Biol 119 – Herpetology
Laboratory Introduction
Fall 2013

P.J. Bergmann, with excerpts from Bonine & Foldi, 2008.

Lab objectives
The laboratory portion of the herpetology course aims to balance some of the lecture material by giving you a hands-on, practical, and interactive experience. The lab should allow you to better visualize some of the topics discussed in lecture, and to learn skills that are difficult to impart in a lecture setting. Toward these ends, the major objectives of the lab portion of this course are:

1. To introduce you to the basic principles of systematic herpetology, including the taxonomic and morphological diversity of amphibians and “reptiles”.
2. To teach you how to identify preserved and live specimens in the lab and field.
3. To introduce you to field techniques for studying amphibians and “reptiles”.
4. To encourage critical and independent reasoning and inquiry.

Lab schedule
The lab is scheduled for three hours a week, on Tuesdays from 1:25 to 4:10pm. There will also be two weekend field trips. There are 12 lab sessions, plus the weekend field trips. All lab components, including field trips, are mandatory for all students. The lab schedule is as follows:

<table>
<thead>
<tr>
<th>Date</th>
<th>Activity</th>
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</thead>
<tbody>
<tr>
<td>August 27</td>
<td>No Lab (first day of classes)</td>
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<tr>
<td>September 3</td>
<td>Introduction; Intro to local herps; Using the field guide</td>
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<tr>
<td>September 10</td>
<td>External anatomy; Learning the local herps</td>
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<tr>
<td>September 15</td>
<td>Westboro Field Trip (Sunday)</td>
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<tr>
<td>September 17</td>
<td>Amphibian Diversity 1: Anura; Phylogeny exercise</td>
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<tr>
<td>September 24</td>
<td>Amphibian Diversity 2: Urodela; Using taxonomic keys; Using the library</td>
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<tr>
<td>October 1</td>
<td>Amphibian Anatomy; Review</td>
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<tr>
<td>October 8</td>
<td>Lab Exam 1</td>
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<tr>
<td>October 15</td>
<td>Fall Break – No Lab</td>
</tr>
<tr>
<td>October 20</td>
<td>Field Trip to Museum of Comparative Zoology (Sunday)</td>
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<tr>
<td>October 22</td>
<td>Reptile Diversity 1: Lizards &amp; Crocodylians</td>
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<tr>
<td>October 29</td>
<td>Reptile Diversity 2: Snakes &amp; Turtles</td>
</tr>
<tr>
<td>November 5</td>
<td>Reptile Osteology</td>
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<tr>
<td>November 12</td>
<td>Reptile Soft Anatomy, Review for Lab Exam</td>
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<tr>
<td>November 19</td>
<td>Lab Exam 2</td>
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<tr>
<td>November 26</td>
<td>Topic Presentations</td>
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<tr>
<td>December 3</td>
<td>Review Session for Lecture Final Exam</td>
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</tbody>
</table>
Lab components
The lab will be evaluated based on several components:

<table>
<thead>
<tr>
<th>Component</th>
<th>Points</th>
<th>Percentage</th>
<th>Grade</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lab exam 1</td>
<td>100</td>
<td>10%</td>
<td>10%</td>
<td>October 8</td>
</tr>
<tr>
<td>Lab exam 2</td>
<td>100</td>
<td>10%</td>
<td>10%</td>
<td>November 19</td>
</tr>
<tr>
<td>Lab activities</td>
<td>100</td>
<td>10%</td>
<td>10%</td>
<td>Ongoing</td>
</tr>
<tr>
<td>Course participation</td>
<td>50</td>
<td>5%</td>
<td>5%</td>
<td>Ongoing</td>
</tr>
</tbody>
</table>

Below is information about each component.

Lab exams
There will be two lab exams during the semester. These lab exams will test your knowledge of material presented and available in lab and on field trips. You will be asked to identify local herps to species level (these are those that live in Massachusetts), and other herps to “family” or clade level. Local species appear in **bold** in the lab manual. Note that you may be asked to identify species that are not from Massachusetts to the species level using a taxonomic key. Any other information in this lab manual is also fair game. You should know your external and internal anatomy for lab exams, as well as any natural history information presented during lab time, the basics of phylogenetic reconstruction, how to read phylogenetic trees, and how to use a taxonomic key. You should also be able to answer questions about techniques learned in labs and on field trips. Lab exam format will consist of fill-in-the-blank questions and some short answer (up to a paragraph) questions. The exams will be in the form of stations with demo material about which you will be asked questions. The stations will be timed so that all students have a chance to see all of the material, but time will be available to return to stations you want to revisit at the end of each exam. Lab exams will not be cumulative, except for questions about Massachusetts herps. Due to the format of these exams, it is very difficult to make up a missed exam, so please show up.

Lab activities
During some labs and field trips, you will be given worksheets and exercises on how to use a field guide, how to use a taxonomic key, how to build a phylogenetic tree, and other topics that should help you with the course material. You will be asked to turn in your work from some of these activities for a grade. In addition, there will occasionally be short pop quizzes to better help you prepare for lab exams.

Course participation
If you show up to lab and lecture and participate in course discussions and activities, this is an easy 5% to boost your grade. This grade is based on participation both in lab and lecture, and on having a good attitude during labs and field trips. It should be mentioned that failure to attend labs and field trips will result in a failing grade for the course.

Using this lab manual
The labs you will be doing are specifically designed for this course. This has the advantages of being tailored to the needs of the course and being free to download by students. Each lab is presented in the same format. The **Learning Objectives** is a short section outlining what you should be doing and learning during each lab. The rest of each lab contains specific material that you should learn. Specific instructions that you should follow during the lab are in **bold**, as are questions that you should work on. Finally, there are lists of species of which specimens are available in lab. Species that live in Massachusetts are in **bold**. You are expected to learn to identify these species. Species that do not live in Massachusetts are not in bold and these you will be expected to identify to higher taxa, listed in the lab manual.
Please read the relevant section of the lab manual prior to coming to each lab. There can be a considerable amount of text, and waiting until lab to read it takes away from time you can use to examine specimens and do the assigned activities. Also, come prepared to each lab by bringing a print out of the current lab. It is a good idea to bring past labs as well, so that you can review material from previous weeks if you have time and to facilitate class discussion of the previous lab’s questions. As you work through each lab, focus on the text that is in bold for instructions and the species lists. Also pay close attention to the questions posed throughout each of the labs. These questions are designed for you to engage with the material. Although they are not always worth marks, some of them will be discussed at the beginning of next lab. It is important that you work on them so that you can take part in the discussion (think participation marks).

Academic Integrity, Honesty, and Plagiarism
Academic dishonesty includes any effort to circumvent the evaluation procedures of the course to improve a grade for yourself or other students (“cheating”). Academic dishonesty includes but is not limited to unauthorized examination of written materials (i.e., notes, neighbor’s paper during an exam), misrepresentation of the cause of an absence during an exam or laboratory, submitting the work of another (partially or entirely) as one’s own, alteration of an exam answer to be submitted for regrading, and alteration of data. You are encouraged to report academic dishonesty. Anonymity will be protected if requested. If I believe that academic dishonesty has occurred and I have supporting evidence, I will report the case to the College Board immediately after informing the student that I am doing so, and why. I will recommend that a grade of F be given for the course. All students are expected to adhere to Clark University’s rules of Academic Integrity, available at: http://www.clarku.edu/offices/aac/integrity.cfm.
**Taxonomy**

The taxonomy of organisms is always in a state of flux as systematists study them and gain a better understanding of how they are related. The lab manual printouts available online contain the most current scientific names for the species that will be available to you. Please use these names in preference to any others.

In this course, we will be using the following field guide, which is required:


Please note that some of the names in this guide are outdated and no longer the preferred names. Unfortunately, it is the newest field guide available. It is suggested that you change the scientific names that have changed in your field guide to those used by the course.

We will also use a taxonomic key in lab. Purchasing this key is completely optional, but may be of interest to some students:


The following references, both available online, provided up-to-date scientific names for North American Amphibians and “Reptiles”, and those used by the majority of the scientific community:


Updated more recently:


Both are available at: http://www.herplit.com/SSAR/circulars/HC29/Crother.html. Further taxonomic changes have been made recently, but many are not yet widely recognized.

**Specimen Preservation**

Preservation of whole specimens is traditional in herpetology, and presents some advantages over simply saving skins or skeletons. In most cases, preservation is a two-step process, involving fixation in a 10% formaldehyde solution, called formalin, followed by storage in ethanol.

Formaldehyde denatures protein in a way that is nearly impossible for biological enzymes to lyse, and thus prevents decomposition. The specimen becomes “hardened” in the process. However, formaldehyde is acidic and carcinogenic and not good for storage. After fixation, specimens are soaked in water to remove external formaldehyde and then placed in ethanol or isopropanol for storage. Properly hardened specimens will last indefinitely. The disadvantage to formalin fixation is that it forms cross-bridges between DNA strands, making sequencing very difficult.

Once a specimen has been stored in ethanol it is important to avoid placing it back in water or formalin. The reason is that the reduced osmolarity causes the skin to swell rapidly while musculature remains compact, resulting in the scales splitting away from the skin and ruining the
specimen. Amphibian larvae are usually stored in a more dilute solution of alcohol to avoid excessive desiccation due to their highly permeable and sensitive skin.

All specimens in the Clark University teaching collection are stored in ethanol. Reptiles are stored in 70% ethanol, amphibians in 50%.

When handling specimens in lab, be very careful and follow these rules:
1. Do NOT drop specimen jars on the floor – carry with both hands.
2. Do NOT pick up specimen jars by the lid (leads to jar dropping).
3. Do NOT put specimens in the wrong jar.
4. DO handle specimens gently and with respect.
5. DO keep specimens moist with ethanol and protected from intense light.
6. DO close jars securely when not taking specimens out or returning them.

Safety
There are inherent risks to doing anything, including field work and course labs. Please be aware of these risks and act to minimize them. In the laboratory, you will be exposed to trace amounts of formaldehyde which is a carcinogen. You will also handle ethanol, dead animals, glass jars, and other hazards. To minimize the risk of injury or illness, please refrain from eating or drinking in lab. Some of the snake specimens in lab are venomous, and the venom is potent even after death – please handle these animals with gloves and with care. Above all, use common sense, ask questions, wash your hands, and follow the advice of your instructors. If something does not seem safe to you, particularly in the field, then don’t do it or find a way to make it safe. If you observe someone being unsafe, notify them and your instructors and get out of the way. Feel free to talk to your instructors about these risks.

Some helpful hints
As we look at different herps, think about why these animals look the way they do. What selective pressures might have been at work to produce the diversity of herps we will study? How did the various amphibians solve the problems associated with moving from water to land? How did the various reptiles solve the problems associated with competition for resources and predator avoidance? And so on. Figuring out why certain features evolved will help you remember natural history and other characteristics for exams (and make you a better biologist).

Biology courses are inherently terminology-rich. This means that there is necessarily a memorization component to the course. To more easily memorize large numbers of terms, make a list of terms and go over it frequently. Cramming the night before an exam is a very bad strategy for this kind of course.

During the lab and in the field, you will be expected to learn the local species of herps. There are numerous species of frogs, salamanders, snakes, and turtles in Massachusetts, so there is a considerable number of species to learn. Your field guide is an excellent resource to learn the name of these animals and what they look like. It also contains a lot of natural history information on these animals. Going into the field on your own and working to identify the species that you see will also help you tremendously. Finally, most of these species will be available in lab for
examination as preserved specimens. One strategy at learning them may be to take digital photos while in lab. This allows you to return to the specimen after the lab is over.

Please refer to the study guide on the course website for other study strategies.

**Supplies**

Come prepared to each lab with a printout of the current lab, previous labs, your field guide, a notebook or paper and clipboard, pen and pencil. Bring the same things to the field trips. Read the lab printout before coming to lab. During two of the labs, we will be dissecting specimens, and during most of the labs, we will be handling preserved specimens. Dissecting supplies and gloves will be supplied. A useful and recommended piece of equipment is a **magnifying glass** or **hand lens**, for examining fine details on specimens.

Other supplies will be needed in the field and those are listed in the corresponding lab (lab 3).

**Field Trips**

Field trips are one of the best (and most fun) ways to learn about “reptiles” and amphibians. There will be two field trips during this course, both during one day of a weekend. One field trip will be to the Museum of Comparative Zoology at Harvard University, where you will see what a research museum looks like and how it is an important tool in biodiversity and organismal research. Bring a notebook and writing utensils to the MCZ field trip. The other (first) field trip will be in the field, and is intended to allow you to observe and handle some live herps, as well as learn about field techniques that are used to study them. Being prepared in the field will make the experience better for all involved. Refer to the Lab 3 printout for a few rules to follow in the field, and a list of supplies you should pack with you.