INFORMATION ITEM

Lead Scientist's Report

Summary: Delta Lead Scientist Dr. Laurel Larsen will discuss a recently published paper by Nobriga et al. which explores how predation on Chinook Salmon smolt navigating the Delta may be affected by the increasing pressures of climate change and human interference. Their findings (which draw upon tag-and-release studies, simulation models, and video observations) suggest strategies for minimizing smolt loss to predation during their migration through the Delta to the ocean. The work directly addresses Action 2B from the 2017-2021 Science Action Agenda, which calls for the synthesis of telemetry data to provide an understanding of fish movement and predation.

COLDWATER FISH IN A WARM WATER WORLD: IMPLICATIONS FOR PREDATION OF SALMON SMOLTS DURING ESTUARY TRANSIT. NOBRIGA ET AL., *ECOLOGY AND EVOLUTION,* 2021

Central Valley Chinook salmon are culturally, economically, and ecologically significant. Chinook salmon have a complex life cycle, in which they spend one to two years in their natal streams after hatching before migrating through the Delta to the Pacific Ocean as smolts. After spending two to five years in the ocean, they return to their natal streams to spawn and die shortly afterward.

The journey that Chinook salmon smolts must make through the Delta is critical to the long-term survival of their populations, yet it is fraught with dangers that have increased due to climate change, channelization and impoundment, and invasive species. Salmon making this journey are faced with predation risk from nonnative species such as the Striped Bass and Largemouth Bass (see Attachment 2). Their peril is further increased by warming water temperatures; a previous study conducted in 1989 (Kjelson & Brandes) found that survival decreases to nearly zero as water temperatures near 20°C (68°F).

Because of these and other stressors, two out of the four runs of Chinook salmon supported by the Sacramento and San Joaquin basins are listed under the U.S. Endangered Species Act. However, the relative impact of different stressors, as well as the mechanisms through which they impact salmon populations, remain poorly understood. The 2017-2021 Science Action Agenda called attention specifically to uncertainties in predation, several of which this paper set out to address.

With a focus on predation by the well-sampled Largemouth Bass and Striped Bass, Nobriga et al. conducted studies by examining decades of acoustic telemetry (i.e., tagging) data, new video observations of predation on tethered smolts, and simulation modeling. They first set out to verify that the decades-old finding of a survival threshold at 20°C (68°F) still held, which was affirmed by the telemetry data. They hypothesized that warmer temperatures were linked to higher rates of predation, because Largemouth Bass consume more prey as temperature rises (due to their metabolic needs) and that predation by Largemouth Bass in the vegetated margins of the Delta may effectively chase more smolts into the open water (where Striped Bass hunt) further magnifying predation rates.

In contrast to Nobriga et al.'s hypothesis, the data did not suggest a substantial impact of temperature on predation encounters, though predation by Largemouth Bass was slightly higher at warmer temperatures. Instead, the model suggested that the low survival as the temperature approaches 20°C (68°F) is due to a decline in smolt swimming speed with temperature (and thus a lower likelihood of escaping encountered predators). Because this decline in swimming speed with temperature is not seen in captive fish, the authors speculated that it may be caused by increased disease with warming temperatures in the field, noting that such speculations require additional experimental follow-up.

Regardless of the cause of the precipitous decline of Chinook salmon smolt at 20°C (68°F), additional analyses by Nobriga et al. suggest that smolt survival during their transit of the Delta can be actively managed. Namely, the authors propose that managed inflows during April, May, and June can modify temperatures, due to a strong inverse correlation between flow and temperature during those months. They highlight that pulsed inflows that mimic historic flow patterns may additionally be needed to get smolts moving before temperatures become too warm. Further, any actions that reduce the available habitat for nonnative Largemouth Bass, such as removal of nuisance aquatic weeds or filling of ponded areas through restoration, would likely enhance Chinook salmon survival.

DELTA SCIENCE PROGRAM ACTIVITIES

Delta Lead Scientist "Ask Me Anything" Series

The Delta Lead Scientist "Ask Me Anything" Series provides a monthly opportunity for the scientific community and public to engage with the Delta Science Program through an open "office hours" session. Each session is conducted via Instagram

Live (@deltastewardshipcouncil) with at least one co-host and is organized around a suggested theme. On August 30, Delta Science Program Manager Dylan Stern and Central Valley Regional Board Senior Environmental Scientist Lauren Smitherman joined the Delta Lead Scientist for a discussion on independent peer review, with a focus on the recent release of review report on the Delta Mercury Control Program. See the Council's Instagram site for an archive of the recording. For more information on the review report, see Attachment 3.

The next Delta Lead Scientist "Ask Me Anything" will be September 27, from 12-12:30 PM. Subsequent sessions will continue to occur the Monday after Council meetings, at noon.

ON YOUR RADAR

Environmental Justice Brownbag Series

As part of ongoing social science integration efforts at the Council, the Social Science Integration Team has organized its first series of brown bag seminars on social science. To bring more attention to relevant social and people-focused issues, the upcoming virtual talk series is centered around environmental justice and will feature research scholars and public service experts working on a variety of high-priority topics. Each talk in the series will cover one of four different subtopics: 1) water justice, 2) indigenous justice, 3) environmental justice work in the Delta, and 4) climate justice.

The first talk took place on September 8th at 12 PM and co-featured State Water Resources Control Board Member Laurel Firestone alongside the University of California, Los Angeles postdoc and water governance and justice researcher Kristin Dobbin.

The next talk will take place on November 3at 12 PM and focus on indigenous justice. The talk will feature the University of Michigan professor Dr. Kyle Whyte, who also serves on the White House Environmental Justice Advisory Council.

The third talk of the series, on November 17 at 12 PM, will feature the University of California, Davis professor and environmental justice researcher Dr. Julie Sze, who will talk about environmental justice work in the Delta.

Lastly, Dr. Raoul Lievanos from the University of Oregon will present on December 8 at 12 PM. The talk will focus on the racialized disparities related to sea level rise and flooding risk.

All the series' talks are open to the public, will feature a question-and-answer segment, and are available for registration.

2021 State of the Estuary Summit

On October 1, 2021, the San Francisco 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 State-of-the-Estuary Conference in 2023.

A PRIMER ON DELTA FISHERIES

Delta Science Program staff member Pascale Goertler, a fish ecologist, has produced a two-part primer on "must-know" aspects of Delta fisheries. The first fact sheet (Attachment 4) discusses key nonnative predators of Chinook salmon and depicts the geographical predation "hot spots" that salmon encounter as they navigate through the Delta. The second fact sheet (Attachment 5) provides information about the life cycle and current status of native Steelhead and Rainbow trout.

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

Attachment 3: Review of Delta Mercury Control Program Phase 1 Reports: Delta Science Program Information Sheet August 2021

Attachment 4: Predation of salmon in the Delta

Attachment 5: *Oncorhynchus mykiss* (Steelhead and Rainbow trout)

CONTACT

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