

# How are Sea Lions Affected by the Mercury Levels in Salmon?

H. Valdivia, K. Tricou, S. Garrison

Stevens High School, Science Department, Claremont, N.H.

## Introduction

Our group wanted to know how sea lions are affected by the amount of mercury in salmon. The question was, "How are sea lions affected by the mercury levels in salmon?" We chose this topic because it interested us to know how much mercury accumulates in larger animals, such as sea lions, and how it affects them. The consumption of salmon has led us to believe that the sea lions have large amounts of mercury in them due to bioaccumulation. The following research will show how the consumption of salmon has increased the levels of mercury in sea lions. This is important because sea lions are larger mammals that eat fish. Some people eat a lot of fish too, and their mercury amounts can be similar to those of the sea lions.

If salmon carry mercury, then sea lions will have high concentrations of mercury because of bioaccumulation. In the article "Metal Tissue Levels on Steller sea lion pups," scientists found high levels of mercury in 159 samples out of the 162 they collected, that's approximately 98.1%. The sea lions consume salmon, and the salmon have mercury in them. In the article "Salmon as Transport Vectors for Mercury," we can see the movement of mercury by sockeye salmon. Adult salmon have newborns that carry methylmercury. 12% of methylmercury brought to the spawning grounds by the adults is brought back to the ocean by progeny, called smolts. The mercury transported is a concern due to fishing. When the salmon are being fished, different levels of mercury that are being transported turn to a decreasing level. We wanted to get more information about the fish in the body of water at Saint Gaudens, so we called the New Hampshire Fish and Game. They said that young salmon live there, but as they grow older and larger, they migrate into big water bodies and the ocean. The water that runs through Saint Gaudens is used more as a spawning ground for the salmon. There used to be a lot of salmon in the water body, but in recent years, less fish have been found there due to migration to new places.



## Methods and Materials

We went to Saint Gaudens to collect samples of dragonfly larvae. The samples were sent to Dartmouth to be analyzed in the Chen Lab. Once at Saint Gaudens, we hiked down the trail to the top of the dam. Once at the top, some of our class put on waders and grabbed D-nets to collect samples. Scott measured the samples collected and wrote it on the identification card. The rest of the class used packets of information on the characteristics of certain macroinvertebrates to further identify the specimen, or they put on gloves to be the "clean hands" people and put the macroinvertebrates into Ziploc bags without contaminating the sample. When they had the gloves on, they could not touch anything other than the bags and the spoon. The "dirty hands" people could collect the samples and touch anything except the sample. Once the samples were sent to the Chen Lab at Dartmouth College, the samples were analyzed with a spectrometer so that the scientists could measure the amount of mercury. We collected macroinvertebrates, but there were also fish and other organisms in the water.



The picture below is a map of Saint Gaudens. The Connecticut River shown in this map leads to a small body of water that runs through Saint Gaudens called the "Blow Me Down Brook."



## Results

Figure 1

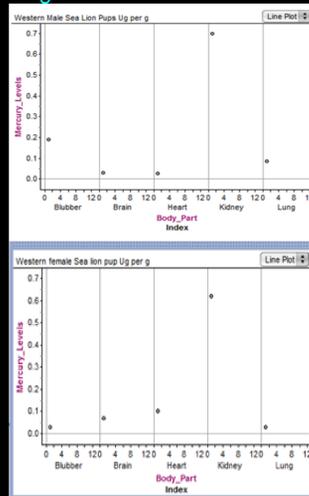


Figure 2

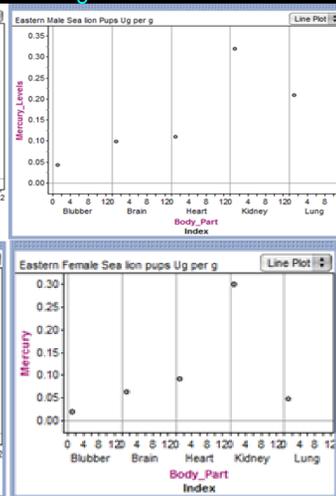


Figure 3

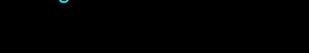


Figure 4

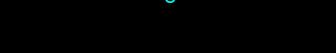
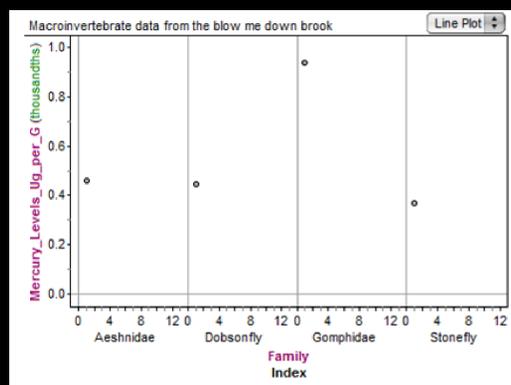


Figure 1 and 2 show the levels of mercury in male Sea lion pups.  
Figure 3 and 4 show the levels of mercury in female Sea lions pups.

Using our data, we found that sea lions have high concentrations of mercury. All of the pups analyzed were dead.



The Figure Above shows the average mercury levels of macroinvertebrates collected in the Blow Me Down Brook.

## Conclusions and Discussion

Using the data we collected, we found out that sea lions have high concentrations of mercury within them. Our graphs show various concentration levels within the various organs of sea lion pups from the age of 0 months- 1.5 years. All of the samples were from dead pups. This supports our hypothesis because we predicted that sea lions would have high concentrations of mercury. These are just pups and they already have high concentrations, so the older sea lions can only have higher levels.

We collected macroinvertebrates at Saint Gaudens, but there's also fish in that water. The fish, such as salmon, eat the macroinvertebrates or plants in the water. The mercury that these macroinvertebrates or plants have in them is transferred to the fish as the fish eats these organisms. Due to bioaccumulation, this mercury builds up within the fish. As you go through each trophic level of a food chain, mercury accumulates. Once the trophic level goes to the larger predatory mammals, like sea lions, the amount of mercury is very high.

### Investigate further

- 1.) Does temperature play a role in mercury concentration?
- 2.) How do the mercury levels in natural habitat and zoos compare?
- 3.) Do mercury levels drastically differ between the different breeds of sea lion?
- 4.) How much of this data is by chance, and how much is actually very accurate?
- 5.) How does location play a role in the levels of mercury?



## Literature Cited

- Baker, Matthew R., Daniel E. Schindler, Gordon W. Holtgrieve, and Vincent L. St. Louis. "Bioaccumulation and Transport of Contaminants: Migrating Sockeye Salmon As Vectors of Mercury." *Environmental Science & Technology* 43.23 (2009): 8840-846. Print.
- Driscoll, C.T., D. Evers, K.F. Lambert, N. Kamman, T. Holsen, Y.-J. Han, C. Chen, W. Goodale, T. Butler, T. Clair, and R. Munson. *Mercury Matters: Linking Research Science with Public Policy in the Northeastern United States*. Hubbard Brook Research Foundation, 2007. Science Links Publication. Vol. 1, no. 3.
- Holmes, Arnie L. "Metal Tissue in Steller Sea Lion Pups." *Journal*. N.p., 2008. Web. 7 Dec. 2013
- Nelson, S.J., 2009. Mercury in snow at Acadia National Park reveals watershed dynamics. *Park Science*, 26(1):35-38.
- Popowicz, T.E. and S.W. Herring. Load transmission in the nasofrontal suture of the pig, *Sus scrofa*. *J. Biomech.* 40(4): 837-44, 2007.
- Purrington, C.B. Designing conference posters. Retrieved <today's date>, 2013, from <http://colinpurrington.com/tips/academic/posterdesign/>.
- Schmidt, Charles. "Salmon as Transport Vectors for Mercury." *Environmental Science & Technology* 44.1 (2010): 11. Print.

## Acknowledgments

We thank Schoodic Education and Research Center Institute, University of Maine Mitchell Center, The National Park Service, Saint Gaudens Historical Site, The Wellborn Ecology Fund, National Science Foundation, Dartmouth GK-12 Program, and The Chen Lab at Dartmouth.

