Case Teaching Notes

for

"Rabbit Calicivirus Disease: Magic Bullet or Pandora's Box? A Case Study on Biological Controls"

by

Gary M. Fortier
Department of Animal Biotechnology and Conservation
Delaware Valley College

Introduction / Background

This case study is designed to foster discussion on the use of biological controls. It was originally written for a wildlife management course taught to juniors and seniors. In addition to the specifics of virulent pathogens as a form of biocontrol, the case covers several broader issues related to assessing an ecological problem and asking questions about it, collecting multiple informed perspectives, risk assessment, and integrated pest management. The central question in the case, whether a virulent pathogen should be intentionally released into the environment, was hotly debated in both the scientific community and the popular press. Use of the case will require that students be familiar with the terminology and concepts fundamental to ecology, including predation, competition, and biological invasions.

The case might be used to discuss the use of pathogens as control agents or to introduce basic concepts from biotechnology. It could logically follow a case study on either the reintroduction of vertebrate predators (such as the release of wolves into the Yellowstone ecosystem), a study of complex trophic level interactions, or a case focusing on biological invasions. While calicivirus has already been released accidentally in Australia and illegally in New Zealand, the fundamental dilemma remains as policy makers continue to grapple with the double-edged sword of biological controls.

Objectives

This is a dilemma case in which the characters are faced with a difficult decision. While the proposed solution, release of the rabbit calicivirus, includes significant risk, there is also a substantial cost to doing nothing. In addition to forming and defending a position, students must address the following pedagogical objectives.

- Understand the potential hazards posed by biological introductions.
- Predict whether a biological control agent is likely to be effective.
- Understand the spread of disease and how pathogens may sometimes be able to jump to new host species.
- Explain the evolutionary "arms race," the evolution of virulence, and why organisms may become resistant to control measures over time.
- Perform a risk assessment.

Classroom Management

The learning issues provided with the case may be passed out with the case study initially in lieu of asking students to brainstorm their own learning issues. Alternatively, they could be integrated into the learning issues identified by the students or omitted altogether. Their inclusion and use will depend upon the level of the students in the course and the number of class periods the instructor wants to dedicate to the case. Students will have to read the case carefully and do some outside reading to fully answer the learning issues. (Suggested answers are provided in a separate Answer Key.)

I have run the case using a problem-based learning approach over the course of two 50-minute class periods to a class of 24 students. In the first period, students are divided into multiple groups of four to five students each. The case study is given to the students but the learning issues are not distributed until the end of class. After reading the case and writing down their initial reactions to the problem, i.e., "Do you think the virus should be released?" the students form a list of questions that must be addressed before a truly informed decision can be made. The instructor pools the

list of questions from all groups on the board and distributes the learning issues accompanying the case. Each group is then assigned a question or group of questions (the questions may be student-generated or derived from the formal learning issues). The students are expected to research their questions and then meet outside class to discuss their answers before the next class meeting. The instructor could provide the references included with the case or put the material on reserve to reduce the workload associated with the assignment. I prefer to let them find their own sources.

At the next class meeting, a jigsaw approach is used to create new groups, with one representative from each of the "expert" groups formed in the last period (see Choe and Drennan 2001). The new student groups must share their findings, resolve each learning issue, and then determine which of four positions they will support: (1) release the calicivirus, (2) release mink, (3) release both, or (4) release neither. Students may be frustrated with the risk assessment that is required to reach a decision. Some issues may be difficult to assess, such as the possibility of future mutation and cross infection. However, students will come to the realization that even if we can never *eliminate* all risk, we are able to weigh the *informed* risk of release versus the risk and cost of not releasing the virus (or of employing other options).

At this point, the instructor can summarize the class discussion on the board and end the case study or employ a follow-up assignment to encourage further analysis. Groups can be combined into teams to resolve the issue through a formal debate. I prefer not to assign students to a given "side" of the debate until the class starts, allowing 10 minutes for each team to get organized at the start of class. This forces students to view the issues from multiple perspectives.

Alternatively, students can develop their positions through various assignments, such as writing a position paper defending their proposal based on the data presented or evaluating a new article from the primary literature on a different system of biological control. In the past I have used both, a class debate followed by written summary reports from each group.

> *Sample Student Assignment*
> Your first task is to read all available material and consult additional sources to assemble a coherent, well supported argument: Should the virus be released? We will use the next class as a discussion period and will hold a formal debate one week from today. In 2 weeks you will submit one report (2–3 pages, typed) for your group with all of the group members' names. You may submit this in one of two formats, either as a report or as a letter to the Ministry of Agriculture and Forestry recommending a specific course of action.
>
> *If you create a report:* Address each of the learning issues in the Analysis section. In addition, explain what could be done to increase the potential success of a calicivirus release. What measures might prevent the shortcomings of the myxoma virus? This should be based on what you've learned in the readings or in discussion with the instructor.
>
> *If you write a letter:* Make a firm recommendation for one of the actions proposed by the committee or for any new action that your group may decide is better. Build a convincing argument by explaining the advantages of your proposal and the disadvantages of each alternative action. Be thorough.

Note: There are numerous techniques available to insure all students contribute to group assignments. These include having students turn in a group paper clearly distinguishing each member's contribution, assigning both group and individual grades, and incorporating peer evaluations (Herreid 1999). It may be necessary to explain to students the value of coming to a consensus, as the characters in the case are required to do!

Answer Key

Answers to the questions posed in the case study are provided in a separate answer key to the case. Those answers are password-protected. To access the answers for this case, go to the key. 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.

References / Resources

Print

I. Anderson and R. Nowak. 1997. Australia's giant lab. *New Scientist* 153:34–37.

P.B. Banks, C.R. Dickman, and A.E. Newsome. 1998. Ecological costs of feral predator control: foxes and rabbits. *Journal of Wildlife Management* 62:766–772.

S.W.T. Choe and P.M. Drennan. 2001. Analyzing scientific literature using a jigsaw group activity. *Journal of College Science Teaching* 30:328–30.

T.H. Duston and Y. van Roy. 1997. Rabbit control in New Zealand. *Science* 276:20.

D. Drollette. 1996. Australia fends off critic of plan to eradicate rabbits. *Science* 272:191–192.

N. Grant. 2001. Conserving dryland lizards by reducing predator–mediated apparent competition and direct competition with introduced rabbits. *Journal of Applied Ecology* 38:1350–61.

C.F. Herreid. 1999. The bee and the groundhog: lessons in cooperative learning and troubles with groups. *Journal of College Science Teaching* 28:226–8.

R.D. Holt and M.E. Hochberg. 1997. When is biological control evolutionarily stable (or is it)? *Ecology* 78:1673–1683.

F.M. Jaksic and J.L. Yanez. 1983. Rabbit and fox introductions in Tierra del Fuego: history and assessment of the attempts at biological control of the rabbit infestation. *Biological Conservation* 26:367–74.

J. Kovaliski. 1998. Monitoring the spread of rabbit hemorrhagic disease virus as a new biological control agent for control of wild European rabbits in Australia. *Journal of Wildlife Diseases* 34:421–428.

P.B. McEvoy. 1996. Host specificity and biological pest control. *Bioscience* 46:401–405.

K.C. Meldrum. 1992. Viral haemorrhagic disease of rabbits. *The Veterinary Record* 130:407.

G. Mutze, B. Cooks, and P. Alexander. 1998. The initial impact of rabbit hemorrhagic disease on European rabbit populations in South Australia. *Journal of Wildlife Diseases* 34:221–227.

P.R. Pech and G.M. Hood. 1998. Foxes, rabbits, alternative prey and rabbit calicivirus disease: consequences of a new biological control agent for an outbreaking species in Australia. *Journal of Applied Ecology* 35:434–453.

E. Pennisi. 1997. Rampaging rabbit virus—again: New Zealand. *Science* 277:1441.

D.V. Perkins and R.N. Saris. 2001. Analyzing scientific literature using a jigsaw group activity. *Teaching of Psychology* 28:111–13.

In addition, numerous editorials, letters, and opinion pieces on RCD were written throughout the mid 1990s, particularly in *Science* and *New Scientist*.

Internet

Note: the sites below cover a range of organizations and viewpoints. A review of these sites may provide a valuable exercise to students in assessing the credibility and reliability of information available over the Internet.

American Rabbit Breeders Association—ARBA Policy on VHD/RHD/RCV
http://www.arba.net/vhdpolicy.htm

American Society for Microbiology (General introduction to viruses)
http://www.microbe.org/microbes/virus1.asp

Calicivirus Home Page, Institute for Animal Health
http://www.iah.bbsrc.ac.uk/virus/Caliciviridae/index.html

CSIRO—Commonwealth Science & Industry Research Org. of Australia
http://www.csiro.au/

CSIRO's Rabbit Calicivirus Disease (RCD) Factsheet (archived pages)
http://www.csiro.au/communication/rabbits/qarabbit.htm

Department of Primary Industries & Energy in Australia
http://www.dpie.gov.au/

New Zealand Ministry of Agriculture and Forestry
http://www.maf.govt.nz/mafnet/

Rabbit Biocontrol Advisory Group—Ministry of Agriculture and Forestry, New Zealand
http://www.maf.govt.nz/mafnet/publications/rabbit-biocontrol-advisory-group/httoc.htm

Rabbit Information Service: The Rabbit Calicivirus Disease Conspiracy Exposed
http://members.iinet.net.au/~rabbit/rrcd.htm

Updates on Rabbit Calicivirus Disease—Australian Academy of Science
http://www.science.org.au/nova/001/001sit.htm

Acknowledgements: This case study was developed with support from The Pew Charitable Trusts. The author wishes to thank Brian Bell for originally alerting him to the exciting dilemma over the release of the myxoma virus several years ago, as well as the two anonymous reviewers whose comments greatly improved the case.