

# The Flow of Research in Aquatic Ecology: How Ecologists Reach a Research Question

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## WHY DO ECOLOGICAL RESEARCH?



The background of this poster represents one of six tanks that we built to test choice of oviposition site. Two breeding females occurred in each half and drilled tubing dripped water down the sides to encourage snails to lay on one of the four structures we provided.

- Conducting research furthers our knowledge of the world in which we live.
- Ecologists investigate the interaction between organisms and their environment and address such problems as exotic invasive species, global climate change, and ecosystem preservation.
- Major environmental issues require natural observation and thorough investigation to reduce impacts or prevent future problems.
- Ecological research attracted us by applying directly to the natural world, using a hands-on strategy, and possessing the potential to be applied in the management of an invasive species.

## HOW TO CHOOSE A RESEARCH FIELD

- Researchers often select their field based on personal interest in a subject. Because researchers are going to be submerged in their field, personal engagement helps overcome the challenges of hard work and long hours.
- Recent discoveries or media attention make some fields more appealing. As the field of science grows, new opportunities for research often present themselves and good ecologists take advantage of these opportunities. In addition, many undergraduates work within their mentor's research area, although the overall project usually has several directions, allowing some independence.

## PICKING A RESEARCH TOPIC

### BROADER OR DIRECT IMPACTS

- Ecologists focus their research on topics that have direct relevance to the interaction between an organism and its environment.
- Research on ecological topics may help explain or improve the environmental issues that threaten the natural state of ecosystems.
- In our research, we focused on trying to slow the invasion of applanisnails in Houston by investigating their egg laying behavior. Finding eggs before they are able to hatch could reduce population growth and limit the damage the snails cause.

### PERSONAL INTEREST

- Personal interests of a researcher remain key to choosing a topic as well as a field. Everyone needs a sense of project "ownership." Experiments often run for long periods of time and not all topics appeal equally to each researcher.
- When deciding what we wanted to study, we chose to work with adult snails because they are easier to work with than the earlier life stages. The topic of reproduction also interested us because many ecologists cite high reproduction as a key invasive characteristic, especially for mollusks.

### PREVIOUS RESEARCH

- Ecological research builds on the previous work of others. In the process of choosing our research topic, we examined the earlier projects in Dr. Burks's lab and identified areas not yet investigated. Adult reproduction and egg laying behavior served as topics that past students had not addressed.
- A. Youens and M. Barnes found that submersion of egg clutches prevented hatching and we wanted to know if the snails laid their clutches at a certain height to prevent this occurrence. By expanding on earlier research, we gain a greater understanding and may piece together insights not as likely with a different line of research.

## DEVELOPING A RESEARCH QUESTION

### AVAILABILITY OF ORGANISMS

- To conduct experimental research on a species, an ecologist must determine the number of organisms they will use in the study.
- Experimental designs that are too large can call for more organisms than can be reasonably acquired and managed. Ecologists must incorporate the availability of usable organisms into their study to produce a workable design that encompasses valid statistical analyses.
- For our experiments, we collected less snails in the wild than we expected. Due to this limitation, we had to adjust our design to work with the snails available and use less snails than originally planned.

### FIELD OBSERVATIONS

- Field observations represent a critical approach to studying an organism's interaction with its environment.
- These observations in the field give the ecologist a sense of their subject that literature and lab experience cannot provide.
- When planning out our experiments, we went to Armand and Horseshen Bayous in Houston to observe applanisnails in nature.
- This field work allowed us to see the possible structures on which the snails naturally lay their eggs. We also observed applanisnails feeding on and hiding in stands of elephant ear plants.

### FACILITY CAPABILITIES

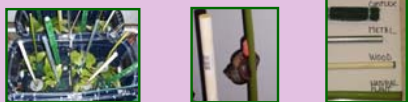
- When planning an experiment, an ecologist must also consider every aspect of the study. This includes the size of the experiment, where it will be conducted, cost, the availability of building materials and any other details specific to the project.
- Many of these project elements depend on the facility, or lab, in which the researcher works.
- In designing our experiment, we used tanks that fit into Dr. Burks's lab, could be locally acquired, and utilized the pumps and water filters available from previous experiments. This process often takes a lot of time.

## PROPOSING A HYPOTHESIS

### SURGE Research Question #1:

What structures do applanisnails prefer to lay on?

**HYPOTHESIS:** When given a selection of available structures, applanisnails will preferentially choose to lay their eggs on plant stalks rather than metal, wood, or AstroTurf.



### SURGE Research Question #2:

What parts of the elephant ear plant do applanisnails prefer to eat?

**HYPOTHESIS:** Applanisnails will choose to eat the leaves rather than the stems of elephant ear plants when they are available.



## NETWORKING

As with everything else, knowing the right people in the right places facilitates the research process. These connections help an ecologist gain access to previously unavailable resources and information. When we traveled to Houston to collect adult snails and egg clutches, Dr. Burks had already worked with the staff at Armand Bayou Nature Center ([www.abnc.org](http://www.abnc.org)). Through this connection, we found out where snails had been sighted, the conditions on the bayou, and borrowed canoes and machetes for free. Without the networking done by Dr. Burks, we would have had a very difficult time working in the field.

## COLLABORATION

In the field of ecology, researchers often collaborate to more thoroughly address an environmental issue. Ecologists use previous research to build upon their own work or work directly with each other on an experiment. Collaboration represents a great way to develop future questions and manage large projects. In our case, we combined our efforts in designing, building, and maintaining the experiments. We collaborated to produce better work than we would have individually. The final product from this summer results from our collective inputs into the projects and both students deserve equal credit. In the future, we will be able to both collaborate as well as develop our own focus.

## IMPROVISATION

As many of our experiments deal with living organisms and aquatic ecologists must often also work with flowing water, the disciplines requires creativity and improvisation. Often designing experiments from scratch, researchers learn to adapt and improvise when problems present themselves. For example, when we traveled to Houston to collect applanisnails in the wild, we intended to bring back around 125 adults for our experiments. We came back with 25! Without panicking, we decided to use adults that we already had in the lab. In addition, each day presented new challenges with our experimental set-up, but we persevered and collected significant data regarding trends in oviposition.

## PUBLICATION

The scientific process ideally ends with a form of dissemination or sharing of scientific information. This poster represents one potential media. However, ecologists also wish to communicate their work to other scientists by submitting papers to peer-reviewed journals. Published papers outline the study while providing background information and the conclusions drawn from the results. The publication process remains highly competitive. Furthermore, the process from submission to actual publication can take months. By continuing a line of lab research, we hope that our oviposition study will eventually be published in an academic journal.