



ETHOGRAM DEVELOPMENT READING

RMC Mate Compatibility Workshop

ETHOGRAMS

An ethogram is a catalog or dictionary of the discrete behaviors typically employed by a species. The included behaviors are sufficiently defined that an observer may record the number of acts, or the amount of time engaged in the behaviors. The ethogram may include drawings or video in addition to a written description of each discrete behavior. In an ethogram, behaviors are described without explicit reference to their purpose. For example, although a specific movement may represent a putative threat display it should be given an objective name such as "head forward" or "bracing display", and not "head forward threat" or "bracing threat". Complete ethograms are often used by zoos & aquariums to describe normal behavior and monitor behavior in order to identify pathology due to illness or poor animal care. The ethogram usually describes only a small portion of the complete behavioral repertoire that is important for asking the question at hand.

HYPOTHESIS

Remember, an ethogram is a *living* document. Not all behaviors will be important to the mate compatibility issue hypothesis you developed last week during class. Decide which behaviors will be important to record in order to address your question or help to solve your issue. If you keep a master copy of your ethogram at your facility you can grow it with each project. For example, it is not uncommon to have a "master ethogram" that encompasses all known behaviors and then subset it to a mating behavior ethogram, maternal care ethogram and a welfare ethogram, each of which may have behaviors specific to the question at hand. You may also have a "pilot" version of your study/question where you test your ethogram and cut behaviors you are not observing frequently after the first couple sessions or after one season of data collection. After the completion of your study it is wise to statistically analyze your ethogram to determine which behaviors are most predictive of mate compatibility and/or reproductive success and which can be trimmed (i.e., behaviors that have all 0s could be eliminated easily as can behaviors that provide no variability in relationship to reproductive success) to keep data collection efficient.

For this week, you will be focusing on courtship and mating behaviors. As you develop your ethogram keep in mind the following points:

1. The type of data collection and the specifics of your ethogram will vary whether you're studying a group (e.g., herd, pack, troop) versus a pair. For example, group research is often done as scan sampling whereas solitary carnivore pairs are usually focal sampling (see below).
2. What stage of breeding you're observing will also determine behaviors. For example, if you are researching at the howdy introduction stage and your species seems too

aggressive for introductions you will not be including copulation or many physical contact behaviors in your ethogram, whereas a study at the introduction phase will have these behaviors. If you're studying across both howdy and breeding introduction periods it's a good idea to include as many behaviors as possible that occur during the two periods (e.g., aggressive and affiliative behaviors) and add a few breeding behaviors during introductions (e.g., mounting, contact aggression behaviors, copulation).

3. Sometimes your species may be a particularly shy species or their behaviors may be too affected by the presence of observers. In these cases, it is probably most productive to have video monitoring and train researchers to score video at a later, convenient time.
4. Remember, all species have evolved to be most active at a certain time of day to either avoid predation or increase their efficiency, so some species won't be most active at time periods observers are available. A large number of species are nocturnal, so problems in breeding may be occurring because mating introductions are performed during suboptimal times. Make sure while developing your ethogram that you attempt a few observations at different times of the day and/or record animals 24/7 with video for a period of time to ensure that you're capturing all courtship and breeding behavior.
5. This course is likely taking place outside of your breeding season, so you will need to think back to the breeding season and incorporate behaviors that may not be observed during this workshop but that are present during the breeding season. You can also take advantage of nature shows and YouTube to get species-typical breeding behaviors, if available.

The Behavior Scientific Advisory Group has a great tutorial for animal behavior research methods that we have included as a resource for this workshop. It is very helpful if any of the following information is confusing or you need clarification (or if you just want to learn more about the topic!). Specifically, the section on Ethogram development will be useful moving forwards.

MEASURING ANIMAL BEHAVIOR

1. Description of behavior

Behavior can be described either in terms of its structure, i.e., its appearance and physical form (e.g., "run bill along wing feathers"), in terms of the consequences/effect of the behavior on the environment, other individuals or the subject itself (e.g., "preen"), or in terms of the spatial relationship of the subject to the environment or other individuals (e.g., "approach the mate" or "leave the nest"). Description of structure is usually preferable because it can be more accurate and repeatable and because it is neutral.

2. Measures

Whatever the level of description (element, pattern or sequence) behaviors can be quantified using four basic types of measure:

1. **Latency:** time from some specified event (e.g., start of recording) to the onset of the first occurrence of the behavior. This is not often used for most behaviors in an ethogram used for mate compatibility research, but specific latencies may provide a great deal of information. Below are the ones we most typically incorporate into our mate compatibility trials:
 - i. Latency to first howdy barrier contact of the opposite sex - This latency can be useful in determining relative “motivation” for breeding particularly if one individual of the pairing seems more motivated than the other.
 - ii. Latency to first affiliative proximity event - This latency can be useful in determining relative motivation and affiliation for potential breeding introductions.
 - iii. Latency to first mounting attempt - This latency can be useful in determining relative motivation and affiliation for breeding.
2. **Frequency:** number of occurrences of the behavior per unit time. This measurement has been shown to be the most useful in quickly and accurately quantifying mate preference. It is easiest to hit observer reliability on this measure across multiple observers, which also increases its usefulness as a measure.
3. **Duration:** length of time the behavior lasts (total, average, etc.)
4. **Intensity:** defined according to behavior (e.g. loudness of the long-call in the black-headed gull, partly or fully raised head feathers in a jay or low and high intensity of fighting according to absence or presence of physical contact, respectively), usually expressed as defined levels (e.g. high, medium or low) or on a defined scale.

Behaviors can be defined according to types which lie at the extremes of a duration scale: Events and States.

1. **Events:** behaviors of instantaneous to short duration (<5s), which are best described by their frequency (e.g., vocalizations). Events are often repeated rapidly in Bouts that can be measured both by their duration and frequency.
2. **States:** behaviors of relatively long duration (>5s), which can be best described by their total or average duration (e.g., body postures or position in the environment).

These categories are not strict, and Events can also be described by duration if we're looking at a small time scale (e.g., duration of different vocalization types), while States can be measured by frequency when measured over a long time scale (e.g., number of feeding bouts in a day).

3. Recording methods

How you collect the data you will need to answer your research question is affected by the research question itself and the logistics of doing behavioral observations. We have only briefly described the different data collection methods in order to give you an idea about the time demands and differing levels of efforts required for each.

Certain recording methods are sometimes better suited for one purpose than another and result in different kinds of information. In general, we suggest using the **Focal Continuous method for mate compatibility research**.

One of the first decisions to make is how many animals to observe at one time.

1. **Focal animal:** At any one time, the observer is only focusing their observations and recording behavior on a single individual. Typically used in studies based on ethograms that contain more than just a few behaviors and/or a combination of States and Events, studies of complex behavioral patterns, or in species that change behavior regularly and quickly.
2. **Group:** The observer simultaneously records the behavior of all individuals in the focal group. This approach is used when the ethogram is more simple, when the animals can be seen clearly and reliably, when the actual identity of each animal being studied is less important, or when behavior does not change often. It is not used very often unless animals are very sedentary and the number of animals in the group is small, because as behavior becomes more dynamic and/or as the number of animals to focus on goes up, the quality of the data collected tends to go down.

Once you have decided on your focal approach, it is time to choose a data collection method. We will cover the basics of the four most common methods used in behavioral research. We'll start with the methods that are the least intensive but also yield the least amount of useful information and move on to the most intensive but information-rich methods.

1. **Ad libitum sampling:** This approach is basically informal note-taking based on what the animals are doing. It is unstructured in that there are no strict rules of when to write something down or how to express it, and thus is largely not useful in actually quantifying behavior.
2. **One-Zero sampling:** In this method, the observation period (e.g., one hour) is divided into increments (e.g., 5 minute periods). At the end of each increment, the observer simply writes down a "1" next to any behavior that occurred during the previous five minutes or a "0" next to behaviors that do not occur during that increment. This method is one of the easiest methods and works for both states and events, but it does not provide accurate estimates of durations or frequency.

3. **All occurrences sampling:** In this approach, the observer simply keeps a count or tally of the number of occurrences of behaviors in the ethogram that are performed by the focal animal(s) during the observation session. This is generally an easy method to use unless you are tracking a large number of behaviors, individuals, or behaviors that occur very frequently. This method only provides a rate or frequency of behavior and provides no information on duration of behavior.
4. **Scan sampling:** Similar to one-zero sampling, this method involves dividing the observation session into timed intervals (e.g., one-minute intervals). Each time one of the intervals elapses (usually signaled by a timer or stopwatch), the observer records only what the animal(s) is(are) doing at that moment. Think of it as taking a photograph every minute and writing down only what the animal is doing in the photograph. Behaviors that occur in between the intervals are not recorded (unless you are tracking them with one of the previously mentioned methods above). This approach works well for focal animals or focal groups when the focal group size is not very large. This method is not recommended for capturing rare behaviors or events.
5. **Continuous sampling:** This is the most information rich and potentially challenging method to use but is also the method we most recommend for mate compatibility, as courtship and breeding behaviors tend to be quick, intense, and information rich. During the observation session, the observer writes down the start and stop time of every behavior whenever it occurs. An exception is behavioral events which usually are so quick, their duration is difficult to capture. Still, these are captured with a tally whenever they occur and an attempt is made to record when they occurred. This method provides the most accurate estimates of durations of behavioral states and provides estimates of frequency of behavioral events. It also provides data on sequences of behaviors. Because of the rigor of this method, in most cases it is only used with focal individuals and not groups, but certain kinds of sedentary and/or less behaviorally dynamic species may be studied in focal groups using continuous sampling. Behavioral observation software or collection of data via video or voice dictation can be advantageous when using this method. There are currently two popular apps used in zoos that make this method much easier for volunteers and interns: [Animal Behaviour Pro](#) and [Zoo Monitor](#).