

Introduced Species Summary Project

African Clawed Frog (*Xenopus laevis*)

[Project Home](#) | [Taxonomy](#) | [Identification](#) | [Distribution](#) | [Introduction](#) | [Establishment](#) | [Ecology](#) | [Benefits](#) | [Threats](#) | [Control](#) |

Common Name: African Clawed Frog
Scientific Name: *Xenopus laevis*

Classification:

Phylum or Division: Chordata
Class: Lissamphibia
Order: Anura
Family: Pipidae



Identification: The genus *Xenopus* is the only frog with clawed toes. Within this genus, *laevis* is the only species that exceeds 100 mm in length, with female adults reaching 110-130 mm and male adults generally 10-30% smaller. Other than size, morphological differences among *Xenopus* species are rather indistinct.

The African clawed frog has a flat body with a relatively small head. Its skin is smooth, with dorsal surfaces usually colored in mottled hues of olive-brown or gray with darker marks and ventral surfaces a creamy white color. This frog has no tongue, no teeth, no eyelids, and no external eardrums. Its forelimbs have four unwebbed fingers and its hind limbs have five long, webbed toes with dark claws on the three outer toes.

Original Distribution: The African clawed frog is native to the cooler regions of sub-Saharan Africa. Its range includes the highlands between the African Cape and the plateau of Cameroon and Nigeria, and excludes the Zaire Basin and the hotter lowlands of East Africa. The African clawed frog is an air breathing aquatic frog that occurs in virtually every body of water in its native range. It inhabits natural waters, such as rivers, lakes, ponds, marshes, rainpools, and swamps, as well as manmade waters, including reservoirs, dams, flooded pits, ditches, and wells. This frog is most commonly found in stagnant or still waters of ponds or sluggish streams, but may also inhabit fast flowing water.

Current Distribution: Feral populations of African clawed frogs outside their original distribution were first documented in the 1960's. They currently inhabit three of the world's five Mediterranean climate regions, including the Cape of Africa, Southern California, and Chile. In the United States, African clawed frog populations have been reported in 11 states, including Arizona, California, Colorado, Florida, Louisiana, Nevada, New Mexico, North Carolina, Virginia, Wisconsin, and Wyoming. There are also known populations in the United Kingdom, Germany, the Netherlands and Ascension Island.

Site and Date of Introduction: The African clawed frog was shipped around the world in the 1940's and 1950's for use in human pregnancy tests after it was discovered that female African clawed frogs begin laying eggs when injected with a pregnant women's urine. To supply the high demand for African clawed frogs in pregnancy assays, techniques were developed to breed and rear large numbers of African clawed frogs in captivity. With the success of captive breeding techniques and because African clawed frogs are easy to care for and resistant to disease, a significant pet trade developed in the 1950's and 1960's. The African clawed frog is now the research vertebrate most widely used for developmental, cell and molecular biology.

Mode(s) of Introduction: The frogs were intentionally released from laboratories around the world when new technologies for pregnancy diagnosis were developed in the late 1950's. Other modes of introduction include intentional releases of unwanted pets and pet escapes from aquariums. With the ongoing use of the African clawed frog in cell and molecular biology research, laboratory escapes are another potential introduction pathway.

Reason(s) Why it has Become Established: The African clawed frog became established because of its affinity for disturbed or artificial habitats, habitat adaptability, dietary diversity, effective defense mechanisms, disease resistance,

high reproductive rate, long life span, and overland dispersal ability.

Affinity for disturbed or artificial habitats

Known invaded sites of the African clawed frog are generally manmade bodies of water and natural waterways subject to disturbance or high environmental variability. Populations have been documented in a beaver pond in Colorado, drainage ditches in California, canals in the Netherlands, ephemeral ponds and underground cisterns in the UK, and artificial ponds in Arizona, California, North Carolina, Virginia, Wisconsin and Ascension Island .

Habitat adaptability

The African clawed frog is extremely salt tolerant (40% sea water) and has successfully established populations near sea cliffs in the UK that are subject to high sea spray. Ideal conditions for the African clawed frog are Mediterranean climates, but adults can tolerate temperature ranges of 0-30 °C and tadpoles can survive temperature ranges of 10-30°C. Populations persist under winter ice in Wisconsin, North Carolina, and Virginia, and in climates near the frog's upper viable temperature range in Arizona. The species can aestivate for up to eight months during periods when ponds completely dry up and can tolerate periods of total starvation lasting up to one year. It can breed successfully in both acidic and alkaline waters with pH ranges of 5 to 9.

Dietary diversity

The African clawed frog is a relatively non-specific predator that hunts on the surface and forages on the bottom for a wide taxonomic range of prey. It feeds preferentially on aquatic insects, although it will eat fish, amphibians and birds, will scavenge on decaying debris, and will resort to cannibalism, taking its own larvae as food. Cannibalism enables it to survive food shortages and to quickly establish in newly formed ponds before prey is available and predators and resource competitors appear. The degree of cannibalism will be self regulating on population size .

Effective defense mechanisms and disease resistance

African clawed frogs have a number of effective defense mechanisms, including rapid reverse movements, synchronized aerial breathing, and secreted skin toxins that deter predators such as snakes. The species also secretes antimicrobial compounds that contain antibiotic, antifungal, antiparasitic and antiviral actions that prevent skin and other types of infections.

High reproductive rate and long life span

The African clawed frog reaches sexual maturity in 6-10 months after metamorphosis and can live 10 to 15 years in the wild. A female can produce up to 27,000 eggs per reproductive session and can produce multiple clutches per season in favorable conditions. In its native range, its breeding season can last for up to 10 months and in California its breeding season is year round.

Ecological Role: In its native range, the African clawed frog feeds primarily on zooplankton as a tadpole, small crustaceans as a recently metamorphosed young adult, and benthic invertebrates as an adult. It is prey for a number of native species, including otters (*Lutra m. tenuis*), reed cormorants (*Phalacrocorax africanus*) and darters (*Anhinga melanogaster*) as well as an introduced species, the large mouthed bass (*Huro salmoides*). It is an intermediate host for a fluke parasite (*Diplostomum (Tylodelphys) xenopodis*) that must be transferred to the final host, such as reed cormorants or darters to mature sexually. The African clawed frog is also harvested by man as a protein source in Cameroon, Sierra Leone, and the Central African Republic.

Benefit(s): In captivity, the African clawed frog is an extremely useful laboratory species. Feral populations of African clawed frogs occupy many habitats that are inhospitable to most species and can survive effectively in depauperate habitats.

Threat(s): In California, virtually ideal climate conditions have enabled the African clawed frog to establish large and extremely dense populations. It has been identified as an exotic predator of the endangered California red-legged frog (*Rana aurora draytonii*) and may also threaten the endangered unarmored threespine stickleback (*Gasterosteus aculeatus williamson*). The African clawed frog is also thought to be a threat to native fish and amphibians in the American Southwest.

Control Level Diagnosis: The control level for this species varies by climate conditions. Regions where seasonal temperatures exceed the African clawed frog's tolerable limits can place a "Minimal Priority" on control since temperature

extremes will prevent establishment of persistent populations. In California and other areas with favorable Mediterranean climate conditions, the species should be considered a "High Priority" for control.

Control Method: Species control should include legislation to minimize the potential for release through the pet trade. This approach has been adopted in several U.S. states where it is illegal to own, transport or sell African clawed frogs without a permit. States that have adopted this approach include Arizona, California, Florida, Kentucky, Louisiana, New Jersey, North Carolina, Oregon, and Virginia. Attempts to eradicate established invasive populations have had mixed results. Attempts including trapping, drainage of ponds, and poisoning have been effective for smaller populations, but have not succeeded with large populations in California.

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Photo: <http://allaboutfrogs.org/info/species/clawedordwarf.html>

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