Herpetology

www.harding.edu/plummer/herp/home.pdf *(Updated 7 May 2012)*

Careers in Herpetology | ***Center for North American Herpetology*** | ***Prospective Students***

Diversity of Recent Herps | ***AmphibiaWeb*** | ***Reptile Database***

Collection List | ***Collection Points*** | ***Grades***

Field Trip Results 2012

Biol. 416 Herpetology (4 hrs) – 2012

The morphology, systematics, ecology, behavior, distribution, and conservation of amphibians and reptiles

Textbooks

- Mattison, C. 2008. Firefly Encyclopedia of Reptiles and Amphibians. 2nd ed. Firefly Books, Ltd.
- Conant, R. and J.T. Collins. 1998. A Field Guide to Reptiles and Amphibians of Eastern and Central North America. Houghton-Mifflin Co.
- Trauth, S. E., H. W. Robison, and M. V. Plummer. 2004. The Amphibians and Reptiles of Arkansas. University of Arkansas Press. (provided)

Class and Lab

There will be little conventional lecturing; most of class time will be spent discussing Mattison but we will also view short videos and discuss handouts and primary literature papers. As you might expect for a class covering the biological diversity of a taxonomic group, there will be a lot of memory work. About 50% of lab time (most of the first half of the semester) will be spent in the laboratory learning the amphibians and reptiles of Arkansas. The remaining 50% will be spent in the field applying knowledge learned in lab, namely, learning how to find, observe, collect, and identify herps in their natural environment.

Evaluation

Amphibian Exam 1	10%	Mills	Pp. 8-63; handouts, videos	27 Jan
Amphibian Lab Practical	10%	Mills	Arkansas amphibians, frog calls	24 Jan
Amphibian Exam 2	10%	Mills	Pp. 8-37, 64-97; handouts, videos	17 Feb
Class participation - amp	10%	Mills		-----
Reptile Lab Practical	10%	Plummer	Arkansas reptiles	28 Feb
Reptile Exam 1	10%	Plummer	Pp. 98-177; handouts, videos	30 Mar
Reptile Exam 2	10%	Plummer	Pp. 98-117; 178-225; hdouts, videos	2 May
Class participation - rep	10%	Plummer		-----
Collection	20%			30 Apr

Recent Literature

A discussion of some of the latest research in herpetology. The discussion leader will choose a recent paper and email a PDF to Plummer by noon Tuesday of the discussion week. Each student must read the paper and be prepared to contribute to the discussion. Do not choose taxonomic papers. Links to papers are posted below.

Name	Tentative Schedule 2012	
	Amphibian	Reptile
Molly	20 Jan	16 Mar
Matthew	20 Jan	16 Mar
Sara	3 Feb	23 Mar
Jessica	3 Feb	23 Mar
Cordell	10 Feb	13 Apr
Patrick	10 Feb	13 Apr
Noah	24 Feb	20 Apr
Bethany	24 Feb	20 Apr
Brad	24 Feb	27 Apr
Landon	10 Feb	27 Apr
Beth	3 Feb	27 Apr

Links

Salamander lab (Travis Hughes)

Frog lab
Turts&lizards_1
Turts&lizards_2
Snakes_1
Snakes_2
Snakes_3

Field Trips <2008
Field Trips 2008
Field Trips 2010
Field Trips 2012
Voluntary snake bite 2010

AR Salamanders
AR Alligator
AR Lizards
AR Frogs
AR Turtles
AR Snakes
AR Frog Calls

Old Exam (Plummer)

Academic Dishonesty | ***Evolution Statement*** | ***Students with Disabilities***

Diversity of recent herps - ***Commit this outline to memory!***

*Amphibian data from **AmphibiaWeb** (http://amphibiaweb.org as of January 4, 2012)*
*Reptile data from **Reptile-Database** (www.reptile-database.org as of November 11, 2011)*

Class Amphibia – **6909 species** (149 new species in 2011)
- Order Caudata (salamanders) - **615 species**
- Order Gymnophiona (caecilians) - **189 species**
- Order Anura (frogs and toads) - **6105 species**

Class Reptilia - **9487 species** (84 new species in 2011)
- Order Testudines (turtles) - **323 species**
- Order Rhynchocephalia (tuatara) - **2 species**
- Order Squamata
  - Suborder Sauria (lizards) - **5537 species**
  - Suborder Serpentes (snakes) - **3346 species**
  - Suborder Amphisbaenia (worm lizards) – **181 species**
- Order Crocodilia (alligators, crocodiles, caimans) - **24 species**

> "These foul and loathsome animals are abhorrent because of their cold body, pale color, cartilaginous skeleton, filthy skin, fierce aspect, calculating eye, offensive smell, harsh voice, squalid habitation, and terrible venom; and so their Creator has not exerted his powers to make many of them."
>
> -Carolus Linnaeus (1758) - recognized a total of only 4400 animal species!

Guidelines for additional taxonomic memory work:

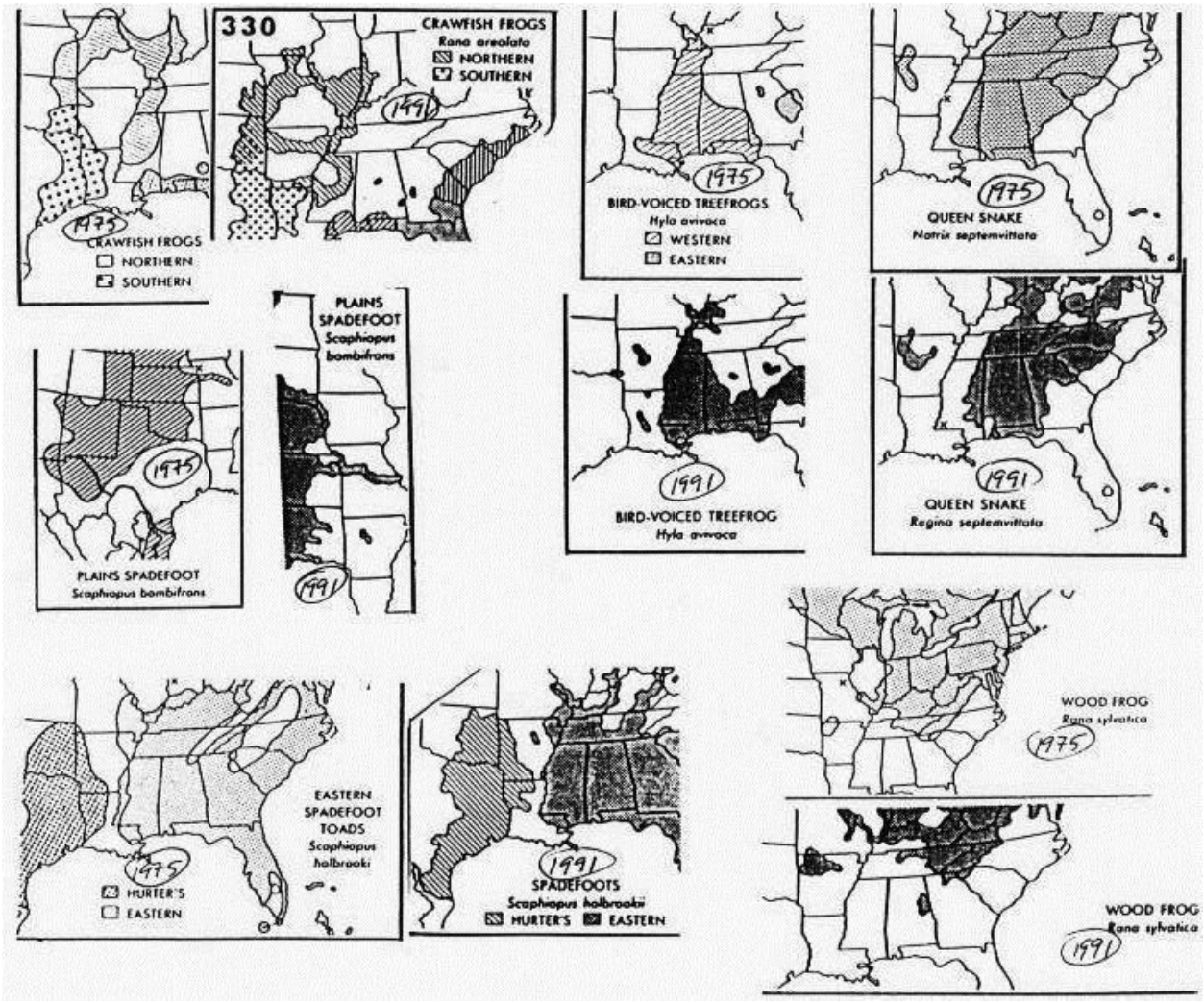
1. For Arkansas, know all the species
2. For the U.S., know all the genera
3. For the world, know all the families

Herp Field Work

A. Purpose of field work
   1. To help beginning students to learn how to learn about the amphibians and reptiles of a given region using the state of Arkansas as a model.
   2. To further the knowledge of the amphibians and reptiles of Arkansas. Many areas of Arkansas are poorly collected; students are encouraged to work in these unknown areas (see distribution maps in Trauth et al. 2004).

B. Use of a field guide - A field guide is an important tool for beginners to help identify specimens and to study distributional patterns. The Conant and Collins (1998) guide for the eastern U.S. and the companion Stebbins (1985) guide for the western U.S. are the standards for North America herps.
   1. Read the Introduction in Conant and Collins (pp. 1-15). Give particular attention to the sections on "Scientific Names", "Common Names", and "Subspecies".
   2. You must be familiar with basic morphological features of herps in order to ID specimens. Such information may be found on pp. 138-141.
   3. A field guide is just that - use it in the field as well as in the lab. Carry it with you on field trips and get in the habit of looking up species as you encounter them. The information will stay with you a lot longer if you will do this.
   4. When trying to identify a specimen, don't rely just on the pictures. Most valuable in identification is knowing what the recognition characteristics are. Remember that the distribution of a species is valuable recognition characteristic. Study the distribution maps!
   5. To help you better understand the biogeography of herps in Arkansas, note the geographic ranges of species which exhibit the following distributional patterns:
      a. species which have a wide geographic range and Arkansas is near the center of distribution (e.g., *Sceloporus undulatus*, p. 233)
      b. species which have a primarily eastern U.S. distribution which reach their western limits in Arkansas (e.g. *Ambystoma maculatum*, p. 438)
      c. species which have a primarily western U.S. distribution which reach their eastern limits in Arkansas (e.g., *Terrapene ornata*, p. 164)
      d. species which have a primarily northern U.S. distribution which have small disjunct (separate) populations in Arkansas (e.g., *Rana sylvatica*, p. 562)
      e. species which have a primarily coastal plain distribution which reach their northern limits in Arkansas (e.g., *Micrurus fulvius*, p. 394)
      f. species which are endemic (found nowhere else) to either Arkansas or to the Interior Highlands (mountainous area of eastern Oklahoma, Southern Missouri, and western and northern Arkansas) (e.g., *Plethodon fourchensis*, p. 475)

C. Herpetology was first taught at Harding University in 1976. At that time, the second edition of Conant's field guide (1975) was hot off the press. In the past 3+ decades, collections made by HU herpetology students have contributed to the knowledge of the distribution of amphibians and reptiles in Arkansas. For example, compare the species distribution maps from the 1975 edition of Conant with those from the 1991 edition below.


330
CRAWFISH FROGS
Rana areolata
NORTHERN
SOUTHERN
1991
1975
CRAWFISH FROGS
NORTHERN
SOUTHERN
1975
BIRD-VOICED TREEFROGS
Hyla avivoca
WESTERN
EASTERN
1975
QUEEN SNAKE
Natrix septemvittata
PLAINS SPADEFOOT
Scaphiopus bombifrons
1991
1975
PLAINS SPADEFOOT
Scaphiopus bombifrons
1991
BIRD-VOICED TREEFROG
Hyla avivoca
1991
QUEEN SNAKE
Regina septemvittata
WOOD FROG
Rana sylvatica
1975
EASTERN SPADEFOOT TOADS
Scaphiopus holbrooki
1975
HURTER'S
EASTERN
1991
SPADEFOOTS
Scaphiopus holbrooki
HURTER'S
EASTERN
WOOD FROG
Rana sylvatica
1991

Why does the discipline of herpetology include amphibians AND reptiles?

Considering that amphibians and reptiles are only distantly related and that reptiles are much more closely related to birds than they are to amphibians, why are amphibians usually grouped with reptiles (for example, in this herpetology course)? The answer is largely historical (Linneaus placed amphibians and reptiles in the same class) and partly practical (similar methods of study). Despite the enormous morphological differences between amphibians and reptiles and the variation seen within each group, their ecology/behavior is much more similar to each other than it is to that of birds and mammals. The fundamental reason for this is grounded in their differences in energetic physiology. Birds and mammals (endotherms) produce body heat physiologically by metabolic processes, whereas amphibians and reptiles (ectotherms) obtain their body heat behaviorally by absorbing heat directly (by basking in the sun) or indirectly (by absorbing heat from a surface warmed by the sun). There are some far-reaching consequences of this fundamental difference which must be understood to fully appreciate why herps do what they do!

Ectothermy and Endothermy: Alternative Energy Use Strategies

1. Observations
    a. Herps are less active than birds or mammals
    b. Herps have a low resting metabolic rate (reptile ~10-15% of similar-sized mammal) which decreases during extended inactivity
    c. Herps regulate their body temperature during periods of activity
    d. Body temperature strongly affects most aspects of a active herp's daily life (relationship between preference and performance)
    e. Herps can make short bursts of rapid activity at <optimal body temperature - fueled by anaerobic metabolism (less thermally dependent)
    f. Herps use only about 3% as much energy in a day as a similar-sized mammal

2. Alternative energetic strategies (Pough 1980)
    a. Ectothermy is a low-energy strategy (herps, most other animals)
    b. Endothermy is a high-energy strategy (birds, mammals, few others)

3. Benefits of ectothermy
    a. Herps can live in environments where resources are either too low or too unpredictable to support endotherms (avoid adverse periods in energetically low-cost dormancy)
    b. Herps can be small (minimum endotherm size - shrew); herps include the smallest terrestrial vertebrates (<0.5 g); 80% of lizard spp and 90% of frog spp weigh <20 g (most mammals >20 g); only in some turtles, snakes, and crocodilians do individuals weigh >500 g (rat size)
    c. Herps can be elongate - maximum endotherm elongation (e.g., weasel - maintenance 2X that of normally shaped mammal of comparable size)
        1) Herps can occupy habitats not available to endotherms
        2) Herps can live in a body size range that is free of competition from birds and mammals
    d. Herps have a high production efficiency (endotherms average <2% vs. ectotherms average 50% [up to 90+%]); biomass conversion 25x that of endotherms
        1) Herps use food primarily for growth and reproduction whereas endotherms use food primarily for keeping their bodies warm

2) Herps have a fundamentally different function in ecosystems than that of birds and mammals; e.g., Hubbard Brook Ecosystem Study:
   - salamanders consumed ~20% of the food consumed by birds, but produced much more new biomass each year than did birds or mammals
   - because salys are so small, they fed on tiny invertebrates not directly available to birds or mammals and thus passed on energy

4. Costs of ectothermy
   a. Herps are limited to thermally optimal habitats and times of activity - more dependent on thermal environment (cf endotherms - active anytime; not stopped by cold or dark)
   b. Herps have limited sustained activity (cf endotherms - fueled by aerobic metabolism; endurance)