# INFORMATION ITEM

Lead Scientist's Report

**Summary:** Delta Lead Scientist Dr. Laurel Larsen will discuss a study by Strong et al. (2021). The study covers a study that tests the effect that wastewater effluent from the Sacramento Regional Wastewater Treatment Plant (Regional San) has on the base of the food web, which is critical to sustaining native fish populations. Dr. Larsen will also provide report-outs from the 11th Biennial Bay-Delta Science Conference and highlight the upcoming Science Actions Workshop and Science Action Agenda Progress Summary.

## RESPONSE OF LOWER SACRAMENTO RIVER PHYTOPLANKTON TO HIGH-AMMONIUM WASTEWATER EFFLUENT. ELEM SCI ANTH. STRONG ET AL. 2021.

Pelagic organism decline (POD) is the precipitous decline in fish populations afflicting the North San Francisco Bay and Delta since 1986, which has triggered listing of several fish species as endangered or threatened. POD has been linked to a plummeting abundance of phytoplankton at the base of the food web, but the root causes are poorly understood and have been a politicized source of debate. Namely, water users, facing regulations related to declining populations of endangered species, argued that nutrients in the Regional San's effluent were a primary cause of decline, and that the wastewater treatment system should be upgraded to meet much stricter discharge requirements. Regional San, in turn, argued that they should not be forced to pay the price for recovery of these species, when Delta water exports were a bigger factor in the decline of fish species. Ultimately, the 2010 National Pollutant Discharge Elimination System (NPDES) permit issued to Regional San required an upgrade to their treatment system; that upgrade came fully online in April 2021.

Scientific controversy also swirls around the ultimate cause of declining food production by phytoplankton and the role that nutrients may play. Though a general principle of gardening is that adding nutrients in the form of fertilizer promotes the growth of plants, the situation in the Delta is more complex. Notably, the Delta is a nitrogen-rich environment, so phytoplankton are not expected to be limited by this nutrient, leading to the hypothesis that the addition of more nitrogen (via wastewater, for example) would have no impact on phytoplankton. Alternatively, previous studies performed in the Delta and lakes far beyond the Delta's boundaries, suggest a more nuanced outcome in which different chemical

forms of added nitrogen have different impacts on phytoplankton. Namely, these studies suggest that in some situations, high concentrations of ammonium (the primary form of nitrogen typically found in wastewater) may inhibit the uptake of nitrates by phytoplankton, resulting in lower phytoplankton abundances overall, as well as shifts in species composition away from the species preferred by native fishes. With this context, the authors of the study—a team funded and led by Stanford University—aimed to test how differing concentrations and forms of nitrogen in Sacramento River water impacted phytoplankton growth through a series of laboratory incubation experiments. By taking surface water from sites both upstream and downstream of the wastewater treatment plant and incubating them under light for 48 hours, the authors tested how nitrogen additions from the wastewater treatment plant could be affecting phytoplankton production in the Lower Sacramento River region of the Delta. Further, they treatment plant effluent to another set of samples from the same sites, ammonium to a third set, and nitrate to a fourth set to evaluate how nitrate uptake, phytoplankton growth, and phytoplankton composition were affected by the amount and form of nitrogen added to Sacramento River water.

The outcome of the incubation experiments revealed no difference in phytoplankton abundance or species composition among the different test groups. However, different levels of light did produce differences in phytoplankton abundance and composition. These results support the hypothesis that phytoplankton in the Delta are not limited by nitrogen (but are limited by light). The authors concluded that a high concentration of ammonium from wastewater is likely not the driver for low phytoplankton production and POD in the Delta.

The upgrade of the Regional San that took place weeks ago will effectively reduce total concentrations of nitrogen while increasing the ratio of nitrate to ammonium. Extrapolating these results suggests that the upgrade may have few food web implications that impact populations of managed fishes. However, it is important to recognize that the Delta is a dynamic place, and the driving factors controlling phytoplankton abundance on the day the incubation samples were collected may not represent those over broader ranges of time and space. This acknowledgment, together with conflicting previous studies, underscores the importance of continued monitoring of nutrient levels and food web effects. Operation Baseline, an effort to document pre-upgrade conditions funded by the Council's Delta Science Program, will play a key role in interpreting these studies.

This study is important for water management decisions in the Delta region due to POD's consequences on the region's organisms, such as the endangered Delta smelt. This study is also in line with action 4a (Implement studies to better understand the ecosystem response before, during, and after major changes in the amount and type of effluent from large point sources in the Delta including water treatment facilities) of the 2017-2021 Science Action Agenda and Chapter 4 of the Delta Plan (protect, restore, and enhance the Delta ecosystem).

## RECENT ACTIVITIES

### *11th Biennial Bay-Delta Science Conference Update*

The Delta Science Program is pleased to announce that content (i.e., recorded plenaries and live sessions, on-demand talks and training, posters, videos, and an art exhibit) from the 11th Biennial Bay-Delta Science Conference (April 6-9, 2021) will be housed on the conference website (http://baydeltascienceconference.org) for attendees to continue to access throughout the summer. The next Bay-Delta Science Conference is scheduled for fall 2022 and is intended to return to the Sacramento Convention Center.

## ON YOUR RADAR

### *Science Actions Workshop*

On July 13-14, 2021, from 9:00 AM to 12:00 PM, the Delta Science Program will virtually host the Science Actions Workshop as part of the 2022-2026 update to the Science Action Agenda (SAA). Workshop participants will work collaboratively to develop near-term priority science actions for the Delta. Building off the collaboratively-developed list of 65 Top Delta Management Questions developed in 2020 and the summary of progress made on the 2017-2021 SAA, these actions will provide a framework for science funding by the Council and its partners. Registration details are available on the Council's SAA webpage.

### *2017-2021 SAA Progress Summary*

The Delta Science Program is tracking progress on the 2017-2021 SAA to further its mission and inform the 2022-2026 SAA update. The Progress Summary (Summary) compiles relevant activities contributing to the 25 science actions in the 2017-2021 SAA and includes a high-level description of progress made and the status for each

science action. [1] The Delta Science Program circulated a draft Summary for public review in late April and early May. The public comments received via an online survey and targeted input from subject matter experts will be used to inform the Science Actions Workshop on July 13-14, 2021. This was the first attempt to formally track progress in addressing the science actions outlined in the SAA. Feedback has been and still is much appreciated.

## 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 Report (to be provided at the meeting)

Attachment 2: Visual Abstract of Article Summary 1

## CONTACT

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[1] https://scienceactionagenda.deltacouncil.ca.gov/pdf/SAA-Progress-Summary.pdf