

Advancing Scientific Understanding & Management of the Delta Through a Food Web Perspective

Review Summary & Progress to Date

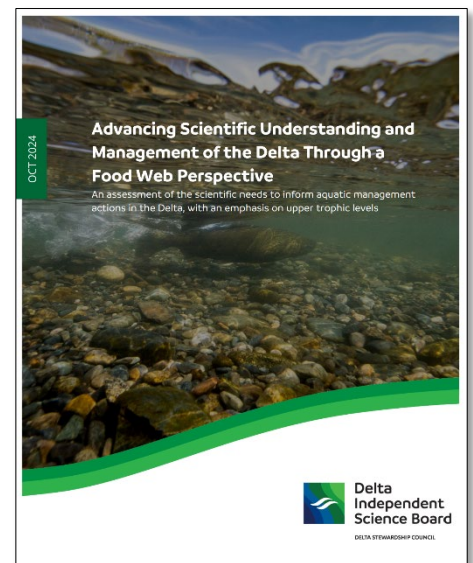


**Delta
Independent
Science Board**

DELTA STEWARDSHIP COUNCIL

Takeaways from the 2024 Independent Science Review on Food Webs

- The Sacramento San-Joaquin Delta is a well-studied system.
- The Delta Independent Science Board (ISB) sees opportunities for better understanding food webs to predict ecological impacts.
- The Delta ISB recommends a collaborative approach to develop a food web strategy that considers the entire food web and not just individual species.
- Future research targeting the science gaps identified in this review will help address actions in the Science Action Agenda.



Holistic Food Web Knowledge can Guide Management Decisions

Managing species of interest, including those listed under the federal and State Endangered Species Act, within the Sacramento San Joaquin Delta is complex as organisms are part of broader interconnected food webs. Food webs show feeding relationships within an ecosystem, how energy and matter move from organism to organism, and can vary with space, time, and changing environmental drivers. To better predict how management actions impact the species of interest, we need a better understanding of the entire food web within the Delta.

Examples of Species of Management Interest in the Delta



Green Sturgeon



Giant Garter Snake



Winter-run Chinook Salmon

Photo Credits (Left to Right): Mike Healey/CDFW, Zarina Sheikh/USGS, and USFWS

Approach

To understand how to better incorporate and advance food web knowledge to manage the Delta's ecosystem, the Delta ISB conducted a review on the topic. The review, completed in October 2024, was based on a literature review, interviews with experts, and a two-day workshop with over 100 participants.



Overall, the review highlighted the need to move towards a quantitative framework that considers the full food web, and not just individual species, into data analyses and modeling.

Moving Towards Quantitative Frameworks for Food Web Models

Food web models range in their complexity depending on the management need. Food web models can help improve understanding on what species are eating, what their preferred foods are, how much of each food type they are eating, and then ultimately, what eats them. More complex models can be created depending on data availability that incorporate other factors to get a better picture of the system.

The Delta ISB found that while food web concepts are present in many past and ongoing Delta activities, there are benefits of moving away from solely conceptual and species-centric models of food webs towards a more quantitative framework that incorporates a fuller understanding of trophic processes from lower trophic levels to apex predators at the top of the food chain. The Delta ISB contends that this approach will provide a better consideration of multispecies responses and a more holistic implementation of management actions on individual species, such as Delta smelt and steelhead.

Recommendations and Progress Made

The Delta ISB recommends designing and implementing a food web science strategy, which could be achieved by forming a Collaboratory to integrate multiple sources of existing data, build food web models, and guide future research. Progress has already been made on these recommendations. For instance, the Delta Modeling Collaboratory facilitated by the Delta Stewardship Council's Delta Science Program has started work on a food webs use case.

Additionally, the Interagency Ecological Program is working on a food-web synthesis to assess the effectiveness of tidal wetland restoration and other resource management actions. Their primary goal is to see if food-web factors such as food availability, predation, or even physical factors are driving changes to species of concern.

Next Steps: Future Research Needed to Fill Science Gaps

There have been great strides to address the Delta ISB's recommendations, however, there are still remaining gaps to be addressed. The Delta ISB sees multiple opportunities for an improved understanding of food webs. In the 2025 cycle for Delta Research Awards and Delta Science Fellowships, there were no studies funded that could address the gaps in this review. Addressing these science gaps align with the priority actions of the [2022-2026 Science Action Agenda](#). There is potential for these gaps to be filled by future calls for research proposals. Importantly, this review shows that there is a plethora of science and data within the Delta community that can be leveraged for a greater understanding of the Delta's ecosystem.

Science Gap	Actions of the Science Action Agenda
Improve quality of food web data for syntheses and for public accessibility	1A: Establish publicly accessible repositories, interactive platforms, and protocols for sharing information, products, and tools associated with monitoring and modeling efforts, in support of forecast and scenario development, timely decision making, and collaborative efforts.
Evaluate linkages between lower trophic levels and upper trophic levels i.e. between organisms at the bottom and the top of food webs	5D: Integrate and expand on existing models of hydrodynamics, nutrients, and other food web drivers to allow for the forecasting of the effects of interacting stressors on primary production and listed species
Characterize the roles of benthic microbes and invertebrates i.e. organisms that live on the lowest level of the Delta or in the sediment	
Further elucidate the role of detritus i.e. decomposing plant and animal material	
Quantify the roles of most abundant fish species	
Evaluate the roles of predatory birds and mammals	5E: Quantify spatial and temporal patterns and trends of chemical contaminants and evaluate ecosystem effects through monitoring, modeling, and laboratory studies
Understand the environmental fate and consequences of contaminants	

Learn More

The [full report](https://deltacouncil.ca.gov/pdf/isb/products/2024-10-02-isb-food-webs-review.pdf) can be found at <https://deltacouncil.ca.gov/pdf/isb/products/2024-10-02-isb-food-webs-review.pdf>. **Questions?** Contact disb@deltacouncil.ca.gov