

DATA *Nugget*

All washed up? The effect of floods on cutthroat trout

Featured scientists: Ivan Arismendi and Stan Gregory from Oregon State University

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Research Background:

Streams are tough places to live. Fish living in streams have to survive droughts, floods, debris flows, falling trees, and cold and warm temperatures. In Oregon, cutthroat trout make streams their home. Cutthroat trout are sensitive to disturbances in the stream, such as pollution and sediment. This means that when trout are present it is a good sign that the stream is healthy.



Mack Creek, a healthy stream located within the old growth forests in Oregon. It has a diversity of habitats because of various rocks and logs. This creates diverse habitats for juvenile and adult trout.

Floods are very common disturbances in streams. During floods, water in the stream flows very fast. This extra movement picks up sediment from the bottom of the stream and suspends it in the water. When sediment is floating in the water, it makes it harder for fish to see and breathe, limiting how much food they can find. Floods may also affect fish reproduction. If floods happen right after fish breed and eggs hatch, young fish that cannot swim strongly may not survive. Although floods can be dangerous for fish, they are also very important for creating new habitat. Floods expand the stream, making it wider and providing more space. Large boulders, smaller rocks, and wood also move into the stream from the powerful behind the moving water. These natural items add to the different types of habitat available.

Ivan and Stan are two scientists who are interested in whether floods have a large impact on the survival of young cutthroat trout. They were worried because cutthroat trout reproduce during the spring, towards the end of the winter flood season. During this time **juvenile trout**, less than one year old, are not good swimmers. The fast water from floods makes it harder for them to survive. After a year, trout becomes mature **adults**. These two age groups live in different habitats. Adult trout live in pools near the

center of streams. Juvenile trout prefer habitat at the edges of streams that have things like rocks and logs where they can hide. Also, water at the edges moves more slowly, which is important for survival of juvenile trout. The edge habitat is good for juvenile trout because it brings them food and does not take too much energy for swimming. In addition, they can avoid getting eaten by the adults in stream pools.

Ivan and Stan work at the H.J. Andrews Long Term Ecological Research site and wanted to know what happens to cutthroat trout after winter floods. They have been collecting data on Mack Creek, one of the streams within their site, since 1987! Major floods occur every 35-50 years. Since flooding can make life difficult for trout, scientists expected trout populations to decrease after major flooding events.

Fortunately, Ivan and Stan had the data they needed because of the long-term data collection that continues to take place in Mack Creek. To study how floods affect trout populations, Ivan and Stan compared population sizes of trout for many years. They decided to look at the population size of both juvenile and adult trout. They compared the **trout population data**, measured as the number of trout, with **stream discharge**, or a measure of how fast water is flowing in the stream. Stream discharge is higher after flooding events. Stream discharge data for Mack Creek is collected during the winter when floods are most likely to occur. Fish population size is measured during the following summer each year.

Scientific Question: What is the effect of major flooding events on adult and juvenile trout populations in Mack Creek?



A cutthroat trout. It is momentarily unhappy, because it is not in its natural, cold Pacific Northwest stream habitat.



Scientists Ivan and Stan preparing to catch cutthroat trout in the stream.

Scientific Data:

Use the data below to answer the scientific question:

Year	Number of juvenile trout	Number of adult trout	Stream discharge (L/s)*
1987	26	53	2373.2
1988	18	35	3920.0
1989	18	35	3832.5
1990	22	59	6685.4
1991	44	47	3894.1
1992	33	53	3940.7
1993	44	58	4324.4
1994	31	67	2864.5
1995	38	52	4767.5
1996	81	52	9793.2
1997	81	60	7200.0
1998	73	80	5240.1
1999	41	61	5942.3
2000	43	56	9557.2
2001	26	70	1525.6
2002	36	48	5858.4
2003	66	42	4784.8
2004	44	55	4517.9
2005	30	68	4704.4
2006	48	64	6950.7
2007	68	58	6943.7
2008	37	80	4226.7
2009	83	70	6398.7

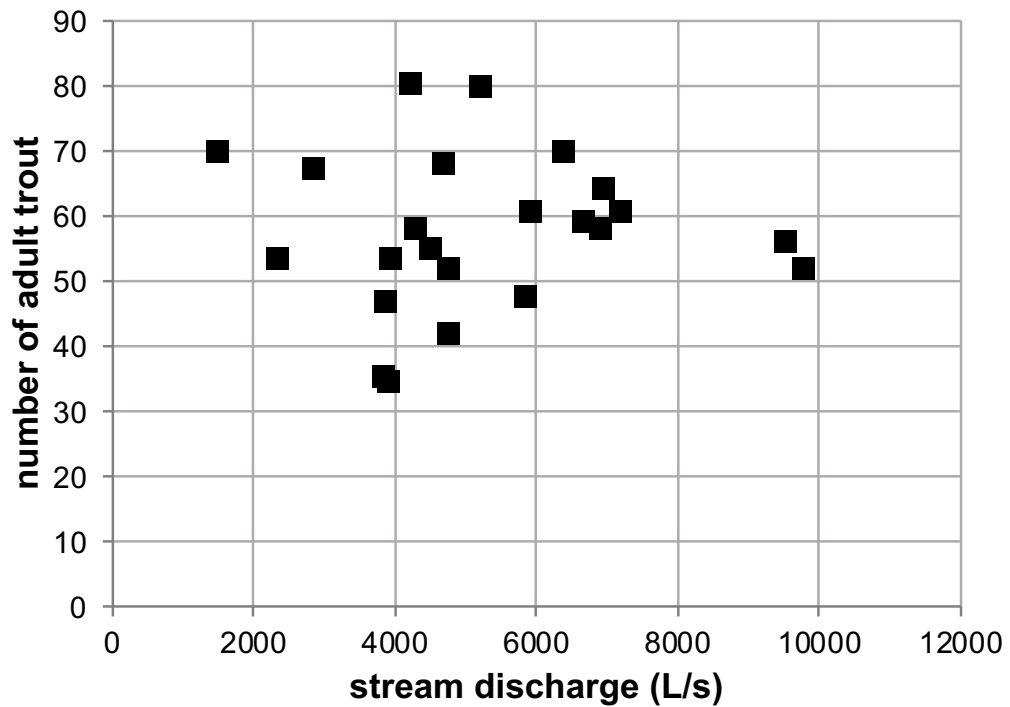
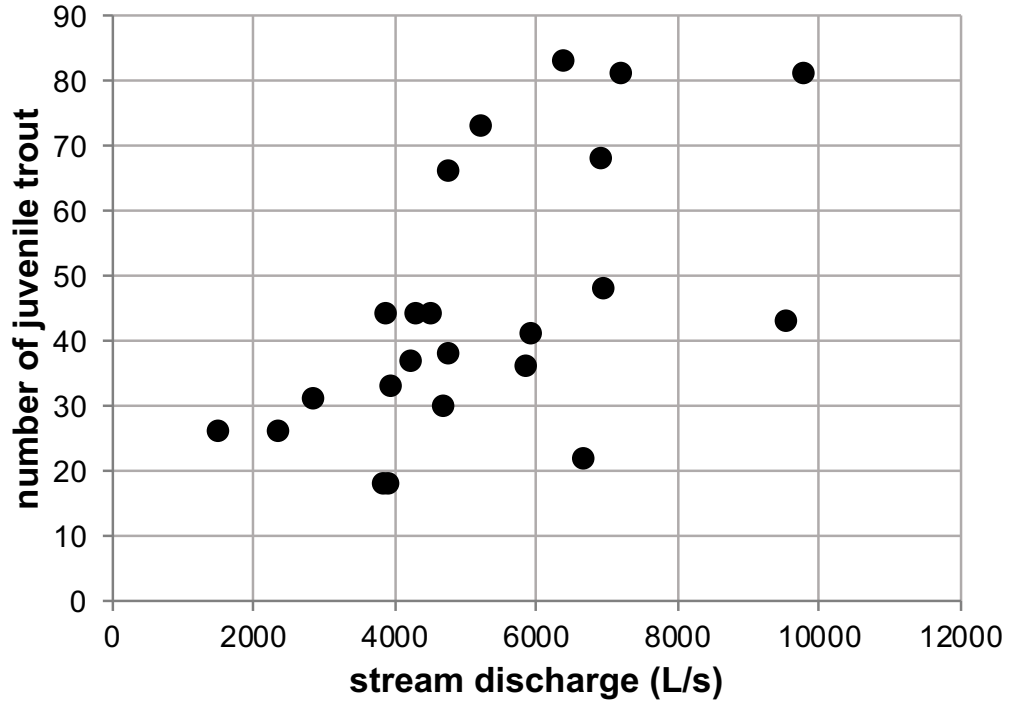
**The scientists measured stream discharge in liters per second (L/s). You can think about discharge as the number of cubes (one foot on each side) filled with water that pass by a point every second. A higher value means that more water is moving in the stream. This measurement is taken in the winter each year when discharge is at its maximum.*

What data will you graph to answer the question?

Independent variable(s): _____

Dependent variable(s): _____

Below are graphs of the data: Identify any changes, trends, or differences you see in your graphs. Draw arrows pointing out what you see, and write one sentence describing what you see next to each arrow.



Name _____

Interpret the data:

Make a claim that answers the scientific question.

What evidence was used to write your claim? Reference specific parts of the table or graphs.

Explain your reasoning and why the evidence supports your claim. Connect the data back to what you learned about the effects of flood disturbances on stream habitats.

Your next steps as a scientist:

Science is an ongoing process. What new question do you think should be investigated?

Name _____

What future data should be collected to answer your question?

Independent variable(s): _____

Dependent variable(s): _____

For each variable, explain why you included it and how it could be measured.

What hypothesis are you testing in your experiment? A hypothesis is a proposed explanation for an observation, which can then be tested with experimentation or other types of studies.