AQUATIC INVADER INVESTIGATOR

On the Trail of a Snail

Name _____ Date _____

INTRODUCTION

You are the Invasion Biology Investigator for the Clear Creek watershed. Your job is to maintain the health of the watershed by protecting it from aquatic invasive species and their impacts. Angie, a local angler, calls you to report a suspicious-looking snail in a nearby stream. "I've never seen anything like it," she says. Unfortunately, Angie lost the specimen. She forgot her camera, so she didn't get a picture. She did remember some important details. You take notes as she describes the snail. "This is a tiny snail. I hooked some vegetation and had to clean off my hook. That's the only reason I noticed the little things. They are smaller than 1 cm, for sure! They're brown and look like specks of dirt from a distance. When I picked up one, it closed itself in the shell with some sort of covering. Their shells are shaped like a cone, and I counted about 5 or 6 whorls."

You agree that this snail is unlike any other snail native to the area and wonder if it is a new invasive species. If it is invasive, you know that you will need to act fast if there is any chance to control it!

PART I: IDENTIFY THE SNAIL

Because the situation is urgent, you decide to try to identify the snail with Angie's verbal description. See page 3 for the list of Hydrobiidae snails you are comparing. After consulting with experts and reviewing some literature, you conclude that the snail belongs to the Hydrobiidae family and was probably introduced by some anglers returning from a fishing trip to Yellowstone National Park. You compile a list of all of the Hydrobiidae snails found in the Yellowstone region and compare their characters to Angie's description.

1 **Which snail is most likely to be the unknown snail?**

2 **What characteristics were most important for identification?**

Hydrobiidae species found in Yellowstone National Park

Compare the description of the mysterious snail you found to these photos to determine the identify of your mystery snail.

(Images from: http://www.esg.montana.edu)

Amnicola 	5 to 6 mm in length, 3 to 4 whorls, bottom whorl twice the width of second whorl.
Potamopyrgus 	This snail has a black or brown, cone-shaped shell. (Maximum size 6 mm, 5 to 6 whorls.)
Taylorconcha 	The single species Taylorconcha serpenticola is listed as threatened. (Maximum size 4 mm, 2 to 3 whorls, creamy yellow color.)
Pyrgulopsis 	Pyrgulopsis are the dominant western springsnails with many species. (Four whorls or fewer, 5 to 6 mm in length; bottom whorl is approximately 30% larger than second whorl.)
Colligyrus 	Maximum size 4 mm, no more than 3 whorls, chestnut brown color.

Create a dichotomous key

Now, create a dichotomous key for the snails pictured in this lesson. A dichotomous key is a method for determining the identity of something by matching a characteristic to a series of possible choices that lead you to the correct name of the item. Dichotomous means "divided in two parts." At each step of the process, the user of the key must compare a characteristic to two possible choices, and each alternative leads to another question pair until the item is identified. It is similar to playing 20 questions. A dichotomous key will have enough questions to identify each member of the group. If your key for the snail is constructed correctly, you should be able to use it to identify any snail in the list above.

As a simple example, you can construct a dichotomous key to identify people (or another group of items) in a classroom, using questions based on gender, hair length/color, glasses (or not), clothing color, etc.

Question 1: Is the person male, or female?

Question 2: Does the person wear glasses, or not?

Question 3: Is the person wearing blue jeans, or not?

etc.

PART II: GET INFORMED

Now that you have confirmed the identification of the mystery snail, your primary concern is what impacts it might have on the stream. To understand its impacts, you need to know more about this organism. Your teacher will share a video and or a powerpoint about the New Zealand mudsnail. As a class, answer the following questions.

1 To what class of organism does the snail belong? _____

_____

2 Did you know that gastropods are the second-most diverse class of organism in the world, with more than 40,000 living species? What is the most-diverse class of organism? _____

_____

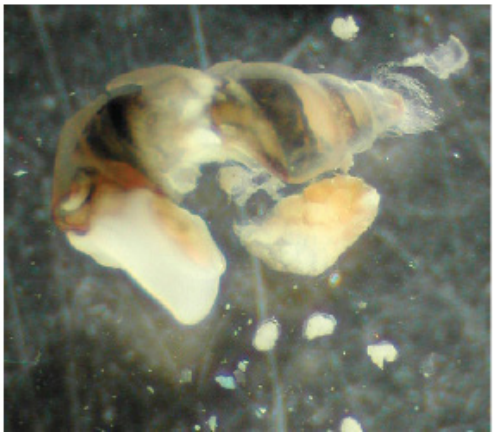
3 To what phylum does the snail belong? _____

4 What other familiar animal is also a gastropod? _____

5 What are the main characteristics of mollusks? _____

6 Does the New Zealand mudsnail undergo protostome or deuterostome development?

_____



New Zealand mudsnails reproduce through parthenogenesis and bear live young. Above: Note the embryos in the bottom whorl of the shell. Right: Embryos released after a snail dissection.

7 The New Zealand mudsnail is a resilient species; it possesses an operculum, a movable cover to the opening of the shell. What purpose does an operculum serve? Is it possible to observe the operculum?

8 Although the New Zealand mudsnail can reproduce sexually, invasive populations tend to consist of self-cloning, live-bearing females that yield 20 to 140 offspring per brood, while brooding up to four times per year. This kind of reproduction is called parthenogenisis. What is the evolutionary advantage of a clonal reproduction strategy? Do you think this type of reproduction contributes to this snail's invasiveness? What is a disadvantage of clonal reproduction?

9 The presence of an operculum allows the New Zealand mudsnail to survive ingestion by a fish. How do you think this fact affects:

- The mudsnails' ability to invade?

- The nutritional value to the fish?

New Zealand mudsnails are as small as a grain of rice, and can easily stow away on hiking boots, horse hoofs, and bicycle tires.

PART III: PREDICT THE RISKS

The New Zealand mudsnail is a new component to the Clear Creek ecosystem. You want to know how the mudsnail may be interacting with or affecting other organisms. Your work crew has collected some of the most common organisms from the stream for you to study.

First Observe

As you study the organisms, note any structures that allow the organism to survive in its environment, for example, structures for getting food, mating, hiding, and defense, and think about the purpose of the structure. Also consider the organism's role in the food web. What is its primary food source? What preys on it? Record your observations in the table on the next page.

On the Trail of the Snail

Organism	Unique Structure or Characteristic	Possible Function	What does it eat?	What eats it?	Family/Order
Algae and periphyton					
Native Snail					
Fly or beetle larvae					
Clam or mussel					
Crayfish					
Fish					
Duck					
Eagle					

OPTIONAL: You can use the answers below to create a simple food web for the species you collected or included in the activity.

Cool fact: Not all gastropods are herbivores. The invasive, veined rapa whelk is carnivorous and preys on other mollusks, such as bivalves (oysters and clams). Most marine predatory snails feed by drilling a hole into their prey, but rapa whelks smother their prey by wrapping around the hinged region of the shell and feeding between the opened valve. They were introduced through ballast water.

Then make a prediction:

Choose one organism listed in your table. How do you think it will interact with the New Zealand mudsnail? (Will it be a prey, predator, competitor, facilitator, or parasite? Will it outcompete or deplete a food source?)

Develop testable hypothesis

Based on this potential interaction, how do you think the mudsnail will impact the organism? What function of the organism will the mudsnail impede or improve? How will the mudsnail affect its population numbers and distribution?¬

Remember, a testable hypothesis will state a predicted relationship, be measurable, and then state a testable consequence and uncertainty of that relationship. For example, a testable hypothesis might be: If New Zealand mudsnails are a poor food source for fish, then fish exposed only to mudsnails will lose weight compared to fish on a diet of native invertebrates.

Design an experiment to test your hypothesis

How would you go about testing this hypothesis? Roughly outline an experiment to test whether the mudsnail has the impact you predicted. Indicate your experimental control and your dependent and independent variables.

Example: Allow one group of fish to eat only mudsnails, and allow another group of fish to eat their normal diet. Make sure that food is the only variable experienced by the fish during the experiment by placing the fish in identical tanks. Weigh the fish before and after the experiment.

- Compare the dependent and independent variables to the control and evaluate the impacts. Fish eating a natural diet may be the control.
- The dependent variable is whatever you measure, for example, the weight of the fish.
- The independent variable is whatever factor you control, for example, the food source.