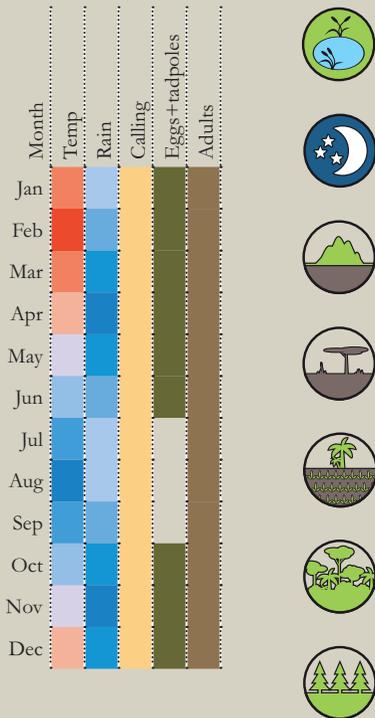
**T**his is a large frog (up to 90 mm long) which can often be found along edges of large streams and rivers. The adults can be found along the banks throughout the year. Males call during both rainy seasons in a series of ‘chirps’ followed by some ‘croaks’ often from sheltered spots under river banks or even floating in the water. If disturbed they jump quickly into the water and are strong swimmers with prominent webbed feet. Their brown and greenish blotched appearance blends in well with both mud and vegetation.

Pairs of frogs lay single eggs in small still areas in streams from October

to April. The tadpoles live in the same areas but may travel up or down stream to disperse. In the Taita Hills they take two years before they metamorphose into frogs, growing to a very large size (up to 60 mm long). If you find a very large tadpole in quiet waters of a stream or river in the Taita Hills, it is almost certainly the Angola river frog.

In the Taita Hills, adults of this species can be found in all of the permanent streams and rivers. Tadpoles have been found in slow moving streams as well as in dammed ponds for community water schemes.

# *Hyperolius glandicolor*



A female reed frog showing typical black and yellow colouration.

## Peters reed frog



Males have a large sac which is inflated when they call. Males have two distinct colour morphs, a typical brown (a), and black and yellow which is similar to females (b).

**T**he reed frog is probably one of the most familiar amphibian species in the Taita Hills. It lives close to permanent water or temporary pools, although adults and juveniles can be found at some distance in forest and shambas alike. During the day these frogs are able to withstand full sun by sitting with their legs close to their bodies to minimise water loss and even turn a very pale colour to reflect the heat. During evening hours or after rainfall they come alive, males sit close to the water on reeds or grasses, extend their large vocal sac and emit a very distinctive ‘bwoep’. When many males are singing in a chorus the noise can become almost deafening. Males have two colour patterns, a normal brown and black with yellow reticulation, which is the pattern more typical of

females. Calling males are territorial and if another male comes too close they emit a distinctive warning ‘croak’.

The reed frog breeds in both rainy seasons, and males can be heard calling throughout the year, especially after rain. Females can be found in the surrounding area until they are ready to mate. They then move towards and select amongst calling males and once in amplexus move to lay their eggs in a cluster on leaves close to the water surface. The eggs develop out of the water and tadpoles finally drop into the water once hatched. The tadpoles develop over a period of weeks until the young metamorphs leave the water and move off into the surrounding area to grow.

## *Hyperolius glandicolor* (cont.)



These frogs have many natural predators including insects, spiders, birds as well as snakes like this white-lipped herald snake (*Crotaphopeltis botamboëa*).

This species is distinctive due to its coloration and its smooth plastic-like shiny skin. Its toes and fingers end in discs which help the animal climb and stick to reeds and grasses. The insides of the legs and ends of the toes are often tinged pink or red. This species can be confused with *Leptopeltis concolor* (page 36) and *Chiromantis petersii* page 56). However, it is smaller than both these species and is the only one with black and yellow patterned females. This species occurs in a large area outside of the Taita Hills, but appears to be closely related to many other species in the same genus.



The skin can appear to be very dry and individuals can tolerate exposure to the sun during the day.

**Peters reed frog**

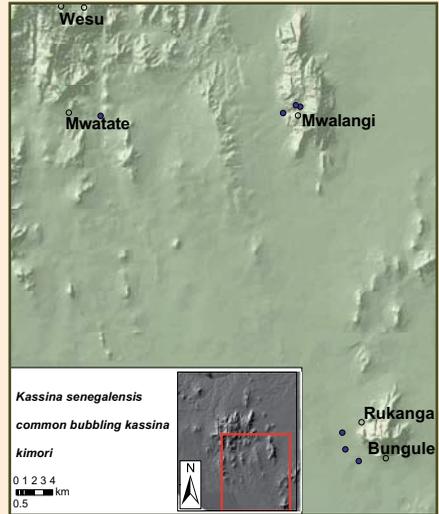
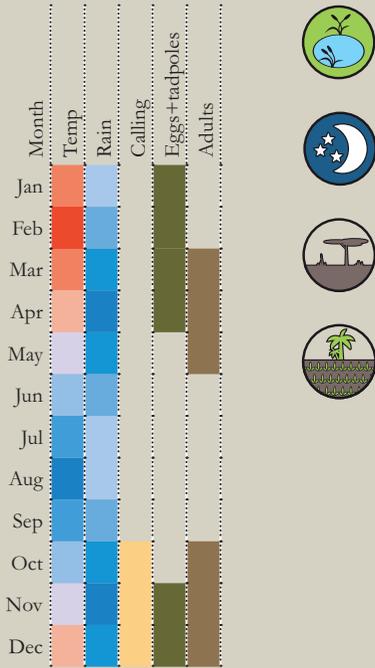
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*Notes*

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# *Kassina senegalensis*



Black markings on the bubbling kassina can vary from lines to spots.

## common bubbling kassina



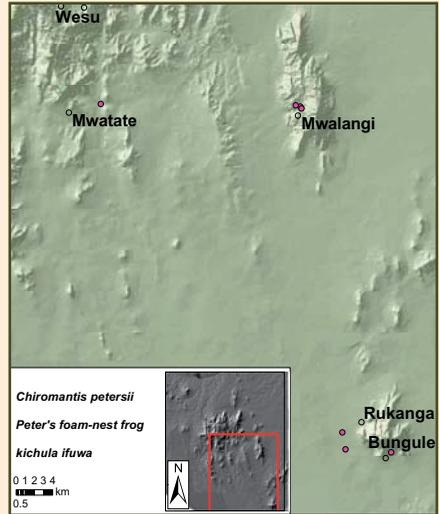
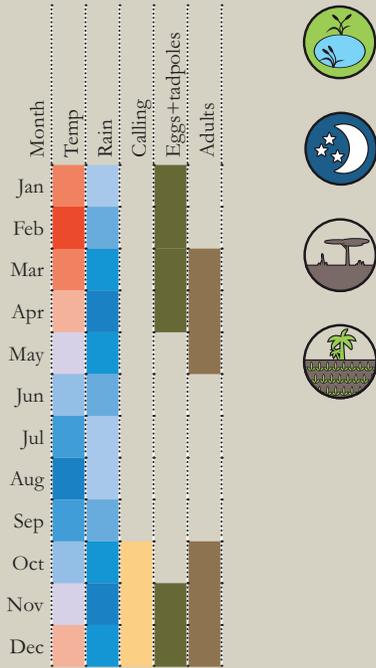
These frogs can be very hard to find as they hide deep in vegetation at the sides of ponds.

**T**he common bubbling kassina is a very distinctive looking frog, the background is an olive-green colour, which can look almost gold, and is covered with regular black spots, each of which has a white ring around it. In the Taita Hills, males have been heard calling in the height of both rainy seasons, March and November. Males call from shallow water around dams or swamps hidden deep under patches of vegetation. The noise sounds like

a series of bubbles rising up from the water, and this gives it the common name: bubbling kassina. Eggs are laid in similar areas where males call in small masses. The tadpoles are also rather distinctive with a high fin.

In the Taita Hills, this frog occurs in the lowland areas, including Sagalla Hill. It is widespread in sub-Saharan Africa, where markings can vary from spots (in Taita Hills) to stripes (elsewhere) running down the back.

# *Chiromantis petersii*



These frogs have very distinctive feet with toes that can grip stems of plants.

## Peter's foam-nest tree frog



You can find these frogs sitting in full sun during the day when they can appear almost white.

**T**his frog lives mostly in the lowland areas around the Taita Hills, and throughout East Africa, although animals can be found on Sagalla at 1 000 m asl. It can be most easily found around dams, pools and swampy areas, where males call from perches on reeds and bushes. The

call is a distinctive 'chirp' followed by musical pulses.

If found in full sun, a Peter's foam-nest tree frog can appear almost white, and is hard to confuse with other species. The hands have opposable fingers, with pads like the

## *Chiromantis petersii* (cont.)

reed frogs, but are much bigger. The skin often appears rough with warts

When males and females mate, the female secretes a sticky substance which she whips up into a foam with her hind legs. Enough foam is whipped to make a nest the size of a football, which overhangs the water. The pair then lay eggs into the centre of the foam nest and the foam dries and hardens on the outside, while remaining moist in the centre. This protects the eggs from drying in the sun, while the bad-tasting foam prevents them from being eaten by predators. Once the eggs have hatched, the tadpoles drop out straight into the water to feed and grow.



A typical foam nest at the side of a large pool.

**Peter's foam-nest tree frog**

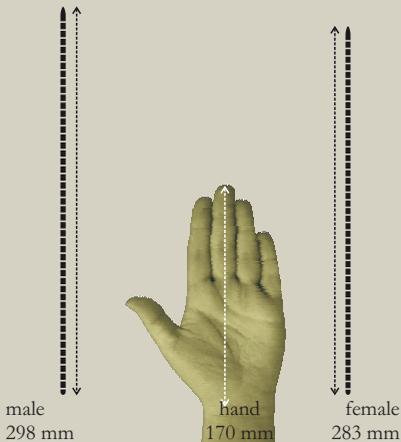
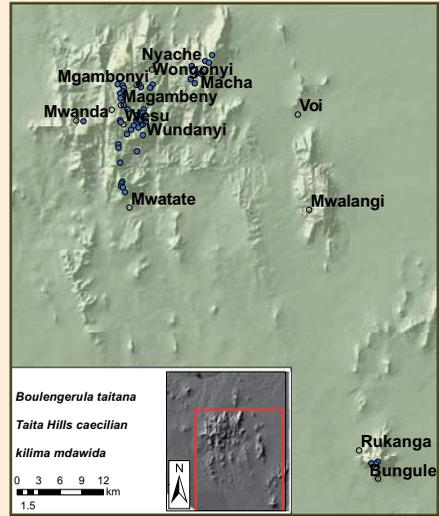
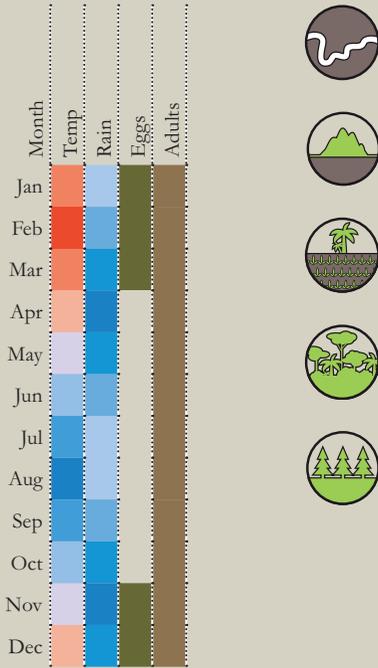
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*Notes*

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# *Boulengerula taitana*



An adult Taita Hills caecilian looks out of place on the ground; naturally they live in the soil where they move around through burrows.

## Taita Hills caecilian

Vulnerable

Taita endemic



A female Taita Hills caecilian broods her eggs in a subterranean burrow.

**T**his species is regularly called ‘mng’ori’ or earthworm, but it is not an earthworm but a different type of amphibian (order Gymnophiona—see page 8). This species lives only in the Taita Hills (Dawida, Mbololo and Kasigau), above 1 000 m. It does live in much the same black, fertile soil that you also find earthworms as it feeds principally on earthworms and termites. They have been found in very high densities on some shambas, especially where there

are bananas growing, but they also occur in natural forest and even in some plantations if the soil is moist enough. This species appears to be limited in its distribution by soil moisture and so does not occur low down or in the dry rain shadow areas (see page 4).

This is a direct developing amphibian (see page 10), laying eggs in small brooding chambers where the female guards them and turns them until they hatch. Once hatched the small

## *Boulengerula taitana* (cont.)



The eggs of this species are joined with a string. The direct developing young can be seen inside curled around a yellow yolk.

pink juveniles have special teeth that are adapted to eat the skin from the mother's back. This skin is believed to be especially nutritious for the young to grow quickly. By the time the young are ready to burrow independently in the soil they have changed to the distinctive black-blue colouration of this caecilian.

Having caecilians in your soil suggests that you have a good and fertile shamba. They are the farmers' friends as they eat a number of insect pests which may attack crop roots. The skull of the Taita Hills caecilian has no orbits for eyes, which are very small and can probably only

tell the difference between light and dark. The adults have three fearsome rows of teeth (although they don't bite people!) which they use to hold onto their prey while they spin in their burrows. Although the adults are nearly blind, they may be able to gauge the size of their prey by the amount of force required to spin it.

As this species is endemic (see page 3) to the Taita Hills and is vulnerable to soil erosion, it is considered to be threatened. You can help ensure the future survival of this species by preventing soil erosion and keeping your shamba free from pesticides and herbicides, that might harm them.

**Taita Hills caecilian**

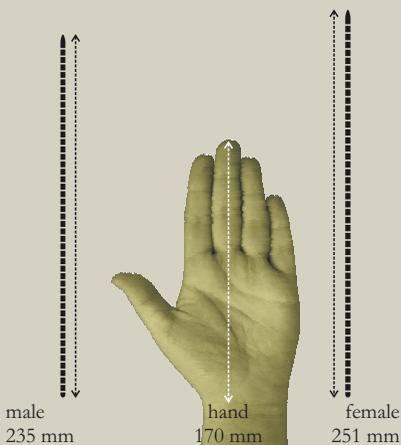
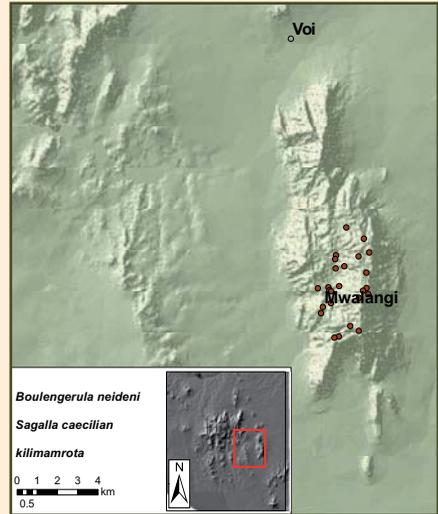
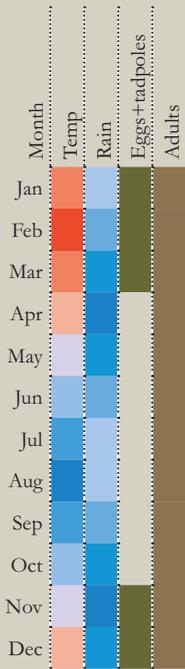
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*Notes*

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# *Boulengerula niedeni*



The *Sagalla caecilian* can occasionally be found above ground, especially when escaping from army ants.

**Sagalla caecilian**

Critically Endangered

Taita endemic



The heads of these caecilians have no visible eyes, the mouth is recessed under the head, and a small pair of tentacles feel the edges of the burrow.

**T**he Sagalla caecilian is a different species to the one that occurs on the other mountains in the Taita Hills. The scientific description was only made in 2005, but previously Sagalla people thought of this animal as ‘mng’ori’ (or earthworm). Now this caecilian has a new kiSagalla name: kilimamrota. As the name suggests, this caecilian only lives on Sagalla, and like the other caecilian,

it only lives in areas that have moist and fertile, black, soil. This means that many areas of Sagalla are unsuitable, including the eucalyptus plantation and the lower dry areas.

There is very little known about this species, but we think that like the other Taita caecilian, it breeds in ‘Vuli’, the short rainy season, laying eggs in a small burrow in the soil.

## *Boulengerula niedeni* (cont.)



In the hand: an earthworm (left) looks very different from the Sagalla caecilian (right).

The young probably also feed off the skin of the mother, before becoming independent. The Sagalla caecilian feeds on earthworms and termites as well as other small invertebrates that live in the soil.

As this species occupies such a small area on Sagalla, and due to the problems with the spreading eucalyptus and ongoing soil erosion, this species is considered to be

Critically Endangered. You can help the future of this endemic species by stopping soil erosion on your shamba, removing alien plants, especially eucalyptus, and by minimising your use of pesticides and herbicides. This species is an indicator to the farmer that his soils are fertile, so remember that what is good for the Sagalla caecilian is good for the farmers of Sagalla.

**Sagalla caecilian**

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*Notes*

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## Further Reading

If you want more information about amphibians in the Taita Hills, or elsewhere in East Africa you might consider the following books:

Channing, A. & Howell, K. 2005. *Amphibians of East Africa*. Chimaira & Cornell University Press, Frankfurt and Ithaca.

Spawls, S., Howell, K.M. & Drewes, R.C. 2006. *Pocket guide to the reptiles and amphibians of East Africa*. Black, London.

The Taita Hills also has a number of endemic reptiles. You can read more about the reptiles of East Africa in:

Spawls, S., Howell, K., Drewes, R. & Ashe, J. 2002. *A field guide to the reptiles of East Africa*. Natural World, San Diego.



## *Clubs and Societies*

If you want to become more involved in the conservation of amphibians or nature in general there are a number of clubs and societies that you might be interested in:

### **Herpetological Association of Africa**

Michael F. Bates  
Department of Herpetology  
National Museum  
P.O. Box 266  
Bloemfontein 9300,  
South Africa  
herp@nasmus.co.za  
or search for 'Herpetological Association of Africa' on the web

### **Nature Kenya**

P.O. Box 44486-00100  
NAIROBI  
Tel +254 20 3749957  
info@naturekenya.org  
<http://www.naturekenya.org>

### **East African Wildlife Society**

P.O. Box 20110-00200  
Nairobi  
Tel +254 020 3874145  
Fax +254 020 3870335  
info@eawildlife.org  
<http://www.eawildlife.org>

If you have collected an amphibian that you think is special (like a tagged *Callulina*) or you want someone to have a look at it, please contact:

### **Herpetology Section**

National Museums of Kenya  
Museum Hill Road  
P. O. Box 40658-00100  
NAIROBI, KENYA  
Tel: +254-(0)20-3742161/31-4 Ext 2245  
kmalonza@museums.or.ke  
<http://www.museums.or.ke>

## About the authors

### *John Measey*

John Measey is an amphibian biologist based at the South African National Biodiversity Institute (SANBI) in Cape Town, South Africa. John first came to the Taita Hills in 2002 in order to work with National Museums of Kenya herpetologists to study the Taita caecilian. Since then he has visited numerous times and learnt much about the amphibians of Taita as well as making many friends.



### *Patrick Malonza*

Patrick Malonza works in the Herpetology Section of National Museums of Kenya in Nairobi. Patrick originally came to Taita to study caecilians with John, but later returned to study for his Ph.D. thesis on the amphibians of the Taita Hills.



### *Vincent Muchai*

Vincent Muchai also works in the Herpetology Section of National Museums of Kenya with Patrick. Vincent previously studied the diversity of amphibians in Kakamega and only came to Taita in 2008 to help monitoring of the threatened Sagalla caecilian and Taita *Callulina*.



## *Assistants*

None of the work presented in this book would have been possible without the help of the full time assistants in Taita who collected most of the data and carried out monitoring of all the amphibians detailed in this book. We recommend that they be allowed to continue in such posts long into the future so that they may inspire future generations of Taita people to care for these wonderful animals.

### *Peter Alama*

---

Peter Alama is from Piringa where he lives with his mother and two brothers. Peter has always been interested in wildlife and jumped at the opportunity to work on the amphibians of Taita. He has become especially good at finding even the smallest of frogs in the forest, even if some of the big ones do get away



### *Renson Dio*

---

Renson Dio lives in Jora near Mount Kasigau with his wife and growing family. Renson has climbed Kasigau many many times for the project and is consequently very fit indeed. He has also travelled many kilometres to help the other assistants in Dawida, Mbololo and Sagalla.



### *Bigvai Karingo*

---

Bigvai Karingo is from Mbololo where he runs a small kiosk in Wongonyi. Bigvai already knew the mountain like the back of his hand, but during the project got to know many other places in Taita, always rising to the occasion and finding frogs.



### *Greshon Kisombe*

---

Greshon Kisombe lives in Sagalla with his parents. Greshon explored areas of the hill that he'd never visited before the project, finding the elusive Sagalla caecilian in numerous places. Greshon left the project in early 2008 to explore other avenues.



### *Oliver Mwakio*

---

Oliver Mwakio found out that he excels as a field biologist. His eyes are always open and his notebook at the ready to write down intimate details of Taita amphibians. Oliver is now a well known figure in Chawia as well as his home in Mwachora.



### *Peter Mwasi*

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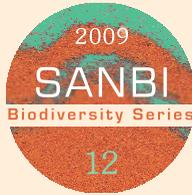
Peter Mwasi was passionate about Taita birds, but we convinced him that there were other more interesting animals out there! Peter can be relied upon to find frogs or caecilians anywhere he's put. Peter now lives with his wife in Kirema near Ngangao and is hoping to find more work in the forests of Taita.



## Index

<i>Amietia angolensis</i> , . . . . .	48	<i>Leptopelis concolor</i> , . . . . .	36
<i>Amietophrynus garmani</i> , . . . . .	31	Mascarene ridged frog, . . . . .	39
<i>Amietophrynus gutturalis</i> , . . . . .	28	<i>Mertensophryne taitana</i> , . . . . .	32
<i>Amietophrynus xeros</i> , . . . . .	31	northern clawed frog, . . . . .	13
Anchieta's ridged frog, . . . . .	43	pale-coloured tree frog, . . . . .	37
Angola river frog, . . . . .	49	Peter's foam-nest frog, . . . . .	57
<i>Arthroleptis xenodactyloides</i> , . . . . .	24	Peters reed frog, . . . . .	51
<i>Boulengerula taitana</i> , . . . . .	60	<i>Phrynobatrachus scheffleri</i> , . . . . .	46
<i>Boulengerula neideni</i> , . . . . .	64	pig-nosed frog, . . . . .	17
<i>Callulina dawida</i> , . . . . .	20	<i>Ptychadena anchietae</i> , . . . . .	42
<i>Chiromantis petersii</i> , . . . . .	56	<i>Ptychadena mascareniensis</i> , . . . . .	38
common bubbling kassina, . . . . .	55	Sagalla caecilian, . . . . .	65
eastern dwarf squeaker, . . . . .	25	Scheffler's puddle frog, . . . . .	47
guttural toad, . . . . .	29	Taita dwarf toad, . . . . .	33
<i>Hemisis marmoratus</i> , . . . . .	16	Taita Hills caecilian, . . . . .	61
<i>Hyperolius glandicolor</i> , . . . . .	50	Taita warty frog, . . . . .	21
<i>Kassina senegalensis</i> , . . . . .	54	<i>Xenopus borealis</i> , . . . . .	12





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12. Amphibians of the Taita Hills / Amfibia wa milima ya Taita. 2009. G.J. Measey, P.K. Malonza & V. Muchai. ISBN 978-1-919976-49-5.

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