

ECOS Inquiry Template

1. Contributor's Name: NATHAN GORDON

2. Name of Inquiry: Feeding the Hungry Stoneflies

3. Goals and Objectives:

- a. **Inquiry Questions:** Where are stoneflies? What food source does a hungry stonefly prefer? Why do certain foods taste better to the stonefly? How do stoneflies help the rest of the river? What eats the stoneflies?
- b. **Ecological Theme(s):** Stoneflies are an important link in the food webs of healthy streams and rivers.
- c. **General Goal:** To demonstrate how insects play an important ecological role in aquatic systems.
- d. **Specific Objectives:**

Academic: Students learn that aquatic insects feed on certain materials and how that affects the ecosystem.

Experimental: Students learn to observe the components of an aquatic ecosystem and make predictions about ecological interactions.

Procedural/technical: Students learn how to find aquatic insects and monitor their behavior in a controlled environment.

Social: Students work as teams to monitor the feeding behavior of insects.

Communication: Students can record data from the feeding tests and compare the results from different insects.

e. **Grade Level:** 5

f. **Duration/Time Required:**

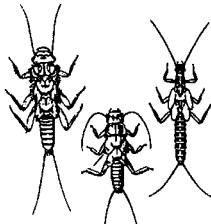
→ **Prep time:** ~2 hours (depending on proximity to stream and insect availability) - Collect stoneflies and potential food sources at the local stream. This could be conducted as a class field trip or by the instructor. However, allowing the students to observe the insect collection and predict potential food sources would be very educational.

→ **Implementing Exercise During Class:** 1 hour - 15 minutes of intro, 30 minutes of insect feeding, 15 minutes to discuss results

→ **Assessment:** 15 minutes of results and discussion about the importance of these insects in the aquatic system

4. Ecological and Science Context:

a. **Background (for Teachers):** Stoneflies belong to the insect order Plecoptera and get their common name from their usual habitat - stones.



Stonefly nymphs (immature) are aquatic insects that need to live in cool, well-oxygenated streams, rivers, and flowing lakes. In fact they are an EPA indicator organism for healthy levels of oxygen in cold water streams. Nymphal stages of development can span 1 to 3 years. Adult stoneflies develop wings, become

Stonefly nymphs.
www.state.ky.us/nrepc/water/stonefly.htm

terrestrial, and only live from 1-4 weeks. Stonefly nymphs are well known to anglers because of their

role as fish food, but they also have to make a living in the stream. What do they eat? Some stoneflies are predators (they like to eat other insects) and some are shredders (they eat leaves, bacteria, algae, and other organic

debris). So a link in the food web is established as stoneflies eat from their surroundings and are, in turn, eaten by fish.

- b. **Background (to present to Students):** Do any students like to go fishing? Do they like to eat fish? What do they think the fish eat? **INSECTS!** So it is very important to have insects in our rivers for the fish to eat. Where do you think the insects live in the river? What do you think the insects eat? Today we are going to find some insects called stoneflies in the river and collect things we think they might want to eat. Then in a few days we'll let the stoneflies decide what they like to eat.

5. Motivation and Incentive for Learning:

- 1) The opportunity to take a field trip to a local river, stream, or lake to find insects should be fun for most students.
- 2) Teams of students will have a "pet" insect for their investigation. This should be fun and give the kids some ownership of the activity.
- 3) Students who like fish should see the importance of these insects to aquatic systems.

6. Vocabulary:

- 1) **Stonefly:** Weak-flying insects, whose nymphs live under stones along the banks of streams. Stoneflies are an important food source for fish and birds, like ducks and geese.
- 2) **Nymph:** The immature life stages of stoneflies. These stages all occur in water.

7. Safety Information:

Be careful around the water. Watch out for swift flows and slick rocks.

8. Materials List (including any handouts or transparency masters):

These numbers are for 5 teams of 4 students, adjust as needed:

1. (1 or 2) Net or screen for collection of insects in the stream
2. (5) Closable tubes or vials for transport of stoneflies in stream water
3. (1) Cooler with ice for the transport of stoneflies
4. (5) Chambers for conducting the feeding study. These should be 5-10 inches in diameter and have raised edges like a Petri dish or Frisbee. They could be square if only 4 food sources are going to be used.
5. (5) Time pieces that measure seconds (or one that every team can see during the feeding)
6. (5) Data sheets for mapping the pattern of the feeding stonefly, the time spent at each food source, and answering the pre-collection and post-feeding questions.
7. (5) Rulers for measuring the insects

9. Methods/Procedure for students:

a. **Pre-investigation work:**

- 1) Field-trip permission must be obtained.
- 2) Transportation must be arranged for students and accompanying adults.
- 3) The class can be divided into work teams that will each assess an insect.
- 4) The pre-collection questions on the data sheet should be discussed and answered among teams (or as a class) prior to the field trip or at the field site (or both).

b. Investigation work:

The collection of insects from the water can be done in a stream by kicking up rocks and silt from the stream bed and catching insects that float downstream in the screen or net. It may or may not be possible for students to participate in this for safety reasons, but if not they could always overturn rocks and look for insects on the rock's underside while the teachers attempt the kick net process.

Insects should be kept in stream water for 24 hours before feeding. Equal amounts of the collected food sources should be placed around the perimeter inside the feeding chamber. Food sources should be equidistant from one another. Potential food sources can be discussed in class or at the stream. Try to include at least stream leaf material, rocks from the stream and wood from the stream.

Release the insect into the center of the plate (randomly) and start recording the time and travel path. Be sure to record how much time the insect eats at each food source and draw its travel path on the data sheet.

1) What evidence (data, samples) do students collect?

Insect size (length, width), potential food sources for the insect, time the insect spends feeding at each food source

2) How do students present the evidence (data)? Record data on individual team data sheets, the teacher can have the students enter their data on a master grid on the chalkboard for all to see. Then a simple bar graph could be constructed to display the "favorite" food source.

3) What conclusions are drawn from the evidence students collect?

Stoneflies may eat a variety of things; stoneflies may heavily prefer one food source over another; variation in size of insect may affect food selection; students get to appreciate the importance of insects and all of their food sources to the aquatic habitat

4) Include examples of data sheets.

10. Assessment: Working through the discussion questions on the data sheet will help students grasp the larger ecological significance of these insects.

11. Extension Ideas:



Crane Fly. FCIT ©2003
<http://etc.usf.edu/clipart>

1) If stoneflies are not available or cannot be found, crane fly larvae could be substituted in this lesson. As larvae in the streams they hang out in areas that are slow and have lots of leaf litter. They are very good at breaking down leaves and are healthier when they are given leaf litter that has bacterial slime on it. So a really fun and easy experiment is to feed the crane fly some sterilized leaves (oven-baked) and some natural leaves. The students can measure the insects, observe feeding behavior, and compare the two food sources. Also, some of the insects will become adults in the lab, which is a nice way to show the insect life cycle. They are so big that it is really easy to see what is going on!

2) This exercise could also be done using a variety of insects (i.e. - stoneflies, mayflies, crane flies) from the stream and contrasting their sizes and eating habits.

12. Scalability:

This inquiry can be scaled to any grade level. Higher grade levels could incorporate more food types (i.e. - grow different bacteria and see which ones the insects prefer), more types of insects, or a longer duration experiment. The major concepts to be learned can be scaled from basic (identifying aquatic insect habitats) to complex (molecular structure of preferred food sources).

13. Science Standards Accomplished:

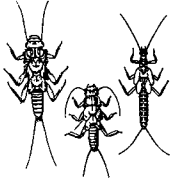
- 1) Life Sciences Standard (Characteristics of Organisms)
-Basic needs and behavior of individuals**
- 2) Life Sciences Standard (Organisms and Environments)
-Behavior related to resource availability and quality**

14. References:

- 1) EPA website with great info about stonefly ecology:
<http://www.epa.gov/bioindicators/html/stoneflies.html>**
- 2) Entomological Society of America presentation describes food web links between bacteria, stoneflies, and fish:
http://esa.confex.com/esa/2005/techprogram/paper_22796.htm**
- 4) The Electronic Naturalist is a great web resource for crane fly info
<http://www.enaturalist.org/unit/147/en/qr>**

15. List of Experts and Consultants:

16. Evaluation/Reflection by Fellows and Teachers of how it went:



FEEDING THE HUNGRY STONEFLIES

DATA SHEET

Pre-Collection Questions:

- 1) Where do you think the stoneflies live in the river? _____
- 2) What eats the stoneflies? _____
- 3) What do you think the stoneflies eat? List 4 possible foods for the stonefly.
 - a) _____
 - b) _____
 - c) _____
 - d) _____
- 4) Which food do you think the stonefly will eat the most? _____ Why? _____

Feeding Study Data:

- 1) Draw the path that the insect follows on the plate. Use the diagram on the back of this paper.
- 2) Record how much time the insect spends eating at each food source

Post-Feeding Questions:

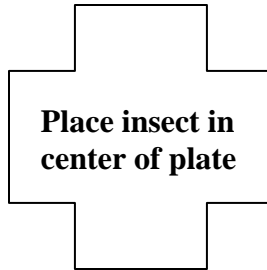
- 1) What food source did your insect spend the most time eating? _____
- 2) Did other teams have the same result? _____
- 3) If not, was there something unique about your insect? _____
- 4) Why do you think your insect chose that food? _____
- 5) Is there a lot of that food source in the river for the stoneflies? _____

Times:

Food 1

Times:

Food 2



Times:

Food 3

Times:

Food 4

Kick Net

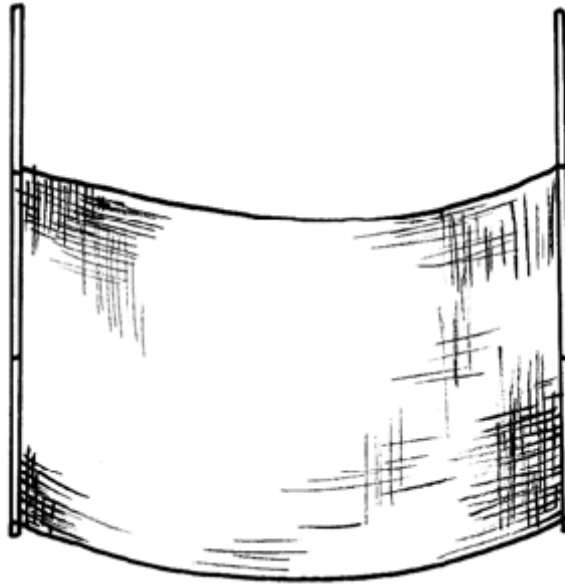
Kick nets, which consist of screening material stretched between two poles, are used for sampling macroinvertebrates. Sampling is done by pushing the two poles into the substrate until the edge of the screen rests on the bottom. Organisms are dislodged by disrupting the substrate on the upstream side of the stream, allowing them to be carried by the current into the screen.

Materials

- two 3 ft x 1.5 in sections of wooden dowel
- one 3 ft x 2 ft section of metal window screen
- duct tape
- staple gun

Directions

1. stretch window screen length-wise between dowels
2. attach window screen to dowels with staples and duct tape (wrap as much screen around dowel as possible to properly secure it)



tape (wrap as much screen around

Illustration: Holly Broome-Hyer

Taken from Utah State University © 2001-2004

<http://extension.usu.edu/sites/wq/PDF's/Making%20equipment.pdf>