

Mosquito Control and Environmental Impact

PRINCIPAL INVESTIGATOR

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ABSTRACT:

As South Florida's population grows in areas that were once wetlands it is becoming more and more important to control mosquitoes as they are vectors for emerging pathogens, such as West Nile virus and various forms of encephalitis. It is easy to disrupt nature's balance when controlling the growth of a vector and students need to be aware of the possible environmental impacts their ideas could pose. If students are not trained to check and study methods of control before imposing them history may simply repeat itself and we could wipe out another species in the process or allow for another pathogen to emerge. It is our responsibility to pass on both the mistakes and success to our students to inspire them to think critically and creatively with the hopes that they will come up with more environmentally friendly proposals that will aid us in controlling emerging pathogens.

MISSION STATEMENT:

The development of this proposal will teach our students about emerging pathogens and aid them to think creatively and critically to cultivate environmentally sound methods of control. This proposal will teach students more about the South Florida environment they live in and how it relates to emerging pathogens and their impact.

DESCRIPTION AND EXPECTED OUTCOMES:

Students will be introduced to emerging pathogens in Environmental AP through population studies. Mosquitoes will be discussed in detail as vectors for malaria, West Nile virus and many forms of encephalitis. As students learn about the options for mosquito control they will be assigned an investigative project.

Bacillus thuringiensis israelensis and *Bacillus sphaericus* are bacteria that are known to kill mosquito larvae and commonly used in lakes and ponds for this reason. Students will be asked to research these bacteria to find out how they kill their hosts. Based on the information they find they will then come up with a way to test their hypothesis. Multiple fresh water species may be used in these experiments to determine the effect these bacteria have on the whole ecosystem.

By the end of this project students will be able to: (1) think critically about human controls and the effects on the environment, (2) confidently develop a research paper and project using the scientific method, (3) understand the relationships between different pathogens and their host species.

This project will be developed and implemented over 12 days. The following is a proposed schedule:

Day 1

- Increasing human populations and problems with emerging pathogens lecture
- Class discussion of population control

Day 2

- Mosquitoes as a vector for emerging pathogens in Florida lecture
- Research group formations and research

Day 3 - Day 4

- Research and hypothesis development of effects of using bacteria as a control

Day 5 – Day 10

- Lab investigations

Day 11

- Group “mock county debates” based on lab findings for or against this form of mosquito control

Day 12

- Research papers due

EXPERTISE AND CONTRIBUTIONS OF THE PI:

Shauna Mercier received her B.S. degree in Marine Science and Biology from the University of Miami. During her time of study Shauna worked for 2 different labs and developed a senior thesis and research paper before graduating. After graduation Shauna gained experience working as a naturalist at the Biscayne Nature Center, where she encountered not only mosquitoes in their natural ecosystems, but abundant aquatic life as well. Shauna has just begun her teaching career over the last year and is working on obtaining her teaching certificate in middle and high school biology. In addition to her training Shauna has gained experience and inspiration for this proposal through a two week training at the University of Florida through the ICORE program.

Shauna Mercier has developed this action proposal and plans to implement the project in her AP Environmental class this fall. Having research under her belt, Shauna will be encouraging and teaching students how to come up with their own research papers. She hopes that her students will gain an appreciation for research and continued creativity.

LITERATURE CITED:

- 1) <http://www.epa.gov/pesticides/health/mosquitoes/larvicides4mosquitoes.htm>
- 2) <http://mosquito.ifas.ufl.edu/Connelly.htm>

BUDGET

- Student Chosen Organisms \$50 – 100
- 5 aerators \$50

Environmental Effects of Mosquito Eating Bacteria

Grades 11 – 12

AP Environmental Science

Chapter 12 Food, Soil and Pest Management

Objectives:

Students will be able to design and conduct experimental research. Students will learn how to evaluate pest control solutions for environmental safety in order to control the spread of emerging pathogens.

Estimated Time:

Once students have started to study Pest Management and their effects on spreading emerging pathogens they will design an experiment. Students will be given 2 weeks to conduct and finalize their research.

Materials/Resources:

Mosquito eating bacteria

Various freshwater organisms

Freshwater

Beakers

Thermometers

Dissolved Oxygen Kits

Teacher Preparation:

In preparation for this lesson the teacher should make sure the students have conducted several experiments and written full lab reports. Students need to have a clear understanding of the scientific process and research skills.

The teacher will introduce a lesson on pest management and emerging pathogens, with an optional debate on mosquito control. From here the teacher will guide the students through the scientific process of evaluating the environmental safety of differing pest management techniques.

Introduction:

Due to the damaging effects of most chemical pesticides on plants and animals it is necessary to find and explore other environmentally safe alternatives. Many factors of mosquito's biology need to be studied in order to come to a sound solution.

One solution that has been proposed in the past is to use a mosquito larvae-eating bacteria in freshwater lakes and ponds. This bacteria will only consume the larvae at certain stages. As with any pest management technique the environmental safety should be taken into consideration. Students will develop procedures for testing the environmental effects of using these bacteria as a pest control.

Exploration and Application:

Upon studying pest management strategies and environmental factors students will be divided into groups of 2 to 3 students. Each group will be asked to come up with a hypothesis and research procedures to test the environmental effects of using mosquito-eating bacteria as pest control.

Materials will be obtained by the teacher after each group's procedures have been approved. Students will be given materials and allowed 2 weeks to implement and practice their procedures.

Upon completing their procedures and tests students will write up a lab report to report their findings. Lab reports will include a title, objectives and hypothesis, introduction, materials, procedures and methods, data and observations, analysis and conclusion.

Using their research findings students will be able to make better decisions on pest controls and their environmental effects. Students will also gain a better understanding of research procedures.

Assessment:

Students will be evaluated based on their final research paper. Each research paper should include a title, hypothesis and objectives, introduction, materials, procedures and methods, data and observations, and analysis and conclusions. Proper background research and experimental procedures will also be evaluated.

References:

1. C. Roxanne Connelly, Ph. D.

Extension Medical Entomologist

Associate Professor Florida Medical Entomology Laboratory

2. Pesticide Environmental Stewardship Program

US. Environmental Protection Agency

<http://www.epa.gov/oppbppd1/pesp/strategies/2008/clarke08.htm>