*Euryce*Alliance Summer Conference 2011

Texas State University-San Marcos

Sponsored by Department of Biology

Date: Friday June 10, 2011

Time: 10am – dinner

Place: Freeman Aquatic Building - Room 136

ABSTRACTS

*Eurycea*Alliance Summer 2011 Meeting

June 10, 2011 | Texas State University – San Marcos

Surface Abundance, Population Size, and Movement of the Georgetown Salamander, *Eurycea naufragia*

Ben Pierce, Southwestern University

The Georgetown salamander, *Eurycea naufragia*, is an endemic neotenic salamander that is known from only 15 sites in Williamson County, TX. We conducted monthly visual encounter surveys of salamanders at two sites from 2007 to 2011 and conducted mark-recapture studies at these sites in the summer of 2010. The numbers of salamanders observed in visual encounter surveys varied from month to month, with higher numbers seen in spring and summer surveys. Estimates from the mark-recapture studies suggest that in the summer of 2010 both populations consisted of approximately 100-200 adult salamanders. Recaptures over a ten-month period demonstrated that marked salamanders exhibited high site fidelity, most being recaptured within 5 m of the point of initial capture. These studies provide basic biological information that can be used to develop a long-range conservation plan for the species.

Notes:

Genetic structure in the Jollyville Plateau salamander, *Eurycea tonkawae*

Paul Chippindale, University of Texas at Arlington

The Jollyville Plateau salamander, *Eurycea tonkawae*, was described in 2000 from springs and caves of the Jollyville Plateau region of Travis and Williamson Counties. Analyses of mitochondrial and nuclear sequences and microsatellites for specimens from dozens of localities throughout the known range show strong support for the distinctiveness of *E. tonkawae* from its closest described relatives, *E. naufragia* and *E. chisholmensis*. Our results also indicate high levels of genetic fragmentation on even small geographic scales, consistent with the complex structure of the aquifer system in the region. The most striking result is a sharp genetic divide between populations associated primarily with the Plateau proper plus its eastern and northern edges, and those on the western-northwestern periphery of the Plateau. This corresponds to the Bull Creek and adjacent Walnut, Shoal, and Brushy Creek drainages versus the Buttercup and Lake Travis drainages. Our results suggest that *E. tonkawae* consists of at least two distinct evolutionary lineages that may represent separate species. This, combined with the apparently patchy distribution and high degree of genetic structure even within each of the two groups, emphasizes the vulnerability of *E. tonkawae* to loss of genetic diversity and highlights the urgent need for a comprehensive conservation strategy.

Notes:

The effect of hydrologic conditions on Jollyville Plateau salamander (*Eurycea tonkawae*) populations

Nate Bendik, City of Austin

Central Texas *Eurycea* salamanders are associated with the karstic aquifers of the Edwards Plateau region, and occur across a range of surface and subterranean habitats including underground stream systems, springs, spring-fed streams and even hillside seeps. In contrast with a few species that are endemic to singular, large springs of the Edwards Aquifer (e.g. *E. sosorum* at Barton Springs), most have larger ranges and inhabit numerous springs and caves. Populations inhabiting surface waters are vulnerable to fluctuations in hydrologic conditions, as surface habitat may run dry during droughts, or get scoured during heavy rains. Central Texas *Eurycea* may be adapted to periodic drying, as some populations have been observed to return after long dry periods. However, droughts are likely to have negative impacts on populations from direct mortality or as a result of increased competition for food and space within subterranean refugia. Floods may also have negative effects on surface populations from habitat alteration, flushing of salamanders downstream to unsuitable habitat, or direct mortality. In this study, I present results from a preliminary investigation of the relationship between counts of Jollyville Plateau salamanders (*E. tonkawae*) and stream discharge. The City of Austin has surveyed salamanders at seven sites from 1996-2010 (although survey frequency varied greatly among sites), providing a large dataset with which to compare historical levels of stream discharge rates. I use daily historical discharge measurements from a U.S. Geological Survey gauge on Bull Creek to develop an overdispersed Poisson regression model of salamander counts, accounting for site-specific abundance and temporal trends. Models including median flow, extreme high flow and extreme low flow covariates are compared under four different time period lengths (1,3,6 and 12 months) to determine whether they help explain past variation in adult and juvenile Jollyville Plateau salamander counts.

Notes:

Conservation implications of population dynamics of the Barton Springs salamander (*Eurycea sosorum*)

Hayley Gillespie , University of Texas at Austin

In this study, I use time-series multiple regression techniques to examine a seven-year time-series of monthly abundance of three size classes (juveniles, young adults and adults) of the endangered Barton Springs Salamander (*Eurycea sosorum*) from two populations: Eliza Spring(ES) and Parthenia Spring (PS).

Though headwater springs are typically described as having relatively stable environmental conditions, results indicate that *E. sosorum* abundance was strongly influenced by periodic extremes in rainfall. These extremes affect cycles in spring flow rates, water temperature, and other physico-chemical parameters. Seven- to twelve-month lags of monthly rainfall variance had the highest explanatory power of *E. sosorum* abundance for all size classes in PS, and for juveniles at both sites; the number of rainfall events per month was most important to young adult and adult size classes at both sites. Only the juvenile size class at PS showed evidence of weak density dependence.

Results of this study suggest that *E. sosorum* employs a “storage effect” type life history strategy in which in which a few long-lived females capable of sperm storage, high fecundity and prolonged survival in subterranean habitat during adverse surface conditions may be sufficient to sustain population sizes observed in this study. In addition, similarly to *Eurycea lucifuga*, oviposition in *E. sosorum* may be triggered by low flow conditions followed by bouts of high rainfall which drives water temperature down, and juveniles may use subterranean habitat as a thermal refuge for growth and development. As climate change threatens to increase climatic variability in central Texas, analysis of population trends as more data is collected will be crucial for determining how *E. sosorum* responds to such changes in the coming years. Finally, results are put into the context of evaluating monitoring and captive breeding protocols, guiding habitat restoration for *E. sosorum*.

Notes:

***Eurycea pterophila* from Jacob's Well Spring, Wimberley, Texas**

Krista McDermid, Zara Environmental LLC

Jacob's Well is one of the largest water-filled caves in Texas. A single historic specimen of *Eurycea* that was reportedly collected from within the cave exhibited a more robust morphotype and a haplotype unique from other Eurycea that were collected from the surface at the site. This collection prompted research into the population in order to characterize the mtDNA variation for salamanders collected from Jacob's Well and determine whether the site hosts a single, recognized species of Eurycea or whether there is a spring-associated morph as well as a cave-adapted morph present. Genetic results indicate that there is only one species present at the site , but recorded some divergence from other populations of the same species. This study represents one of very few documented occurrences of "spring-associated" *E. pterophila* from depths exceeding 70 feet, which supports the theory that spring-associated Eurycea may retreat to inaccessible depths, particularly at ephemeral springs, and remain persistent at a site when the springs are not flowing.

Notes:

So just how many *Eurycea rathbuni* are there?

Joe Fries, US Fish and Wildlife Service

Texas blind salamanders *Eurycea rathbuni* have been collected sporadically from artesian wells and caves in San Marcos since the late 1800s. The artesian well at what now is Texas State University and the Diversion Springs pipe (used to supply clear water for the underwater shows at Aquarena Springs) have been sampled for organisms relatively consistently from late 1975 to present. Numbers of Texas blind salamanders collected from these sources have fluctuated from zero to more than 250 annually. Population estimates have varied from "rather small" to "large" enough to support almost 5,000 annual emigrants. Life history information of a captive population and the collection history from the well and Diversion Springs pipe hint at a "rather small" population.

Notes:

Typhlomolge* Tail Tips Tell Tall Tales: Population Studies of *Eurycea rathbuni

Andy Gluesenkamp, Texas Parks & Wildlife Department

The subgenus *Typhlomolge* contains four species known from aquifer environments along the Edwards Fault Zone in central Texas. Little is known about these extreme stygobites although one of them, the Texas Blind salamander (*Eurycea rathbuni*), was described over a century ago, was one of the first species listed under the ESA, and is possibly the most recognizable salamander in the world. Despite its limited range (known from only eight sites, all within the City of San Marcos), population size and structure in this species have remained largely unstudied. Following a limited mark-recapture study and recent discovery of populations at four sites in New Braunfels, we conducted a population genetics study of *E. rathbuni*. Although we had initially considered the New Braunfels populations to be a potential new species, we determined that the most appropriate designation for these populations, given their overall similarity to *E. rathbuni* and limited sample size, is to treat them as *E. rathbuni*. This represents a 25-mile range extension for the species and is congruent with hydrogeologic hypotheses. We discuss the results of our molecular analyses (involving mitochondrial and nuclear markers) with respect to levels of genetic variation, genetic structure, species boundaries, and possible hybridization with other congeners.

Notes:

Diet and mesohabitat associations of the threatened San Marcos salamander (*Eurycea nana*)

Pete Diaz, US Fish and Wildlife Service

The Endangered Species Act was created to aid in the conservation and protection of species under threat of extinction through all or part of their range. Data regarding habitat associations and dietary needs are required for the efficient recovery and maintenance of endangered or threatened species populations. The San Marcos salamander (*Eurycea nana*) is a spring-associated organism that exhibits a geographic range limited to the headwaters of the San Marcos River in central Texas, USA. The USFWS and the state of Texas currently list the SMS as threatened and its designated critical habitat includes the headwaters (Spring Lake) and the first 50 m of the river. The present study determined mesohabitat associations and the trophic ecology of the San Marcos salamander in its critical habitat. San Marcos salamander habitat associations were determined over a 1-year period and it was determined that San Marcos salamanders are associated with mesohabitats containing cobble and gravel substrates with coverage of *Amblystegium* and filamentous algae. In addition, these mesohabitats account for about 14% of the area within the designated critical habitat. To examine the trophic ecology of the San Marcos salamander, gut contents were collected from salamanders and invertebrate samples from the lake and river were collected. Dietary analyses suggest that the San Marcos salamanders in Spring Lake and the San Marcos River are generalist predators of aquatic invertebrates and the composition of their diets closely follows temporal changes in the invertebrate community. I conclude that due to the generalist and flexible diet of the San Marcos salamander, conservation and recovery issues related to the diet and food availability is likely to be a less substantial issue than mesohabitat availability and quality.

Notes:

Generalization of introduced predators by a threatened Salamander (*Eurycea nana*)

Drew Davis, Texas State University

The introduction of novel predators into an environment may have detrimental consequences on prey species, especially if these species lack the ability to detect, recognize, and respond to these predators. One such species affected by introduced predators is the federally threatened San Marcos salamander, *Eurycea nana*. Predator-naïve (captive hatched) salamanders showed decreased activity in response to the chemical cues of both a native predator (*Micropterus salmoides*) and an introduced predator (*Lepomis auritus*). Since there are native congeneric predators in the San Marcos River, it is possible that there are similarities among all Lepomis which are detected by salamanders. We examined the antipredator response of predator-naïve salamanders to chemical cues from (1) a native *Lepomis* (*L. cyanellus*), (2) an introduced Lepomis (*L. auritus*), (3) an allopatric *Lepomis* (*L. gibbosus*), (4) a sympatric introduced cichlid (*Cichlasoma cyanoguttatum*), and (5) a blank water control to further understand predator recognition by *E. nana*. Analyses reveal that salamanders reduced activity to all predator treatments suggesting that *E. nana* make generalizations about novel predators.

Notes:

Stress hormones in *Eurycea nana*

Caitlin Gabor, Texas State University

Chronic stress in animals is known to impair reproduction and compromise immune responses and thus can be detrimental to population stability. Glucocorticoids are the main vertebrate stress hormones. Corticosterone (CORT) is the main glucocorticoid in amphibians. Vertebrates can exhibit marked increases in CORT within a few minutes following exposure to a stressor such as handling or confinement. Determining the stress levels and basic hormone levels of Eurycea nana is an important component of captive breeding and keeping the species healthy, and will help in future assays if the natural spring conditions decline. We are examining stress hormones in Eurycea nana using water-borne hormone collection techniques. We are examining the impacts of predators, different maintenance methods in the lab and of collecting these salamanders on CORT levels. The results of these experiments will provide help with the maintenance practices of other species of aquatic salamanders.

Notes:

Effects of temperature on San Marcos salamander (*Eurycea nana*)

Val Cantu, US Fish and Wildlife Service

Climate change models predict higher temperatures and frequency of droughts in Texas, which could reduce or completely diminish *Eurycea* habitats, including the San Marcos Springs (relatively constant temperature from 21 to 22°C) where the San Marcos salamander lives. To examine effects of temperature on this species (*Eurycea nana*), we subjected adult male and very gravid female offspring to 21, 24, and 27°C for 2 months We found that mortality increased as temperatures rose as did the total number of salamanders with bacterial, fungal, or viral infections. Conversely, number of salamander ovipositions, percent hatch, and time to hatch decreased with rising temperatures. As temperature increased, change in gravidity drastically decreased while growth, weight, and condition appeared unaffected. We plan to repeat and expand the study with adults and young salamanders, the latter of which may show growth effects more readily.

Notes:

An Early Non-Invasive Method For Determining Egg Viability of Eurycea

Patricia Grant, US Fish and Wildlife Service

A method of determining *Eurycea* egg viability soon after oviposition is described. Early viability determination is essential in order to establish necessary husbandry practices which may or may not affect *Eurycea* egg fertilization. Eight Hundred Eurycea eggs were examined from the period of 12/03/08 to 12/27/09. Eggs were examined under a microscope 4 to 6 days after oviposition. Each egg was characterized by cleavage formation, inner and outer membrane intactness, yolk size and color. Eggs were then individually deposited in a numbered chamber and development was monitored. Results indicated that outer membrane rupture did not affect development, but inner membrane intactness did 100% of the time. Also, yolk size and color was an early indicator as to whether an egg was fertile or infertile.

Notes:

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