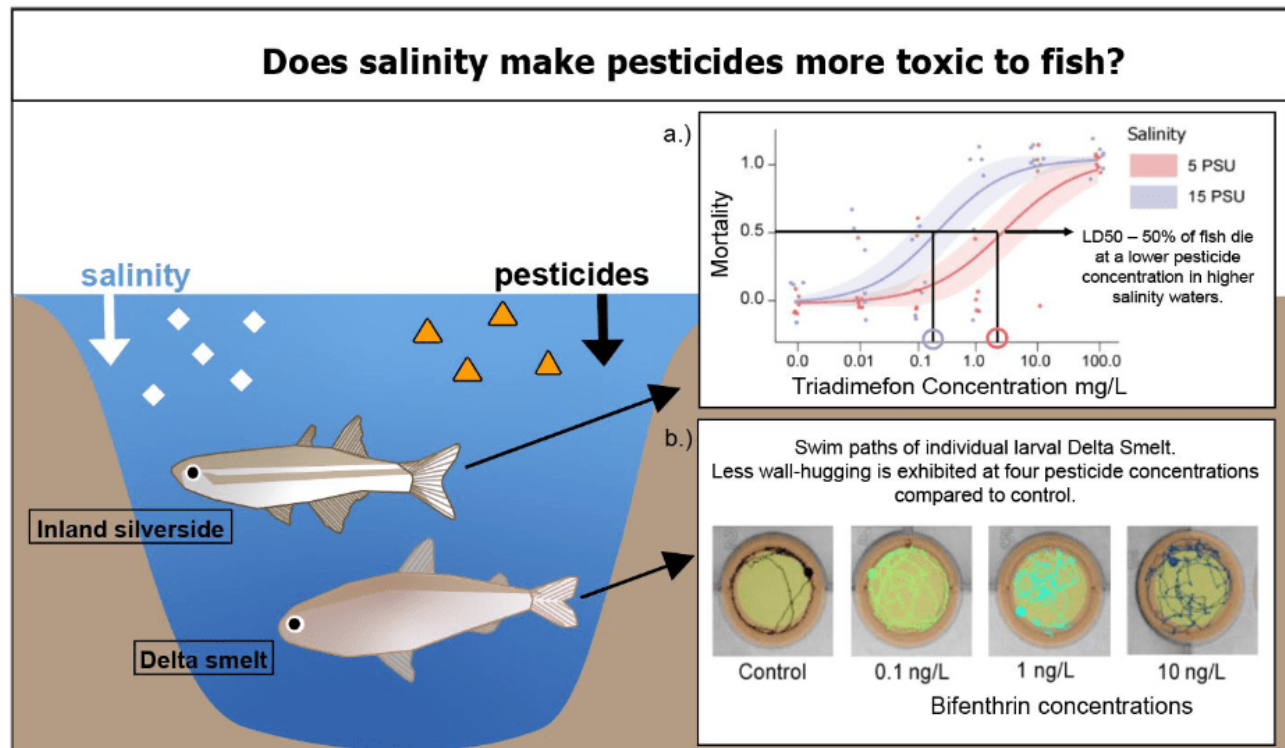


# DELTA LEAD SCIENTIST REPORT: Effects of pesticides on species in the Delta; plus activities of the Delta Science Program

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Maven Science on the Notebook November 30, 2021 0 169

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a.) Modified from Figure 1G of Hutton, S. J., St Romain, S. J., Pedersen, E. I., Siddiqui, S., Chappell, P. E., White, J. W., Armbrust, K. L., & Brander, S. M. (2021). Salinity Alters Toxicity of Commonly Used Pesticides in a Model Euryhaline Fish Species (*Menidia beryllina*). *Toxics*, 9(5), 114. <https://doi.org/10.3390/toxics9050114>

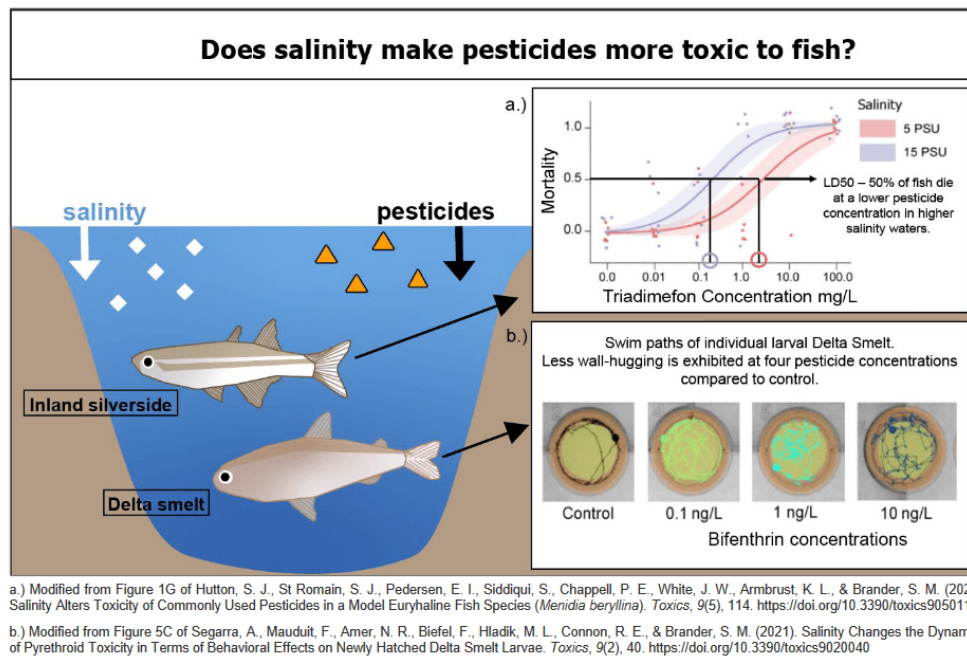
b.) Modified from Figure 5C of Segarra, A., Mauduit, F., Amer, N. R., Biefel, F., Hladik, M. L., Connon, R. E., & Brander, S. M. (2021). Salinity Changes the Dynamics of Pyrethroid Toxicity in Terms of Behavioral Effects on Newly Hatched Delta Smelt Larvae. *Toxics*, 9(2), 40. <https://doi.org/10.3390/toxics9020040>

At the November meeting of the Delta Stewardship Council during the Delta Lead Scientist report, Dr. Laurel Larsen spotlighted recent Council-funded research on the effects of pesticides on species in the Delta and provided an update on the activities of the Delta Science Program.

Dr. Larsen began by noting that the draft 2022-2026 Science Action Agenda has been released for public comment, culminating over a year of hard work by many in the Delta Science Program. She expressed her appreciation for the staff that aided in the effort.

The Science Action Agenda is a document for and by the Delta science community that prioritizes science actions for funding and attention in the 4-5 year timeframe. Dr. Larsen noted that the 2017-2021 Science Action Agenda resulted in \$37 million in funding by several agencies, including the Delta Science Program.

So for her science spotlight, Dr. Larsen profiled findings that have emerged from a project funded by the Council's 2018 Proposal Solicitation Notice. Funding for the studies was awarded to the Brander Lab at Oregon State University, which works on the



In 2021, two papers were published by the Brander Lab in the journal, *Toxics*, on their work in the Delta: one by Segarra *et al.*, and the other by Hutton *et al.* Collectively, these papers address science 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. Dr. Larsen noted that this action saw significant progress according to the 2021 progress summary.

The paper by Segarra *et al.* looked specifically at how exposure to one of two common agricultural pesticides at concentrations typically found in the Delta impacts the behavior of larvae of the endangered Delta smelt. The larval stage is of interest because the Delta smelt spawn between late fall and early spring when rains wash higher amounts of runoff containing these pesticides into the Delta.

The study also looked at how interactions between these pesticides and salinity impacted the behavior of smelt larvae, which is an important question given that sea level rise and drought both tend to elevate salinity throughout the Bay-Delta. Salinity can effectively change ionic bonding properties at a molecular level, impacting the way or rate at which contaminants are taken up into cells and their overall toxicity for the organism.

After exposing different test groups of captive Delta smelt larvae to their assigned levels of pesticide concentration and salinity, the researchers quantified their overall swimming activity levels and where they were swimming in their containers.

*“Healthy Delta smelt larvae will hug the walls of their containers, which is an instinctual behavior that indicates an evolved strategy for avoiding predators in the wild,”* said Dr. Larsen. *“As you can see from the photographs on the lower right of the slide, this wall-hugging behavior was lost when larvae were exposed to any concentration of this particular agricultural pesticide Bifenthrin. The researchers also found that higher salinity levels further decreased this wall hugging behavior, which suggests that the interaction of salinity and pesticide exposure in the wild put the Delta smelt at increasing risk of predation.”*

*“The other main finding that came from that paper was that all levels of pesticide exposure also changed the larvae’s activity levels compared to the control group. In some cases, the smelt larvae were more active; in other cases, they were less active.”*

In the second study by Hutton et al., the extent to which agricultural pesticides increase the mortality of larvae at two different salinity levels was addressed. The difference between this study and the first study profiled is that in this experiment, researchers looked at seven different pesticides rather than just one. They also examined the effects on mortality and the concentration at which the larvae will die. In addition, the researchers conducted their experiments on inland silverside, rather than Delta smelt. Inland silversides are a common organism used by EPA in studies of contaminant toxicity.

As with the first study, this study also showed that higher salinity enhances the toxicity of agricultural pesticides by up to about 50% for some concentrations of Triadimefon; this pesticide’s toxicity was found to be most enhanced by salinity.

*“The bottom line here is really twofold,”* said Dr. Larsen. *“First, agricultural pesticides have behavioral and survival impacts on key fish species in the Delta at all concentrations in which they’re typically found in the Delta. And then second, rising salinity levels during drought or as a result of sea level rise serves as a double whammy by enhancing the toxicity of those contaminants.”*

*“Studies such as this one are critically important as a conceptual basis for assembling models that forecast the future suitability of the Delta for species of concern. And also, they’re necessary for providing the scientific underpinning for contaminant management strategies by entities such as the EPA and Regional Water Quality Control Boards.”*

## **Activities of the Delta Science Program**

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**Science Action Agenda:** Dr. Larsen noted that she already announced the release of the Science Action Agenda for public comment at the outset of the report because it’s important to point out that the Council funds this work, and a key role of the science program is to report back on the work that is funded. Public comment is due by January 21. The Science Action Agenda will be presented to the Council at its December meeting. [The 2022-26 draft Science Action Agenda is here.](#) [More information on the Science Action Agenda is here.](#)

**Environmental Justice Brown Bag Series:** The third webinar in the series featured Dr. Kyle White from the University of Michigan. He discussed tribal management of natural resources, tribal disenfranchisement, and how tribal groups organize those topics and are really central to the environmental justice movement. He spoke of how all communities should be involved in natural resource management and how tribal communities deserve sovereignty. “His work inspires thought around how the Delta Stewardship Council and other natural resource management agencies can learn from tribal communities that have long-term experience around natural resource management, and how they can better incorporate those communities’ values,” said Dr. Larsen. [All webinars in the series can be viewed here.](#) The fourth webinar in the series will be held on Wednesday, December 8 at noon and will focus on climate justice related to sea level rise in flooding risk and Stockton. [Register here.](#)

**The Delta Lead Scientist Asked Me Anything is also ongoing:** The November 1 session was with two-time California SeaGrant Delta science fellow, Denise Colombano, who discussed Delta Science Fellowship opportunities. Next year, the Delta Science Program will announce the solicitation for the new class of Delta science fellows. The fellowships are available to postgraduate students at the master’s and postdoctoral scholar levels.

*“This fellowship is our mechanism of funding early career scholars to advance research that addresses science actions outlined in that science action agenda, and also to help them connect their work to the management community,”* said Dr. Larsen. *“Former Delta science fellows have gone on to become some of the top leaders in our science community, and also those of other locations.”*

**The Delta Interagency Invasive Species Coordination Team’s biannual symposium on Delta invasive species will be held virtually on December 15.** The topic of the symposium is early detection and rapid response to species invasions and will highlight current early detection efforts, lessons learned, and future challenges and opportunities. This symposium will also provide an opportunity for participants to contribute feedback on the draft Delta Early Detection and Rapid Response framework being developed by the Delta Interagency Invasive Species Coordination Team. [Register here.](#)

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