INFORMATION ITEM

Lead Scientist's Report

Summary: As climate change effects increase and impact ecosystems at multiple scales, it is important we anticipate the impacts and develop management plans to resist or adapt to these changes, as called for by Management Need 6 of the Science Action Agenda (*Assess and anticipate impacts of climate change and extreme events to support successful adaptation strategies*). As such, this month, we highlight a review that brings together decades of research from over 170 sources to anticipate the effects climate change will have on specific species and habitats of the San Francisco Estuary (Estuary). Published in the latest edition of *San Francisco Estuary and Watershed Science*, the review features the Council's Eva Bush and Delta Science fellow Denise Colombano as authors. It is a product of the Interagency Ecological Program's Climate Change Team.

CLIMATE CHANGE EFFECTS ON SAN FRANCISCO ESTUARY AQUATIC ECOSYSTEMS: A REVIEW, HERBOLD ET AL., 2022.

Herbold and colleagues focus their review on identifying the impacts of four distinct drivers related to climate change: 1) earlier, shorter, and more intense peak flows and inundation of floodplains, 2) salinity intrusion, 3) higher water temperatures, and 4) an increase in invasive species, coupled with a decline on native species. Further, they focus on delineating impacts on two keystone fish species (Chinook salmon and Sacramento splittail) and on three habitat types that these species rely on (floodplain, tidal marsh, and open water). The second part of the paper focuses on management actions that can increase resilience in light of those impacts. A few of the key highlights include:

Floodplains: Changing the timing and duration of peak flows shortens the time that floodplains are inundated and the changes that occur when they are inundated. These changes may adversely impact food webs, which receive large influxes of phytoplankton and zooplankton from floodplain inundation. Chinook salmon may experience a timing mismatch with periods of inundation shifting to earlier in the year before juveniles seek floodplain access, and inundation times may be too short or water temperatures too warm to support sustained foraging and persistence on the floodplain. Sacramento splittail, which use floodplains for

spawning, would experience similar challenges from altered timing and duration of inundation. These challenges can be managed through projects that promote floodplain inundation at lower river water levels (such as the notch in the Fremont Weir) and projects that enlarge floodplains (such as the Lookout Slough Tidal Habitat Restoration and Flood Improvement Project).

Tidal marshes: The extent to which Chinook salmon use tidal marshes is poorly understood, but juvenile splittail rely on marshes within the Delta's Low-Salinity Zone for food and cover from predators. Drowning of these marshes—or migration of the Low-Salinity Zone upstream of the north Delta's marshes—could impose a bottleneck on their population. As with floodplains, marsh restoration can supplement these losses, but many north Delta marsh sites are at low elevations, potentially risking inundation with sea-level rise. Sites with potential for upland migration of marshes would be most suitable as long-term climate-resilient habitat.

Open water: The most significant risk climate change poses for Chinook salmon in open-water habitat is through warmer water temperatures, which may have lethal or sublethal (including enhanced vulnerability to toxins) effects. Warmer water temperatures, in turn, facilitate species invasions that clear sediment from the water column and enhance predation. Sacramento splittail are less vulnerable to temperature or predation, but they are sensitive to salinity gradients, and salinity encroachment may prevent genetic mixing between two geographic populations in the Delta. Though supplementation for splittail is unlikely in the near future, supplementation and hatchery operations (combined with trucking around the Delta during periods of warm temperature) will continue to be essential to maintaining robust populations of Chinook salmon into the future.

Summary: Habitat restoration may be one of the most important tools for imbuing native fish species with the capacity for resilience as climate change intensifies. In addition, the authors underscore the need for maintaining long-term monitoring programs to document ecological change and the impacts of harmful algal blooms, extreme events like floods, and levee breaks.

A copy of the report can be found here: https://escholarship.org/uc/item/2xb097t7.

DELTA SCIENCE PROGRAM ACTIVITIES

Water Temperature Model Review Report-Out

On July 19-20, 2022, the Delta Science Program convened an Independent Review Panel to evaluate the US Bureau of Reclamation's (USBR) Water Temperature Modeling Platform (WTMP) for the Shasta/Keswick/Sacramento River system. USBR is setting a precedent for water temperature modeling, and though water temperature is already a priority management issue in the west, it may become a management issue in other regions as climate change progresses.

Panelists were impressed with the water temperature modeling platform overall and the productivity of the relatively small USBR team devoted to the project. There was also plenty of preliminary feedback, which USBR felt was quite constructive. The feedback focused on areas of the documentation that needed clarification for purposes of transparency, suggestions on how technical considerations like data gap-filling and estimation of inflows might be improved, and how to improve the methods for testing the model performance and assessing how errors accumulate across different modeling components. The panel also had several questions for the USBR and requested clarification of information that could help them better address their charge questions. The next step will be for the panel to work independently and produce a review report.

This review will be followed by another, tentatively scheduled for fall 2023, assessing the WTMP for the American River and Stanislaus River systems and the overall Central Valley Project.

Social Science Community of Practice

Work continues to build the Bay-Delta Social Science Community of Practice (CoP), which aims to build a network of social science scholars, practitioners, and allies committed to advancing applicable and relevant research on the human dimensions of the Bay-Delta. The CoP's next effort is to work to improve its integration with existing Bay-Delta collaborative science forums to begin building more interdisciplinary partnerships and research efforts. Planning is underway for a workshop for fall 2022, in which CoP members will interact with representatives from the Delta science venues to get to know each other and begin collaborating on interdisciplinary research ideas. More details and registration information on the workshop will be available in a subsequent LSR.

Delta Residents Survey

The Delta Residents Survey is a collaborative research effort led by California Sea Grant, Delta Science Program, Sacramento State University's Institute for Social Research, and Social Science Community of Practice collaborators. The research team is developing a household survey to distribute to Delta residents to better understand residents' attitudes, values, experiences, and behaviors related to the Delta as a unique place. The team aims to reach a demographically and geographically representative sample of Delta residents to ensure that the team surveys the wide diversity of perspectives from residents in this region. This summer, the research team is working to "beta-test" the survey with community members to get their feedback on ”test” questions before fully launching the survey in fall 2022 to early 2023.

More information about social science integration at the Council can be found on the website (https://deltacouncil.ca.gov/social-science#collapseThree)

ON YOUR RADAR

Harmful Algal Bloom Workshops

The Delta Science Program is convening a Harmful Algal Blooms (HABs) workshop on November 8-9, 2022, to facilitate discussions for creating a Delta-region HABs monitoring strategy. HABs are events in which algal species grow rapidly and produce toxic or harmful effects. HABs and their associated toxins are increasingly a problem in the Sacramento-San Joaquin Delta and are expected to become more prevalent with climate change impacts fueling the conditions (e.g., low water flow, increased water temperatures) that lead to blooms. Toxins from HABs can harm aquatic life and humans and impact the water bodies California relies on for industry, drinking water, and recreational purposes.

The workshop will be public and will serve as an interactive forum for Delta stakeholders to discuss critical topics around monitoring practices, rapid reporting for community safety, and collaboration opportunities. The HABs workshop supports the implementation of Science Action Agenda Action 2B to “Develop a framework for monitoring, modeling, and information dissemination in support of operational forecasting and near real-time visualization of the extent, toxicity, and health impacts of HABs.”

Information for registration will be provided in a subsequent update.

BY THE NUMBERS

Delta Science Program staff will summarize 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: Article Visual of Herbold et al., 2022

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