African clawed frog

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The **African clawed frog** (*Xenopus laevis*, also known as the **xenopus**, **African clawed toad**, **African claw-toed frog** or the ***platanna***) is a species of African aquatic frog of the Pipidae family. Its name is derived from the three short claws on each hind foot, which it uses to tear apart its food. The word *Xenopus* means "strange foot" and *laevis* means "smooth".

African clawed frogs can grow up to a length of 5 in (13 cm). They have a flattened head and body, but no tongue or external ears.

The species is found throughout much of Sub-Saharan Africa (Nigeria and Sudan to South Africa),[2] and in isolated, introduced populations in North America, South America, and Europe.[1] All species of the Pipidae family are tongueless, toothless and completely aquatic. They use their hands to shove food in their mouths and down their throats and a hyobranchial pump to draw or suck things in their mouth. Pipidae have powerful legs for swimming and lunging after food. They also use the claws on their feet to tear pieces of large food. They lack true ears but have lateral lines running down the length of the body and underside, which is how they can sense movements and vibrations in the water. They use their sensitive fingers, sense of smell, and lateral line system to find food. Pipidae are scavengers and will eat almost anything living, dying, or dead and any type of organic waste.

African clawed frog

Conservation status

Least Concern (IUCN 3.1)[1]

Scientific classification

Kingdom:	Animalia
Phylum:	Chordata
Class:	Amphibia
Order:	Anura
Family:	Pipidae
Genus:	*Xenopus*
Species:	***X. laevis***

Binomial name

Xenopus laevis

Daudin, 1802

Contents

Description

These frogs are plentiful in ponds and rivers within the south-eastern portion of Sub-Saharan Africa. They are aquatic and are often greenish-grey in color. Albino varieties are commonly sold as pets. “Wild type" African Clawed Frogs are also frequently sold as pets, and often incorrectly labeled as a Congo Frog or African Dwarf Frog because of similar colorings. They are easily distinguished from African Dwarf Frogs because African Clawed Frogs have webbing only on their hind feet while African Dwarf Frogs have webbing on all

four feet. They reproduce by laying eggs (see frog reproduction). Also, the clawed frogs are the only amphibians to have actual claws used to climb and shred foods like fish or tadpoles. They lay their eggs from winter till spring during wet rainy seasons they will travel to other ponds or paddles of water to search for food.[3]

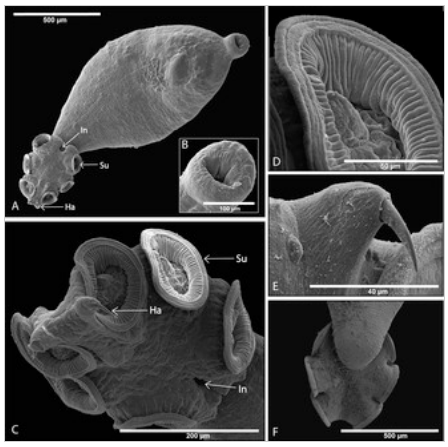
The average life-span of these frogs ranges from 5–15 years with some individuals recorded to have lived for 20–25 years.[4] They shed their skin every season, and eat their own shed skin.

Although lacking a vocal sac, the males make a mating call of alternating long and short trills, by contracting the intrinsic laryngeal muscles. Females also answer vocally, signaling either acceptance (a rapping sound) or rejection (slow ticking) of the male.[5][6] This frog has smooth slippery skin which is multicolored on its back with blotches of olive gray or brown. The underside is creamy white with a yellow tinge.

Male and female frogs can be easily distinguished through the following differences. Male frogs are usually about 20% smaller than females, with slim bodies and legs. Males make mating calls to attract females, sounding very much like a cricket calling underwater. Females are larger than the males, appearing far more plump with hip-like bulges above their rear legs (where their eggs are internally located). While they do not sing or call out like males do, they do answer back (an extremely rare phenomenon in the animal world).

Both males and females have a cloaca, which is a chamber through which digestive and urinary wastes pass and through which the reproductive systems also empty. The cloaca empties by way of the vent which in reptiles and amphibians is a single opening for all three systems.[7]

In the wild



The monogenean *Protopolystoma xenopodis*,[8] a parasite of the urinary bladder of *Xenopus laevis*

In the wild, *Xenopus laevis* are native to wetlands, ponds, and lakes across arid/semiarid regions of Sub-Saharan Africa.[2][9] *Xenopus laevis* and *Xenopus muelleri* occur along the western boundary of the Great African Rift. The people of the sub-Saharan are generally very familiar with this frog, and some cultures use it as a source of protein, an aphrodisiac, or as fertility medicine. Two historic outbreaks of priapism have been linked to consumption of frog legs from frogs that ate insects containing cantharidin.[10] Wild *Xenopus* are much larger than their captive bred counterparts.
Xenopus laevis in the wild are commonly infected by various parasites,[8] including monogeneans in the urinary bladder.

Use in research

Xenopus embryos and eggs are a popular model system for a wide variety of biological studies.[11][12] This animal is widely used because of its powerful combination of experimental tractability and close evolutionary relationship with humans, at least compared to many model organisms.[11][12] For a more comprehensive discussion of the use of these frogs in biomedical research, see the Wikipedia entry for *Xenopus.*

Xenopus has long been an important tool for in vivo studies in molecular, cell, and developmental biology of vertebrate animals. However, the wide breadth of *Xenopus* research stems from the additional fact that cell-free extracts made from *Xenopus* are a premier in vitro system for studies of fundamental aspects of cell and molecular biology. Thus, *Xenopus* is the only vertebrate model system that allows for high-throughput in vivo analyses of gene function and high-throughput biochemistry. Finally, *Xenopus* oocytes are a leading system for studies of ion transport and channel physiology.[11]

Although *X. laevis* does not have the short generation time and genetic simplicity generally desired in genetic model organisms, it is an important model organism in developmental biology, cell biology, toxicology and neurobiology. *X. laevis* takes 1 to 2 years to reach sexual maturity and, like most of its genus, it is tetraploid. It does have a large and easily manipulated embryo, however. The ease of manipulation in amphibian embryos has given them an important place in historical and modern developmental biology. A related species, *Xenopus tropicalis*, is now being promoted as a more viable model for genetics.

Roger Wolcott Sperry used *X. laevis* for his famous experiments describing the development of the visual system. These experiments led to the formulation of the Chemoaffinity hypothesis.

Xenopus oocytes provide an important expression system for molecular biology. By injecting DNA or mRNA into the oocyte or developing embryo, scientists can study the protein products in a controlled system. This allows rapid functional expression of manipulated DNAs (or mRNA). This is particularly useful in electrophysiology, where the ease of recording from the oocyte makes expression of membrane channels attractive. One challenge of oocyte work is eliminating native proteins that might confound results, such as membrane channels native to the oocyte. Translation of proteins can be blocked or splicing of pre-mRNA can be modified by injection of Morpholino antisense oligos into the oocyte (for distribution throughout the embryo) or early embryo (for distribution only into daughter cells of the injected cell).[13]

Extracts from the eggs of *X. laevis* frogs are also commonly used for biochemical studies of DNA replication and repair, as these extracts fully support DNA replication and other related processes in a cell-free environment which allows easier manipulation.[14]

The first vertebrate ever to be cloned was an African clawed frog, an experiment for which Sir John Gurdon was awarded the Nobel Prize in Physiology or Medicine 2012 "for the discovery that mature cells can be reprogrammed to become pluripotent". [15]

Additionally, several African clawed frogs were present on the space shuttle Endeavour (which was launched into space on September 12, 1992) so that scientists could test whether reproduction and development could occur normally in zero gravity.[16][17]

X. laevis is also notable for its use in the first well-documented method of pregnancy testing when it was discovered that the urine from pregnant women induced *X. laevis* oocyte production. Human chorionic gonadotropin (HCG) is a hormone found in substantial quantities in the urine of pregnant women. Today, commercially available HCG is injected into *Xenopus* males and females to induce mating behavior and to breed these frogs in captivity at any time of the year.[18]

Model Organism Database for *Xenopus*

Xenbase is the Model Organism Database (MOD) for both *Xenopus laevis* and *Xenopus tropicalis*.[19]

As pets

Xenopus laevis have been kept as pets and research subjects since as early as the 1950s. They are extremely hardy and long lived, having been known to live up to 20 or even 30 years in captivity.[20]

African Clawed Frogs are frequently mislabeled as African Dwarf Frogs in pet stores. The astute pet owner will recognize the difference, however, because of the following characteristics:

- Dwarf frogs have four webbed feet. African Clawed Frogs have webbed hind feet while their front feet have autonomous digits.
- African Dwarf Frogs have eyes positioned on the side of their head, while African Clawed Frogs have

eyes on the top of their heads.
- African Clawed Frogs have curved, flat snouts. The snout of an African Dwarf Frog is pointed.

They are as easy to take care of as fish.

As a pest

African Clawed Frogs are voracious predators and easily adapt to many habitats.[21] For this reason, they can easily become a harmful invasive species. They can travel short distances to other bodies of water, and some have even been documented to survive mild freezes. They have been shown to devastate native populations of frogs and other creatures by eating their young.

In 2003, *Xenopus laevis* frogs were discovered in a pond at San Francisco's Golden Gate Park. Much debate now exists in the area on how to exterminate these creatures and keep them from spreading.[22][23] It is unknown if these frogs entered the San Francisco ecosystem through intentional release or escape into the wild. San Francisco officials recently drained Lily Pond and fenced off the area to prevent the frogs from escaping to other ponds in the hopes they starve to death.

Due to incidences in which these frogs were released and allowed to escape into the wild, African Clawed Frogs are illegal to own, transport or sell without a permit in the following US states: Arizona, California, Kentucky, Louisiana, New Jersey, North Carolina, Oregon, Virginia, Hawaii,[24] Nevada, and Washington state. However, it is legal to own *Xenopus laevis* in New Brunswick and Ohio.[25][26]

Known feral colonies of *Xenopus laevis* do also exist in South Wales, United Kingdom.[27]

The African clawed frog may be an important vector and the initial source of *Batrachochytrium dendrobatidis*, a chytrid fungus that has been implicated in the drastic decline in amphibian populations in many parts of the world.[2] Unlike in many other amphibian species (including the closely related western clawed frog) where this chytrid fungus causes the disease Chytridiomycosis, it does not appear to affect the African clawed frog, making it an effective carrier.[2]

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External links

- Xenbase (http://www.xenbase.org/) A *Xenopus laevis* and *X. tropicalis* web resource.
- The stages of *Xenopus* embryonic development (http://www-cbd.ups-tlse.fr/organismes/nieuwkoop/nieuwkoop.html) Adapted from P.D. Nieuwkoop and J. Faber's Normal Table of *Xenopus laevis* (Daudin).
- Xenopus laevis Keller Explants (http://www.cshprotocols.org/cgi/content/full/2007/12/pdb.prot4749)
- Xenopus laevis recordings (http://content.lib.utah.edu/cdm4/results.php?CISOOP1=exact&CISOOP2=exact&CISOMODE=grid&CISOGRID=thumbnail,A,1;title,A,1;subjec,A,0;common,200,0;none,A,0;20;title,none,none,none,none&CISOBIB=title,A,1,N;identi,A,0,N;common,200,0,N;none,A,0,N;none,A,0,N;20;title,none,none,none,none&CISOTHUMB=20%20%284x5%29;title,none,none,none,none&CISOTITLE=20;title,none,none,none,none&CISOHIERA=20;identi,title,none,none,none&CISOSUPPRESS=0&CISOFIELD1=subjec&CISOROOT=/wss&CISOBOX1=Amphibians&CISOFIELD2=common&CISOBOX2=African+Clawed+Frog)

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