

Amphibians, their current status, and an important AZA course for any amphibian keeper

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I was recently awarded the American Association of Zoo Keepers Geraldine Meyer Professional Development Grant. This award provided funding to attend the AZA Amphibian Biology, Conservation and Management course (ABCM), a class instructed by a diverse group of pioneers in the field of amphibian biology, conservation, and husbandry. So why do amphibians deserve a course solely devoted to them?

1. Amphibians are awesome

Amphibians are in a class by themselves, literally. The class Amphibia includes caecilians (Order Gymnophiona), salamanders (Order Caudata), and frogs and toads (Order Anura). The direct Greek translation of the word amphibia is “both” “life” referring to a biphasic life, usually with aquatic larvae (tadpole or pollywog) and terrestrial adults. There are many exceptions to this, however. For example Solomon Islands Leaf Frogs (*Ceratobatrachus guentheri*) skip the aquatic stage whereas some caecilians (e.g., *Typhlonectes*) and salamanders (*Siren* and *Amphiuma*) have an entirely aquatic life cycle.

There are traits common to all amphibians. All are ectothermic (i.e., their body temperatures are influenced by environmental temperatures) vertebrates possessing a naked, permeable skin that directly absorbs water. Their skin also allows for cutaneous respiration, or breathing across the skin; some salamanders (plethodontidae) have no lungs and are entirely dependent upon cutaneous respiration. Amphibian skin contains

many glands, some of which excrete toxins. Among the most toxic are dart frogs in the genera *Dendrobates* and *Phylllobates* and newts like *Taricha granulosa*. Other skin secretions serve to deter predators (the slimy salamander [*Plethodon glutinosus*] secretes sticky substances) or keep the skin moist and facilitate respiration through the skin.

There are many unusual, almost alien-like, adaptations found within Amphibia. In the genus *Gastrotheca*, eggs are carried in a pouch, in some species by the mother, in others by the father. Suriname Toads (*Pipa pipa*), a highly aquatic anuran species, have a very interesting mating ritual in which both the male and female swim in loops. As the eggs are released and fertilized they fall, adhere to and become embedded in the female's back. *Boulengerula taitanus*, a species of caecilian, pushes parental care to the limits as mother provides nutrition to recently birthed offspring, which bite and eat her skin using specialized teeth (Kupfer et al. 2006). Even the typical tadpole's (e.g., *Bufo* or *Rana*) morphological transformation into a frog is very dramatic undergoing drastic internal and external (mouth parts, growth of appendages, tail absorption) changes.

2. Amphibians are important

In addition to simply being amazing creatures, amphibians are important components of their ecosystem. Amphibians play the role of both predator and prey. As predators, many amphibians are responsible for controlling insects and the diseases associated with them. As prey, they supply a link to higher trophic levels. In parts of New England, the biomass of one species of salamander (*Plethodon cinereus*) in a given area of habitat can equal or exceed that of all the mammals the area.

Amphibian skin secretions have long been valued for their medicinal properties. Recently peptides identified from numerous species have been demonstrated to prevent

HIV infection (Van Compernelle et al. 2005). The potential benefit amphibians will serve for medicine is limitless as scientists continue to discover applications using chemicals secreted by amphibians.

With their permeable skin and biphasic lifestyle, amphibians are highly susceptible to pollutants and other environmental hazards. For this reason, amphibians are commonly referred to as the modern day “canary in the coalmine” and are important indicators of environmental health. Global amphibian declines likely signal ecological plight that could affect all living organisms including humans.

3. Amphibians are facing a global crisis

Amphibian declines are occurring globally. Nearly one-third of all amphibian species are currently threatened with extinction, and 122 species have gone extinct since 1980. Current extinction rates are 211 times the normal background amphibian extinction rate (McCallum 2007). Current threats to amphibians include habitat destruction/loss, pollution, pathogens, introduction of exotic species (often other amphibians; e.g., introduced populations of bullfrogs [*Lithobates catesbeiana*] and African clawed frog [*Xenopus laevis*]), and a fairly recently described parasitic fungus (*Batrachochytrium dendrobatidis*) commonly referred to as amphibian chytrid (Longcore et al. 1999). There is often interplay among these causes, and all are the result of human activities.

4. Amphibians need our help through conservation efforts

Just as humans have caused amphibian extinctions, we must play a role in their preservation. The Amphibian Conservation Action Plan (available online at www.amphibianark.org/pdf/ACAP.pdf) was composed by 60 specialists as a response to

the crisis. An important part of this is the Amphibian Ark (see www.amphibianark.org). Many species will need to be brought into captivity temporarily to be managed if they are to persist at all and Amphibian Ark addresses this effort. The Toledo Zoo, site of ABCM, is one of only two zoos worldwide (the other being the Bronx Zoo) to manage Kihansi Spray Toads (*Nectophrynoides asperginis*), native to the Kihansi Gorge of Tanzania and thought to be extinct in the wild, with hopes that they will be reintroduced to their native habitat.

The international conservation community dubbed 2008 the *Year of the Frog* (see www.yearofthefrog.org) to draw attention to the global amphibian extinction crisis and to encourage and assist work towards amphibian conservation. Although the *Year of the Frog* has concluded, work towards amphibian conservation through collaborative breeding and population management, public education, and scientific research must continue if this highly fascinating and valuable taxonomic group is to persevere.

You the reader can do plenty to help preserve these animals for future generations. A good place to start is by simply reducing your carbon footprint or going green (reduce driving, purchase organic foods, limit pesticide and fertilizer use). It is also important to be a responsible pet owner. Do not purchase your pet from unreliable sources and never release a pet into the wild.

ABCM

In addition to the highly informative and all-inclusive lectures, during ABCM students obtained hands-on learning in exhibit fabrication. This was one of the most enjoyable and applicable components of the class. Instructors demonstrated that designing and maintaining aesthetically pleasing, naturalistic exhibits is fun and easy.

Incorporating various species of live plants (not just *Pothos*) and water features into the setup should not intimidate keepers.

Students were also allowed to track development in amphibian larvae. After toads were injected with hormones to induce reproduction, eggs were laid and fertilized. By observing the fertile eggs and later the tadpoles under a dissecting microscope, students were able to identify the various developmental stages (Gosner 1960) through the remainder of the course.

Other pertinent topics included various components vital to amphibian husbandry. Because amphibians, with their permeable skin and aquatic life stage, really are physiologically tied to their environment, monitoring water quality is extremely important for proper development and health. Diet is also crucial to amphibian health. It must be varied and include nutritious prey items. Another section of the course was devoted to live food culturing.

I strongly recommend that keepers enroll in ABCM. For those interested in amphibian biology, husbandry, and/or conservation, this class is a must. It is very comprehensive, and even an experienced herpetologist/herpetoculturist will benefit.

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