Assignment 4: Constructing an Ethogram and Hypotheses about Animal Behavior

The goal of this assignment is to have you apply your knowledge of behavioral ecology to behaviors that you personally observe. First, you will quantify behavioral observations using an ethogram. Second, you will generate a hypothesis about your behavioral observations and propose a way to experimentally test your hypothesis.

What is an Ethogram?

The word “ethogram” is derived from the Greek roots “ethos,” meaning “custom or habit” and “-gram,” meaning “something written or drawn, a record.” An ethogram is thus exactly what it sounds like, a catalogue of all the behaviors an individual of a given species might perform in a given context. Ethograms are important tools in behavioral ecology, because they allow researchers to quantify (and thus rigorously analyze) animals’ behavior. In developing an ethogram, behavioral ecologists make careful, objective observations of animals in numerous different situations and habitats. Researchers do not, at least initially, try to make any assumptions about the purposes of the behaviors they record.

For example, a behavioral ecologist might wish to compare the aggression levels of monkeys in troops living near and far from human habitations. He or she would need to develop some way of quantifying aggression and then use this quantification scheme to measure the aggression levels of monkeys in each area. One approach would be for the researcher to first observe the monkeys and describe the full range of their behaviors, without any judgments regarding which behaviors were “aggressive.” Then, he or she would divide the behaviors he or she had observed into clearly defined, objective units and determine which behaviors should be classified as “aggressive” (based on the consequences of those behaviors in nature or on descriptions of similar behaviors in closely related species). Finally, the researcher would use this ethogram to score behaviors in the monkeys he or she was studying, quantify aggression levels in troops both near and far from human homes, and compare those levels.

The essential element of an ethogram is its descriptions of the organism’s behaviors. Behaviors should be defined so that they are unambiguous and repeatable (i.e., any behavior performed by the animal corresponds to one, and only one, behavior on the ethogram). The range of behaviors included and the level of detail involved in the description of any given behavior depend both on the animal for which the ethogram is being developed and the purpose for which it will be used. For example, a study of foraging behavior in a solitary species might use an ethogram that only included behaviors involved in searching for and consuming food, but an ethogram developed to analyze social behavior in a cooperative breeder would need to be much more complex and include interactions between multiple individuals.

For two examples of ethograms developed for very different purposes and in different animals, please see the papers by Langkilde et al. (2003) and MacNulty et al. (2007) posted to the class assignments page of the course website.
**Your Assignment:**

1. Choose a species of animal about which you are curious and which you can easily observe. This may a wild animal in nature or a wild animal kept in captivity in a semi-natural setting (such as at an aquarium). The assignment should not be done on a domesticated animal or a captive wild animal has spent the majority of its time interacting humans. This rules out pets (cats, dogs, parrots, etc) and farm animals (cows, horses, chickens, etc). You should also not do the assignment using videos of animal behavior. The goal should be to learn something about animal behavior in its natural ecological context. Please record the species that you decide to study. If you are having difficulty identifying the species, then please talk with the instructor or TAs for help. You can also include a photo/picture of the animal if you are not able to identify the species.

2. Observe an individual (or a group, although I’d recommend starting with an individual) of this species for at least one hour. Try to observe the same individual continuously for the full time, but this will obviously be more difficult for some species than for others. If you need to, you can make observations across multiple separate occasions or across different individuals. While observing the animal, write down notes on all the behaviors you see it exhibit. Depending on the animal you choose, you may also want to use a voice or video recorder to help you document the full range of its behaviors. You should not attempt to influence or affect the behavior of the animal during your observations.

3. Based on your observations from step 2, develop an ethogram for your species. This ethogram should include clearly defined, unambiguous behaviors that you (or another researcher) could use to evaluate the species that you have chosen to study. Definitions should describe the position of the animal’s body and any movements it makes while performing each behavior. Be careful not to speculate about the purpose of the behaviors at this point! You may also wish to include photographs or drawings of the animal performing each behavior.

4. Using your ethogram, observe your species for at least 15 minutes and develop a “behavior budget” that describes how often the animal performs each behavior. Depending on the species you choose, you may use either of two observation techniques:

   a) Focal individual sampling: Follow a single individual for the entire 15 minutes. Record all behaviors the individual performs and the time spent performing each.
   b) Group scan sampling: At set intervals (e.g. 30 seconds or 1 minute) scan a group of individuals of the species you have selected and record how many individuals in the group are performing each of the behaviors you defined on your ethogram.

   Record the time of day and the geographical location where you make these observations.

5. Develop a hypothesis or set of hypotheses about one or more of the behaviors that you observed. The hypothesis should deal with a reason why the animal that you observed exhibited the behavior or behavioral budget that you documented. You should have both a null and alternative hypothesis. For example, in the lecture about the good genes hypothesis we went over the experiments of Welch on gray tree frogs. The null hypothesis was that there was no difference between long and
short calling males in offspring survival. The alternative hypothesis was that there was a difference between long and short calling males in offspring survival. Welch could reject the null hypothesis because she showed a difference in survival of the offspring. The alternative hypothesis was accepted, which lends support to the good genes hypothesis. The good genes hypothesis was not proven, but only supported (an important distinction).

6. Develop a hypothetical experiment or set of experiments that could be used to test your hypothesis. A good source of inspiration of possible experiments are the studies discussed in class. Note that your experiments should be feasible for one person to do with a budget of up to $10,000 (the budget of many graduate student projects) in the time frame of one year. Proposing to do a breeding experiment with elephant seals is not feasible because they are not easily manipulated.

**To Turn In**

1. Your ethogram, with clear, unambiguous descriptions of the behaviors you observed. This should be similar to Table 1 in the example paper by Langkilde et al. (2003) or Table 2 in the example paper by MacNulty et al. (2007). The ethogram should be around one page long, but may range between 0.5-1.5 pages depending on the complexity of the behaviors that you observe. The ethogram should be in the format of a list or table.

2. Your animal’s behavior budget, including the date, time, and context in which you made the observations. This should be around a half page long. The behavior budget should separate from the ethogram and list the behaviors that were observed during the 15 minute time interval and the amount of time each behavior was observed.

3. A write-up of your hypothesis and proposed experiment. This should be 1.5-2 pages, typed, single-spaced, normal margins, and 12 pt font. The write-up should include the following:
   a. An introduction of the topic of your hypothesis. For example, if your hypothesis is that the behavior you observed was due to selection arising from male-male competition, your introduction should introduce the topics of sexual selection and male-male competition.
   b. Following the introduction, you should describe the behavior and the species that you observed.
   c. You should then give your null and alternative hypothesis (or hypotheses). Briefly state why you think your hypothesis should apply to this behavior. Your justification may draw on class material because it is typical to justify hypotheses based on what has been observed in other species. Please be specific when referencing studies discussed in class and ideally include a citation for the study.
   d. Describe an experiment or set of experiments that could be used to test your hypothesis. The experiments should be able distinguish your null from alternative hypotheses. Describe the expected outcomes that would support the null vs. alternative hypotheses. For example, recall the paper you read on the fly mimicking the spider. One hypothesis was that the wing pattern helped deter predation. The null hypothesis would be that the wing pattern did not affect predation. An experiment was done where tephritid flies either had patterned wings or clear house fly wings. The null hypothesis would be rejected if there was a significant difference in predation between the two groups. The null hypothesis would be accepted if there was no difference in predation.
Notes on the assignment

This is an independent assignment. Your ethogram and behavioral budget should be unique. Certain species lend themselves to easy behavioral observation, so if you happen to work on the same species as someone else in the class that is fine. However, this is not a group assignment. Your observations and hypotheses should be your own.

Feel free to talk to the instructor or TAs if you have any questions or would like any advice about choosing a species, developing your ethogram, or making observations.

Due dates and time line

This assignment will be due in class Friday December 5th. No late assignments will be accepted because lots of time has been allocated for this assignment. Here are a few key dates to keep in mind for this assignment.

October 27-29: Animal observations in section. Sections this week are to help you get you started on this assignment. You should use the section time as a way of trying to observe animals, think about which animals are feasible to work on, and discuss ideas with the TAs.

November 10-14: There are no in-class sections this week due to Veterans Day. However, this is a good opportunity to conduct animal observations on your own.

November 17-19: Sections this week will be to give you feedback on your animal observations and to help you in generating hypotheses and tests for those hypotheses. Note that this section feedback has been switched to an earlier date than that listed on the syllabus so that you can receive feedback sooner. You are expected to bring a draft of your ethogram to section. Expect to talk about your behavioral observations and hypotheses.

November 24-26: There are no in-class sections this week due to Thanksgiving. However, this means that you have time to try to finish off your behavioral observations and other parts of your assignment.

December 5: The assignment is due.

Grading
(36 total possible points, 13% of your grade)
Ethogram: 10 points
Behavior Budget: 6 points
Hypotheses, Tests, and Discussion: 20 points

Note that your grade will be affected if little effort is put into the assignment.

Things to keep in mind

1. When choosing an animal, keep in mind that the discussion is worth slightly more than the ethogram itself. If you observe an animal that is relatively sedentary or not very active, it may be easier to do the ethogram, but more difficult to come up with hypotheses for the observed behaviors. One strategy that you could take is to begin by observing a few different animals (such as on the animal observation walk during your section) and look for a species that exhibit behaviors that you find interesting and that you think will inspire a good hypothesis. You can then use the ethogram to collect more data about the behavioral repertoire of the species and the context with which it exhibits its behaviors.

2. This assignment is strictly observational. You should not try to alter the animal’s behavior or do an experimental manipulation of behavior. You should also pay attention
to safety concerns when observing animals. This means that you should not get close to rattlesnakes and should not try to pet the elephant seals.

3. There is a lot more flexibility in this assignment than the other ones, because the goal is to have you investigate something that you are interested in. You should take this assignment seriously and not put it off until the last minute. A lot of time has been allocated for you to do this assignment and two hours of section have been devoted to helping you with the assignment. Your grade on the assignment will reflect the amount of effort that you put into it.

**Places to go to observe animals**

This assignment requires you to observe wild animals. Santa Cruz is a great location for seeing lots of different species, and you could easily do this assignment on the campus of U.C. Santa Cruz. Here are a few recommendations about places that you could go to see some interesting behavior.

**Places on Campus**

The Arboretum: If you haven’t been to the Arboretum before, it is well worth going. It is a really good place to observe birds (hummingbirds, quail, etc). There are also lizards to be seen amongst the rocks.

The Redwood forests: There is interesting life in the understory of the redwoods such as banana slugs, insects, and birds. However, a lot of animals spend their time in the canopy of the trees. Normally this area is difficult to observe. However, we have some great bridges and buildings on campus where you can observe life near the tops of the trees.

The fields near the West entrance: I have been told that there are ground squirrels here. Ground squirrels have some really interesting behaviors and are relatively easy to observe since they stay near their holes.

The Seymour Center: For those of you interested in marine life, you can do your assignment at the Seymour Center (or the Monterey Bay Aquarium). Note that since the animals are captive, this does have the potential to change their behavior. However, a wide range of behaviors can be observed in captivity, with the advantage that the animal can be observed for long periods of time. This could be a good place to go if you are having a difficult time observing animals for long enough time periods to get data. The Seymour Center is free to UCSC undergraduates with a student ID card.

One resource for finding animals on campus is the book *The Natural History of the UCSC campus*. This book describes the natural history of UCSC and includes guides and maps to what sort of wildlife you can observe on campus. Details on the book can be found at [http://mnhc.ucsc.edu/ucscnh/index.shtml](http://mnhc.ucsc.edu/ucscnh/index.shtml). The book is $13 at the bookstore and I would imagine that the campus library would also have a copy.

**Places off Campus**

The coastline: West Cliff drive is a good place to observe seabirds (pelicans, cormorants, sea gulls, etc) and marine mammals (seals, sea lions, otters). Binoculars would be useful for observing many of these species. Many of the species found along the coastline are quite numerous and relatively sedentary, which helps when collecting data.

Wilder Ranch and Natural Bridges: Both have lots of interesting wildlife.

The Wharf: Sea lions can be observed here.

Año Nuevo State Park: Elephant seals can be observed here as well as other animals.