WFS 493/560
Test #2 Review

Tadpole Development and Ecology

1. Know which Gosner stages are included in embryonic development.
2. Know the Gosner stage when the heart begins to beat.
3. Understand the relationship between rate of embryonic development and dissolved oxygen concentration.
4. Know range of embryonic duration across anuran species.
5. Understand the relationship between embryonic survival and water temperature.
6. Understand species adaptations to variations in water temperature, especially in temperate regions.
7. Be able to come up with hypotheses for the differences in temperature tolerance plasticity for anuran embryos developing in temperate and tropical regions.
8. Know which Gosner stages are the hatchling stages.
9. Know the Gosner stage when the gills begin to circulate.
10. Be able to describe development of the gills and extensions of the operculum cover.
11. Understand the function of the adhesive organ.
12. Know what anatomical structure is best and most consistent for identifying tadpole species.
13. Be able to describe the process of gill irrigation in tadpoles.
14. Know the length range of the intestines in amphibians.
15. Understand how macrophagy may influence intestine length, buccal cavity volume and number of food filtering apparatuses.
16. Know which Gosner stages are included in tadpole development, and pre- and pro-metamorphosis stages.
17. Know which stages (pre- or pro-metamorphosis) are dedicated to body and limb growth.
18. Know the morphological differences between carnivorous and omnivorous tadpoles.
19. From Petranka's paper (website) and the lecture, be able to describe the evidence he provides suggesting that macrophagous feeding and carnivory may be more common in tadpoles than previously thought.
20. Understand some of the evolutionary advantages of consuming more proteinaceous foods.
21. Know the environmental thresholds (i.e., when survival decreases) of tadpoles for water temperature, salinity, dissolved oxygen, NH_3, NO_2, and NO_3.
22. Be able to describe some predator defenses of tadpoles.
23. Know which Gosner stages are considered metamorph stages.
24. Know the Gosner stage when the forelimbs emerge.
25. Know the typical range of tadpole development duration in temperate and tropical regions.
26. Know 2 hormones important in metamorphosis and understand how their concentration in the blood changes through development.
27. Be able to define phenotypic plasticity (also see Newman's paper on the website).

Influences of Cattle (Liz Burton and Chandler Schmutzer)

1. Be able to provide 4 hypotheses for how cattle may negatively influence amphibians.
2. Be able to describe the *Ribeiroia* trematode life cycle. Also, be able to provide a possible evolutionary reason for trematodes inducing malformations in amphibians.
3. Be able to describe the trends in relative abundance and species richness of tadpoles between cattle-access and non-access wetlands, and provide some explanations for why these trends may exist.
4. Understand the major differences in tadpole species composition and water quality between cattle-access and non-access wetlands, and be able to provide some explanations for why these trends may exist.
5. Be able to describe the trends in algal and detrital biomass between cattle-access and non-access wetlands, and be able to provide some explanations for why these trends may exist.
6. Be able to describe the trends in FV3 prevalence in tadpole populations between cattle-access and non-access wetlands and among seasons, and be able to provide some explanations for why these trends may exist.

7. Be able to describe the trends in relative abundance of postmetamorphic amphibians captured in pitfall traps between cattle-access and non-access wetlands, and how captures differed among age classes.
8. Understand the major differences in anuran species composition and vegetation structure between cattle-access and non-access wetlands, and be able to provide some explanations for why these trends may exist.

Postmetamorphic Survival

1. Be able to define estivation.
2. Know 3 cues that are important in stimulating emergence from estivation.
3. Be able to define hibernation.
4. Know 3 hibernation strategies and how this may differ among anuran families.
5. Know the primary stimuli for food acquisition in amphibians.
6. Know the 3 cell types in the chromatophore responsible for amphibian colors.
7. Be able to describe the 2 types of coloration adaptations to avoid predation.
8. See assigned readings for Chap 8, 9, and 10 for additional information.

Amphibian Sampling (Liz Burton and Chandler Schmutzer)

1. Given this lecture, the lab at Seven Islands, the methods provided in Liz and Chandler's lectures on their thesis results, and Pete Wyatt's lecture, be able to devise an unbiased amphibian sampling design for a study that will assess community composition and population size of larval, juvenile, and adult anurans and salamanders at a particular site (e.g., a pond surrounded by forest). NOTE: Your design should include several methods, and discuss sampling location, frequency (how often per week), and duration (in a year). Assume that resources for sampling are not limited for this exercise. This will be a long essay question.
2. Be able to describe Liz's results on breeding call duration.

Cave Salamanders (Matt Niemiller)

1. Know 3 attributes of caves that limit colonization by vertebrates.
2. Be able to provide some general phenotypic characteristics of cave dwelling salamanders.
3. What are the 2 salamander families that contain troglobitic (exclusively cave dwelling) salamanders?

Global Amphibian Declines

1. Know how many species are listed as threatened and endangered in the United States and Puerto Rico (see slide and handout). Also, know the name of the only known extinct amphibian in the United States.
2. Know that it is estimated that approximately 43% of amphibian species are in declines, and how this percentage differs from birds and mammals.
3. Know where the greatest number and proportion of species are in decline in the western hemisphere. Note: greatest number and greatest proportion are different.
4. Know approximately what percent of amphibian species have insufficient population data collected to understand their current status.
5. Be able to describe how the total number and percent of species in decline differ among the 3 amphibian orders.
6. Know the name of the international conservation organization that is in charge of monitoring and assessing the status of global amphibian populations.
7. Be able to describe how basic aspects of amphibian biology and population structure contribute to the likelihood of population declines.
8. Know the 8 hypotheses for amphibian declines.
9. Be able to provide an example of sublethal effects.
10. Know what types of species are most susceptible to UV-B radiation.

11. Know the name of the North American anuran species that has experienced significant declines due to the chytrid fungus.
12. Know the genus of Iridovirus that is responsible for mass die-offs of amphibians in the United States and elsewhere.
13. Know the 2 leading causes for global amphibian declines.
14. Know the 2 mechanisms that trematodes use to cause malformations.
15. Be able to explain why trematodes are most likely the cause of widespread amphibian malformations (i.e., compare and contrast with other hypotheses).

TWRA Amphibian Monitoring and Tennessee Salamanders (Pete Wyatt)

1. Be familiar with TWRA monitoring methods to help in answering #1 under the Amphibian Sampling lecture.
2. Know the answers to the questions that Pete provided (see presentation labeled, Amphibian Pre-test).
3. Know how many species of salamanders we have in Tennessee according to Pete.
4. Know which Ambystomatid salamander breeds in the fall.
5. Know which species of amphiuma, hellbender, siren and mudpuppy that we have in Tennessee (common names are fine).
6. Know which family of salamanders is most specious in Tennessee.
7. Know which species the imitator salamander looks most like (common name is fine).
8. Know which species of Plethodontid is the largest.
9. Know the species of Plethodontid whose biomass exceeds the biomass of any other vertebrate in the southern Appalachians.
10. Know which species of salamander is the rarest in Tennessee.

Agricultural Land Use Effects

1. Be able to describe the trends in relative abundance of amphibians between cropland and grassland wetlands, and provide some explanations for why these trends may exist.
2. Be able to describe the trends in relative abundance of amphibians between the 2 years of the study, and provide some explanations for why these trends may exist.
3. Be able to describe the trends in amphibian community source-sink dynamics between cropland and grassland wetlands, and provide some explanations for why these trends may exist.
4. Be able to describe the trends in postmetamorphic body size of amphibians between cropland and grassland wetlands, and provide some explanations for why these trends may exist.
5. Be able to describe the trends in postmetamorphic body size of amphibians between the 2 years of the study, and provide some explanations for why these trends may exist.
6. Know the 2 components of landscape structure, and how they may influence amphibian populations.
7. Be able to describe how landscape structure may have influenced species composition of amphibians using wetlands on the Southern Great Plains, and how these results may have influenced by competitive ability and predation rates.

Amphibian Diseases and Pathology (Dr. Debra Miller)

1. Know the 10 points to remember (Miller handout).
2. Given a description of gross signs, be able to provide a logical (and substantiated) determination of the pathogen (similar to the exercise in class).

Amphibian Conservation Techniques

1. Be able to summarize the life cycle events and habitat needs of amphibians in aquatic and terrestrial environments.
2. Know the 3 methods for managing shoreline vegetation for amphibians.

3. Know which herbicide has been connected with high mortality rates in tadpoles and juvenile amphibians.
4. Understand the importance of providing wetlands with diverse hydroperiods for amphibians, and understand how we can do this through wetland management techniques.
5. Understand the 4 techniques used to maintain high water quality in wetlands.
6. Know when is the best time to use Rotenone to kill fish for amphibian convervation.
7. Know the some consequences of using Rotenone for fish kills.
8. Know the compound that can be used to neutralize Rotenone.
9. Know how long Rotenone usually persists at lethal concentrations in an aquatic environment, and how water temperature may influence breakdown rate.
10. Be able to describe 4 techniques used to manage the terrestrial environment for amphibians.
11. Be able to describe a shelterwood cut.
12. From lecture and their paper (on the website), understand Semlitsch and Bodie's recommendations for buffer size width and the biological basis for them.
13. Be able to describe the importance of small wetlands for amphibians, and how removal may impact successful dispersal.
14. Be able to describe the possible effects of roads on amphibian populations.
15. For forest roads, what is the road-effect zone?
16. Be able to describe some techniques used to mitigate the impacts of roads on amphibians.

Chytrid Fungus in Panama (Roberto Brenes)

1. Attend lecture.

<u>Required Readings</u>:

See website. Yes, there will be questions (approximately 10% of test will come from the readings). I suggest especially focusing on the following, because they contain information that was not covered in class lectures.

1) Adaptive Plasticity (Newman 1992)
2) Chap 8 (Relationships with the Environment, Duellman and Trueb 1994; pp. 197-223)
3) Chap 9 (Food and Feeding, Duellman and Trueb 1994; all)
4) Chap 10 (Enemies and Defense, Duellman and Trueb 1994; pp. 247-259)
5) Pinder et al. (1992) handout: Estivation and Hibernation
6) Effects of Clearcutting on Appalachian Salamanders (Petranka et al. 1993)
7) Effects of Even-Aged Harvest on Amphibians in Maine (deMaynadier and Hunter 1998)
8) Recommendations for Wetlands Buffers: Amphibians and Reptiles (Semlitsch and Bodie 2003)
9) Principles for Management of Aquatic Breeding Amphibians (Semlitsch 2000: Journal of Wildlife Management 64:615-631)—Need to get from library or check out from 203 Ellington PSB.

<u>Readings for Brenes Lecture</u>:

10) Emerging Infectious Diseases and the Loss of Biodiversity in a Neotropical Amphibian Community (Lips et al. 2006)
11) The Effects of Amphibian Population Declines on the Structure and Function of a Neotropical Stream Ecosystems (Whiles et al. 2006)