How Delta food webs have changed: integrating detrital material into the Delta food web puzzle

Study Period
2021 – 2025

Funded by:

Delta Science Program
DELTA STEWARDSHIP COUNCIL

About this project

Sacramento-San Joaquin Delta (Delta) ecosystems are suffering a collapse in pelagic ecosystems due in part to a decline in energy flow from detrital material (dead phytoplankton, aquatic and terrestrial vascular plants, and minerals), resulting in population declines in threatened and endangered native fish species. Declining primary productivity, decreasing sedimentary inputs to the Delta, impacts of climate change, and the shift in nutrients due to the EchoWater Resource Recovery Facility (EchoWater Facility) upgrade completed in 2023 together evoke a dire need to characterize rapidly changing algal and detrital particle sources and cycling within the Delta to inform management solutions that could improve the food web and better support native fish.

To fill this knowledge gap, the researchers assessed the spatial distribution and availability of detrital particles to pelagic aquatic food webs within the Delta by modernizing and developing in-situ light sensors and integrating physical and chemical measurements. They also conducted lab experiments to characterize particle sources and quality by using biomarkers and genetic material to identify species present in the detritus.

Lead investigators

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Project objectives

- Fill in gaps in our knowledge about the sources and dynamics of organic detritus particles transported into and produced within the Delta, including an assessment of their spatial distribution and availability to pelagic aquatic food webs
- Assess the impact of changed nutrient loading on phytoplankton communities
- Create maps of the distribution of nutrients, phytoplankton abundance, and phytoplankton community structure
- Assess whether upgrades to the EchoWater Facility effectively reduced nutrient concentrations, improved phytoplankton productivity, and altered the phytoplankton communities in the Delta

Why this research matters

This research can help provide real-time assessments of restoration and water management activities in the Delta. Beyond that, this project integrates powerful tools to connect detritus particle biogeochemistry and food web resilience, not only benefiting Delta science but also offering insights applicable to human-impacted estuaries worldwide.

Management application

Understanding how nutrient management actions (such as a wastewater treatment plant upgrade or habitat restoration) may restore primary production levels and, in turn, benefit native fish habitats, and will shape future Delta management priorities and potentially guide the management of other imperiled estuaries and coastal systems.

Next steps

Project data will be publicly available in accessible formats on the USGS ScienceBase portal through online interactive visualizations hosted on the USGS cloud-based Tableau server.

Connection to the 2017-2021 Science Action Agenda

3: Develop Tools and Methods to Support and Evaluate Habitat Restoration

4: Improve Understandings of Interactions Between Stressors, Managed Species and Communities

5: Modernize Monitoring, Data Management, and Modeling