Where in the World? Why Species Live Where They Do

As can be well imagined by now, reptiles and amphibians are an incredibly diverse group of animals in just about all aspects of their biology, behavior, and natural history. And this most certainly includes the many diverse arrays of habitats they live in, and their geographic locations and distributions, not only for species we are most familiar with being native, or indigenous to North America, but more foreign and exotic species as well found elsewhere in the world. But one good question which sometimes is asked, or comes up, and will be the focus of this educational article, is *why* a particular species occupies the habitat(s) and/or geographic distributions that they do. Why are some species much more successfully able to not only survive, but thrive in a wide variety of environments, while some others do not? Why might populations of certain species be found only in one or a very small number of specific areas, but not others, even a few miles away? The answers, or at least those to the best of our current knowledge, research, and understanding of a species, shall be highlighted further in this article.

The Basics

To start with the basics, it of course should be mentioned that all animals, including all reptiles and amphibians, possess the same biological requirements in order to survive. These of course include needing food and to eat, adequate amounts of water, moisture, and/or hydration, adequate shelter and cover to avoid being seen and exposed to potential predators and other threats, suitable habitat, suitable temperatures, climate, and humidity, and sufficient mating and reproductive opportunities available. On top of all of these factors are, oftentimes, competition with other similar species for such resources. All animals possess some sort of ecological niche, or roles in their environments, which can be generalized or much more specialized depending on the species. In other words, what the species "does", or the purpose it serves in its environment, what it eats and what eats it, among many other factors, all can define a species' niche.

In some cases, these environmental factors alone are enough to determine where a given species may or may not occur, or be able to live. Obviously, for example, a large and/or tropical, exotic/nonnative species from elsewhere in the world is quite unlikely to survive or thrive anywhere other than perhaps a very small portion of the United States, and North American continent. However, when the focus is on

more native species to a given area, there are also usually more additional, specific reasons as to where many other species may occur, and the ecological roles they have taken on over the course of hundreds, if not thousands of years to avoid local competition with other similar species.

When it comes to species which have been very widespread and successful over a broad range due to a variety of factors, we can often state that these species are habitat generalists. This means that a species generally is tolerant of disturbance, and does not have any special or specific habitat or ecological requirements in order to thrive or do well in. These species can be found in a variety of habitats and areas provided their basic requirements are met. Many species which have evolved to become very successful in living within close proximity to humans and are tolerant of frequent habitat and environmental changes or disturbances can often be said to be such generalists. Many harmless North American species which can be found in or around homes, gardens, agricultural or cultivated areas, or just about any other cleared or disturbed area are habitat generalists, and some of these familiar species can include the American Toad (*Anaxyrus americanus*), which usually only require sufficient water to be able to breed and reproduce in, Common Gartersnakes (*Thamnophis sirtalis ssp*.), North American Ratsnakes (*Pantherophis sp*.), and our lovely and colorful Painted Turtles (*Chrysemys picta ssp*.).

Sometimes, more direct or indirect human induced factors can also influence where a species may be found or end up, and this usually is most often the case when it comes to introduced and/or invasive species, or at least is how and why most reptile or amphibian species may be able to cross larger distances through such human means and intervention. A variety of factors, such as accidental or unintentional transports and stowaways, intentional or accidental pet releases or escapes, for ornamental or aesthetic reasons, or sometimes for bio-control efforts to control other innovative or invasive species can all be reasons why a species might be accidentally or deliberately transported and/or released into another area in which they may not be indigenous to. Sometimes, however, a few species and their native ranges may be less well defined or understood as a result of them being very widely dependent upon or being able to co-exist as a result of humans for such long periods of time, and in the case of some species such as the nonnative House Gecko (*Hemidactylus spp*.), are said to be truly cosmopolitan, or highly anthropogenic species in where they live and their distribution throughout the world. In fact, in some of these cases, these species have been greatly helped as a result of human activities and, for instance may have been able to become much more abundant and successful with humans than in many, more natural or otherwise undisturbed habitats, a thought which would seem counter-intuitive to many.

The More Complicated Factors

When it comes to the many more complex, or complicated factors determining where a species may or may not occur, there are also usually more specific reasons which can be examined and considered as well, and we can also often look to that specific specie's biology, natural history, and habitat requirements to perhaps be able to explain why they are found in the areas that they are. In contrast to species which are habitat generalists, those species which require or are found in only in more specific areas and habitats can be said to be habitat specialists. These habitat specialists generally are less tolerant of human or environmentally induced changes, and thus tend to decline at much more rapid

and concerning rates in many areas of the world in the face of these changes and thereby oftentimes warranting a greater conservation concern or status.

Sometimes these more specific factors can still be somewhat broad and well-known, and still encompass many different species in different areas relative to others, while in other cases, they can be much more narrowly focused. For example, in some climates of the more northern reaches, characterized by shorter and cooler seasons, an animal's reproductive methods and period of gestation can be one such broad, yet specialized factor for influencing where the species occurs. Take for instance, the ranges and distributions of many ovoviviparous versus oviparous snakes in that most ovoviviparous species typically require longer, warmer periods and adequate areas to gestate and deposit, and subsequently be able to incubate their eggs. This may be one reason why in some of these more northern areas, the vast majority, if not all snake species tend to be viviparous or oviparous, as a means of more quickly and successfully reproducing in these environments, and as to why ovoviviparous species diversity may be less in these areas. This is similarly the case with some rattlesnake species that reach the northern limits of their ranges as well, and which, while not ovoviviparous, require similar environmental conditions for incubating their young.

Salamanders and newts, which are also collectively known as the caudates, are perhaps the best known groups of animals, out of reptiles and amphibians at least, for which many are known for being habitat specialists requiring more pristine and specific habitats in order to exist. In fact, it is right here in the United States, and even perhaps more specifically the Greater Appalachian Mountain Range and Valley of the eastern United States, which is home to perhaps the greatest salamander and other caudate diversity out of anywhere else in the world. As many as 72 or more different caudate species alone call this limited range home! One such large and diverse group of salamanders, known as the Plethodontidae, or the "lungless" salamanders, are a group of salamanders which must absorb oxygen through their skin and/or roofs of their mouths without the use of lungs, and are especially prevalent within this region. The Spring Salamander (*Gyrinophilus porphyriticus*), is only one of many examples in which we can look to their specific biological characteristics in determining where they occur. This specie's relatively large body size means they possess a smaller respiratory surface to overall volume compared to many other salamanders, and is partly the reason why this species must occur only in cool well-oxygenated montane streams, brooks, or other high quality wetlands. And as with the habitat and breeding requirements for many salamanders in general, these bodies of water ideally must be fishless, as many species of fish act as important predators of adult and/or larval salamanders. Other habitat requirements, such as large, flat rocks and other submerged debris for ample hiding and foraging opportunities must also exist as components of these specie's habitats. If even the topography, temperatures, and/or even bedrock type in these cases are not correct, these salamanders will not be likely to occur.

So How Do Species End Up Where They Do?

At this point, one question which may sometimes be asked is "how does a certain species end up in the areas that they are in in the first place?" Well, this is an excellent question, considering very few species of reptiles and amphibians are highly mobile, at least in the sense that they cannot, and/or do not generally make large or long distance migrations or movements to or from one area and another in the

course of hundreds or even thousands of miles away. While most reptiles and amphibians can and do disperse to new areas, they are typically done over much smaller distances over the course of perhaps a few miles over time. However, there are some other reasons why some species sometimes can be found in relatively unexpected areas that didn't necessarily involve long distance travelling to begin with.

One such example are what are known as relict, or remnant populations within a given area or region. A relict population is just that- a small portion or remnant of that specie's historically larger or more widespread population which has always been present, but has been extirpated, or having caused to become locally extinct or no longer viable, and can typically be characterized by several common characteristics. Typically, these relict populations are characterized as having relatively small remaining population sizes and numbers of individuals, as well as most, if not all remaining animals within them having very low reproductive rates or otherwise may only consist of old and/or non-reproductively viable individuals. Timber Rattlesnakes (*Crotalus horridus*) and many species of box turtles (*Terrapene spp*.) are some of the examples in which these species may only still occur as relict populations in some areas.

In some other cases, a species may occur as what are known as disjunct ranges from the remainder or majority of that species' range elsewhere. This can occur due to habitat loss and fragmentation over long periods of time from when the species' range may have been more broad and contiguous historically, or sometimes due to other speciation and evolutionary events over time separating some individuals or populations from their primary ranges. One such example right here in Wisconsin is the Western Slender Glass Lizard (*Ophisaurus attenuatus*), which is a very unique species of legless lizard restricted to the sandy oak and pine barrens, oak savannahs, and prairies of west-central Wisconsin, and which is disjunct from their range elsewhere further south in the United States. Similarly, Wisconsin's newest species of indigenous snake, the Lined Snake (*Tropidoclonian lineatum*), occurs in the state as a disjunct population from areas where the species may be more common and widespread further west into the central and south-central Great Plains states of the United States. Unlike a relict population, however, these disjunct populations can often be much more reproductively active and viable, and can have larger population sizes, but their ability to disperse is more limited due to the nature of their fragmented, or disjunct ranges.

Conclusion and a Note on Range Maps

To summarize, and as it can be further imagined by now, there are many different factors which can influence, or play roles into how and where a given species may occur, and there is certainly always much more that can and should be learned and discussed with regards to each and every species and where they occur. Everything within a given species' ecosystem influences one another and is connected in one way or another, including influencing where a species can occur. Everything from even tree and habitat makeup and composition, which in turn determines potential food and prey animal availability, sheltering, and breeding and reproductive opportunities all play interconnected roles in these species' environments. Sometimes it may be that a species, such as the aforementioned timber rattlesnake, requires deep, rocky dolomite, limestone, or sandstone rock crevices and fissures that go well beneath the frostline to be able to successfully den and overwinter at such sites, and is a significant reason why some of these species are much more restricted in their habitats in the Midwestern and Northeastern

regions of the U.S. where they occur than in more southern states. Similarly, another species of Wisconsin and Midwestern lizard, as well as another turtle species, the Prairie Racerunner (*Aspidoscelis sexlineata*) and Ornate Box Turtle (*Terrapene ornata ornata*) both reach the northernmost limit of their ranges in these areas, and are the reasons why these fast and spirited greenish-yellow lizards, or colorfully domed chelonians may only be found in warmer, xeric areas of sparse vegetation and deeper, sandier soiled habitats in which they are able to successfully overwinter.

Most have also seen and are at least somewhat familiar with species range maps for one or more given species locally, at the state level, or nationally or globally. These range maps are typically formed and based upon data and collected specimens collected by public or private educational and other scientific or research institutions having spent the time and research from the given locales, and can oftentimes be helpful in giving one at least some idea of the overall geographic range or distribution of the given species. This is certainly not to say that a species' range or distribution is always static or can never change, or that range maps are always irrefutably correct, as ranges are certainly always expanding or contracting depending on varying factors. Sometimes a range map can be outdated or have incomplete data during the time the given maps were created. Range maps are certainly not arbitrary, but can be theoretical or hypothetical, broadly encompassing an entire area of a state or region where a species may *potentially* occur, and actual range maps where more specific or precise areas or locales where a species has been observed or collected for the purpose of mapping their distributions may be pinpointed. In any event, there are many different biological reasons for why many species of amphibians and reptiles, as well as other animals for that matter, may occur in one area but not another, and it is our hope that this educational article provides further insight into answering these always intriguing questions.

Sources

Briggs, Kelly. ***Why Do Species Live Where They Do and Not Where They Don't.*** 05 March 2019. The Orianne Society. https://www.oriannesociety.org/why-do-species-live-where-they-do-and-not-where-they-dont/