DELTA SCIENCE FELLOW 2016

Delta Stewardship Council
Delta Science Program

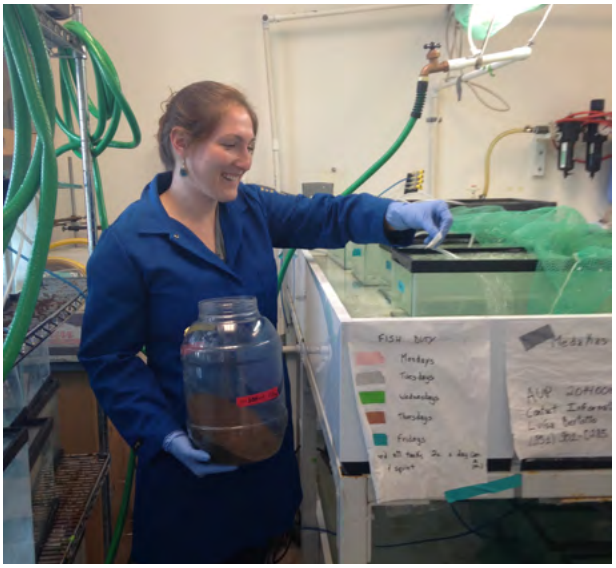
Sea Grant California

Marissa Giroux
Doctoral Student
University of California, Riverside

WHY THIS RESEARCH MATTERS

Chinook salmon and steelhead trout go through a series of physiological changes known as smoltification to be able to live and mature in saltwater. However, with salinities and temperatures increasing in historically freshwater areas, these fish, which are already endangered in the Bay-Delta, may be facing new stressors. Pesticide runoff into the Delta is common due to the urbanization and agriculture of many regions and can adversely affect fish. Additionally, previous research has shown that salinity exposure increases the toxicity of contaminants in anadromous fish, and it is had been demonstrated that bifenthrin, a common insecticide in the Delta, can have endocrine disrupting effects on juvenile salmonids.

The effects of premature hypersaline acclimation due to climate change on pyrethroid toxicity in salmonids



LEFT: Giroux feeds juvenile Chinook during exposure to a combination of stressors. *Danny Luu* / BELOW: Giroux studied the development of juvenile chinook (shown) and steelhead trout, two endangered species that live and breed in the estuaries of the San Francisco Delta. *NOAA*

PROJECT

In this project, Giroux examined the impacts of hypersaline conditions, various temperatures, and exposure to bifenthrin on the development of juvenile Chinook salmon and steelhead trout. She tested the impacts of premature hypersaline acclimation and temperature on the survival and smoltification process on several species of juvenile salmonids; examined the combined effects of premature acclimation to saltwater, temperature, and bifenthrin exposure; and predicted population-level effects of drought and pesticide runoff on the health of endangered salmonid species.

RESULTS

Results of the project show that chemical and climate-change related stressors have sublethal but measurable impacts on hormone levels and behavior at several life stages for juvenile salmonids. Hormone levels influence growth, development, and other physiological processes, therefore providing insight into sublethal effects that could be significant for endangered salmon populations.

The study also found that combined stressors of temperature, hypersalinity, and bifenthrin specifically affected growth hormones that are vital in the smoltification process.

RESULTS (continued)

Although multiple stressors did not cause direct mortality on some stages of juvenile salmonids, the effects on endocrine and reproductive pathways could have population-level impacts.

MANAGEMENT APPLICATIONS

This research will provide information to California Department of Pesticide Regulation for potential pesticide management in the Delta, as well as to the California Department of Fish and Wildlife for conservation practices of endangered juvenile salmonids in the Delta.

This research can also help fisheries management predict the effects of climate change on susceptible salmonid populations in combination with chemical stressors. The results can be used directly in assessing the risk of climate change and pesticide exposure in salmonid populations for regulatory purposes.

Giroux performed behavioral assays in the Y-maze test on juvenile Chinook salmon exposed to bifenthrin and increasing temperatures.

PRESENTATIONS

Giroux M, Luu D, Schlenk D. 2018. Effects of Temperature and Bifenthrin on the Neuroendocrinology of Juvenile Chinook Salmon (*Oncorhynchus tshawystscha*). Platform presentation at the *2018 Ocean Sciences Meeting*, Portland, OR. February 2018.

Giroux M, Luu D, Schlenk D. 2017. Effects of Temperature and Bifenthrin on the Endocrinology of Juvenile Chinook Salmon (*Oncorhynchus tshawystscha*). Platform presentation at the *38th Annual North America Society of Environmental Toxicology and Chemistry Meeting*, Minneapolis, MN. November 2017

Giroux M, Luu D, Schlenk D. 2017. Effects of Temperature and Bifenthrin on the Endocrinology of Juvenile Chinook Salmon. Platform presentation at the *19th International Symposium on Pollutant Responses in Marine Organisms*, Matsuyama, Japan. June 2017.

Giroux M, Luu D, Schlenk D, 2016. Effects of Temperature on the Endocrinology of Smoltification in Juvenile Rainbow/Steelhead Trout (*Oncorhynchus mykiss*). Poster presentation at the *Bay-Delta Science Conference*, Sacramento, CA. November 2016.

RESEARCH MENTOR

Daniel Schlenk, University of California, Riverside

COMMUNITY MENTORS

Xin Deng, California Department of Pesticide Regulation
Maureen Downing-Kunz, United States Geological Service

CONTACT

Marissa Giroux
mgiro003@ucr.edu

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California Sea Grant, Scripps Institution of Oceanography, University of California, San Diego,
9500 Gilman Drive, Dept. 0232, La Jolla, CA 92093-0232
casgcomms@ucsd.edu / CASG-18-022