Amphibians Adaptations To Harsh Environments in Deserts

Amphibians are a very key species in our environment and ecological world. The study and research among amphibians can contribute to not only modern science, but also the future at hand. Being such environmentally sensitive, this category of species, is able to show changes in the ecosystem before we even can detect it. Some of the major contributors consist of Frogs, Salamanders, and Caecilians. Each are diverse and unique in their own way, from birth to metamorphosis stage, until eventually adulthood. Depending on the species, the young (typically larva) can be nested in a body of water, however, other amphibians don't always get this luxury. Desert amphibians are faced with much harder challenges, effecting their behavior, energy output, and bodily function. (Nguyen).

The environment is a constantly changing variable that greatly affects an amphibian, and has the potential to critically change the species overall health. The desert is a very hot, dry, threatening place to species that do not have the adaptations to live there. This environment typically resides well over one hundred degrees Fahrenheit, this then changes the soil and ground temperatures significantly. The ground can be more than twenty degrees hotter than the air. Directly effecting the amphibians, these creatures have to have adaptations and habitual instinct when dealing with such demanding temperatures nearly all hours of the day. Normally mammals have the ability to drink plenty of water and become cool through the process of respiration. Panting, which is something seen at the local dog park, is a cooling strategy. However this works for the pets at home, these creatures in the desert fail to have consistent water supply.

A group of people were very curious on how these amphibians were surviving with such harsh living conditions in the Mojave Desert. They conducted a study on zebra tailed lizards and focsed primarily on how the body temperature is controlled with such harsh heat index. To create this study, they had to capture these animals and immediately take the temperature within thirty seconds after noosing. Any longer and the stress of capture/ handling can skew the body temp within the animal, rendering the measurement useless. If available, they also took the temperature of the top soil in order to compare how much this effected their core temperature, if at all.

The body temperature is a very delicate system. Mammals are endotherms, how regulate their own heat within the body. The most well-known example of this is humans. The human body has the ability to find its way back to a specific temperature, normally around 97.6 degrees Fahrenheit. This has do to homeostasis, which the body wants to receive constantly. Amphibians on the other hand are known as ectotherms, which means they rely on the environment solely to adjust their body temperature and receive heat. This can be a dangerous game because the body does have the potential to overheat. With the dry and hot climate of the desert, these animals have adapted and created habitual techniques in maintaining a healthy body temperature. This is exactly what this study found when researching the zebra tailed lizards.

By collecting temps from the multiple lizards, they could get an average body temperature. They

focused on two weather scenarios, one overcast skies, the other clear sunny skies. Many were captured and found during sunny skies with an average body temp of 39.2C, this differentiated from the overcast skies averaging at 33.9 C. This study proved that lizards tended to prefer above average optimal body temps when foraging, as oppose to below. They also concluded that the desert find rare change in environment, so the lizards body rarely see dramatic change in the weather. And by never changing the environment, the bodies of these lizards stay changing at neatly consistent intervals, making a change in the ecosystem very crucial to these ectothermic species. (Packard).

Humanity has been inflicting immense amounts of stress on the environment, which then induces stress on species that live there. A prime example would be an increase of temperatures and warm spells due to human overproduction of harmful materials damaging the ozone. This has created what is called global warming. Humans see little impact as they merely just take off an extra layer of clothing, but the underlying issue remains. These amphibians, along with other species, use optimal energy to keep their bodies at specific temperatures. If the temperature of our earth keeps slowly increasing, this means our wildlife is using more of its energy trying to stay cool. This has a ripple effect. If an animal is constantly trying to keep its body temperature from overheating, then this is less energy it can use towards survival, reproduction, foraging etc. A species not focusing on reproduction has the potential to die out completely and becoming extinct; this creates a butterfly effect for the species that it was prey to or preyed on, overall creating an imbalance. Everything in a successful ecosystem has a purpose, when humans begin to change the natural process of this ecosystem by being neglectful to our environment, it has the potential to disrupt the whole system. This is why researching amphibians, because of their permeable skin and ectothermic bodies, has become so important to the scientific community (Rozen?Rechels).

Similar to the Zebra-Tailed lizard study, another was conducted in the Chihuahuan desert on amphibians and their adaptations to the unforgiving climate. A species in the desert has to be smart on how to avoid the heat if the solar radiation is too extreme on its body. With little place to hide, the individual will have to come up with an alternative solution. After observing in the Chihuahuan Desert, researchers found adaptations to help aid this issue. Couch’s Spadefoot is a frog that lives up to its name. Many amphibians use borrowing as a tool to escape the suns rays and stay cool in the lower soil layers. The Spadefoot has spades on its hind feet to help dig and borrow in the sand. This is a common solution for desert amphibians, they constantly seek out a microhabitat in order to maintain that ability to adjust their body temperature according to the environment they surround themselves with. Another adaptation they found was on the fringe-toed lizard. This had fringelike scales on its toes located on its hind legs, this aided in running across the terrain specific to sand and rocky desert ground. These are only many of the physical adaptations these creatures’ posses, many more tactics are used to increase the chance of the species survival (Rozen?Rechels).

Reproduction is a key role in maintaining a healthy species. With reproduction, must come some source of diversity. Creating an environment with no diversity, can be catastrophic if a specific gene fails to fit the species for survival. However, when is comes to reproduction, many species fight to achieve great success because this is the ultimate goal. An animal will strive to produce the most successful offspring so that its genes can be carried on, called reproductive output. Amphibians in the desert are challenged with what can be a very simple task. Ectotherms will grow and reach maturity at smaller sizes and younger stages due to warmer climates, because those are usually the most optimal. However, this can be unsuccessful in the

long run because studies have been linked to shorter lifespan and less reproductive output with smaller size. Also, with a harsh environment like the dessert, the species is under more stress which also negatively effects the reproduction output; this can mean less offspring, slower growth rates, and late maturity levels. Studies also show that when an animal has a shorter lifespan and thermal response window, the creature has a harder time to adapt to environmental change. This can be crucial to any given animal.

Water is extremely limited in the desert, which is both used in maintaining temperature and in nesting. As discussed earlier, amphibians typically use water to lay their eggs and nest. This is commonly known in frogs as their offspring hatch as tadpoles and metamorphosize into species with legs so they can live on land. This is not usually an issue with environments with access water and constant precipitation, however, the desert only receives a about ten inches of rain per year. This forces these amphibians to use surface water to lay the eggs, which gives them a very small window of time before the water dries back up.

Thermo-Hydroregulation is the set of processes and individual species obtains to maintain a thermal balance in the body to create optimal reproduction. Keeping water in the body not only aids to reproduction but also the overall health of the individual. Amphibians are very well equipped to live in harsh climates such as the desert because they have anatomical structure linked to aiding. The skin tends to be thicker and less likely to lose water, color also has a lot to do with this. Thermo-Hydroregulation is not only a matter of physical characteristic in a species, it also consists of behavioral mechanisms. Some of these behavioral mechanisms include activity, choosing a microhabitat, drinking and foraging patterns. With ectotherms, they are more likely to focus on behavioral thermo-hydroregulations, as oppose to solutions such as evaporative cooling. An example of this would be a lizard choosing to stay less active during the hottest part of the day so it can maintain the amount of water inside its body. By keeping a optimal amount of water available for the species bodily functions and prime temperature, the lizard is at less risk of overheating and dehydration. (Rozen?Rechels).

Overall, amphibians are an impressive species that scientists should continue to study in order to obtain many amounts of data on the overall ecosystems change and wellbeing, due to the sensitivity of these organisms. These ectothermic bodies create different patterns and strategies these amphibians are using to survive in harsh environments with adaptations both physical and internal.

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