



CASE TEACHING NOTES for “Fecal Coliforms in Antarctica”

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INTRODUCTION

Synopsis

In this case study, students explore the environmental consequences of Antarctic research as they design experiments to assess the impact of disposing untreated sewage from a research station into the ocean. Students review experimental methods to measure coliform bacteria, examine data, and decide what actions, if any, should be taken.

Background

In the early 1990s, environmental activists in Greenpeace blew the whistle on the scientific and expeditionary trash accumulating in Antarctica. Garbage dumps from nearly every expedition littered the continent. Ongoing waste management paid little attention to minimizing the impact of the presence of humans in Antarctica. Although the Antarctic continent is vast (roughly the size of Australia), it is a priceless wilderness shared by all nations. Greenpeace activists argue that human waste in Antarctica is unacceptable. Since then, international efforts have cleaned up garbage dumps and waste disposal methods have improved.

One lingering problem is the treatment of sewage from McMurdo Station, a scientific outpost operated by the National Science Foundation. This facility provides a U.S. presence on the Antarctic continent and offers logistical support to scientists. McMurdo Station currently dumps its sewage into McMurdo Sound. This practice will change with the construction of a future sewage treatment facility, but to date (2002) nothing has been done to stem the flow. McMurdo Sound would be a pristine aquatic system if not for the McMurdo Station sewage.

This case explores the decisions a microbiologist makes as she tackles this contamination problem. I developed the case for either a non-majors course in science literacy or for a general microbiology class studying bacterial detection methods. For non-majors, the instructor would emphasize the mechanics of data collection and analysis and may touch on the environmental implications of finding fecal coliforms in Antarctic waters. For microbiology students, the instructor would highlight the bacteriology and pair lecture sessions with laboratory experiments. I wrote this case for my classes of 32 to 96 non-majors and 24 microbiology majors.

Objectives

To teach students about:

- Experimental design
- Appropriate use of controls
- Data collection
- Data interpretation
- How scientific data inform policy makers

- Fecal coliform detection methods
- Environmental awareness

DETAILED CASE ANALYSIS

Although this case outwardly deals with fecal contamination in Antarctic waters, students can explore several lines of investigation depending on the course objectives. These are discussed along with answers to the case questions in the detailed analysis for this case.

Detailed case analysis is provided in a separate file that is password-protected. To access this information, go to the [detailed case analysis](#). You will be prompted for a username and password. If you have not yet registered with us, you can see whether you are eligible for an account by reviewing our [password policy and then apply online](#) or write to answerkey@sciencecases.org.

CLASSROOM MANAGEMENT

This interrupted case can be completed in an hour but may take longer depending on the objectives of the individual instructor.

- 10 minutes: Small groups read and discuss Part I of the case, answer questions, and design sampling schemes.
- 13 minutes: Selected groups report to the larger class, discuss sampling schemes, and explore appropriate controls.
- 7 minutes: Small groups work on the microbiological content of Part II.
- 10 minutes: Small groups read and answer questions on Part III, filling in the blank sampling sites, and discussing what levels would elicit response from the National Science Foundation to clean up the sewage outfall.
- 10 minutes: Instructor shows students the data that Sally obtained (presented as Part IV), then facilitates a class discussion on the results. Finally, student opinions on action levels are explored and group recommendations are discussed.

REFERENCES

1. Smith, J.J., Howington, J.P., and G.A. McFeters. 1994. Survival, physiological response, and recovery of enteric bacteria exposed to a polar marine environment. *Appl. Environ. Microb.* 60:2977-2984. [Further reading on fecal coliform survival in Antarctic waters.]
2. “Antarctica,” <http://www.coolantarctica.com>. [Nice resource for information about Antarctica.]
3. Difco Manual, 11th Edition. 1998, Difco Laboratories, Sparks, Maryland. [Information about growth media.]

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Image Credit: The National Science Foundation’s main office in McMurdo, known as the Chalet. [NSF photo](#) by Peter West.

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