INTRODUCTION

There have been five major extinction events over geological time. However, the current rate of extinction or reduction of species and their habitats is directly related to human actions. As this trend continues, difficult practical and ethical decisions regarding the value of life come to the forefront. For seventh grade students, biodiversity is introduced during biology or life science courses, often as an extension of evolution, natural selection, and descent from common ancestry. However, the ethical implications of humanity’s role in this most recent loss of diversity are seldom considered.

As part of a short biodiversity unit, a survey was developed for students to express their ethical values regarding conservation of biodiversity or protection of species. The unit spanned four class periods, combining species diversity science, the plight of endangered species and their protection, a living reptile program presented in the classroom, poster art supporting protection of a specific species, and the ethics survey. This unit was piloted in the 2013–2014 school term. Student responses to questions on the ethics survey were taken before and after the unit’s completion. An unexpectedly high level of interest in, concern for, and understanding of the relationship between human actions and the plight of endangered species was noted. This was expressed in the student assessment of the reptile program and consistent high scoring on the ethics survey.

Ethics arrives at the forefront of biodiversity, as concerns for conservation and preservation often stem from ethical or moral values aimed at combating the destruction of this planet’s resources. Science teaching relies on the presentation of scientific facts, even though some of these may be open to heated debate. However, in the case of biodiversity, the presence of scientific fact alone has not been enough to change actions or approaches to avoid the acidification of the oceans, reduce the accumulation of carbon dioxide in the atmosphere, or curtail the current human-caused species extinction rates (4). As with many developments in biotechnology, science alone is not shaping public opinion or legislation (3), and students are exposed to genetic screening and counseling for which ethical codes or ethical choices are still being established. We can expect the same to be true for preservation and conservation of endangered species.

PROCEDURE

This unit was prepared for secondary science, specifically for seventh graders in a life science/biology course. The students met every other day for four 90-minute blocks. Over these four periods, lessons included readings, discussion, endangered animal poster construction, a live animal program, and an explanation of an ethics survey. The ethnic or cultural background of the students at the time of the survey was: Hispanic 26, African-American 12, Asian 27, Caucasian 6, and those of mixed ethnic backgrounds 19, totaling 90. This included four advanced classes and one on-level class, with a gender ratio of 43 males to 47 females.

As this unit had not been taught before, special time was taken to explain objectives before starting. The objectives were written to include specific deliverables and demonstration of knowledge, aiding students to:

1. Describe what is meant by biodiversity and its relation to our studies on descent with modification, as presented in a short-essay response
2. Understand the meaning and difference between endangered, extinct, and threatened species by making a poster on a species and explaining why and how it fits the classifications
3. Complete a species organizer for the animals presented during the reptile program, including their natural home, whether they are endangered or threatened, and their scientific and common name
4. Determine ethical positions for biodiversity by completing an anonymous survey before and after the unit

In teaching science, we rely on the presentation of scientific facts. However, presenting facts alone is not always enough to change actions or approaches, as is evident in
teaching biodiversity, where education has not led to avoiding the acidification of the oceans, reducing the accumulation of carbon dioxide in the atmosphere, or curtailing the current human-caused species extinction rates (1). Science teachers are content specialists who can teach the scientific underpinnings of biodiversity but have much less experience introducing ethical questions that allow our students to contemplate what biodiversity and conservation mean and to explore the personal values associated with their opinions.

To address the above concern, a learning cycle lesson plan incorporated the unit’s unique key features (Table 1). Using this format meant that the unit was familiar, using four of the 5 Es (engagement, exploration, explanation, and evaluation) as presented (2). Before engagement began, students participated in the anonymous ethical survey on values and beliefs they hold regarding biodiversity. This was a 15-question survey focusing on ethical questions, values, and judgments, and it was repeated at the end of the unit. Each question was first read aloud and students could ask for clarification. A discussion on ethics was also held, so that students felt comfortable before starting the survey. Students were told that there was no right or wrong answer, and that results would be looked at in aggregate, with no one getting a grade.

**DISCUSSION**

While the unit focused primarily on the science underlying biodiversity and endangered versus extinct species, an ethical survey was added to determine student values as to whether or not, and under what conditions, the conservation of biodiversity might occur. In part, the unit was structured on the premise that a first-hand encounter with diversity of living organisms would lead to an enhanced understanding of life on earth and threats and dangers to species, including habitat destruction caused by humans. Approximately 60 out of 90 students believed that the presence of the live reptile program in the classroom was key to expanding their understanding of biodiversity, as shown from survey question 13 (Table 2). In addition, content knowledge can be seen in answers to the last question, where 83% selected the correct answer as to the importance of biodiversity.

This unit demonstrated that it is possible to take an ethical “pulse” of students on complex scientific topics. I would argue that due to the unprecedented rate of habitat destruction, loss of species, acidification of the ocean, and difficulties in protecting endangered species (5), it is imperative that all those teaching biodiversity, biology, or ecology...
take time to educate and help students with ethical decisions they face regarding the current extinction as a counter force to the indifference seen regarding the natural world, as identified by Wilson (6).

Further analyses of the various lessons/activities for this unit are presented in Table 1. The unique features of the unit are being evaluated after this initial trial year to see how they might be improved or modified for those seeking to include ethical implications for biodiversity.

SUPPLEMENTAL MATERIALS

Appendix 1: List of Black Rock Reptile (www.blackrockreptiles.com) species for classroom notes and observations

Appendix 2: Survey questions to gauge ethical choices among students before and after presentations and visit of 15 species of living reptiles to the class

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REFERENCES