The Food Web Productivity at Rock Creek

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Abstract: The objective of this lab is to find out the food web productivity of Rock Creek. This includes which of the feeding levels contribute most to the energy. However, the constant rain has caused this year's data to be inaccurate. For this reason, we decided to use the results from a previous year. Using previously recorded data, we categorized the insects into the four functional feeding groups: scrapers, collectors, predators, and shredders. We then sorted them again into categories of mayflies, caddisflies, stoneflies, mide, and other. By collecting insects from each feeding level, it was determined that energy gradually decreases with each higher feeding level.

Introduction: The experiment that was undertaken was an investigation into the productivity, or energy, of Rock Creek and how it is transferred throughout the food web. The objectives of the experiment were to use the data collected to produce precise estimates and to apply these calculations to the food web. This experiment is important because it is needed to gain a thorough understanding of Rock Creek so that studies, conservation efforts, economic endeavors, and other actions related to the stream can be improved. Theoretically, the results of the experiment should show a high energy level in Rock Creek and a gradual decline in energy with each increasing level of the food web. All data was collected at Rock Creek. (Soliveres et. al.).

Stream Energy: The stream energy is found by using the sum of total calories multiplied by the Rock Creek stream area multiplied by .0012 to find the total calories represented by insects.

Food Web: A network of feeding relationships by which energy and nutrients are passed on from one species of living organisms to another.

Functional Feeding Group: A classification approach that is based on behavioral mechanisms of food acquisition rather than taxonomic group

Shredders: Eat the vegetation that falls into the stream

Collectors: Scavenge for dead organisms, detritus, and other food particles

Scrapers: Consume algae and associated materials

Predators: Feed on other consumers

Theory: Higher feeding levels always have less insects (and therefore less energy) than lower feeding levels due to the necessity of having more food than consumers. If one population feeds on another population, then the population being eaten must be larger so that the consumers have an abundance of organisms to eat.

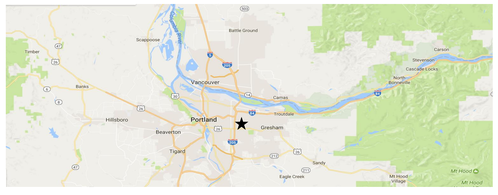

Figure 1: A regional map of our study location at Rock Creek compared to the Portland metropolitan region

Methods

- Experimental set-up: The materials used for this experiment were one bucket, one sealed container, a few milliliters of ethanol, and tools for extracting insects from the water.

•Location: Rock Creek, Clackamas, Oregon.

•Experimental design:

1) A sample of the stream water was extracted using a bucket.
2) The water was poured into the sealed container.
3) A few milliliters of ethanol were poured into the container to kill the insects in the water.
4) Samples of the stream water were examined. Students extracted all insects from the water and added them up to produce a total number of insects and the number of insects in each feeding level.

- Statistical analysis: By sorting the insects we extracted into feeding levels, we found that the number of insects in each feeding level decreases in the feeding levels higher in the food web. In other words, energy decreases in higher feeding levels.
- Formulas:
- Model assumptions: -Stream energy and energy in each feeding level is consistent throughout the year and the entire length of the stream.
- All insects have the same number of calories.
- Data analysis: -There are less insects in higher feeding levels than higher feeding levels.
- Energy decreases in higher feeding levels, which is a result that supports our theory.

Results

-Using previously recorded data from years 2010 to 2017, we have found that shredders have the highest caloric values.
-Our hypothesis was proven to be correct after analysing our data. The amount of calories in each insect.
-Some limitations we had were the assumptions that last year's data applies to this year and that it is accurate. Another limitation was the weather of each season that previous students collected data from because we had to assume that the environmental conditions were the same throughout the years.

Figure 2: An aerial view of a shallow area of Rock Creek

Energy Levels of Rock Creek's Feeding Groups

Functional Feeding Groups	Scientific Name	Order (fly)	Cal	Mean Number	Total Cal	Total Cal Represented by Insects in a Snickers Bar
Predators	Rhyacophilidae Perlidae Perlodidae Chloroperlidae	Caddis Stone Stone Stone	1.30 4.90 4.90 4.90	7.00 7.20 3.80 5.80	9.10 35.0 19.0 28.0	20
Collectors	Baetidae Leptophlebiidae Ephemerillidae Ameletidae Hydropsychidae	May May May May Caddis	0.0807 0.0807 0.0807 0.0807 1.30	490 48.0 4.20 0.83 14.0	40.0 3.90 0.34 0.07 18.0	25
Scrapers	Heptagenidae Limnephilidae	May Caddis	0.0807 1.30	20.0 4.30	1.60 5.60	10
Shredders	Lepistomatidae Brachycnetridae Nemouridae Leuctridae Tipulidae	Caddis Caddis Stone Stone Crane	1.30 1.30 4.90 4.90 12.0	0.33 0 15.0 18 2.90	0.43 0 74.0 87.0 35.0	25

Figure 3: A chart that describes the four functional feeding groups of predators, collectors, scrapers, and shredders into different types of insects, their order, calories, their average, their total calories and their energy (Energetic/caloric content for each fly order was found from a study from the University of Colorado, Boulder: "Quantifying Feeding Ecology of Macroinvertebrates in Boulder Creek, Colorado, USA: How Does Altitude Influence Food Availability?")

Discussion

- The purpose of this experiment was to accumulate information about the total energy of Rock Creek and how that applies to the various levels of the food web, which we accomplished.
- Our hypothesis was proven to be correct, because shredders-the lowest feeding level-were found to have the highest energy.
- Overall, we proved that energy really does decrease as one looks higher on the food chain; shredders had the most energy, while the consumer levels had less.
- These finding are important because they provide insight on the topic of food webs in stream ecosystems like Rock Creek. Knowing these stream functions can lead to improvements in conservation efforts regarding the stream.
- Our results line up with the results found by other groups in the class; all groups found that energy decreases in higher feeding levels.
- Some assumptions of the experiment are that stream energy is constant throughout the year and throughout the entire length of the stream, and that each insect has the same number of calories. Some limitations of the experiment are that we do not know if the section of the stream that was studied is an accurate representation of the entire stream.
- Citations: Soliveres, Santiago, van der Plas, Fons, Manning Peter, Schmit, Barbara, and Allan, Eric. "Biodiversity at Multiple Trophic Levels is Needed For Ecosystem Multifunctionality." *Nature.com*. 17 August 2016. Web. 20 April 2017.

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