Linking Multiple Concepts in an Active Introductory Diversity Lab

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BACKGROUND

Most introductory biology labs address the topic of species diversity. Traditionally, an overview of diversity is accomplished one of two ways: through a survey of skeletons and preserved organisms in the lab or through a series of dissections. There are several issues associated with these approaches. First, students often lack motivation to complete these exercises. Several comments from our students regarding these labs included phrases such as 'it was boring' and 'became repetitive'. Secondly, these approaches are often very 'cookbook' style and fail to promote student interactions, both with each other, and with the material (specimens). Finally, all too often students (and instructors) fail to tie in evolutionary concepts and conservation concerns (species extinctions) into the concept of diversity. To overcome these issues, I have developed a more inquiry based method where students learn about diversity by observing animal behavior and using the resources at the local zoo.

GOALS

• To create more student interest by incorporating choice-based exercises.

• To create an active exercise where students observe animal behavior and interact with each other.

• To incorporate the topics of ecology, evolution, and conservation into the concept of species diversity.

• To link habitat diversity and organismal diversity.

OVERVIEW

Following a series of guided questions, students first gain an understanding of the purpose of zoological parks. Upon arriving at the zoo, the class divides into groups, which then choose to explore various unique taxa. During their explorations, they make observations regarding adaptations, behavior, camouflage, habitat, and exhibit construction. Finally, students proceed to discuss their observations in order to address a series of guided questions. This exercise gives students an opportunity to choose which exhibits and species they explore based on their interests, while mixed group discussions ensure students still learn about a broad spectrum of diversity. Additionally, students work to discover the connections between evolution and ecology in shaping diversity and to make hypotheses regarding diversity in the future.

PART 1: What is a Zoo?

Before the field trip, students independently complete a series of questions to help them understand the variety of purposes associated with zoological parks. Students can use web resources to explore the variety of ways that zoos contribute to conservation. Examples include: captive breeding, genetic preservation, education, and various aspects of research (hormones, behavior, etc).

PART 2: Groups

The class is asked to divide into groups of 2, giving students a choice of partner. Each group is then allowed to choose a unique zoo assignment (Table 1). A zoo assignment consists of specific taxa and groups of displays at the zoo where students will spend time collecting data. These areas are designated ahead of time with the purposes of minimizing overlap in the data gathered by various groups, ensuring coverage of most taxa present, and providing approximately equal numbers of displays available to each group. At the St. Louis Zoo, I created a total of 11 different zoo assignments (Table 1; Figure 1). I provide students with a map designating the zoo assignments and meeting locations (Figure 1).

TABLE 1. Various zoo assignments within the St. Louis Zoo.

Zoo Assignment #	Zoo Area	Taxa
1	Bird Cage	Birds
2	Flight Cage, Bird Garden, Penguin & Puffin Coast	Birds
3	Bear Pits, Sun bear, Big Cats	Bears, Cats
4	Primate House, Fragile Forest	Primates
5	Insectarium Group 1	Insects
6	Insectarium Group 2	Insects
7	River's Edge	Hippos, Rhinos, Elephants
8	Red Rocks Group 1	Ungulates
9	Red Rocks Group 2	Ungulates
10	Amphibian & Reptile House	Amphibians
11	Amphibian & Reptile House	Reptiles

FIGURE 1. Map of St. Louis Zoo (http://www.stlzoo.org/downloads/STLZooMap2009.pdf) with zoo assignments (red dashed lines) and meeting locations (red 'x'). Maps given to student groups are more specific (only 1 zoo assignment per map + meeting locations) to avoid confusion.

PART 3: Data Collection

Students work together within their groups to gather data on 10 species of their choosing (must be in their specific zoo assignment). The data on each species includes geographical distribution, habitat, adaptations (color, behavior, etc), conservation status, and threats to success. Students are instructed how to record their data on note cards (to maintain consistency between groups and facilitate communication later). They are told to use one note card per species and are given a sample note card to help them (Figure 2). The species on the sample note card is present at the zoo, but not found in any of the zoo assignments. This portion of the exercise takes approximately 1 hour to complete. When they are finished, they are told to meet in a designated location to communicate their findings with the other groups.
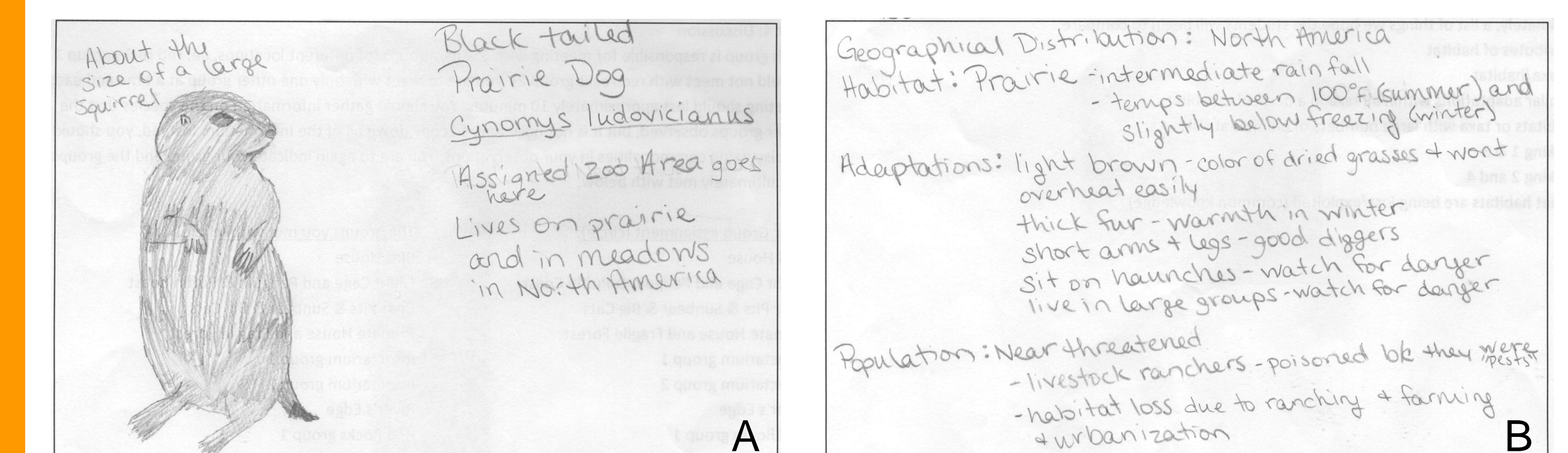

FIGURE 2. An example of a sample note card distributed to students. This sample card has data on the black tailed prairie dog. Side A is the un-lined front side of the note card with a picture of the species and other descriptive information. Side B is the lined reverse side of the same card containing the remaining data that was recorded on the black tailed prairie dog.

PART 4: Discussion

Each group is responsible for meeting with 5 other groups representing different taxa. Groups are to meet with only one other group at a time and each meeting should last approximately 10 minutes. They are told to gather information on the species observed by other groups, but not necessarily copy down all the note cards. Instead, they are told to discuss commonalities in their data. Students are given questions to guide their discussions and are told that tables can help organize information.

EXAMPLE QUESTIONS
• How do the characteristics of organisms that live in a particular habitat compare across taxa?
• How are organisms of different habitats similar/different?
• Compare and contrast the organisms that are at risk.
• What areas of the world are commonly exploited? What habitats are being lost/exploited?

Example Test Question: Compose an essay addressing the link between habitat and organismal diversity. Be sure to discuss the roles of evolution and ecology, including aspects of your observations and discussion from the zoo.

ACKNOWLEDGEMENTS