RIVER MORPHOLOGY AND FRESHWATER SALMON HABITAT

MEASURING STREAM VELOCITY - TEACHER KEY

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MEASURING STREAM VELOCITY: PART 1

Given the importance of salmon to the ecosystems and peoples in the North Pacific, there are many scientists and researchers studying the relationships between salmon and their environments to better understand how suitable habitat is and what may be affecting their health and survival. Based on what you learned from Kyla and Maria, pretend you are a Salmon Scientist and make predictions for the following questions.

Here are five questions. For each one, develop a hypothesis or a prediction of what you think the answer is. Bonus points if you can suggest a test that would help you figure out the answer. For example:

Research question example: *How will changes in the width affect velocity on the same stream?*

Prediction: *On the same stream, an area that is narrower will have a higher velocity than the wider area of that stream. This is because the volume of water in the stream has not changed, so the water moves faster and with more force to get through the narrower channel.*

Test: *Set up two race courses - one to measure velocity at the narrow stretch of stream, and one to measure velocity at the wider area of the stream. Compare the time it takes for a floating rubber ducky to travel the same distance in both areas.*

Think-Pair-Share!

Think about your answer individually, then pair up to see what others thought of, and share your ideas with the class.

Research question 1:	Prediction:
What will happen if we only measure stream velocity from the thalweg?	Measuring only from the thalweg will tell us the maximum current velocity of that area of the stream. If we want to find out the average velocity of the stream, then we have to measure from different starting points across the stream. Test:
Research question 2:	**Prediction:**
How can we get an accurate estimation of the average velocity of the stream?	Divide the width of the stream into 4 or 6 sections (depending on how wide it is), and measure velocity at each section. Add up all the measured velocities and divide by the number of measurements to get the average velocity. Test:
Research question 3:	**Prediction:**
How will climate change impact stream velocity over time?	Climate change will likely make the seasonal trends in stream velocity more pronounced over time. Increased rainfall and storm intensity during the winter months will mean more water entering the streams, causing the flow to be faster during that season. With increased warming, precipitation is predicted to fall more as rain than snow, again contributing to higher winter flows. That reduced snowpack over the winter will mean that there is less snow melting in the spring, so spring freshets will lessen, reducing average stream velocities during this season over time. With rising temperatures during the summer months, and an increase in the duration of droughts, the low flows will persist for longer. Test:

Research question 4:	Prediction:
What are some reasons why stream velocity might change over the course of one day or a week?	• rainfall • LWD or other debris forming a blockage • a blockage of LWD or other debris being dis-lodged • snowpack melting (spring time) Test:
Research question 5: Revisit the stream width exercise – what do you think you would see if you measured the wetted width every six hours and graphed it with stream velocity?	**Prediction:** If you measured the wetted width, it should follow the same trend as the changes in stream velocity. With increased flow, the level of the water will rise, which will increase the wetted width. **Test:**

MEASURING STREAM VELOCITY: PART 2

The **velocity** of, or the speed at which, water moves in a creek, stream or river has a huge impact on the habitat. Flowing water delivers oxygen below the surface, and helps to keep Pacific salmon eggs in the spawning gravels oxygenated. Pacific salmon prefer streams where the water is moving, but not too fast! The faster water moves, the more force it may have to carry particles with it. This means that fast-flowing rivers may be more turbid than slower-moving waters. Fast-moving water can also carry debris like branches, leaves, and LWD - all of which can alter the habitat by creating blockages, adding nutrients or providing cover.

Velocity is rarely uniform across a channel - the area with the fastest flow is called the **thalweg,** and it will also be the deepest part of the channel. Maria and Kyla measured velocity in metres per second (m/s) at a few points across the channel each hour so they could get a more accurate sense of the waterway's velocity. Below is a table of the values that they calculated. It shows the average stream velocity for every hour for an entire day – starting at 6 am through 5 am the next day. Plot the values they collected into a graph to see how the stream velocity changed throughout the day! Plot in 0.05 increments. Provide a title for the graph and label the x and y axis.

Time	Velocity (m/s)
6:00 am	0.14
7:00 am	0.13
8:00 am	0.14
9:00 am	0.20
10:00 am	0.22
11:00 am	0.22
12:00 pm	0.23
1:00 pm	0.22
2:00 pm	0.18
3:00 pm	0.16
4:00 pm	0.14
5:00 pm	0.14

Time	Velocity (m/s)
6:00 pm	0.14
7:00 pm	0.16
8:00 pm	0.16
9:00 pm	0.16
10:00 pm	0.16
11:00 pm	0.20
12:00 am	0.20
1:00 am	0.22
2:00 am	0.24
3:00 am	0.27
4:00 am	0.26
5:00 am	0.24

What graphs will look like, whether drawn or created in excel:

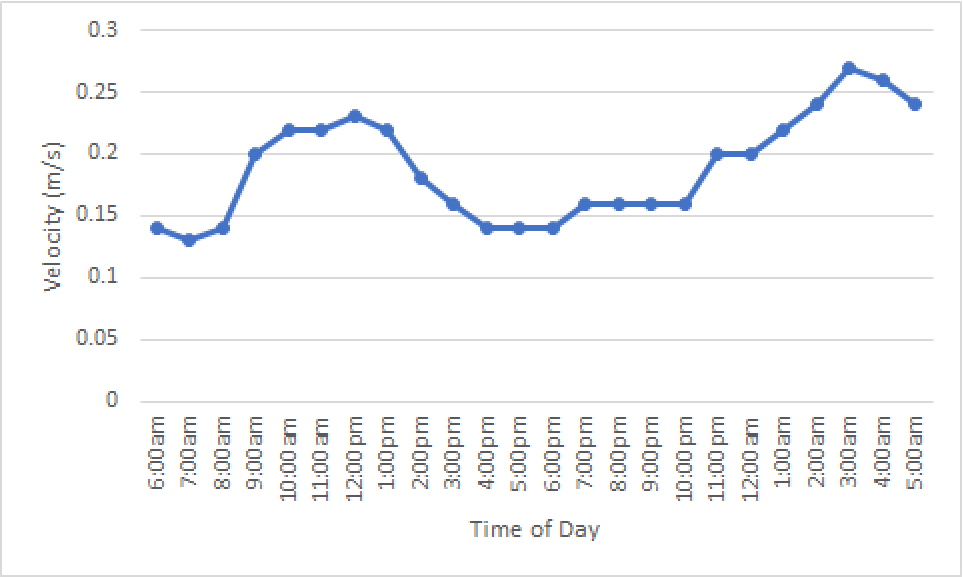

Figure 1 - Stream velocity dataset across a 24-hour period, collected by Pacific Salmon Foundation.

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