AXOLOTLS

Bottom of Form

Although axolotls are endangered in the wild, they have captivated the hearts and attention of researchers and breeders for decades. What other creature can you think of that is able to regenerate most of its body parts, resist cancer and remain a teenager (they never complete metamorphosis) its entire life?  Unfortunately, a population bottleneck has caused a vast reduction in the axolotl gene pool over the last few decades. Many biologists believe there isn't enough variety in the remaining axolotl gene pool to sustain the continuation of the species. According to a recent article in National Geographic (September, 2016), without intervention, axolotls could become extinct in the wild as early as 2020. However, there are scientists working with Mexican agriculturists that are currently trying to revive the unique species. Axolotls are being bred in captivity and then introduced into their natural habitat near Mexico City under the protection of local agriculturists. Let's hope they succeed!

Axolotls come from a lake and canals outside of Mexico City. Because of invasive species introduced to that area as well as an increased demand for water that has drained many of the canals, the always smiling axolotl is considered CRITICALLY ENDANGERED in the wild.   
  
Axolotls are unique in many ways. First, like other salamanders, axolotls possess the ability to regenerate. Not only can they regenerate limbs and their tails, they can also regenerate portions of their jaw, parts of its brain and spinal cord, damaged parts of its heart and lungs, and almost any other part of its body! Researchers have also studied them to try and determine why they never complete metamorphosis. Axolotls are the only salamander that never reaches the metamorphosis stage of adulthood. Rather, they stay in the larval (juvenile) stage. All other salamanders eventually lose their gills and tail and live their adult life on land. Not so with the axolotl! Instead, they live their adult lives in fresh water. breathing with a complete set of gills (the feathery looking appendages you see on the side of its head) as well as rudimentary lungs. The lungs do not work well enough to sustain the axolotl outside of water. However, you will see him swimming to the surface and take a gulp of air from time to time. The axolotl is a Urodele amphibian, which includes all newts and salamanders. However, unlike the others that leave the water once they are sexually mature, the axolotl stays solely aquatic.   
  
Axolotls are also studied because of their resistance to cancer and their ability to accept organs from other donors without rejection. If the eye of one axolotl is transplanted to another, the recipient accepts the new eye as its own allowing the axolotl to see with the new organ! What amazing creatures!  
  
Axolotl larvae are naturally hypothyroidic. This makes them invaluable resources for studying the function of thyroid hormones and resistance. Injecting large levels of thyroid hormone has been a way to force axolotls to complete metamorphosis.

**COMMON NAME:**Axolotl

**SCIENTIFIC NAME:***Ambystoma mexicanum*

**TYPE:**Amphibians

**DIET:**Carnivores

**AVERAGE LIFE SPAN IN THE WILD:**10 to 15 years

**SIZE:**Up to 12 in

**WEIGHT:**2.11 to 8 oz

**ABOUT THE AXOLOTL**

The axolotl (pronounced ACK-suh-LAH-tuhl) salamander has the rare trait of retaining its larval features throughout its adult life. This condition, called neoteny, means it keeps its tadpole-like dorsal fin, which runs almost the length of its body, and its feathery external gills, which protrude from the back of its wide head.

**Differences From Other Salamanders**

Found exclusively in the lake complex of Xochimilco (pronounced SO-chee-MILL-koh) near Mexico City, axolotls differ from most other salamanders in that they live permanently in water. In extremely rare cases, an axolotl will progress to maturity and emerge from the water, but by and large, they are content to stay on the bottom of Xochimilco’s lakes and canals.

Close relatives of the tiger salamander, axolotls can be quite large, reaching up to a foot in length, although the average size is closer to half that. They are typically black or mottled brown, but albino and white varieties are somewhat common, particularly among captive specimens.

**Population Decline**

Axolotls are long-lived, surviving up to 15 years on a diet of mollusks, worms, insect larvae, crustaceans, and some fish. Accustomed to being a top predator in its habitat, this species has begun to suffer from the introduction of large fish into its lake habitat. Natural threats include predatory birds such as herons. A non-native fish such as the common carp (Cyprinus carpio) and the invasive species tilapia (Oreochromis niloticus) also love to dine on axolotls. Ironically, these were introduced to Xochimilco in the 1970s and 1980s through programs run by the Food and Agriculture Organization of the United Nations, with the aim of getting more protein into local diets. Research has shown has shown that axolotls are most vulnerable to carp when they are at the egg stage, and to tilapia when they are juveniles, but reveals that if they can grow beyond a certain size, they might still thrive (Zambrano, L., Valiente, E. & Vander Zanden, M. J. *Biol. Invasions*, 2010).

Populations are in decline as the demands of nearby Mexico City have led to the draining and contamination of much of the waters of the Xochimilco Lake complex. They are also popular in the aquarium trade, and roasted axolotl is considered a delicacy in Mexico, further shrinking their numbers. They are considered a critically endangered species.

RESEARCH

In the 1980s, axolotls helped scientists to develop a model explaining how cells take on different forms in embryos. The ‘cell state splitter’ model proposes that many stem cells turn into specific tissues in the body through waves of pulling and stretching as embryos. Scientists found that they could watch the axolotl’s cells squeeze and stretch before they formed tissues. More recently, in 2011, extract from axolotl oocytes has been used to stop breast-cancer cells multiplying by switching on a tumor-suppressor gene (Allegrucci, C. *et al.* *Mol. Cancer* **10**, 2011).

But perhaps the most fascinating contribution of the axolotl to science has been in regenerative medicine. The animals can grow back missing limbs, tails, organs, parts of the eye and even portions of the brain. Many scientists have presumed this is because, being neotenic, they retain some trait from their embryonic stages, although other salamanders seem to regenerate even as adults.

Are you ready to help save this fascinating “water monster”? According to some researchers, if axolotls do not have a suitable home, their extinction in the wild might be inevitable, no matter what they do. According to a study published by National Geographic in 2016, their extinction could be as early as the year 2020. Fortunately, there are some farmers in Mexico that do not accept that fate. They are damming off portions of the lake to protect axolotls from predators. Researchers are also breeding wild type axotls and releasing them into the lake as adults.

Axolotls Questions

1. What has caused a reduction in the axolotl gene pool?
2. Without intervention, when does National Geographic predict axolotls will be extinct?
3. Axolotls are native to what country?
4. Who are scientists working with to revive the population of axolotls?
5. Name 5 parts axolotls have been known to regenerate:

1.

2.

3.

4.

5.

6. What type of an amphibian is an axolotl?

7. How long do axolotls normally live in the water?

8. What are the feathery appendages that protrude from the head of an axolotl?

9. Do axolotls have lungs? Explain.

10. Why do researchers study axolotls in relation to cancer?

11. If the eye of one axolotl is transplanted into another axolotl, what will happen?

12. How are scientists able to force axolotls to morph into adulthood?

13. Why are axolotls valuable resources for studying thyroid hormones?

14. What type of diet does an axolotl consume?

15. What lake are axolotls found in (the name)?

16. Name a close relative to the axolotl that was discussed in the article.

17. Name two fish predators that that caused a large decline in the axolotl population.

18. During what stage are axolotls most vulnerable to carp?

19. During what stage are axolotls most vulnerable to tilapia?

20. What is the conservation status of axolotls?

21. Find out 10 facts about the mudpuppy and list them below.

Axolotl Answers

1. Population bottleneck
2. 2020
3. Mexico
4. Mexican agriculturists
5. Tails, limbs, jaw, brain, spinal cord, heart, lungs
6. Urodele
7. Their entire life
8. Gills
9. Yes, they have rudimentary lungs that do not work well enough to sustain it for a long period of time outside of the water
10. Axolotls are resistant to cancer
11. The eye (organ) will be accepted and the axolotl will be able to see with the new eye.
12. By injecting large levels of thyroid hormones.
13. Axolotls are naturally hypothyroidic
14. Meat – they are carnivores
15. Xochimilco
16. Tiger salamander
17. Carp, tilapia
18. egg stage
19. juvenile
20. critically endangered