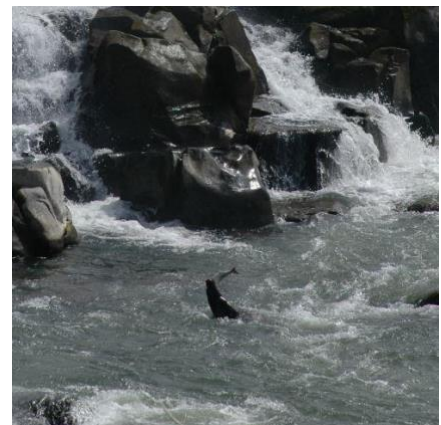# Sea Lion Data Analysis - Student Worksheet

Sea Lion Feeding Frenzy

Background: Pinnipeds (seals, sea lions, and walruses) are important members of marine ecosystems around the world. Their populations dwindled before being protected under the Marine Mammal Protection Act of 1972. Despite their importance, there are considerable knowledge gaps regarding the health impacts of coastal contaminants in pinnipeds at both individual and population levels. Researchers are mostly limited to studying stranded animals that are often sick. Some sea lions in the Pacific Northwest, however, have adapted the behavior of traveling far upriver and feeding on fish (including endangered salmon species) congregating near the base of dams. Because of this, the federal government has authorized the euthanization of a certain number of sea lions at the dams. Scientists are able to study these otherwise healthy sea lions to see the impacts of coastal contaminants.

The data in this activity is from the Oregon Department of Fish and Wildlife's annual 2018-2019 pinniped management report for Willamette Falls. Table 1 shows the number and type of fish remains identified from the stomachs and large intestines of 33 euthanized California sea lions below Willamette Falls from 2018-2019. Table 2 shows total blood mercury concentrations in micrograms per liter ($\mu g/L$) measured in blood samples from California sea lions during a pilot study in 2019. Total mercury in the blood was analyzed using atomic absorption spectrometry following the EPA method using a Lumex machine by Dr. Sarah Rothenberg at Oregon State University.

Left: Willamette Falls near Portland, Oregon; right: sea lion eating a salmon at base of Willamette Falls

Directions: Look over the sea lion diet data (Data Analysis Spreadsheet) and use it, coupled with this worksheet, to complete te activity and answer the following questions.

Step 1: Use the data in **Table 1a: Sea Lion Diet Data** to fill in **Table 1b: Converting raw data into percentages**.

1. What percent of each fish species did each sea lion consume? (Hint: Don't include 0% when you are filling in the table as this will complicate the next question.)

Sea Lion ID	% Salmon	% Steelhead	% Shad	% Carp	% Perch	% Pacific Lamprey
FT-8-13						
U-G42						
2-50						
1-37						
FT-8-5						
FT-8-11						
01-07						
FT8-9						
2-51						
FT-8-8-10						
1-82						
1-78						
8-12						
FT-8-10						
C-099						
X-668						

2. Make a stacked column graph to show the percentage of fish in each individual sea lion's diet. Follow these instructions to make one on Google Sheets or Excel.
    a. On the spreadsheet, highlight Table 1b that you just filled in with the percentages.
    b. Click insert then select Chart. Choose a Stacked Column chart.
    c. Copy and paste the graph below.

Step 2: Use the data in **Table 2: Sea lion blood mercury concentration** to complete this next part.

1. Make a bar graph to compare the total mercury concentrations of the individual sea lions. Follow these instructions to make one on Google Sheets or Excel.
    a. On the spreadsheet, highlight Table 2.
    b. Click insert then select Chart. Choose Column or Bar chart.
    c. Copy and paste the graph below.

2. Looking at the data, what sea lion has the highest total blood mercury concentration?

3. Why do you think this sea lion has higher levels of mercury compared to the other sea lions? (Hint: can you make any connections between the diet data in Table 1a and mercury concentrations?)

Step 3: Making connections

Look at the table below of average mercury concentrations in fish species. Why might some species of fish have higher levels of mercury than others?

Fish Species	Salmon	Steelhead	Shad	Carp	Perch	Lamprey
Average Mercury Concentrations	0.022	0.035	0.038	0.11	0.150	0.400