



## **INFORMATION ITEM**

### Lead Scientist's Report

---

**Summary:** Delta Lead Scientist Dr. Laurel Larsen will discuss two recently published papers by Segarra et al. and Hutton et al., reporting on work that the Council funded through the 2018 proposal solicitation to the Brander lab at Oregon State University. The studies investigate the impact of increased salinity levels in estuary waters on the toxicity of several pesticides that commonly pollute their waters. The researchers test how different salinity levels affect pesticides' toxicity in the water on two fish species found in the Bay-Delta. Their results reveal that salinity can influence the toxicity of these pesticides in estuary waters, but more work is needed to understand the extent and full mechanisms behind this influence.

---

**SALINITY CHANGES THE DYNAMICS OF THE PYRETHROID TOXICITY IN TERMS OF BEHAVIORAL EFFECTS ON THE NEWLY HATCHED DELTA SMELT LARVAE. SEGARRA ET AL., TOXICS, 2021.**

**SALINITY ALTERS TOXICITY OF COMMONLY USED PESTICIDES IN MODEL EURYHALINE FISH SPECIES (MENIDIA BERYLLINA). HUTTON ET AL., TOXICS, 2021**

Changing salinity patterns in estuaries resulting from rising sea levels and more variable rainfall patterns can potentially impact aquatic life in several ways. One way, currently poorly understood, is through a potential enhancement of the toxicity of pollutants. The authors of these papers addressed this knowledge gap by testing how a few common agricultural, industrial, and household pesticides interact with different salinity levels and how early-life exposure of these pollutants affect two estuary fish, the endangered Delta smelt and the Inland Silverside (nonnative to the Delta but a model species commonly used in EPA toxicity studies).

While both studies test the effects of different concentrations of pesticides on early life stage fish across a salinity gradient, they use different endpoints to measure toxicity. The study by Segarra et al. (2021) looks at any behavioral disturbances exhibited in Delta smelt larvae as a result of exposure. This life stage was chosen since increased concentrations of pesticides found in the San Francisco Bay coincide with the spawning season of the Delta smelt, which takes place in late fall to spring when rainwater often brings more pollutant runoff into different water systems. Behavioral tests were performed after exposing almost 2,000 embryos to one of two selected pollutants at varying salinity levels. The research team

measured swimming activity and movement away from the center of the plate (or wall-hugging), a behavior used to avoid predation, through cycles of light and darkness. The study found that even low concentrations of these pesticides affect Delta smelt larvae behavior, resulting in either hypo- or hyperactivity in the larvae compared to their respective control groups. Additionally, salinity levels also affect the dynamics of pesticide toxicity and larvae behavior. Specifically, there is an inverse correlation between larvae wall-hugging and salinity, meaning that higher salinity levels lead to decreased wall-hugging, a behavior which could potentially put Delta smelt at higher risk of predation in the wild.

The second study, by Hutton et al. (2021), looked at survival rates of Inland Silverside larvae after exposure to one of seven pesticides at two common estuarine salinity levels. While the Inland Silverside is not native to California, it was chosen for this study because it can tolerate a large range of salinity levels and is moderately sensitive to pollutants. As with the first study, the authors concluded that salinity demonstrated a potential to influence toxicity in Inland Silverside larvae. In the higher salinity, the toxicity of most chemicals tested in the study increased, significantly so with a commonly used fungicide. However, the extent to which salinity influences toxicity over a range of salinity levels and other factors is still not fully understood, nor are the mechanisms through which salinity impacts toxicity. Future studies focusing on an extended range of salinities and the many possible mechanisms driving these toxicity changes would lead to better risk assessment of organisms living within these conditions.

Both studies underscore why it is important to understand the changing salinity regimes of estuary systems and the possible enhancing effect higher salinity has on some common pollutants. The studies directly address Action 4D of the 2017-2021 Science Action Agenda, which is to “evaluate the effects of toxicity on aquatic species survival including possible effects on predation.” This work is also relevant to Chapter 4 of the Delta Plan, which focuses on protecting, restoring, and enhancing the Delta ecosystem. The vulnerability of important yet critically endangered species such as the Delta smelt can be better assessed when both biological and physical stressors, like altered salinity levels, are factored into their survival circumstances.

## DELTA SCIENCE PROGRAM ACTIVITIES

### *Delta Lead Scientist "Ask-Me-Anything" (AMA) Series*

On November 1, Denise Colombano, a postdoctoral scholar at UC Berkeley and a two-time Delta Science Fellow, joined Dr. Larsen to discuss the Delta Science Fellowship opportunity. This AMA session was the second in a series of two sessions focused on fellowship opportunities with the Council for students at the masters through postdoctoral scholar level. Archives of all sessions are available for viewing at the Delta Stewardship Council's Instagram page. The last AMA of 2021 will be held on December 20, at noon.

### *Update on Science Action Agenda*

Delta Science Program staff are very close to releasing the first full draft 2022-2026 Science Action Agenda (SAA) for public review. The draft, which will be presented to the Council at its December meeting, will be available for public comment for two months. As a reminder, the SAA prioritizes and aligns science actions to meet management needs for the Sacramento-San Joaquin Delta. The document, updated every four to five years, is used to guide science funding, promote collaboration, and further the vision of *One Delta, One Science*. It is a pivotal part of the Delta Science Strategy. The 2022-2026 SAA has been developed with extensive input from Delta scientists, managers, and stakeholders. To learn more, please visit <https://scienceactionagenda.deltacouncil.ca.gov/> or email [SAA@deltacouncil.ca.gov](mailto:SAA@deltacouncil.ca.gov)

### *2021 State of the Estuary Summit Report-out*

Every two years, the San Francisco Estuary Partnership hosts a conference that highlights the management and ecological health of the San Francisco Bay-Delta Estuary. The event showcases the latest information about regional work to sustain and improve the estuary's habitats, living resources, water quality, climate resilience, and environmental stewardship.

This year, the event pivoted to a free, fully virtual, one-day State of the Estuary "Summit" held on Friday, October 1, that spotlighted environmental justice, community engagement, and climate resilience. Approximately 750 people registered for the summit, originating from across the San Francisco Estuary and as far away as Hawaii and the United Kingdom. Just under half of the registrants represented federal, state, and local governments. In contrast, approximately 17% represented NGOs, 10% represented consultants, 10% academic institutions, and

the remaining registrants represented a mix of education, water and wastewater entities, Native American groups, and private interests.

The morning plenary featured a lineup of luminary speakers including the Delta Stewardship Council's Special Assistant for Planning and Science, Amanda Bohl, U.S. Congresswoman Jackie Speier, Resources Agency Secretary Wade Crowfoot, and Native American Spokespeople Corrina Gould from the Confederated Villages of Lisjan, and Valentin Lopez from the Amah Mutsun Tribal Band and Mamah Mutsun Land Trust. Afternoon plenaries featured innovative partnerships and community and youth efforts aimed towards building resilience against climate change and addressing environmental justice and included a talk on Delta Adapts by the Council's Harriet Ross.

Midday and late afternoon breakout groups gave attendees the chance to participate in more intimate discussions centered around 15 topic areas of timely significance to the region. These were organized by moderators from throughout the estuary, and topics included (but were not limited to) the integration of science activities across the Bay-Delta interface, key management questions to address nutrient enrichment, how traditional ecological knowledge is woven into western science and management, new science advancing living shoreline concepts, and humanizing the homeless through empowerment and health initiatives.

To watch recordings of the plenary talks: <https://www.sfestuary.org/state-of-the-estuary-conference/>.

## **ON YOUR RADAR**

### *Environmental Justice Brownbag Series*

The third talk of the four-part environmental justice brownbag series took place on November 3 with a talk on Indigenous justice by Dr. Kyle Whyte of the University of Michigan. The last talk will be given by Dr. Raoul Lievanos of the University of Oregon. This talk will be taking place Wednesday, December 8<sup>th</sup> at 12-1PM where he will be speaking on climate justice related to sea level rise and flooding risk in Stockton. As a reminder, all the series' talks are open to the public, will feature a Q&A segment, and are available through zoom registration.

For more information on the rest of the series:

<https://caseagrants.ucsd.edu/events/webinar-environmental-justice-reforms-in-government>. Recordings of past talks are available on the Council's [YouTube channel](#).

*Delta Interagency Invasive Species Coordination (DIISC) Symposium*

The Delta Interagency Invasive Species Coordination (DIISC) Team will be hosting a virtual Delta Invasive Species symposium on December 15 from 9 AM-2:30 PM focused on early detection and rapid response (EDRR) to species invasions. The symposium will consist of invited talks and a panel discussion to highlight EDRR lessons learned, current EDRR efforts across the Delta and beyond, and future challenges and solutions for EDRR work. The symposium will also provide an opportunity for participants to contribute feedback on the draft Delta EDRR Framework being developed by the DIISC Team. Held every two years, the DIISC symposium is a forum for Delta managers, researchers, and decision-makers to meet, share and synthesize information, and communicate best practices and lessons learned pertaining to species invasions. Registration is now open and can be completed here:

[https://us06web.zoom.us/webinar/register/WN\\_ySWjLFgPRUuRI-aM8PNQYQ](https://us06web.zoom.us/webinar/register/WN_ySWjLFgPRUuRI-aM8PNQYQ).

**BY THE NUMBERS**

Delta Science Program staff will provide a summary of current numbers related to Delta water and environmental management. The summary (Attachment 1) will inform the Council of recent counts, measurements, and monitoring figures driving water and environmental management issues.

**LIST OF ATTACHMENTS**

Attachment 1: By the Numbers Summary (provided at the Council Meeting)

Attachment 2: Visual Abstract of Article Summary 1

**CONTACT**

Dr. Laurel Larsen  
Delta Lead Scientist  
Phone: (916) 445-0463