

Group Formation to Support an Integrated Approach to the Study of Animal Diversity

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To reinforce the idea that the study of animal diversity relates to all biology topics, I have students self-identify based on their area of interest (either cell/developmental, genetics, evolution, or ecology/conservation). After they select a topic, four-member groups are assembled with one member from each topic area. Groups are given a real world problem and are asked to prepare a presentation which outlines the problem for the rest of the class and focuses on the solutions or next research steps. This structure illustrates the importance of considering multiple lines of inquiry in addressing complex issues.

Keywords: Group Work, Problem Solving, Oral Presentations

Introduction

This activity allows students to practice both group work and oral presentation skills. Effective group requires practice, but once mastered, is desirable to employers. The National Association of Colleges and Employers lists teamwork as one of the top ten skills they look for on applicant resume's (Koncz 2012). Further, Higher Education Strategy Associates, a think-tank focused on post-secondary education, conducts monthly polls of Canadian undergraduate students and in 2012, almost half their student panel suggested they wished they had more experience with soft skills, such as managing group work and being self-motivated, after graduating and while looking for a job (Usher 2012). The majority of our students take this class in the fall semester of their second year, when both managing group work and delivering oral presentations is a relatively new skill.

Student Outline

As you enter, please choose a topic area; cell/ developmental, genetics, evolution, or ecology/ conservation. You will then form a group with a member from each topic area. Each group will be randomly assigned a presentation topic based on the taxa to be studied over the course of the term. Each presentation will be limited to ten minutes and every member of the group must speak at some point in the presentation. The presentation will focus on a real world problem as described below. Start your presentation with an outline of the problem and focus the bulk of your presentation on the solutions or next research steps, keeping your topic choice in mind.

The directed questions are:

1. **Cnidarian:** In recent years giant Nomura's jellyfish (*Nemopilema nomurai*) have proliferated in the Sea of Japan and created havoc on the fishing industry (Ryall 2009). You have been hired as fisheries consultants in order to help local fisherman deal with the problem. The fishermen want to know how the increasing numbers of jellyfish on a regular basis are going to affect their livelihood and what they should do about it.

You remember that you saw a comprehensive article on the subject by Dr. Uye, a local expert (Whiteman 2011). Thinking about the four topic perspectives, how would you build on his studies to better advise the fishermen?

2. **Worms:** In searching for citizen science projects to participate in you come across the great lakes worm watch (<http://www.nrri.umn.edu/worms/>), which encourages research on the invasive nature of earthworms (*Lumbricus terrestris*). Shortly after finding this page you come across two more related articles, "Invasive Earthworms Denude Forests in U.S. Great Lakes Region" (Tennesen 2008) and "Alien Worm Invasion 'Threat to Forest'" (Kinver 2011).

Based on what you read, would the Nova Scotia forests be at risk from an earthworm invasion? Thinking about the four topic areas how would you assess the risk and further research the problem?

3. **Molluscs:** The Ontario's Grand River Conservation Authority has hired you as consultants. The job will involve staffing the educational resource centre and helping out with the fresh water muscle conservation projects.

A quick internet search tells you that freshwater mussels across North America are in decline (Graf 2008), but that conservation efforts are underway (Endangered Mussels 2007).

What key points should you cover at your first meeting that will demonstrate your knowledge of the problem and some of the issues that might arise with the current conservation methods?

4. **Crustaceans:** In lecture you learned about the tongue eating louse and you excitedly go and tell all your friends about this cool parasite! While fascinated and grossed out, they also ask about how these animals breed, what keeps the fishes body from rejecting the parasite and how this relationship might have come about. Very few studies have been done on these animals so your task is to develop at least one testable question and propose a study for each of the four topic areas.

5. **Insects:** You are invited to a family BBQ at a lake and as evening approaches everyone starts to be bitten by mosquitoes. One of your relatives suggests all mosquitoes should be eliminated. Thinking about the four topic areas, how would you respond?

6. **Echinoderms:** While studying for your upcoming exam you stumble on this blog post <http://echinoblog.blogspot.ca/2012/08/ophiothela-brittle-stars-invade-atlantic.html> and the accompanying PDF file:

<http://www.nhm.org/site/sites/default/files/echinoderms/Invasive%20Ophiothela.pdf>

Along with documenting instances of the invasion, what else could or should be done? Are there aspects of echinoderm biology which has made them particularly adaptive?

7. **Fish:** While enjoying fish 'n chips with a friend, you start discussing the number of places fish are found; everywhere from the tropics to the Arctic. Your friend asks you how fish are able to live in seawater close to the freezing point. Having recently read a nature paper on how antifreeze evolved in fish (Cheng and Chen 1999), you explain the process. Your friend inquires if this is also what happens in Arctic fish and if they are related despite being so far apart. Thinking about the four topic areas, how would you respond?

8. **Amphibians:** After hearing about Caecilians in class, you wonder why you haven't come across this group before. An internet search leads you to this slideshow (http://www.huffingtonpost.co.uk/2012/02/23/chikilidae-caecilians-new-legless-amphibians-discovered-in-india_n_1295997.html) with adorable baby Caecilian photos and an article on the discovery of a new family (Nelson 2012).

Thinking about the four topic areas how would you find out more about these animals?

9. **Reptiles:** You are thinking of renting a car to drive home for Christmas, and your parents suggest you should use other means to travel. Along with worries of blizzards and icy roads, your mom sends you this article (Karstens-Smith 2012). She also tells you there are other articles (United Press International 2012) and Videos (<http://www.youtube.com/watch?v=78qA-Q7L5Qc>) and (<http://www.youtube.com/watch?v=l8rxJRslNU4>) (DO NOT WATCH IF YOU ARE SNAKE PHOBIC!)

This reminds you of the case of invasive brown snakes on Guam (Rodda and Savidge 2007), and gets you to wonder why snakes are such good hitchhikers and why is this behavior maintained in the population?

10. **Birds:** You join a local non-governmental organization and volunteer on a project on energy sustainability. You learn there is a growing interest from government and Nova Scotia Power to use wind energy in the coming years. For your part you want to look at how wind turbines affect bird migration and how that might help inform where they are placed. There are two recent studies out of the UK (Carrell 2012) and (Crumpton 2012). How could you apply these studies to Nova Scotia or build (suggest new studies) on their results.
11. **Mammals:** Your co-op job is with the Nova Scotia Department of Wildlife. At first you are just manning the phones and answering questions about Nova Scotia Wildlife. As season changes to mid-winter you find you are getting more and more calls about bats flying around instead of hibernating. It's suggested this is due to the arrival of White-nose syndrome (Chung, 2012). After showing interest, your boss asks you to come up with some ideas about what the effect of this syndrome might be on our bat population.

Notes for the Instructor

The animal diversity course in which this exercise is assigned is a second year course aimed at our Biology & Marine Biology majors. Each week throughout the term, students are given three hours of lecture material and three hours of laboratory instruction. The lectures survey the major animal taxa, giving the students an introduction to each group; while in lab students are presented with examples of the taxa in various forms including live, fresh, preserved specimens and prepared slides. There are eleven lab sessions over the course of the term, nine of which are dedicated to a specific taxon (i.e., arthropods). This schedule allows for one or two presentations at the start of every lab session.

To encourage the non-presenting groups to read the directed question prior to lab and to listen to the presentation, we ask each non-presenting group to come up with one rebuttal to the proposed idea or to build on one of the presented ideas. This usually takes an additional ten minutes.

These specific questions were written in 2012, and many of the topics were in the news or relatively recent issues. This helped ensure that students were forced to come up with their own solutions instead of relying on finding a solution in the literature. To remain current the questions should be changed every two to three years.

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