



# CASE TEACHING NOTES

for

## "*Si el Norte Fuera el Sur:* A Case of Squirrel Monkey Identities"

by

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### INTRODUCTION

This case was designed for BIO134, *Fundamentals of Tropical Biology*, which is part of a four-course semester field program accredited by Duke University and implemented by the Organization for Tropical Studies (OTS) in Costa Rica. Students who matriculate in the program are expected to have a basic understanding of ecology and evolutionary processes by the time they begin the program. Because our students come from several universities across the United States, the range of understanding of basic evolutionary processes is often wide at the start of the semester. In previous semesters, we have tried to address this issue by giving an introductory lecture to review evolutionary processes. Unfortunately, the lecture approach has not worked well. Students often "tune-out" because they have had ample exposure to terms like "directional selection" and "stabilizing selection." Therefore, they assume that they know the material, when in fact subsequent testing consistently demonstrates they have little understanding of how to apply their knowledge of these processes to real-world scenarios.

James A. Hewlett's case study "Trouble in Paradise: A Case of Speciation" (see <http://ublib.buffalo.edu/libraries/projects/cases/paradise/paradise.html>) provided a great idea as to how to approach this problem. While the basic scenario, objectives, and application of this case are similar to Hewlett's, I have introduced at least three important changes. First, I adapted his scenario to a Costa Rican problem by incorporating the Central American squirrel monkey, *Saimiri oerstedii*. This allows the evolutionary case to be used simultaneously to introduce students to specific aspects of Costa Rican fauna, geography, and conservation. Second, the exercise is introduced in the first week of our program, allowing students to review and apply what they have already learned about evolutionary biology prior to coming to Costa Rica. Finally, students work in small groups and present their results orally (as opposed to an individual written assignment). This encourages students to get to know each other and begin the exchange of ideas and knowledge during the very first week of the program. In addition, the oral presentation format allows me to identify misunderstandings about the evolutionary process and correct them with the help of the rest of the group as part of an interactive discussion.

### Objectives

This case study will allow the students to:

- Review and consolidate their background understanding of evolutionary processes that give rise to speciation.

- Apply concepts of micro- and macro- evolution to the divergence of two populations of Central American squirrel monkey.
- Interpret simple data about squirrel monkeys, make inferences, and draw conclusions from that data.
- Produce an original evolutionary story about the divergence of two populations of squirrel monkeys, using actual and fabricated data.
- Learn the geography of southwest Costa Rica and understand the role of geography in generating species diversity.
- Understand the concept of species and the implications of this concept for conservation.
- Work cooperatively in small groups to develop skills in creative problem solving.
- Develop a collaborative relationship with fellow students in an academic and social environment.

## Student Preparation

In order to complete this case study, students will need to understand:

- the species concept.
- each of the concepts on the "Concept List" provided in the case.

Successful completion of the case also depends on a basic familiarity with biogeography, comparative behavior, and comparative morphology. As stated earlier, students who participate in the program are expected to have a background in these areas before they arrive in Costa Rica. If necessary, the professor may choose to briefly review, via a discussion format, the species concept as well as the "Concept List" before students begin working on the case.

Because this case focuses on Costa Rica, it is useful for students to have an introduction to the geological history and climate of Central America in order to complete their stories. In BIO134, this information is provided to the students via lecture and reading assignments prior to the completion of the case. Appropriate background reading for this topic can be found in Janzen's (1983) *Costa Rican Natural History* and in Stiles and Skutch's (1989) *A Guide to the Birds of Costa Rica* (see [references](#) below for further bibliographic detail).

## CLASSROOM MANAGEMENT

One model for presenting this case to a class is the following, which I have used successfully in BIO134:

- Give students the case as a handout the second or third day of the program.
- If necessary, discuss the species concept as well as terms from the "Concept List" with the students at the time the case is assigned.
- Randomly assign students to groups of four or five.
- To make sure all the concepts are covered during one session of oral presentations, assign each group three distinct concepts with which they will work. Explain to the students that they are allowed to incorporate additional concepts as their story requires.
- Allow several days for students to develop their scenario.

- To keep students focused on scientific plausibility (and not get carried away with making their presentations merely comical and entertaining), meet briefly with each group before the session of oral presentations. Discuss the assigned concepts and how they have been applied to each scenario.
- Have each group present their scenario to the rest of the class orally using the format of their choice. Oral presentations should last no more than 10 minutes.
- Following the oral presentations, engage the students in a final group discussion to clarify any misunderstandings of the presented concepts.

Limiting each student group to three assigned concepts works in BIO134 because it ensures that all the concepts we want reviewed are included in one round of oral presentations. However, if the instructor wishes to give more creative freedom to the students, each group could develop its own set of evolutionary concepts to address. Important concepts that are left out in the round of oral presentations could then be covered at the discretion of the professor at some other time.

As a basic reference for evolutionary processes, we recommend students read chapters 5 and 6 of E.O. Wilson's *The Diversity of Life*. In addition to refreshing their memories, this reference provides a variety of evolutionary stories from which students may draw ideas. I also recommend having a basic evolutionary textbook on hand (such as Douglas J. Futuyma's *Evolutionary Biology*), as well as giving students ready access to additional squirrel monkey references from the primary literature. (In a typical university setting, students generally have an easier time accessing these resources on their own. However, at OTS field stations in Costa Rica, library and Internet resources are limited, making it necessary to provide basic reference material directly to the students.)

Not all scenarios need to be constructed in support of the hypothesis that the Osa and La Cusinga populations are two separate species. For example, in one presentation the students argued that the populations represented the same species, but were behaviorally isolated because females from the Osa did not recognize gray-capped males from La Cusinga as potential mates. Students reasoned this was a learned behavior, and proposed that if Osa females could be convinced to mate with La Cusinga males, their female offspring would learn to recognize both gray caps and black caps as belonging to potential mates in subsequent generations. In their scenario, they obtained a generous donation from Clairol, allowing them to dye the La Cusinga male monkeys' caps black and solve the problem!

### **Student Response to the Case**

I have field-tested this case study once with OTS undergraduate students and the response was very positive. Even though they had just met each other, students worked together successfully to come up with a variety of plausible scenarios. Interestingly, all groups chose to dramatize their presentation, acting out the evolutionary scenario by playing the part of squirrel monkey protagonists.

In a brief informal evaluation of the activity, students consistently agreed that the case study provided an adequate, interesting, and creative review of evolutionary concepts. In addition, most students cited getting to know their classmates as an important component of the activity. All students enjoyed the opportunity to learn something about squirrel monkeys.

Concerns expressed by the students included the need for more information about the monkeys, as well as the need for adequate support material for defining evolutionary concepts. In response to these criticisms, I subsequently expanded this case to include more information about squirrel monkeys. I also

included more explicit suggestions in the teaching notes regarding additional support material for the students. However, since one objective of the case is to have the students draw upon their own background knowledge, I chose not to include definitions of evolutionary concepts in the case handout itself. At the discretion of the professor, these can be obtained through outside reference material and added to the case study handout.

## REFERENCES

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6. Janzen, D.H. 1983. *Costa Rican Natural History*. Chicago, Illinois: University of Chicago Press. pp 12-65.
7. Stiles, F. Gary, and Alexander Skutch. 1989. *A Guide to the Birds of Costa Rica*. Ithaca, New York: Comstock Publishing. pp. 4-19.

If you would like to locate more Central American squirrel monkey references, consult the library database BINABITROP at the OTS web site <http://www.ots.ac.cr>.

You might also enjoy viewing this [Quicktime movie \(2.5 MB\)](#) of a squirrel monkey (*Saimiri oerstedii*) catching and eating insects at his home in the Drake Bay Wilderness Camp near [Corcovado National Park](#). This movie, provided with permission by [Dr. Hays Cummins](#), is one of several used in connection with his Tropical Ecosystems of Costa Rica course. See his extensive multimedia collection at <http://jrscience.wcp.muohio.edu/html/TropEcoCostaRicaImage.html>.

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**Image Credit:** Photograph of *Saimiri oerstedii* is provided courtesy of Lawrence Williams and the [Squirrel Monkey Breeding and Research Resource](#), University of South Alabama. Used with permission and partially funded by NIH grant P40-RR01254.

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