FORM AND FUNCTION: FEEDING IN BIRDS

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INTRODUCTION

Niche is an important but elusive concept in ecology. Differences in the size and degree of overlap of niches of sympatric species can be used to identify areas of competition and understand patterns of species diversity. Different species that overlap in their use of resources, such as food resources, are expected to differ in one or more characters, often in morphological characters. In this lab exercise, you are going to make a series of measurements on the bills and legs of specimens of birds that you are likely to see at bird feeders. First, you will develop hypotheses and predictions that relate feeding behaviors to morphology. During this week, you will collect foraging data at selected bird feeders. In two weeks, you will turn in a short research paper, in proper scientific format, in which you will present your study.

LEARNING OBJECTIVES

The student will:

- examine the relationship between morphological traits and behavior
- make *a priori* hypotheses on how morphology (form) is related to foraging behavior (function)
- write up your hypothesis, methods, results, and discussion in proper scientific format

MATERIALS

study skins or freezer specimens of various local birds that use feeders

1 set of calipers/two-three students

field guides, and monographs and species accounts of common species at feeders

observable feeding station with an array of feeders and foods

PROCEDURE

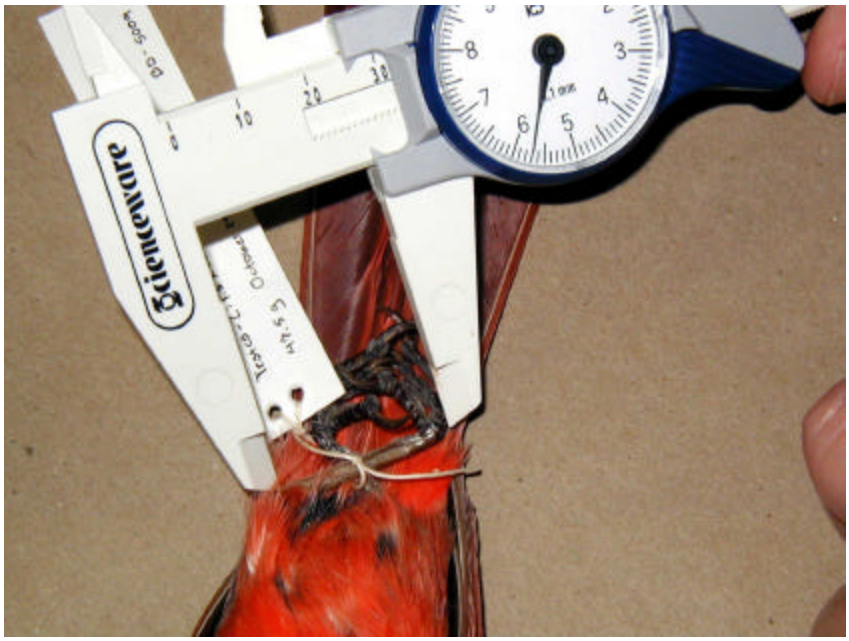
Measurements on bird skins

Your instructor will provide 2-5 specimens for each of the feeder birds that you are likely to observe. If study skins are used they should be handled with care. Study skins of birds are prepared to lie on their backs, so do not lay them on their ventral surfaces, as you may damage bills, legs, and tails. Skins are fragile and should not be held by the bill, head, tail, or legs.

For each specimen, use the calipers or a plastic ruler to measure the features listed on the following page. All measurements are in millimeters. If necessary, use the topographic guide to bird structure in your field guide to help locate the structures listed.

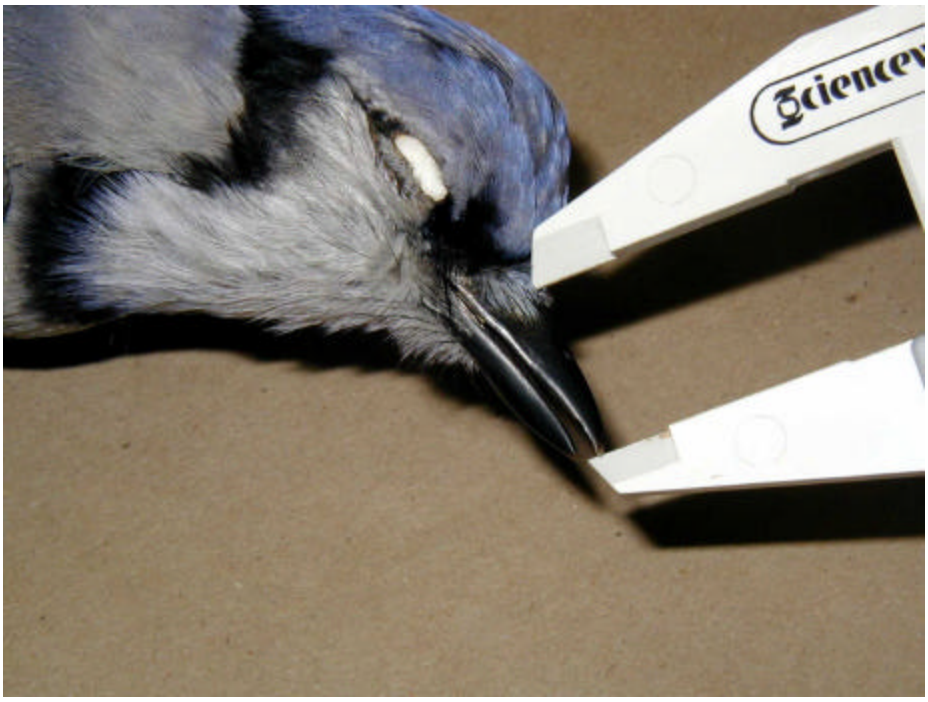
total length: the overall length from the tip of the bill to the tip of the longest tail feather, with the bird lying on its back

tarsal length: a diagonal from the middle of the ankle joint (behind) to the middle of the joint between the tarsus and the middle toe (in front)

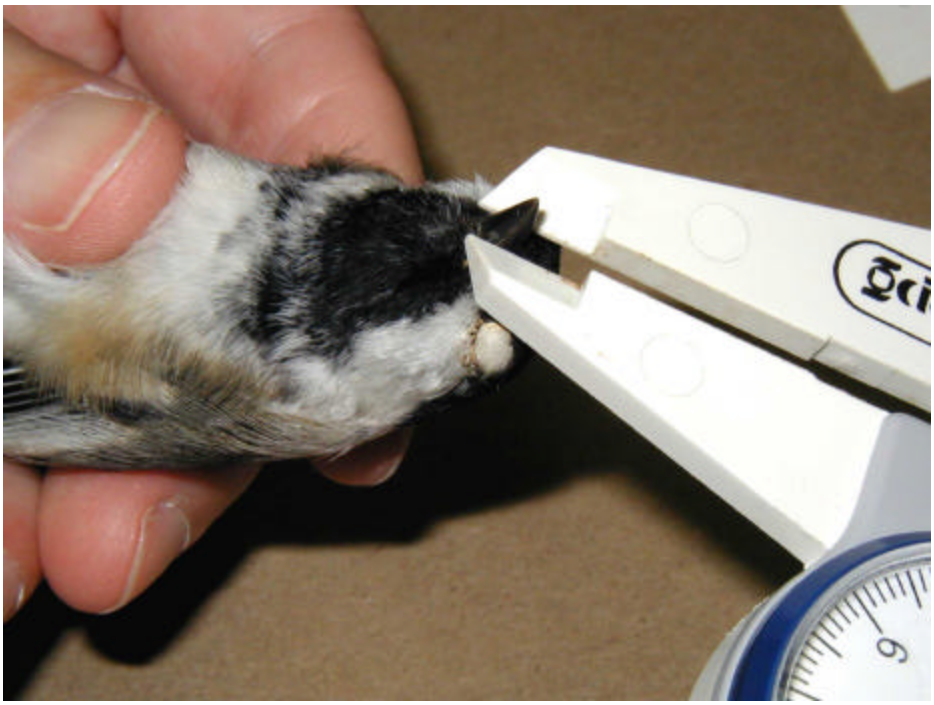


hallux length: length of toe 1 (the toe projecting posteriorly) from middle of ankle joint to tip of claw (you may want to measure and note shape of claw)

bill length: chord of the culmen from the tip of the upper mandible to the implantation of feathers



bill width: widest point from one side to the other side of bill



bill depth: deepest point from upper mandible to lower mandible.

Record the measurements for the specimens on a data sheet the class designs. Different groups may measure different birds, but each pair of students needs to have data for all species.

Generation of hypotheses and predictions about feeding behavior of different species

Based on the measurements you have collected from the class, generate at least two different hypotheses about foraging behavior of different species of common feeder birds. Hypotheses may deal with where a bird feeds, what it eats, or how it competes with other birds. Look through your field guide and the books in lab to get some ideas. Things to keep in mind are that ground feeders and above-ground feeders may differ in leg:body length ratio or in relative length of hallux or claw compared to tarsus; that differences in bill size/shape may relate to differences in size of seeds taken, in handling times of seeds, and in how species or individuals handle seeds; and that dominant species or individuals may chase or exclude subordinate individuals from preferred resources. You may want to sum bill dimensions to create a single index of bill size.

You need to discuss your hypotheses with your instructor, and you will turn in a copy of your hypotheses and predictions before you observe feeding. You will be testing *a priori* hypotheses, which means you have generated the hypotheses before you collect your data on feeding.

Feeding Observations

At an arranged time, you will observe feeding behavior of birds at an established feeding station. You should be concealed from the birds but able to observe them. A blind or site equipped with a window with one-way glass that conceals observers is ideal. Be relatively still and quiet to avoid disturbing the feeding animals.

Sampling Techniques

Several different ways exist to sample and record behavior. For this assignment, you will use *scan sampling* at 5-minute intervals. In scan sampling you rapidly scan, or census, a group of subjects at regular intervals, and you record the behavior of each individual at that instant (Martin and Bateson 1993). Scan sampling will restrict you to recording only a few simple types of behavior, such as the species of each bird, where it is located, what food it is taking, and how many individuals of each species are foraging (see sample list of feeding sites and foods below). Working in teams will enable one person to record data while the other person(s) reports the data at each interval. If one of your hypotheses is based on displacement or chasing interactions among species, you also will have to collect data on the behavior by counting instances of these behavioral patterns within intervals.

In theory, the time for which each individual is watched in a scan sample is instantaneous. In practice, the time should be short and relatively constant, with a single scan taking from a few seconds to a few minutes, depending on the number of individuals and the amount of information recorded for each individual. The interval between the start of successive scans should be constant (in this study, 5 min). One potential bias with instantaneous sampling is the tendency of the observer to record conspicuous behavior even if it occurs slightly before or after the sample point (Martin and Bateson 1993). Such a recording bias will tend to overestimate the more noticeable behavior patterns, so avoid recording behavior that occurs outside of scan intervals (except for displacement interactions, if required by your hypothesis).

For our purpose, scan sampling has practical advantages over focal sampling (in which you would focus on a single individual and watch it for a period of time). Scan sampling should allow you to obtain data that are more evenly representative across individuals and time of day, and scan samples may be averaged to provide a single score. If you plan to use scan samples as separate data points, they must be statistically independent of one another, i.e., be spaced out over time. Samples taken at intervals of 1 or 5 minutes often may not constitute independent samples, especially if the same individuals remain on feeders the entire time. However, samples obtained by different groups (on different days or at different times of day) may be independent.

Your Data Collection

After you make one or more hypotheses concerning feeding activities of different species of birds based on morphological data, you are to collect a **minimum** of 10 five-minute scan samples at some point before the next laboratory meeting. Because we want samples to be independent, only one group may record data at a given time.

Record the date and time of your sampling periods and the weather conditions (temperature, clear or overcast, presence or absence of snow cover, etc.), as these factors may influence feeding patterns. Also, keep track of the presence of other types of species, such as squirrels and avian predators (hawks), as they may influence which species of birds are present at the feeders.

Feeding sites and foods (and water) may include:

(1) hanging thistle feeder,
(2) open shelf or tray feeder with mixed millet and sunflower,
(3) roofed feeder with sunflower,
(4) hanging suet feeder,
(5) open ground with fallen seed, and
(6) a water tray.

You will turn in your data on feeding observations in class next week. Your data will be compiled and distributed to members of the class so that all groups will have multiple sets of data for use in writing your papers. You will turn in your completed research paper in class in two weeks.

You may work in groups of 3 for this assignment; you need to include a statement at the end of the paper indicating who did what work, and you all must sign the statement.

REFERENCES

Martin, P., and P. Bateson. 1993. Measuring behaviour: An introductory guide. 2nd ed. Cambridge Univ. Press, Cambridge, England. Chapter 6, pp. 84-100.

DATA SHEET FOR BIRD MEASUREMENTS USED IN MICHIGAN IN WINTER

Species	Overall length	Tarsus length	Hallux Length	Bill Length	Bill Width	Bill Depth
Mourning Dove						
Northern Flicker						
Red-bellied Woodpecker						
Downy Woodpecker						
Hairy Woodpecker						
Blue Jay						
Tufted Titmouse						
Black-capped Chickadee						

Species	Overall length	Tarsus length	Hallux Length	Bill Length	Bill Width	Bill Depth
White-breasted Nuthatch						
Northern Cardinal						
Song Sparrow						
American Tree Sparrow						
Dark-eyed Junco						
White-throated Sparrow						
American Goldfinch						
House Finch						
House Sparrow						

SUGGESTIONS FOR INSTRUCTORS

The bird species included in this exercise should (1) be common to regular visitors at feeding stations, (2) be readily identifiable to species (and sex, if necessary), (3) be available as multiple, replaceable study skins or freezer specimens, and (4) range substantially in taxonomy, morphology, and foraging substrate.

It is possible to supplement or replace direct observations with video recordings of feeder activity. Video tapes can be useful in training novices to record behaviors of wild birds. Tapes also can be a lab-saver if feeders are inactive or unavailable.