INFORMATION ITEM

Lead Scientist's Report

Summary: Delta Lead Scientist Dr. Laurel Larsen will discuss two different papers that look outside the Delta to examine how other large-scale socio-ecological systems are likely to exhibit changes in response to sea-level rise (Vasilopoulos et al., *Environmental Research Letters*, 2021) and how their institutions are adapting to the challenge of sea-level rise (Lubell and Morrison, *Environmental Research Letters*, 2021). Collectively, the papers illustrate potential blind spots in anticipating future physical changes induced by sea-level rise and highlight strategies that are proven to be effective in promoting adaptation to those changes.

ESTABLISHING SUSTAINABLE SEDIMENT BUDGETS IS CRITICAL FOR CLIMATE-RESILIENT MEGA-DELTAS. VASILOPOULOS ET AL. *ENVIRONMENTAL RESEARCH LETTERS,* 2021

In their recent paper on "Preparing scientists, policy-makers, and managers for a fast-forward future" (Norgaard et al., *SFEWS*, 2021), the Delta Independent Science Board issued a recommendation for horizon scanning, the practice of anticipating future change for which there are few hints in the present. One component of horizon scanning is to remain abreast of developments in other systems that are in many ways analogous to the Delta. This study illustrates the potential importance of a process not currently given much consideration in the Delta: how declining sediment supply affects the physical template of the Delta and interactions with sea-level rise. Sediment supply to the Delta has been declining since the end of the hydraulic mining era, with adverse repercussions for native fishes such as the Delta Smelt and, potentially, for future salinity intrusion, as this article suggests.

The world's major river deltas are host to important ecosystem services that serve a wide range of socio-economic purposes. Yet, most of these deltas are vulnerable to assorted pressures that threaten their environment. A combination of flooding from rising sea-levels, subsidence due to groundwater extraction and organic soil loss, and sediment starvation due to the trapping behind dams contribute to large deltas' instability. As a result, the area of a delta where flow is dominated by tidal forces, defined in this paper as tidal extent, can move inland. This tidal intrusion matters because tidal extent controls saline intrusion, water and sediment movement, and channel stability. For these reasons, understanding the pressures

that affect a delta's tidal extent can also help shape strategies for mitigation and adaptation to climate change, to secure the future stability of major deltas.

This paper focuses on the Mekong delta in Vietnam, which is identified as one of the world's most vulnerable deltas by the Intergovernmental Panel on Climate Change (IPCC) and serves as a good analogy for other large deltas undergoing similar pressures. Most notably, the Mekong delta's fluvial (or river) sediment supply has been declining since at least the 1980s due to effects from activities such as extensive sand mining. As a result of this sediment starvation, the Mekong delta is also experiencing accelerated channel bed-lowering. This brings with it an increase of saltwater intrusion, a disturbance to the delta's sensitive ecosystem.

Here the authors used computer models to evaluate contributions of sea-level rise, subsidence, and channel deepening associated with sediment starvation to a tidal extent. They found that channel deepening, a process seldom considered in sea-level rise vulnerability assessments was the largest contributor to changes in tidal extent. If left unchecked, channel bed-lowering in the Mekong will expand the delta's tidal extent by up to 56 km (35 miles) in the next two decades.

This study demonstrates that a healthy sediment budget is an important part of maintaining channel beds and tidal extent at major deltas globally. With respect to the Sacramento-San Joaquin Delta, the findings argue for the importance of including sediment in integrated models of future scenarios and for treating the physical template of the Delta as dynamic rather than static. These needs will be aided by ongoing efforts of the Interagency Model Steering Committee and continued investment in cyberinfrastructure for making models accessible and interoperable.

INSTITUTIONAL NAVIGATION FOR POLYCENTRIC SUSTAINABILITY GOVERNANCE. LUBELL AND MORRISON. *NATURE SUSTAINABILITY,* 2021.

Sustainable governance of socio-ecological systems is a complicated task made increasingly more complex when multiple institutions and individuals must cooperate to address a shared issue. In this perspectives paper, Lubell and Morrison establish a framework for how agencies, organizations, and individuals (i.e., "actors") can strategically navigate these complex arrangements of institutions to increase adaptive capacity (i.e., the capacity of a system to achieve sustainability). This work is relevant to the Council's Delta Adapts initiative, which may prompt the development of new institutional frameworks for building adaptive capacity. Lubell and Morrison's framework is grounded in four critical elements of how actors navigate socio-ecological systems: knowledge of the system, relationships among

actors, strategies, and decisions/implementation (see Attachment 2). They illustrate and exemplify their framework through two case studies that exhibit contrasting strategies for navigating multi-institutional arrangements, with contrasting outcomes for sustainability. The first study examines institutional approaches to addressing sea-level rise and flooding at the San Francisco Bay. The second study focuses on coral bleaching at the Great Barrier Reef.

To assess the institutional response to sea-level rise at the San Francisco Bay, the authors looked at the 2019 *Bay Adapt: Regional Strategy for a Rising Bay* initiative. The main goal for Bay Adapt is to unify an assortment of regional agencies, stakeholders, and other institutions and identify a collective goal and vision for sea-level rise adaptation in the San Francisco Bay. By engaging these actors, Bay Adapt established a collaboration and trust between a wide variety of working groups, thus eliminating the fragmentation and coordination problems that polycentric systems are often fraught with. Another fruitful strategy used in Bay Adapt was the adoption of goal sequencing. Rather than focusing on immediately reaching a final goal, those engaged in Bay Adapt developed smaller, piecemeal goals and identified the appropriate institutions for their coordinated assignments. Lastly, equity and climate justice are also major themes of Bay Adapt, with community leaders and environmental justice organizations participating in the innovative collective.

Lubell and Morrison argue that these strategies positively assisted in expanding investments and efforts for sea-level rise adaptation in the San Francisco Bay. On the other hand, they argue that the response to coral bleaching on the Great Barrier Reef has had an effect counter to building adaptive capacity. Namely, the leadership group attempted to address coral bleaching largely through technology-based adaptations over community-based strategies.

RECENT ACTIVITIES

Science Actions Workshop Report-Out

The Science Action Agenda (SAA) is a key part of the Delta Science Strategy, together with the Delta Science Plan and State of Bay-Delta Science. It sets the four-year agenda for science funding priorities and science actions and influences funding decisions by all agencies that fund Delta science. On July 13 and 14, 2021, the Delta Science Program (DSP) hosted the Science Actions Workshop as part of the update to the 2022-2026 Science Action Agenda (SAA).

Roughly 50 scientists and managers from federal and state agencies, academia, consulting groups, and water agencies joined nearly 20 staff facilitators and

notetakers from the Council for the two-day workshop. The workshop's goal was to identify Science Actions that were responsive to six Management Needs for the 2022-2026 SAA. These Management Needs stem from the 65 Top Delta Management Questions developed in 2020, and include: 1) improving coordination and integration of large-scale experiments, data collection, and evaluation across scales and institutions; 2) enhancing monitoring and model interoperability, integration, and forecasting; 3) expanding multi-benefit approaches to managing the Delta as a social-ecological system; 4) building and integrating knowledge on social processes and human behavior to support effective and equitable management; 5) acquiring new knowledge and synthesizing existing knowledge of interacting stressors to support species recovery; and 6) assessing and anticipating climate change impacts to support successful adaptation strategies.

A pre-workshop survey was sent to approximately 100 workshop registrants to solicit draft Science Actions and kickstart the breakout sessions at the workshop. Over 150 Science Actions were submitted through this process. Workshop attendees then discussed, edited, organized, and drafted additional Science Actions during concurrent breakout sessions on both days.

Currently, staff from the DSP are reviewing and merging the 177 Science Actions that resulted from the workshop and will prioritize the set of Science Actions based on criteria that were reviewed and commented on by workshop participants. The DSP will circulate the draft prioritized set of Science Actions to workshop participants to review and comment on in the coming weeks. The DSP is aiming for 25 Science Actions to be included in the 2022-2026 SAA. The full draft 2022-2026 SAA will be circulated for public review in Fall 2021.
To learn more, please visit https://scienceactionagenda.deltacouncil.ca.gov/ or email SAA@deltacouncil.ca.gov

Delta Science Program Completes Independent Review of Delta Mercury Control Program Phase 1 Studies

At the request of the Central Valley Regional Water Quality Control Board, the Delta Science Program has completed a two-part review of the characterization and control studies associated with the Delta Mercury Control Program (DMCP). The DMCP requires that “discharging entities” (e.g., wastewater) develop characterization and control studies to evaluate approaches for managing methylmercury (the most bio-available form of mercury), and that nonpoint sources develop characterization studies. The purpose of the independent review coordinated by the Science Program was to evaluate the results, conclusions, and

completeness of each study. Part one of the review was completed in August 2019, and part two of the review was completed in July 2021. The recently released review assessed two studies on mercury dynamics in tidal wetlands and modeling of open water mercury dynamics in the Sacramento-San Joaquin Delta. The independent review panel lauded the significant progress made toward understanding the complex mercury dynamics in the Delta and recommended areas of improvement, including that the modeling should incorporate climate change and biological components such as bioaccumulation. Recommendations will inform updates to the DMCP and mercury targets in the Delta, which will take effect in 2022.

ON YOUR RADAR

National Center for Ecological Analysis and Synthesis (NCEAS) Working Group

Ecological synthesis is a critical component of ecosystem-based management and informed decision-making. The need for increased capacity, dedicated time, and coordinated synthesis in the San Francisco Estuary (SFE) is widely recognized and included as an action in the Delta Science Plan, Science Action Agenda, and Interagency Ecological Program Science Strategy. This effort, led by the Delta Science Program (DSP) in partnership with the National Center for Ecological Analysis and Synthesis (NCEAS), will provide high-quality training in data science and statistics and an opportunity for enhanced collaboration among agency and academic scientists in a focused working group. The products from this working group will offer strong scientific support to inform decision-making for restoration, protection of endangered species, and the management of flow actions in the SFE. This working group will focus on the drivers of the estuarine food supply and how they affect Delta food webs under future climate and management scenarios. The scientific understanding that will emerge from the workshop will form a basis for actions relevant to Core Strategy 2 (Restore ecosystem function) in the Ecosystem Amendment to the Delta Plan and help establish a linkage between habitat restoration and impacts on native fishes.

This summer, the NCEAS Working Group has working to compile relevant datasets from the Interagency Ecological Program and other sources. In addition, the three-week synthesis, collaboration, and statistics training curriculum is currently in the planning stage and will be held in September, October, and November 2021.

2021 State of the Estuary Summit

In normal years, the State of the Estuary Conference is organized as a 2-3 day event by the San Francisco Estuary Partnership during odd years to focus on the latest information on the management and ecological health of the San Francisco Bay-Delta Estuary. However, this year the decision was made to scale back to a 1-day, virtual "summit," given the continuing uncertainty for in-person gatherings and the growing screen fatigue brought on after more than a year of virtual events. On October 1st, 2021 the Estuary Partnership will hold a free, fully virtual, one-day State of the Estuary "Summit" showcasing the region's work to sustain and improve the estuary's habitats, living resources, water quality, climate resilience, and environmental stewardship. This year will spotlight environmental justice, community engagement, and climate resilience, amongst other critical and timely topics. Once speakers are confirmed, and the agenda is finalized, information will be made available on the Estuary Partnership's website at https://www.sfestuary.org/. The San Francisco Estuary Partnership expects to return to the usual in-person format in 2023.

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 Summary (provided at the Council Meeting)

Attachment 2: Visual Abstract of Article Summary 1

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