Teetering on the Brink of Extinction? (Or Is It Too Late?): Instructor Guide

Title

Teetering on the Brink of Extinction? (Or Is It Too Late?)

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Discipline

Biological Sciences

Target Audience

Introductory, non-majors

Keywords

Conservation, ecosystem, endangered species, evolution, molecular genetics, population genetics

Length of Time/Staging

Several days of one-hour class periods, students working in groups. Out-of-class research may be required.

Abstract

The Florida panther is an endangered subspecies of puma (*Felis concolor coryi*). Within the context of problems posed by the management of the panther, the students are introduced to molecular genetics as a tool for making decisions relevant to a population, to the importance of genetic variability, and to other factors that affect the stability and evolution of an organism. Students are expected to produce a written report that summarizes their understanding of the population, its status, and its future.

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Format of Delivery

Two or three class periods, the pages of the problem delivered in stages, with students answering the questions at the end of each page prior to being handed the next. A group report required at end.

Student Learning Objectives

1. The factors that affect genetic variability in natural populations.
2. Factors that affect the sustainability of a population or organisms that is/are endangered.
3. Ways that modern genetic techniques can be used to help understand the relatedness of organisms.
4. How genetics and evolution are related.
5. What evolution is, how variation is introduced, role of natural selection in the introduction of variation (i.e., lack thereof).
6. Role of science in making decisions that have environmental and economic consequences.

Student Resources

Introductory biology texts are good for coverage of molecular genetics, population genetics and dynamics, and evolutionary theory.

Problem-specific information may be found in the following journal citations:

1. O'Brien, S.J., et al. (1990). Genetic introgression within the Florida panther *Felis concolor coryi.* National Geographic Research 6(4): 485-494.
2. O'Brien, S.J. (1994). A role for molecular genetics in biological conservation. Proceedings of the National Academy of Science, U.S.A. 91:5748-5755.
3. Maehr, D.S. and Caddick, G.B. (1995). Demographics and genetic introgression in the Florida panther. Conservation Biology 9(5):1295-1298.
4. Fergus, C. (1991). The Florida panther verges on extinction. Science 251(4998): 1178

5. Land, D.E. and Lacy, R.C. (2000). Introgression level achieved through Florida panther genetic restoration. Endangered Species Update 17(5):100.

Instructor Resources

Florida Panther Society

Friends of the Florida Panther Refuge

Florida Panther Net

Florida Fish and Wildlife Commission

U.S. Fish and Wildlife Service

USFWS Endangered Species Program

Author's Teaching Notes

General Notes:

1. Pass out the problem in stages. Do not hand out pages two or three until the students have dealt questions on the previous page. The problem may require two or three class periods, with individual research between periods on learning issues identified by and distributed amongst the group members. Upon return to the class, groups will probably want to discuss the findings of their research and discuss how the information relates to the questions.
2. Some of the questions exist more in the domain of public policy and environmental issues while others will push students to thinking about the relevant ecological, cellular, and genetic processes. Emphasis can be altered by the instructor to suit his/her preference and the time available.
3. A preliminary draft of the report should be shared at the third class period and the final report, signed by all group members, turned in thereafter.
4. For the biological concepts involved, an introductory college biology text might be supplemented with resources in cellular and molecular biology and ecology. Web-based resources include newspaper articles and a few full-text science journal articles can be found to enhance students' appreciation of this particular problem.

Part 1

If the first page is distributed at about the middle of the first class, students will have time to discuss their understanding of the problem, brainstorm the possible ways that the panther population could be boosted (Question 1), and choose one or two of the most plausible. Question 2 should require them to think about the factors that contribute to population dynamics, i.e., birth rate, survival, age to sexual maturity, longevity, etc. Question 3 enters into a review of the sources of genetic variation, processes of gamete production, and population allelic frequency. The depth of this discussion by students can be determined by the instructor. This may be an opportunity remedial activities or lecture if the instructor determines that misconceptions are prevalent.

Part 2

For introductory biology, Question 1 can be used to engage students in thinking about how molecular biology can inform important biological conservation issues. Similarly, Question 2 prompts students to investigate the processes of microevolution and speciation. A lawsuit to stop the captive breeding program was settled prior to trial (Question 3), but the issue was to be contested on the potential damage to the population by removing them from the wild and uncertainties about the success of the breeding program. FFA argued that it would be far better to invest in improving habitat.

Part 3 and Group Project

The group project should indicate that the students have thought about both the problem of introgression by genes of other subspecies and what might be the requirements of a sustainable population, including the issues posed by simultaneous land development and panther recovery efforts.

Assessment Strategies

Formative assessments (low- or no-stakes) of student understanding can be incorporated by having groups submit responses to some or all of the questions at the end of Parts 1 and 2. The end-of-problem group project may be evaluated according to a problem-specific set of criteria and a generic rubric for responses provided to students. Individual assessments can be incorporated into problem-specific items occurring on hourly or final exams.

Solution Notes

Students deepen their understanding of how biology can inform policy decisions, and that new tools allow the reexamination of old questions, such as "What is a species?