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INFORMATION ITEM

Lead Scientist's Report

Summary: This report covers 6 items:

Collaborative Science Activities: (1) Delta Science Fellows selected; (2) Review of Proposition 1 grant proposals for possible Delta Science Program funding;

Science Communication: (3) Journal article on the spread of invasive submerged aquatic vegetation; (4) Update on Central Valley salmonid predation research; (5) Two posters from the 2015 State of the Estuary Conference; (6) "By the Numbers" summary.

Collaborative Science Activities

Delta Science Fellows Selected

The Council's Delta Science Program has selected the 2016 Delta Science Fellows. Fellowship awardees, comprised of nine predoctoral and postdoctoral researchers, will receive up to two years of funding for salary, research supplies/equipment, and travel. The goal of the Delta Science Fellows Program is to bring together junior scientists with Delta agency scientists and senior research mentors to work collaboratively on data analysis and research projects relevant to Delta policy and management. This is the first cohort of Science Fellows that responded to the call for applications focused on the high-impact science actions endorsed by the Delta Plan Interagency Implementation Committee (DPIIC). Since 2003, the Delta Science Fellows Program has paired graduate students and postdoctoral researchers with Bay-Delta agency scientists and senior research mentors in order to address research priorities and pressing science questions of the Bay-Delta system. Together with competitive research grants, the Delta Science Fellows Program is a key mechanism for implementing a shared and balanced portfolio of research funding that address sustainable short-term and long-term science needs, as described in the Delta Science Plan.

The 2016 class of fellows research project will address the following broad topics, based on the high-impact science actions developed jointly with the agencies that form DPIIC:

- Assessing the effects of drought on the Delta;
- Effectiveness and implications of habitat restoration actions;
- Decision support tool development for management of estuarine and migratory species;
- Science supporting the enhancement and protection of the cultural, recreational, natural resource, and agricultural values of the Delta.

The 2016 Delta Science Fellows, their project titles, and other details will be provided at the April Council meeting.

Delta Science Program Review of Proposition 1 Grant Proposals

The Science Program has reviewed highly ranked research grant proposals, originally submitted for potential funding to the California Department of Fish and Wildlife (CDFW) under its Proposition 1 Restoration Grant Program in support of the Delta Science Plan. As prescribed in the grant programs funded by the Water Quality, Supply, and Infrastructure Improvement Act of 2014 (Proposition 1), CDFW was allocated $87.5 million to fund multi-benefit ecosystem restoration projects and scientific studies that support the Delta Science Program with distribution of funding to occur on an annual competitive basis over a 10 year period of time. The research grant proposals reviewed were marked as high-priority but, with the high volume of grant proposals, CDFW was not able to fund these through its 2015–2016 solicitation. Given the high-priority ranking of the proposals and their potential to further science pertinent to the State's coequal goals, CDFW shared these proposals with the Delta Science Program for internal review and consideration for potential funding by the Council. Staff with expertise pertaining to topics covered by the grant proposals conducted internal review of these projects and provided reviews and recommendations to the Council's Science Program management, who collectively are developing funding recommendations that will be brought to the Council at the April Council meeting.

<u>Science Communication</u>

Journal Article – "Measuring Landscape-Scale Spread and Persistence of an Invaded Submerged Plant Community from Airborne Remote Sensing" *Maria J. Santos, Shruti Khanna, Erin L. Hestir, Jonathan Greenberg, and Susan L. Ustin*. Ecological Applications, 2016

Invasive plant species can affect ecosystems by decreasing the abundance and diversity of native species, affecting evolutionary processes, disrupting established communities and ecosystems, and plaguing restoration efforts. In the California Bay-Delta, aquatic habitats are heavily invaded by nonnative plant species, introduced via international shipping, recreation, agriculture, horticulture industries, and other pathways. The Bay-Delta has been described as the most heavily invaded estuary in the world, with various habitats showing between 40 percent and 100 percent of the species present as nonnative. Concerted research is warranted to further understand the spread and persistence of invasive plants. Understanding how invasive species thrive is critical for management and reduction efforts. Unfortunately, making observations necessary to understand invasive species is a challenge due to wide variation of growth rates and persistence depending on location and time. Furthermore, the submerged nature of many aquatic plants makes them especially difficult to monitor.

In a recently published report, Santos et al. (2016) investigated how invasive submerged aquatic vegetation (SAV) spreads and persists in the Bay-Delta. To determine the effect of SAV over a large spatial and temporal scale, the authors took an aerial approach, allowing them to monitor more than 2,220 km^2 (about 850 square miles) of waterways from 2004-2008, making this the largest-scale study of its kind in the Bay-Delta. By developing remote sensing approaches that can image wavelengths

specific to SAV, these researchers were able to efficiently monitor the persistence, distribution, and rate of spread of submerged plant communities at local and regional scales. From 2004-2008, SAV yearly new growth accounted for 40 percent to 60 percent of SAV area, with 50 percent surviving to the following year. Over the five years examined, the spread rate and persistence of SAV decreased. While this study did not differentiate between native and non-native SAV, current approaches enable researchers to distinguish the two, allowing for methods necessary to monitor the recently approved performance measure from chapter 6 of the Delta Plan pertaining to understanding trends in the spatial distribution and coverage of nuisance non-native aquatic plants in the Delta.

Update on Central Valley Salmonid Predation Research

Multiple stressors impact Central Valley salmonids and have led to overall population declines. These stressors include alterations in habitat, food webs, and flow, declines in water quality (e.g. temperature, dissolved oxygen, toxicant burdens), and introduced invasive species. Predation from native and invasive species is one stressor that may have a significant impact on Central Valley salmonids.

A 2013 workshop was convened by CDFW, the Delta Science Program, and the National Marine Fisheries Service to assess the best available science pertaining to the effects of fish predation on salmonids in the Sacramento-San Joaquin Delta and watershed. An expert panel was formed to review the workshop presentations, compile current scientific literature on the topic, and produce a white paper synthesizing the current state of knowledge and provide recommendations for future research directions.

The white paper lead author, Dr. Gary Grossman, a researcher with more than 20 years of fisheries advisory work in the Delta and expertise studying population and community dynamics and habitat selection in fishes, led the expert panel. The white paper notes that predation in and around the Delta may have a large impact on Central Valley salmonids as some studies indicate that the predator population could potentially consume all outmigrating juvenile salmonids; however, science on predator/prey dynamics of Central Valley salmonids was limited, spread across disparate sources, and not always readily available. Despite the presence of numerous potential predatory fish, research indicated that most predators of juvenile salmonids are generalists and no research to date clearly indicated that mortality experienced by juvenile salmonids was primarily due to predation. Along with these results the panel provided a list of recommendations pertaining to establishment of an online, searchable, Delta-science data repository, standardization methods for collection of important research data (e.g. fish abundance estimates, tagging studies, dietary studies), and a list of future research needs.

CDFW, a convener of the 2013 workshop, announced a $1 million solicitation in September 2014 for research that would address “watershed predation of threatened and endangered species”. Three projects have been funded and specifically focus on: 1) understanding how habitat modifications and hatchery practices influence striped bass predation rates on juvenile Chinook salmon and juvenile salmon movement behaviors; 2) investigating how predator-prey density impacts survival for out-migrating

Chinook salmon and steelhead in the lower San Joaquin River and South Delta; and 3) using field experiments to understand how habitat type and turbidity impact the relationship between striped bass density and Chinook salmon mortality. All of these projects address research needs identified in the 2013 white paper by Grossman and colleagues.

More recently on Feb. 10, 2016, Dr. Grossman provided Congressional testimony at an oversight hearing titled, "The costly impacts of predation and conflicting federal statutes on native and endangered fish species." Grossman testified that predation is likely a proximate or secondary cause for the decline in Central Valley salmonid populations and not the primary or ultimate cause. He notes that any environmental factor that adversely impacts juvenile salmonid fitness will increase the probability of mortality from predation. Altered habitats, flows, and contaminants that increase predation risk "could easily be the ultimate cause of predation mortality". He stressed that current science cannot accurately quantify the population level impact of predation on Central Valley salmonids and that management actions such as invasive predator control could have a positive, neutral, or even negative impact on salmonid populations. Given the current state of knowledge Dr. Grossman recommends that future efforts to increase Central Valley salmonids should focus on "habitat and flow restoration, contaminant remediation and alteration of artificial structures that disorient and trap fish".

Poster Summaries from the 2015 State of the Estuary Conference

Longfin Smelt Distribution, Abundance, and Evidence of Spawning in San Francisco Bay Tributaries. *Christian Parker, James Hobbs, Jon Cook, Patrick Crain, Emily Trites, Micah Bisson, and Arthur Barros*

Since the listing of Longfin Smelt as a threatened species under the California Endangered Species Act in 2009, CDFW has conducted the Smelt Larval Survey from January to March to provide near real-time distribution data for Longfin Smelt larvae. Currently the Smelt Larval Survey occurs within the Delta, Suisun Marsh, and Napa River; however, Longfin Smelt may be spawning in other tributaries of San Francisco Bay. Workers from UC Davis conducted fish larval surveys in three San Pablo Bay tributaries including the Napa River, Sonoma Creek, Petaluma River, and Coyote Creek from January 2015 to March 2015 to investigate additional areas wherein Longfin Smelt may be spawning. Longfin Smelt larvae were collected in all but Coyote Creek. These data indicate that Longfin Smelt are spawning in areas outside the sampling coverage of the Smelt Larval Survey. Additional geochemical tracer research will be conducted to ascertain the proportion of the adult Longfin Smelt population originating from these tributaries.

Predation on Fishes in the Sacramento-San Joaquin Delta: Current Knowledge and Future Directions. *Gary Grossman*

Decreased habitat availability in the Delta has likely increased the negative impact of predation on native Delta fishes by concentrating remaining populations in smaller areas. Dr. Grossman compiled predator-prey data for invasive and non-invasive Delta species to investigate the current state of knowledge on the influence of

predation on native Delta fishes. Although predator-prey data came from disparate sources results indicate that predators were only occasionally focused on individual prey species and that predators such as striped bass, largemouth bass, and Sacramento pikeminnow typically consumed a variety of both native and invasive fishes. Overall, the data indicates that predators consumed the most available and abundant fishes (i.e. invasive Delta fishes). Reptilian, avian, and mammalian predator-prey data are sparse; however, Grossman notes that these predators may have significant effects on native species (i.e. salmonids) in altered Delta habitats. Although these general points may be drawn from existing predator-prey studies data are still relatively sparse. More research including long-term dietary studies with attempts to establish predator preferences, rather than just consumption data, is urged to ascertain the spatial-temporal impact of predation on Delta fishes.

By the Numbers

Delta Science Program staff will give 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 *(report to be provided at the Council Meeting)*

Contact

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