Interagency Ecological Program
2023 Annual Work Plan DRAFT

California Department of Fish and Wildlife staff sorting and recording catch from the Bay Study. (Credit: Lynn Takata, Delta Stewardship Council)

Interagency Ecological Program
Cooperative Ecological Investigations Since 1970

November 2022

A few comments from IEP Lead Scientist as we finalize the 2023 Annual Work Plan:

Persistence through a pandemic

Unbelievably, IEP scientists and program managers rarely missed a beat during the COVID-19 pandemic. That's not to say our survey crews and staff weren't affected – they were. Significantly. And they shouldered a great deal of responsibility and bore personal safety concerns to complete their assigned tasks with professionalism and enthusiasm, as always. I wanted to recognize their willingness to go to great lengths, to work long hours, and to show up under confusing and difficult working conditions to do their jobs. For the most part over the last two pandemic years, IEP surveys and Program activities have been completed or modified acceptably to continue to meet our mandated responsibilities for collecting data relevant to tracking the status of endangered species and their habitats in the Estuary. To these everyday heroes of our sometimes-unsung IEP day-to-day survey slog, a heartfelt ***Thank You!*** on behalf of IEP stakeholders, managers, scientists, and supervisors. We have a "world-class" monitoring program because we are lucky to be served by world-class employees. Your work is very much appreciated.

Commitment to survey reviews and revisions of data collection activities

Because collection of credible, relevant, and durable environmental data involves continuous re-appraisal of pertinence, priority, and usefulness to managerial and scientific purpose, the IEP is taking steps with stakeholder partners to revise and improve its efforts at on-going review and revision of our long-term data collection schemes. Re-designing and re-organizing both long-term and special study related collection to better serve evolving needs of management agencies and the scientific community will be a feature of Annual IEP Workplans into the future. I'm wondering as I write this (just on the verge of projected prolonged heat wave in the late summer in most of California) how well we are equipped track, document, archive, and understand Harmful Algal Blooms (HABs) in the Estuary. This has been a topic for some years within the IEP, but when it comes down to collecting and processing the appropriate samples, I wonder if we need to make more real investments in equipment (boats, nets, storage, analysts)? My guess is that we will, and soon.

Understanding the place of science in policymaking

I had the recent experience of trading perspectives with more than a dozen fellow scientists as one member of a scientific advisory team supporting interagency collaboration within the San Francisco Estuary. As part of our interactions, we discovered it has been a common experience over the 200+ years of agency-relevant science represented in the meeting to discover that, however much we value and strive to produce credible and relevant science, the scientific portion of policymaking is at times remarkably small. While some might regard this as disappointing, the groupthink produced on the day I describe was more hopeful, and the consensus was that this makes the opportunities to produce and wield good science ones to be coveted, shared, and celebrated. I think this is something we can keep in mind as we strive to make the IEP the best collaborative science enterprise we can. Our work matters to California water policymaking. As we go about our work and discover just how much we need IEP

data to inform policy, we should be happy to point out where the IEP has a proven track record of data collection and synthesis over the last decades. We should also be willing to listen to where we need improvements, and where we may be headed next – the coming climate changes will demand more from all of us in this regard. Estuary ecology will continue to surprise us; we'll need to be ready!

Keep doing all that you do.

Respectfully,

Steve Culberson, Ph.D.
IEP Lead Scientist
August 30, 2022

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What is the Interagency Ecological Program?

The Interagency Ecological Program (IEP) is a consortium of three state agencies [the California Department of Fish and Wildlife (CDFW), California Department of Water Resources (DWR), and the California State Water Resources Control Board (SWRCB)] and six federal agencies [the U.S. Bureau of Reclamation (USBR), U.S. Fish and Wildlife Service (USFWS), U.S. Environmental Protection Agency (USEPA), U.S. Army Corps of Engineers (USACE), National Marine Fisheries Service (NMFS), and the U.S. Geological Survey (USGS)]. IEP member agencies have been conducting cooperative ecological investigations in the Bay-Delta since the 1970s. The mission of the IEP is to provide and integrate relevant and timely ecological information for management of the Bay-Delta ecosystem and the water that flows through it. The mission is accomplished through collaborative and scientifically sound monitoring, research, modeling, and synthesis efforts for various aspects of the aquatic ecosystem. The IEP addresses high priority management and policy science needs to meet the purposes of, and fulfill responsibilities under, State and Federal regulatory requirements, and relies upon multidisciplinary teams of agency, academic, non-governmental organizations, and other scientists to accomplish this mission.

What does the Work Plan represent?

This Work Plan reflects the annually planned work by IEP agencies to be conducted as part of the consortium within the Bay-Delta ecosystem during the calendar year. The authorities, responsibilities, and management needs for implementing (and funding) of projects and programs included in this plan are generally guided by, and in some cases are defined by, various regulatory requirements, such as the biological opinions, incidental take permits, and water rights decisions that cover the operations of the State Water Project (SWP) and the Central Valley Project (CVP). It is intended that this annual plan reflect a finer-scale focus for planning encompassed within a higher level of planning (3 to 5 years and beyond) outlined by the IEP Science Strategy.

What is included?

Monitoring, research, and synthesis projects focused on the Bay-Delta aquatic ecosystem that meet the mission and vision of IEP and fulfills one or more of the IEP's goals and objectives outlined in the IEP Science Strategy, are eligible for inclusion in the Work Plan.

This Work Plan includes four broad elements that encompass the various projects and activities conducted by the IEP. These elements are further divided into subcategories that differentiate the type of work activities performed.

The four elements and their associated subcategories are the following:

I. **Compliance Monitoring Elements** - This category includes surveys that are required by regulatory documents including, but not limited to, NMFS and USFWS BiOps, CDFW Incidental Take Permit for the State Water Project and Central Valley Project, Salmon and Delta Smelt Resiliency Strategies, and State Water Board Water Right Orders and Decisions). Regulatory requirements may specifically identify compliance monitoring surveys, or they may be general

requirements to conduct fisheries monitoring. Agencies that operate the federal and State water projects (USBR and DWR, respectively) or implement other actions (e.g., USACE) are obligated to implement "compliance monitoring" of fish populations and water quality to satisfy requirements issued by the resource and regulatory agencies (e.g., CDFW, USFWS, NMFS, SWRCB) for the operation of the water projects.

Compliance Monitoring elements can be generally split into two subcategories focused on either real-time operations or long-term status and trends. However, some monitoring efforts may overlap between the two subcategories and supply information for real-time operations *and* status and trends, for example the fall mid-water trawl survey.

- **Operational Monitoring:** Information from these monitoring efforts and surveys is relied on to make real-time operational decisions regarding threatened and endangered species take limits and meeting flow-dependent water quality requirements, and operational limitations (e.g., Delta Cross Channel gates, export limits) as conditions of water rights.
- **Long-term Ecological Monitoring** –These surveys provide information on the long-term status and trends of fish populations, invertebrates, and water quality that are potentially affected by water diversions, contaminants, invasive species, and other stressors on the Bay-Delta ecosystem over time.

II. **Special Study Elements** – This category includes two subcategories focused on the motivation behind the special studies, including those focused on synthesis, modeling, and reviews. Proposals for a special study can come from within a particular agency or from any IEP Governance entity. For Directed Studies, funding must be included for the study to be incorporated into the IEP Annual Work Plan. Specialized projects focused on synthesis, modeling, and reviews are solely dependent on staff capacity, through in-kind contributions from participating member agencies. Compliance Related Directed Studies inform regulatory efforts, whereas Non-Compliance Directed Studies are more generally informing resource management. Directed Studies are typically a lower priority than the Compliance Monitoring (i.e., Operational Monitoring and Long-term Ecological Monitoring) when resources become constrained and can end abruptly when priorities are redirected.

- **Compliance Related Directed Studies** – These are pilot projects required to inform specific compliance-related short-term information needs (e.g., TUCP, barriers, ITP, BiOp, etc.). As part of regular review of IEP monitoring, some of these pilot projects have the potential to become part of a longer-term compliance monitoring program and may, under the approval of the Coordinators and Directors, be moved to the Compliance Monitoring Element. Some of these projects may include synthesis and modeling projects with activities necessary to update conceptual models that are the basis of regulatory documents. Many, but not all, of these

directed studies generally require take authorization pursuant to the Endangered Species Act.

- **Non-Compliance Related Special Studies** – These are short-term studies to address specific scientific questions, areas of critical uncertainty and data gaps regarding species of interest, natural communities, and landscape-scale processes to inform management actions. Some of these studies may also include synthesis projects and reviews of current studies and programs to improve methods, the value of data collected, and the contextual setting of IEP environmental monitoring. The studies involving field work may require take authorization pursuant to the Endangered Species Act while most synthesis and review projects do not require take authorization to implement.

III. **Teams and Outreach Elements** – This category includes three subcategories focused on specialized work teams and community outreach and engagement activities:

- **Technical Teams –** These teams are led by an agency representative who drives the direction and completion of a specific study to meet a need identified by IEP agencies and provide accountability to the agencies initiating the effort. Consultants and outside experts may be invited to provide topical support. Due to the high interest of the topics covered by these teams, they may be tied to a specific Project Work Team to facilitate stakeholder outreach and input.
- **Project Work Teams** –These work teams provide a scientific forum for coordination, collaboration, discussion, and review of focused and specific topic areas of importance. Project Work Team (PWT) members serve as scientific experts and advisors on a voluntary basis for specific science topic areas and, as a group, help to facilitate the sharing of information to the broader science community. Along with the IEP PWT Co-Chairs and Stakeholders meetings, PWTs are the primary forum for external input and collaboration.
- **Workshop** – The workshop is an annual IEP event that facilitates the sharing of IEP data and research findings with the larger estuary science community.

IV. **Program Support Element** – This category is focused on activities to manage and implement the program in an efficient, effective, and consistent manner. Program Management is administered by the IEP Program Manager and the Program Support Team. The Program Manager is responsible for the overall program administration and with the assistance of the Program Support Team provides the business support necessary to implement IEP activities. These activities include staff time and expenses in each agency responsible for IEP activities (e.g., program and project management, data management, etc.).

V. **Closed Work Plan Elements** – This category includes project element numbers that are closed or that are being discontinued for the year. Closure can be due to lack of funding, project completion, or other reasons.

What is not included?

The IEP Work Plan does not reflect all monitoring, studies, research, and synthesis work occurring in the Estuary. Specifically, it does not reflect work conducted by other independent programs that are not directly part of the collaborative effort. Similarly, some efforts, such as support for project work teams (PWTs), workshops, or regulatory staff, may not be explicitly defined in the Work Plan because they are variable in time or extent, or are subsets of included elements, such as on-going synthesis.

How is the Work Plan developed?

The IEP member agency staff initiate, lead, and actively engage in collaborative science and adaptive management teams to consider shared priorities between the member agencies and the larger science community to inform development of the Work Plan. The IEP Work Plan development follows general guidance by the IEP Directors provided during the development period to:

- Pursue goals and strategies in the IEP Strategic Plan, Governance Framework, and Science Strategy, and consider actions in the Delta Stewardship Council's Delta Science Plan and related Science Action Agenda.
- Seek implementation of compliance monitoring, enhancement of long-term baseline data sets, continuation of studies necessary to understand the ecosystem within a watershed context, and the need for science in the overarching categories identified by the IEP Directors.
- Follow a strategy to integrate priorities into work planning by focusing on (a) leadership, (b) scientific investigations, (c) fiscal responsibility, and d) integration with other priorities.
- Capitalize on the experience and perspectives of Project Work Teams (PWTs) and IEP Stakeholders to establish candidate priority monitoring and research.

Changes to Note from Prior Work Plan

- PEN 047 (DWR) Yolo Bypass Fish Monitoring Program moved from the Baseline Status and Trends sub-category to the Operational Monitoring sub-category.
- PEN 322 (USFWS) Estimating Abundance of Juvenile Winter-run Chinook Salmon and Entering and Exiting the Delta (SAIL) moved from Directed Studies category to the Compliance Monitoring Long-term Ecological Monitoring sub-category.

Table 1: 2023 IEP Work Plan Summary.

The work plan contains 75 elements across 4 categories with 40 of those elements having costs totaling $32,482,000.

Category	Number of Elements	Elements with Cost	Category Cost ($1,000s)
Compliance Monitoring Elements	26	25	$21,715
Special Study Elements	23	14	$9,681
Teams and Outreach Elements	25	0	$0
Program Support Element	1	1	$1,236

Table 2: Summary Across Sub-Categories.

The work plan contains 75 elements across 8 sub-categories. The cost for each sub-category is identified in the table below.

Sub-Category	Number of Elements	Elements with Cost	Sub-Category Cost ($1,000s)
Operational Monitoring	23	23	$20,211
Long-term Ecological Monitoring	3	2	$1,504
Compliance Related Directed Studies	13	9	$8,257
Non-Compliance Related Special Studies	10	5	$1,424
Technical Teams	4	0	$0
Project Work Teams	20	0	$0
Workshop	1	0	$0
Program Management	1	1	$1,236

Table 3: Compliance Monitoring Elements: Operational Monitoring Sub-Category Summary.

The 2023 work plan contains 23 elements in the Operational Monitoring sub-category with costs totaling $20,211,000.

Element	Project Title	Principal Investigator	Amount ($1,000s)
2023-003	Fall Midwater Trawl Survey (FMWT)	S. Slater, CDFW	$1,032
2023-007	Summer Townet Survey (STN)	S. Slater, CDFW	$1,034
2023-011	Estuarine and Marine Fish and Crab Abundance and Distribution Survey (Bay Study)	K. Hieb, CDFW	$500
2023-012	Bay Shrimp Abundance and Distribution Surveys (Bay Study)	K. Hieb, CDFW	$168
2023-029	San Francisco Bay Salinity and Temperature Monitoring	P. Work, USGS	$350
2023-030	Delta Flows Network	C. Ruhl, USGS	$919
2023-033	20 mm Delta Smelt Survey (20 mm)	L. Damon, CDFW	$550
2023-047	Yolo Bypass Fish Monitoring Program (YBFMP)	N. Kwan, DWR	$851
2023-053	Juvenile Salmon Monitoring (DJFMP)	E. Huber, USFWS	$4,120
2023-059	Coleman National Fish Hatchery Late-Fall Run Production Tagging	K. Niemela, USFWS	$234
2023-071	Mossdale Spring Trawl (Mossdale)	S. Tsao, CDFW	$295
2023-072	Environmental Monitoring Program	T. Flynn, DWR	$5,200
2023-073	San Joaquin River Dissolved Oxygen Monitoring	T. Flynn, DWR	$25
2023-074	Central Valley Juvenile Salmon and Steelhead Monitoring (Knights Landing)	N. Bauer, CDFW	$602

Element	Project Title	Principal Investigator	Amount ($1,000s)
2023-077	Upper Estuary Zooplankton Sampling	A. Barros, CDFW	$342
2023-088	Spring Kodiak Trawl (SKT)	L. Damon, CDFW	$250
2023-093	UCD Suisun Marsh Fish Monitoring	T. O'Rear, UC Davis	$300
2023-096	Smelt Larva Survey (SLS)	L. Damon, CDFW	$500
2023-104	Operation of Thermograph Stations	E. Parvin, USGS	$60
2023-296	Investigation of the Distribution and Abundance of Longfin Smelt in the SFE	L. Lewis, UC Davis	$350
2023-301	Juvenile Salmon Emigration Real Time Monitoring (DJFMP)	E. Huber, USFWS	$229
2023-311	Tidal Wetland Monitoring Study	C. Bowles, CDFW	$2,100
2023-353	Fish Facilities Monitoring	L. Damon, CDFW	$200

Table 4: Compliance Monitoring Elements: Long-term Ecological Monitoring Sub-Category Summary.

The 2023 work plan contains 3 elements in the Baseline Status and Trends sub-category; 2 of the 3 elements have costs totaling $1,504,000.

Element	Project Title	Principal Investigator	Amount ($1,000s)
2023-002	Adult Striped Bass Population Estimates	D. Stompe, CDFW	$558
2023-303	Salmon Survival Studies (DJFMP)	B. Matthias, USFWS	$0
2023-322	Estimating Abundance of Juvenile Winter-run Chinook Salmon Entering and Exiting the Delta (SAIL)	B. Matthias, USFWS	$946

Table 5: Special Study Elements: Compliance Related Directed Studies Sub-Category Summary.

The 2023 work plan contains 13 elements in the Compliance Related Directed Studies sub-category; 9 of the 13 elements have costs totaling $8,257,000.

Element	Project Title	Principal Investigator	Amount ($1,000s)
2023-043	Estimation of Pelagic Fish Population Sizes	L. Mitchell, USFWS	$0
2023-062	Quantitative Analysis of Stomach Contents and Body Weight for Pelagic Fishes	S. Slater, CDFW	$184
2023-208	Statistical Support (DJFMP) Delta Smelt Life Cycle Model	L. Mitchell, USFWS	$0
2023-249	Gear Efficiency in Support of Delta Smelt Modeling Efforts	L. Mitchell, USFWS	$0
2023-281	North Delta Flow Action: Role of Improved Yolo Bypass Flows on Delta Food Web Dynamics	L. Twardochleb, DWR	$924
2023-325	Enhanced Delta Smelt Monitoring (EDSM)	D. Barnard, USFWS	$3,759

Element	Project Title	Principal Investigator	Amount ($1,000s)
2023-329	Extracting Better Information from Long-Term Monitoring Data: Estimating Occupancy and Abundance of Near Shore Fishes in the Sacramento-San Joaquin River Delta	E. Huber, USFWS	$640
2023-333	Enhanced Acoustic Tagging, Analysis and Real-Time Monitoring	C. Michel, UCSC/NMFS	$1,000
2023-335	Suisun Marsh Salinity Control Gate Study	R. Hartman, DWR	$300
2023-346	Using Delta Smelt Enclosures to Support Species Recovery	B. Schreier, DWR	$400
2023-349	Endangered winter-run Chinook salmon entrainment prediction tool: a machine learning approach to inform management	J. Gaeta, IEP at CDFW	$0
2023-351	Ecological Impacts of Drought: Monitoring and Synthesis	R. Hartman, DWR	$550
2023-352	Larval Smelt Entrainment Monitoring	L. Damon, CDFW	$500

Table 6: Special Study Elements: Non-Compliance Related Synthesis, Modeling, and Reviews Sub-Category Summary.

The 2023 work plan contains 10 elements in the Non-Compliance Related Synthesis, Modeling, and Reviews sub-category; 5 of the 10 elements have costs totaling $1,424,000.

Element	Project Title	Principal Investigator	Amount ($1,000s)
2023-330	Aquatic Habitat Sampling Platform: Platform Utility and Delta Implementation Studies	J. Merz, CFS	$627
2023-342	Spatio-Temporal Community Patterns for Early Life Stages of Fishes and their Associations with Zooplankton in the Upper San Francisco Estuary	G. Castillo, USFWS	$60
2023-347	Survey Design Review for IEP Long-term Monitoring Efforts, Year 1 (smelts) (**On Hold**)	S. Culberson, IEP at DSC	$0
2023-348	Ecosystem Engineering Impacts of Water Primrose (*Ludwigia* spp.) in the Delta	E. Hestir, UCM	$500
2023-354	Physical and Biological Drivers of Fish Distribution in Suisun Bay (**New Study**)	M. Young, USGS	$157
2023-355	Phytoplankton Enumeration Synthesis Project (PESP) (**New Study**)	S. Perry, DWR	$0
2023-356	An Assessment of a Novel Framework to Identify Within-Year Spatial and Temporal Sampling Redundancies in Long-Term Community Monitoring Programs (**New Study**)	J. Gaeta, IEP at CDFW	$0
2023-357	Submersed Aquatic Vegetation in the Delta: Composition, Niche Occupancy and Response to Climatic Factors (**New Study**)	S. Khanna, IEP at CDFW	$0
2023-358	Zooplankton Monitoring Design Review: Gaps, Strength, and Redundancies (**New Study**)	K. Arend, USBR D. Ellis, IEP at CDFW	$0

Table 7: Teams and Outreach Elements: Technical Teams Sub-Category Summary.

The 2023 work plan contains 4 elements in the Technical Team sub-category; none of these elements have costs.

Element	Project Title	Principal Investigator	Amount ($1,000s)
2023-T20	IEP Data Utilization Work Group (DUWG)	D. Bosworth, DWR S. Bashevkin, SWRCB	$0
2023-T21	Central Valley Fish Facilities Review Team	J.C. Dealy, USBR	$0
2023-T27	Salmon Assessment of Indicators by Life Stage (SAIL)	R. Johnson, NOAA	$0
2023-T28	Longfin Smelt Technical Team	M. Eakin, CDFW	$0

Table 8: Teams and Outreach Elements: Project Work Teams (PWT) Sub-Category Summary.

The 2023 work plan contains 20 elements in the Project Work Team sub-category; none of these elements have costs.

Element	Project Title	Principal Investigator	Amount ($1,000s)
2023-T03	Sturgeon PWT	J. Kelly, CDFW	$0
2023-T04	Estuarine Ecology Team (EET) PWT	K. Kayfetz, DSC	$0
2023-T05	Biotelemetry PWT	K. Clark, DWR J. Kelly, CDFW	$0
2023-T06	Spring Run Salmon PWT	F. Cordoleani, NOAA M. Johnson, CDFW	$0
2023-T07	Resident Fishes PWT	N. Kwan, DWR A. Nanninga, USFWS	$0
2023-T09	Tidal Wetland Monitoring PWT	S. Sherman, CDFW	$0
2023-T11	Winter Run Salmon PWT	E. Meyers, CDFW	$0
2023-T12	Juvenile Monitoring PWT	B. Poytress, USFWS	$0

Element	Project Title	Principal Investigator	Amount ($1,000s)
2023-T13	Central Valley Salmonid Hatchery PWT (Dormant) (Satellite team of Central Valley Salmonid PWT)	J. Nelson, CDFW	$0
2023-T14	Aquatic Vegetation PWT	S. Khanna, IEP at CDFW N. Rasmussen, DWR	$0
2023-T15	Steelhead PWT	M. Beakes, USBR R. Bilski, CDFW	$0
2023-T16	Upper Sacramento River Salmon PWT	K. Niemela, USFWS	$0
2023-T17	Contaminants PWT	K. Hoffmann, CDFW T. Lee, DSC	$0
2023-T18	Flow Alteration PWT	R. Hartman, DWR M. Wulf, USGS	$0
2023-T22	Predation PWT	T. Pilger, FISHBIO G. Steinhart, USFWS	$0
2023-T23	Water Quality and Phytoplankton PWT	K. Bouma-Gregson, USGS J. Cooke, CVWB TBD, CDFW	$0
2023-T24	Genetics PWT	M. Baerwald, DWR E.W. Carson, USFWS J. Rodzen, CDFW	$0
2023-T25	Data Science PWT	R. Hartman, DWR T. Hinkelman, ESA	$0
2023-T26	Climate Change PWT	S. Bashevkin, SWRCB D. Colombano (UCB)	$0
2023-T29	Zooplankton PWT	C. Burdi, CDFW	$0

Table 9: Teams and Outreach Elements: Workshop Sub-Category Summary.

The 2023 work plan contains one element in the Workshop sub-category; this element does not have a cost associated with it.

Element	Project Title	Principal Investigator	Amount ($1,000s)
2023-T01	2023 IEP Annual Workshop	S. Fong, IEP at CDFW	$0

Table 10: Support Elements: Program Management Sub-Category Summary.

The 2023 work plan contains 1 element in the Program Management sub-category with costs totaling $1,236,000.

Element	Project Title	Principal Investigator	Amount ($1,000s)
2023-OAC	IEP Oversight and Coordination	S. Fong, IEP at CDFW	$1,236

Footnotes:

"$0": This active or pending element does not have current year or carry over funding included in this work plan. These are typically time-only extensions during the publication phase, no cost studies, work pending future phases or implementation.

"#": For planning purposes, rough cost estimates are provided for each work plan element as described with the assumption that required and optional study components will be implemented, although actual effort may be somewhat less depending upon factors such as the information needs of the agencies, funding availability, field conditions and outcomes of earlier studies. It is important to recognize that expenditures are planned and implemented in the budgets of the participating agencies, not through the IEP as a separate agency.

"1": USBR and CDFW initiated an expedited review process so that potential improvements can be implemented as soon as possible. The survey redesign effort is being done by CDFW to satisfy a term in the 2021 cooperative agreement USBR has with CDFW to provide monitoring services that fulfill USBR permit requirements. Any changes approved through the redesign effort could modify the monitoring design, monitoring data produced, and the budget of surveys described in the 2022 IEP workplan that was approved by the IEP Directors in December 2021. In addition, the redesign effort may result in adjustments to the IEP Survey Design Review for Long-term Monitoring Efforts (workplan number 2022-347). IEP member agencies acknowledge these changes may occur and that changes to monitoring designs would likely require modifications to this workplan. The IEP Coordinators Team will keep the IEP Directors Team informed about progress of the redesign effort and IEP Directors will be provided the opportunity to act on any potential changes to the IEP 2022 Workplan.

Superscript "1" has been attached to the following IEP elements:

2023-003 Fall Midwater Trawl Survey[1] FMWT S. Slater, CDFW

2023-007 Summer Townet Survey (STN)[1] T. Malinich, CDFW

2023-033 20-mm Delta Smelt Survey (20 mm) [1] L. Damon, CDFW

2023-088 Spring Kodiak Trawl (SKT)[1] A. Chorazyczewski, CDFW

2023-096 Smelt Larva Survey (SLS) [1] A. Chorazyczewski, CDFW

2023-347 Survey Design Review for IEP Long-term Monitoring Efforts, Year 1 (smelts) [1] S. Culberson, IEP at DSC

"2": Nexus information in this column is provided for convenience by the California Department of Water Resources and State Water Resources Control Board staff.

2023 IEP Work Plan – Element Details

I. Compliance Monitoring Elements

A. Operational Monitoring

2023-003 Fall Midwater Trawl Survey[1] (FMWT)

PI: Steve Slater (CDFW)

The Fall Midwater Trawl Survey was initiated by the California Department of Fish and Wildlife (CDFW) to determine the relative abundance and distribution of age-0 Striped Bass (*Morone saxatilis*) in the San Francisco Bay/Sacramento-San Joaquin estuary. Sampling has been conducted annually since the project's inception in 1967, with the exceptions of 1974 and 1979. While initiated for the purpose of sampling Striped Bass, the survey is designed to sample pelagic species and the data has been routinely used for other upper estuary pelagic species, including Delta Smelt (*Hypomesus transpacificus*), Longfin Smelt (*Spirinchus thaleichthys*), American Shad (*Alosa sapidissima*), and Threadfin Shad (*Dorosoma petenense*). These species, along with Striped Bass, are considered important indicators of estuary health and all have suffered substantial population declines in recent decades. The Delta Smelt and Longfin Smelt are of particular importance because the former is listed and managed under both the United States and California Endangered Species Acts (ESA), while the latter is listed and managed by the state of California ESA. As a result, continuation of the FMWT survey is mandated by a federal Delta Smelt Biological Opinion for the coordinated operation of the Central Valley Project and the State Water Project. FMWT survey data are used to determine the allowable number of Delta Smelt (i.e., take of Delta Smelt) that can be entrained in the state and federal export facilities in the southern Sacramento-San Joaquin Delta.

Compliance with the following:

2018 USFWS BO	RPA 1,5
2020 CDFW ITP	Table 3.13-1; 3.13.7, 8.1.5.2, 8.3.3, and 8.5.2
D-1485	Terms 10a, 10b, 10c
D-1641	Term 11b
USBR BA/ROD	Status and Trends Table C-2[2]

May also inform or follows up on:
Natural Resource Agency Delta Smelt Resiliency Strategy
Suisun Marsh Salinity Control Gate
North Delta Food Web Managed Flow
USBR Directed Outflow Program

Funding Agency	Amount in thousands of dollars
DWR	$516
USBR	$516
Total	$1,032

2023-007 Summer Townet Survey[1] (STN)

PI: Steve Slater (CDFW)

Summer Townet Survey (STN) is a long-term effort to monitor young pelagic fishes in the upper San Francisco Estuary. Since 1959, STN has sampled fixed locations from eastern San Pablo Bay to Rio Vista on the Sacramento River, and to Stockton on the San Joaquin River, and a single station in the lower Napa River. The study area was expanded in 2011 to include the Sacramento Deep Water Ship Chanel and Cache Slough. Currently, 40 stations are sampled every other week June through August using a conical, fixed-frame net, which is pulled obliquely through the water column 2 to 3 times at each station. Data collected at 31 stations are used to calculate annual relative abundance indices for age-0 Striped Bass and Delta Smelt. The remaining 8 stations are sampled to increase our understanding of juvenile fish abundance and distribution in the lower Napa River and the north Delta. In 2005, STN added a zooplankton net to assess fish food resources at each station and a subset of the fish collected are retained for diet analysis by CDFW researchers (see element # 062). The STN also measures water temperature, water clarity and specific conductivity. Managers and researchers use the data collected by STN to inform decisions and improve our understanding of the health of the upper San Francisco Estuary.

Compliance with the following:

2018 USFWS BO	RPA 5
2020 CDFW ITP	Table 3.13-1; 3.13.7
D-1485	Terms 10a, 10b, 10c
D-1641	Term 11b
USBR BA/ROD	Status and Trends Table C-2[2]

May also inform or follows up on:
Delta Smelt Resilience Strategy (DSRS)
Suisun Marsh Salinity Control Gate
North Delta Food Web Managed Flow Actions
USBR Directed Outflow Program

Funding Agency	Amount in thousands of dollars
DWR	$517
USBR	$517
Total	$1,034

2023-011 Estuarine and Marine Fish and Crab Abundance and Distribution Survey (Bay Study)

PI: Kathy Hieb (CDFW)

The San Francisco Bay Study (Bay Study) is conducted by CDFW and was implemented in 1980 to determine the water quality needs of fish, crabs, and shrimp downstream of the delta. The Bay Study currently samples 52 stations monthly from South San Francisco Bay to the lower Sacramento and San Joaquin rivers with an otter trawl and midwater trawl, which are towed from a research vessel. The study is designed to sample young (age-0) fishes and crabs and juvenile and adult shrimp from open water, soft bottom habitats deeper than 3 meters. Note that shrimp are the focus

of the companion program element "Shrimp Abundance and Distribution Survey". For the fish and crab program element, the Bay Study calculates and reports annual abundance indices and abundance trends for 30+ species of fish and 5 species of crabs. We also track and reports seasonal abundance patterns and annual and seasonal distributional patterns for these species. Ultimately, the abundance trends and distributional patterns are related to physical factors - primarily freshwater outflow, but also ocean and estuarine water temperature, ocean upwelling, and ocean climate indices, such as the Pacific Decadal Oscillation and North Pacific Gyre Oscillation. The goal is to determine what factors may control recruitment and distribution of important estuarine and marine fishes and crabs that rear and reside in the San Francisco Estuary.

Compliance with the following:

2020 CDFW ITP	Table 3.13-1; 3.13.7 and 8.1.5.2
D-1485	Terms 10a, 10c
D-1641	Term 11b
USBR BA/ROD	Status and Trends Table C-2, C-3[2]

May also inform or follows up on:
2018 USFWS BO

Funding Agency	Amount in thousands of dollars
DWR	$250
USBR	$250
Total	$500

2023-012 Bay Shrimp Abundance and Distribution Surveys (Bay Study)

PI: Kathy Hieb (CDFW)

The San Francisco Bay Study (Bay Study) is conducted by CDFW and was implemented in 1980 to determine the water quality needs of fish, crabs, and shrimp downstream of the delta. The shrimp program element is a companion to the "Estuarine and Marine Fishes and Crabs Abundance and Distribution Survey" element. The Bay Study currently samples 52 stations monthly from South San Francisco Bay to the Sacramento and San Joaquin rivers with an otter trawl and midwater trawl, which are towed from a research vessel. The study is designed to sample young (age-0) fishes and crabs and juvenile and adult shrimp from open water, soft bottom habitats deeper than 3 meters. For the shrimp program element, the Bay Study calculates and reports annual abundance indices and abundance trends for 6 common species of shrimp. We also track and report seasonal abundance patterns and annual and seasonal distributional patterns for these species. Ultimately, the abundance trends and distributional patterns are related to physical factors - primarily freshwater outflow, but also ocean and estuarine water temperature, ocean upwelling, and ocean climate indices, such as the Pacific Decadal Oscillation and North Pacific Gyre Oscillation. The goal is to determine what factors may control recruitment and distribution of the most important estuarine and marine shrimp that rear and reside in the San Francisco Estuary.

Compliance with the following:

2020 CDFW ITP	Table 3.13-1; 3.13.7 and 8.1.5.2
D-1485	Terms 10a, 10c
D-1641	Term 11b
USBR BA/ROD	Status and Trends Table C-2, C-3[2]

May also inform or follows up on:
Understanding Estuary Food Webs
Ecological Contribution of Restored Areas
Restoring Native Species and Communities
Impacts of Non-Native Species

Funding Agency	Amount in thousands of dollars
DWR	$84
USBR	$84
Total	$168

2023-029 San Francisco Bay Salinity and Temperature Monitoring

PI: Paul Work (USGS)

Freshwater outflow from the Central Valley to the estuary is highly modified by water diversions and flood control. This in turn alters the distribution of salinity, temperature, and associated habitat in the estuary. This study collects data to observe the spatial variability of temperature and salinity throughout the estuary. Data are collected every 15 minutes at six sites; in most cases, sites have sensors at two depths to observe vertical variations. These data improve our understanding of water quality and transport processes, provide ancillary data that support the calibration of numerical models including those used to simulate habitat, pollutant transport, dredged material disposal, and wetland restoration. This project is an ongoing monitoring study designed to identify long term trends.

Compliance with the following:

D-1485	Terms 10a, 10b, 10c
D-1641	Term 11a
USBR BA/ROD	Adaptive Management Program Monitoring, Table C-3[2]

May also inform or follows up on:
Effects of Climate Change and Extreme Events
Understanding Estuary Food Webs

Funding Agency	Amount in thousands of dollars
DWR	$325
USGS	$25
Total	$350

2023-030 Delta Flows Network

PI: Catherine Ruhl (USGS)

The US Geological Survey, Bay Delta Hydrodynamics Program has been collecting water level, velocity, and flow data in the Sacramento-San Joaquin Delta since 1978. Today, the flow network includes 35 stations throughout the Delta and in some cases

have expanded to include water quality data collection as well. The data collected at these stations are critical for understanding the circulation and mixing patterns in the complex and interconnected channels that comprise the Delta region. Understanding Delta hydrodynamics is imperative to documenting current conditions and to understanding the impacts of proposed major infrastructure projects and regulatory actions being taken to protect threatened and endangered species in the Delta.

Compliance with the following:

2020 CDFW ITP	Table 3.13-1
D-1485	Term 10a, 10b, 10c
D-1641	Term 11a, Table 5, Figure 4

May also inform or follows up on:
2018 USFWS BO
POD

Funding Agency	Amount in thousands of dollars
DWR	$836
USGS	$83
Total	$919

2023-033 20-mm Delta Smelt Survey[1] (20 mm)

PI: Lauren Damon (CDFW)

The 20-mm Survey samples the upper San Francisco Estuary every other week from March through July at 47 fixed stations to determine the distribution and abundance of juvenile Delta and Longfin Smelt. Results from this survey are provided in near-real time to assess the entrainment risk.

Compliance with the following:

2020 USFWS BO	RPA 5
2020 CDFW ITP	Table 3.13-1; 3.13.7 and 8.4.2
D-1485	Term 10a, 10b, 10c
D-1641	Term 11b
USBR BA/ROD	Status and Trends Table C-2[2]

May also inform or follows up on:
Effects of Climate Change and Extreme Events
Understanding Estuary Food Webs

Funding Agency	Amount in thousands of dollars
DWR	$300
USBR	$250
Total	$550

2023-047 Yolo Bypass Fish Monitoring Program (YBFMP)

PI: Nicole Kwan (DWR)

The objectives of this interdisciplinary monitoring effort are to collect baseline data on lower trophic levels (phytoplankton, zooplankton, and aquatic insects), juvenile and

adult fish, and water quality. Understanding the specific environmental conditions that trigger migrations and enhanced survival and growth of native fishes (esp. salmon and smelt) are of critical importance for restoration efforts, and the Yolo Bypass is a critical linkage in the health of fish populations and the entire bay delta ecosystem. Furthermore, the mechanisms through which lower trophic organisms reach higher abundance in the Yolo Bypass are not well understood. The YBFMP will serve to fill in these information gaps. The Yolo Bypass has been identified as a high restoration priority by the National Marine Fisheries Service and US Fish and Wildlife Service Biological Opinions for Delta Smelt, winter & spring-run Chinook Salmon. The YBFMP informs the restoration actions that are mandated or recommended in these plans, provides valuable response data for adaptively managing bypass weirs, and provides critical baseline data on floodplain ecology.

Compliance with the following:

2020 CDFW ITP	Table 3.13-1

May also inform or follows up on:
2009 NMFS BO
2008 USFWS BO

Funding Agency	Amount in thousands of dollars
DWR	$851
Total	$851

2023-053 Juvenile Salmon Monitoring (DJFMP)

PI: Eric Huber (USFWS)

The Delta Juvenile Fish Monitoring Program conducts weekly beach seining (year-round) within the lower Sacramento River and Delta and the lower San Joaquin River, and bi-weekly seining (year-round) in San Francisco Bay and San Pablo Bay to monitor the relative abundance and distribution of juvenile Chinook Salmon and other juvenile fishes in unobstructed near-shore habitats. Year-round surface trawling is conducted in the Sacramento River near Sacramento and in the San Joaquin River near Mossdale to monitor juvenile Chinook Salmon entering the Delta. In addition, year-round surface trawling at Chipp's Island monitors juvenile Chinook Salmon exiting the Delta. Surface trawling at Mossdale is conducted in cooperation with the California Department of Fish and Wildlife.

Compliance with the following:

2020 CDFW ITP	Table 3.13-1
2009 NMFS BO	11.2.1.3(8) d. pg. 586
D-1485	Terms 10a, 10b, 10c
D-1641	Term 11b
USBR BA/ROD	Status and Trends Table C-2[2]
USBR BA/ROD	Real-time Monitoring Table C-1[2]

May also inform or follows up on:
Understanding Estuary Food Webs
Ecological Contribution of Restored Areas
Restoring Native Species and Communities

Impacts of Non-Native Species

Funding Agency	Amount in thousands of dollars
DWR	$2,575
USBR	$1,545
Total	$4,120

2023-059 Coleman Nat. Fish Hatchery Late-Fall Run Production Tagging

PI: Kevin Niemela (USFWS)

This element consists of coded-wire tagging of all Coleman National Fish Hatchery late fall-run production to ensure proper race identification during subsequent recovery of fish at Delta export facilities, and in juvenile and adult sampling programs. Approximately 1,100,000 late fall-run Chinook Salmon will be marked and tagged each year. Recovery of tagged late-fall run fish is also part of the spring-run recovery plan. (Note: This is part of the US Fish and Wildlife Service Delta Juvenile Fish Monitoring Program.)

Compliance with the following:

2020 CDFW ITP	8.6.1 and 8.6.4
2009 NMFS RPA	2011 amendments (Action IV.3)
D-1485	Terms 10a, 10b, 10c
D-1641	Term 11b

May also inform or follows up on:
Restoring Native Species and Communities
Chinook Salmon and Central Valley Steelhead

Funding Agency	Amount in thousands of dollars
DWR	$124
USBR	$110
Total	$234

2023-071 Mossdale Trawl (Mossdale)

PIs: Eric Huber (USFWS) and Steve Tsao (CDFW)

The Mossdale Trawl monitors timing and production (indices and estimates) for the out-migrating fall-run Chinook salmon smolts at this location since 1987 by then the California Department of Fish and Game and now California Department of Fish and Wildlife. The Mossdale Trawl is the key juvenile salmonid monitoring activity in San Joaquin Basin passing into the South Delta. Sampling is coordinated year-round between CDFW and USFWS DJFMP staff. The data collected is provided to all interested stakeholders including CDFW, NOAA, NMFS, USFWS, USBOR, SWRCB, DWR, local water districts and NGO weekly.

Compliance with the following:

2020 CDFW ITP	Table 3.13-1; 3.13.2
2009 NMFS BO	11.2.1.3-5, 11.2.1.3-8
D-1485	Terms 10a, 10b, 10c
D-1641	Term 11b

USBR BA/ROD	Status and Trends Table C-2[2]
USBR BA/ROD	Real-time Monitoring Table C-1[2]

May also inform or follows up on:
Restoring Native Species and Communities

Funding Agency	Amount in thousands of dollars
DWR	$250
CDFW	$45
Total	$295

2023-072 Environmental Monitoring Program

PI: Ted Flynn (DWR)

The Environmental Monitoring Program's (EMP) monitoring and reporting requirements are described in Water Right Decision 1641 (D-1641). D-1641 requires that the EMP conduct a comprehensive environmental monitoring program to determine compliance with the water quality standards. The EMP is also mandated in the Incidental Take Permit for operation of the State Water Project. The EMP collects monthly discrete water quality, nutrients, phytoplankton, zooplankton and benthic samples and continuous water quality data throughout the San Francisco Bay Delta. The program objectives are to 1) document compliance with Bay-Delta water quality objectives; 2) maintain a long-term baseline record and provide a record of trends; 3) develop and improve predictive tools to assess changes within the Bay-Delta; 4) provide accurate and validated water quality information on a timely basis in a format appropriate for a variety of users; and 5) respond to the findings of ongoing monitoring, changing conditions within the Bay-Delta, and the needs of management with special studies.

Compliance with the following:

2020 CDFW ITP	Table 3.13-1; 3.13.7
D-1641	Terms 3, 11a, 11c, 11d, and 11e, Table 5, Figure 4
USBR BA/ROD	Status and Trends Table C-2[2]

May also inform or follows up on:
FLOAT
POD

Funding Agency	Amount in thousands of dollars
DWR	$2,600
USBR	$2,600
Total	$5,200

2023-073 San Joaquin River Dissolved Oxygen Monitoring

PI: Ted Flynn (DWR)

EMP monitors dissolved oxygen (DO) levels in the Stockton Ship Channel to ensure that water quality objectives established by the Central Valley Regional Water Quality Control Board and State Water Resources Control Board are being met as well as to document long term trends in water quality in the area. EMP's continuous water quality station near Rough and Ready Island (RRI) records DO measurements at 15 minutes

intervals at three separate depths. If daily DO values remain below minimum thresholds for three consecutive days, additional discrete monitoring is triggered to measure DO values at fixed stations upstream and downstream of RRI.

Compliance with the following:

D-1641	Terms 11a, 11b, Table 5, Figure 4

May also inform or follows up on:
Science Action Agenda

Funding Agency	Amount in thousands of dollars
DWR	$25
Total	$25

2023-074 Central Valley Juvenile Salmon and Steelhead Monitoring (Knights Landing)

PI: Nick Bauer (CDFW)

The California Department of Fish and Wildlife operates a juvenile salmonid monitoring program on the Sacramento River near Knights Landing (rkm 144). One pair of rotary screw traps out-fitted with 8-foot cones captures juvenile salmonids emigrating from the upper Sacramento River to the Sacramento-San Joaquin Delta. Data are collected on the temporal distribution and relative abundance of Chinook salmon (*Oncorhynchus tshawytscha*) and steelhead trout (*O. mykiss*), in addition to run composition for Chinook.

Compliance with the following:

2009 NMFS BO	
2019 NMFS BO	
2020 CDFW ITP	Table 3.13-1; 7.5.2
D-1485	Terms 10a, 10b, 10c
D-1641	Term 11b
USBR BA/ROD	Real-time Monitoring Table C-1[2]

May also inform or follows up on:
Resilience to Climate Change
Restoring Bay-Delta Native Fishes and Community Interactions: Salmonids

Funding Agency	Amount in thousands of dollars
DWR	$301
USBR	$301
Total	$602

2023-077 Upper Estuary Zooplankton Sampling

PI: Arthur Barros (CDFW)

The Zooplankton Study has estimated the abundance of zooplankton taxa in the upper San Francisco Estuary since 1972, as a means of assessing trends in fish food resources and is part of a D-1641 mandate to monitor water quality and related

parameters. Sampling with three gear types occurs monthly at 23 stations located throughout San Pablo Bay, Suisun Marsh, Suisun Bay and the delta.

Compliance with the following:

2020 CDFW ITP	Table 3.13-1
D-1641	Term 11a, Table 5, Figure 4
USBR BA/ROD	Status and Trends Table C-2[2]

May also inform or follows up on:
FLOAT

Funding Agency	Amount in thousands of dollars
DWR	$171
USBR	$171
Total	$342

2023-088 Spring Kodiak Trawl[1] (SKT)

PI: Lauren Damon (CDFW)

The Spring Kodiak Trawl targets adult Delta Smelt during their spawning season. The trawl samples 40 fixed stations throughout the upper San Francisco Estuary and is conducted monthly from January through May. Reproductive stage is determined for all Delta Smelt caught during this survey to approximate when and where spawning is occurring. Reproductive timing, abundance, and spatial and temporal distribution results are reported in near-real time to resource managers to evaluate Delta smelt entrainment risk at water export facilities.

Compliance with the following:

2020 CDFW ITP	Table 3.13-1; 3.13.7, 8.1.5.1, and 8.1.5.2
2020 USFWS DS BO	
D-1485	Terms 10a, 10b, 10c
D-1641	Term 11b
USBR BA/ROD	Status and Trends Table C-2[2]

May also inform or follows up on:
Effects of Climate Change and Extreme Events
Restoring Native Species and Communities

Funding Agency	Amount in thousands of dollars
DWR	$125
USBR	$125
Total	$250

2023-093 UCD Suisun Marsh Fish Monitoring

PI: Teejay O'Rear, UC Davis (UCD)

The Suisun Marsh Fish Study, a collaboration among UC Davis, DWR, and volunteers that began in 1980, monitors fish and invertebrate assemblages monthly throughout Suisun Marsh, primarily with otter trawls and beach seines. The main purpose of the study has been to understand environmental and anthropogenic factors affecting the

aquatic community, in part by providing baseline data and methods for finer-scale ancillary studies focused on elucidating mechanisms. Aside from papers in peer-reviewed publications and presentations at conferences such as the Bay-Delta Science Conference, the primary conduit of the study's information is the annual report, which is completed each April and is available on either DWR's and UC Davis's websites (e.g., https://watershed.ucdavis.edu/user/53/library). Information collected by the study is crucial for delineating long-term trends, documenting, and understanding new species invasions, and gauging restoration and management actions.

Compliance with the following:

2020 CDFW ITP	Table 3.13-1
BCDC	4-84(M) Special Condition B
USACE	Permit 1622E58B Special Condition 1
Revised Suisun Marsh Monitoring Agreement (Agreement Number 4600000634)	
D-1485	Terms 10a, 10b, 10c
D-1641	Term 11b

May also inform or follows up on:
Effects of Climate Change and Extreme Events
Restoring Native Species and Communities

Funding Agency	Amount in thousands of dollars
DWR	$300
Total	$300

2023-096 Smelt Larva Survey[1] (SLS)

PI: Lauren Damon (CDFW)

The Smelt Larva Survey samples the upper San Francisco Estuary every other week from January through March at 44 fixed stations to determine the distribution and relative abundance of larval Longfin smelt. Results from this survey are provided in near-real time to assess the risk of entrainment.

Compliance with the following:

2020 CDFW ITP	Table 3.13-1, 3.13.7 and 8.4.2
D-1485	Terms 10a, 10b, 10c
D-1641	Term 11b
USBR BA/ROD	Status and Trends Table C-2[2]

May also inform or follows up on:
Effects of Climate Change and Extreme Events
Restoring Native Species and Communities

Funding Agency	Amount in thousands of dollars
DWR	$375
USBR	$125
Total	$500

2023-104 Operation of Thermographic Stations

PI: Edmund Parvin (USGS)

Water-quality work at these sites consists of continuous monitoring of water temperature at sites 11303500, San Joaquin River at Vernalis, CA and 11389500, Sacramento River below Wilkins Slough near Grimes, CA, and sediment sampling at site 11303500, San Joaquin River at Vernalis, CA. Temperature measurements are recorded at fifteen-minute intervals during the entire water year. The purpose is to provide continuous information on the temperature regime in the river to help evaluate effects on fisheries, amphibian, and other aspects of the aquatic ecosystem. Daily observer suspended sediment sampling is conducted to assist in determining the load carried by the San Joaquin River, additional sampling for sediment is conducted by USGS crews on a regular basis as part of the load determining protocols. The purpose of the data that the USGS collects is to better understand the transition from cold water to warm water regimes and how fluxes in sediment and temperature magnitude interacts to control the transition.

Compliance with the following:

2009 NMFS BO	I.2.1 (performance measures) I.4, IV
D-1641	Terms 11a and 11b
USBR BA/ROD	Real-time Monitoring Table C-1[2]

May also inform or follows up on:
2008 USFWS BO

Funding Agency	Amount in thousands of dollars
DWR	$55
USGS	$5
Total	$60

2023-296 Investigation of the Distribution and Abundance of Longfin Smelt in the SFE

PI: Levi Lewis (UCD)

Longfin Smelt populations have declined rapidly in the SFE, and little remains known about their distributions in wetland habitats of the lower SFE. The need for understanding their distribution, habitat use, and reproductive biology is outlined in the IEP Longfin Smelt Science Plan (LFSSP). Here, Longfin Smelt are sampled in wetlands of the lower estuary to address data needs identified in the LFSSP including expanded monitoring and development of a captive culture program for Longfin Smelt. Water quality data will be paired with data on fish abundance, size structure, and maturity to provide additional information on the geographic distribution of Longfin Smelt, critical habitats, associations with environmental conditions; and to provide broodstock for the Longfin Smelt captive culture program.

Compliance with the following:
Longfin Smelt Settlement

Funding Agency	Amount in thousands of dollars
DWR	$250
USGS	$50
San Jose City	$50
Total	$350

2023-301 Juvenile Salmon Emigration Real Time Monitoring (DJFMP)

PI: Eric Huber (USFWS)

Beach seining and surface trawling are conducted 3 days/week from October 1st to January 31st near Sacramento to detect the arrival of older juvenile Chinook Salmon entering the Delta. Monitoring data are used to inform Delta Cross Channel Gate closure decisions from October 1st to December 15th in order to minimize the diversion and mortality of emigrating juvenile winter-run sized Chinook Salmon. These data also were and will continue to be used to inform biological opinions, and drought operations planning decisions. (Note: This is part of the US Fish and Wildlife Service Delta Juvenile Fish Monitoring Program.)

Compliance with the following:

2020 CDFW ITP	Table 3.13-1
D-1485	Terms 10a, 10b, 10c
D-1641	Term 11b
USBR BA/ROD	Status and Trends Table C-2[2]
USBR BA/ROD	Real-time Monitoring Table C-1[2]
2009 NMFS BO	11.2.1.3 (8) d. pg. 586

May also inform or follows up on:
Restoring Native Species and Communities

Funding Agency	Amount in thousands of dollars
DWR	$85
USBR	$144
Total	$229

2023-311 Tidal Wetland Monitoring Study

PI: Christy Bowles (CDFW)

The CDFW Fish Restoration Program will collect fish and invertebrate data near existing and planned tidal wetlands. These data will provide information on how fish and invertebrate communities change pre-/post-restoration. A suite of sampling gears will be deployed to capture fish and invertebrates throughout the year to characterize their use, relative abundance, and community compositions at tidal wetlands. Over time, the Fish Restoration Program will assess the effectiveness tidal wetland restoration as it relates to providing food sources and habitat refuge for at-risk native fishes.

Compliance with the following:

2020 CDFW ITP	Table 3.13-1
2019 USFWS BO	

May also inform or follows up on:
Restoring Bay-Delta Native Fishes and Community Interactions: Salmonids and Delta Smelt
Aquatic Vegetation Dynamics

Funding Agency	Amount in thousands of dollars
DWR	$2,100

Total	$2,100

2023-353 Fish Facilities Monitoring

PI: Lauren Damon (CDFW)

The State Water Project (SWP), operated by the California Department of Water Resources (DWR), and the Central Valley Project (CVP), operated by the U.S. Bureau of Reclamation (USBR), export water out of the San Francisco Bay Delta for urban and agricultural use in California. When water is exported, fish become entrained into the diversion. Since 1957, the USBR has salvaged fish at the Tracy Fish Collection Facility (TFCF). CDFW's Fish Facilities Unit, in cooperation with DWR, began salvaging fish at the Skinner Delta Fish Protective Facility (SDFPF) in 1968. The salvaged fish are trucked daily and released at several sites in the western Delta. The schedule of fish hauling is dependent on salvage rates, debris loading, and special-status-species procedures. Salvage of fish at both facilities is conducted 24 hours a day, seven days a week at regular intervals. Sampling of entrained fish at the SDFPF and TFCF is the source for CDFW's daily salvage and loss estimates for the monitoring of incidental take of listed fish species.

Fish salvage and loss information at the SDFPF and TFCF is used extensively in water project monitoring and planning. The Fish Facilities Monitoring Project manages the data collected on fish entrained and salvaged at the SDFPF and TFCF. Directed by cooperative agreements and funded by USBR and DWR, project staff are responsible for key entry, quality assurance, data processing, data reporting, and other database management activities for these facilities. This project maintains one of the largest historical databases on Delta species available and has been used in assessing the effects of new facilities and programs, water project operations proposals, and evaluation of proposed CALFED alternatives.

Compliance with the following:
2020 CDFW ITP

May also inform or follows up on:
Restoring Native Species and Communities

Funding Agency	Amount in thousands of dollars
USBR	$200
Total	$200

B. Long-term Ecological Monitoring

2023-002 Adult Striped Bass Study

PI: Dylan Stompe (CDFW)

This program element provides data to assess the impact of freshwater flow diversion on the structure, function, and health of the bay-delta ecosystem. It does this by providing indices of adult striped bass abundance, completing the life cycle monitoring of San Francisco Estuary striped bass in addition to the Fall Midwater Trawl and

Summer Townet Survey. With these project elements, recruitment limiting periods in striped bass life history can be identified and assessed in relation to water operations.

Compliance with the following:

D-1485	Terms 4e,10a, 10b, 10c
D-1641	Term 11b

May also inform or follows up on:
Fisheries Policies set for by the California Fish and Game Commission for management of Striped Bass
Delta Fisheries Management Policy

Funding Agency	Amount in thousands of dollars
DWR	$279
USBR	$279
Total	$558

2023-303 Salmon Survival Studies (DJFMP)

PI: Bryan Matthias (USFWS)

The objective of this task is to assess juvenile salmon survival in the south Delta, and to determine the relative importance of factors influencing salmon survival as they move through the Delta. The results are used to inform several management groups (i.e., the Collaborative Adaptive Management Team's Salmon Scoping Team workgroup).

May also inform or follows up on:
Restoring Native Species and Communities

Funding Agency	Amount in thousands of dollars
DWR	In-kind Contribution
USBR	In-kind Contribution

2023-322 Estimating Abundance of Juvenile Winter-run Chinook Salmon Entering and Exiting the Delta (SAIL)

PI: Bryan Matthias (USFWS)

This is a continuation of a five year project funded by CDWR and CDFW and the Central Valley Project Improvement Act in 2017. The objective of the project is to improve estimates of population abundances for fall, winter and spring run juvenile Chinook Salmon at Sacramento and Chipps Island by improving trawl efficiency estimates using data from releases of coded wire tags (CWT), acoustic tags (AT), and by genetically sampling the trawl catch in 2022 and 2023. The project will (1) develop statistical models for estimating trawl efficiencies using 2016-2022 data for paired AT-CWT releases of winter run and fall-run Chinook Salmon; (2) use 2016-2022 genetic sampling of trawl catch in combination with efficiency estimates to estimate population abundances of fall, spring and winter run at Sacramento and Chipps Island for 2016-2022; (3) implement trawl efficiency studies for multiple salmon runs in 2022-2023 informed by the prior results and in coordination with hatcheries for inclusion of AT fish with existing CWT releases; and (4) combine trawl efficiencies with genetic samples of

trawl catch to provide estimates of fall, spring and winter-run salmon abundance (with estimated precision) entering and exiting the Delta in 2016-2022.

Compliance with the following:

D-1485	Terms 10a, 10b, 10c
D-1641	Term 11b

May also inform or follows up on:
Restoring Native Species and Communities

Funding Agency	Amount in Thousands of Dollars
DWR	$604
USBR (CVPIA)	$342
Total	$946

II. Special Study Elements

A. Compliance Related Directed Studies

2023-043 Estimation of Pelagic Fish Population Sizes

PI: Lara Mitchell (USFWS)

Estimates of fish abundance, and corresponding measures of uncertainty, are critical for assessing the status of the population, estimating vital rates such as survival and reproduction, and developing management actions aimed at population recovery and sustainability. This work focuses on advancing abundance estimation methods for multiple life stages of Delta Smelt based on a variety of sampling surveys, including the 20-mm Survey, Summer Townet Survey, Fall Midwater Trawl Survey, Spring Kodiak Trawl Survey, and the Enhanced Delta Smelt Monitoring program. Such abundance estimates serve as input data for models linking environmental covariates and management actions to population dynamics. This work also extends methods that were developed for Delta Smelt to Longfin Smelt, which is another species of management concern. Work on Longfin Smelt abundance estimates will continue to build on exiting models for Longfin Smelt population dynamics and growth. Abundance modeling for Longfin Smelt will differ from models for Delta Smelt because of their longer life span and different geographic patterns throughout the life cycle.

Compliance with the following:

D-1485	Terms 10a, 10b, 10c
D-1641	Term 11b

May also inform or follows up on:
2010 POD Work Plan – On-Going Studies

Funding Agency	Amount in Thousands of Dollars
USFWS	In-kind Contribution

2023-062 Quantitative Analysis of Stomach Contents and Body Weight for Pelagic Fishes

PI: Steve Slater (CDFW)

The Diet and Condition study has provided information on the food habits of pelagic fishes in the estuary since 2005. We focus on the temporal and spatial differences in diet composition and feeding success of Delta Smelt, Striped Bass, Threadfin Shad, Longfin Smelt, Mississippi Silversides, and American Shad. This study was created to address questions of food limitation in young fish by understanding the types and amount of prey eaten among seasons and regions of the upper estuary. Food limitation can be an important factor to the annual recruitment success of young fishes. Stomach contents are identified to describe fish diets and stomach fullness. This study is a collaboration with IEP monitoring surveys with samples provided by STN (2023-007), FMWT (2023-003), 20-mm (2023-033), Smelt Larva Survey (2023-096), Bay Study (2023-011), SKT (2023-088), and USFWS EDSM (2023-325).

Compliance with the following:

D-1485	Terms 10a, 10b, 10c
D-1641	Term 11b

May also inform or follows up on:
Delta Smelt Resiliency Strategy (DSRS)
Directed Outflow Project
Suisun Marsh Salinity Control Gate
North Delta Food Web

Funding Agency	Amount in Thousands of Dollars
DWR	$92
USBR	$92
Total	$184

2023-208 Statistical Support (DJFMP) Delta Smelt Life Cycle Model

PI: Lara Mitchell (USFWS)

The DSLCM is a state-space model for Delta Smelt population dynamics that is fit using long-term fish survey data sets from multiple surveys corresponding to different life stages (e.g., post-larvae, juveniles, sub-adults, and adults). The model is designed to estimate survival rates between life stages and recruitment rates between year-classes, and to establish a quantitative link between these rates and management actions and environmental conditions. The goal of the modeling effort is to provide guidance on effective management actions that would both prevent extinction and lead to a rebuilding of the population contingent on environmental conditions beyond the control of USFWS.

Compliance with the following:

D-1485	Terms 10a, 10b, 10c
D-1641	Term 11b

May also inform or follows up on:
FLOAT

POD

Funding Agency	Amount in Thousands of Dollars
DWR	In-kind Contribution
USBR	In-kind Contribution

2023-249 Gear Efficiency in Support of Delta Smelt Modeling Efforts

PI: Lara Mitchell (USFWS)

Gear selectivity evaluations are needed to integrate catch data from multiple trawl surveys to estimate abundance and ultimately to model population dynamics for Delta Smelt and other species of management concern. Data from simultaneous, adjacent deployment of IEP survey gears has permitted the estimation of selectivity curves relating the relative capture probability of Delta Smelt and can be used for other species of a given size across gears. These selection curves have been used to calculate estimates of Delta Smelt abundance which were then used as input data in a hierarchical state-space life cycle model. As an extension of this work comparing and integrating data from multiple survey programs, we plan to investigate whether any bias can be detected in data from fixed site surveys such as the Spring Kodiak Trawl, Fall Midwater Trawl, and 20-mm when compared with data from random site surveys such as the Enhanced Delta Smelt Monitoring program. This analysis will be relevant to the sample design development of current and future monitoring programs in the San Francisco Estuary. It may also provide insight on how to integrate CDFW and USFWS survey data to inform population trends.

Compliance with the following:

D-1485	Terms 10a, 10b, 10c
D-1641	Term 11b

May also inform or follows up on:
POD

Funding Agency	Amount in Thousands of Dollars
USFWS	In-kind Contribution
CDFW	In-kind Contribution

2023-281 North Delta Flow Action: Role of Improved Yolo Bypass Flows on Delta Food Web Dynamics

PI: Laura Twardochleb (DWR)

In a collaborative effort between CA Department of Water Resources, US Bureau of Reclamation, CA Department of Fish and Wildlife, US Fish and Wildlife Service, United States Geological Survey and San Francisco State University, this project monitors and evaluates the effects of augmented summer and fall flows in the Yolo Bypass and North Delta areas on lower trophic food web dynamics and benefits to listed fish species. Using both continuous and discrete sampling approaches, this study will relate hydrologic patterns to chlorophyll-a, nutrients and primary productivity rates, plankton densities and composition (phytoplankton and zooplankton), contaminant

concentrations, as well as water quality parameters such as electrical conductivity, turbidity, and dissolved oxygen.

Compliance with the following:

D-1485	Terms 10a, 10b, 10c
D-1641	Term 11b
2019 USFWS BO	
2020 CDFW ITP	

May also inform or follows up on:
Delta Smelt Resiliency Strategy (DSRS)
IEP FLOAT MAST

Funding Agency	Amount in Thousands of Dollars
DWR	$924
Total	$924

2023-325 Enhanced Delta Smelt Monitoring (EDSM)

PI: Denise Barnard (USFWS)

The primary objective of the Enhanced Delta Smelt Monitoring program (EDSM) conducted by the U.S. Fish and Wildlife Service is to enhance the data available for calculating life stage-specific estimates of abundance and distribution for Delta Smelt at management-relevant time scales. The EDSM program employs a stratified random sampling design that includes multiple crews trawling concurrently at multiple sites in pre-defined strata in the San Francisco Estuary. EDSM sampling occurs year-round via Kodiak trawls and 20 mm gear. Daily catch summaries and weekly abundance reports are distributed to managers and stakeholders. Catch data on smelt and salmonids are also made available to the Smelt Monitoring Team and Salmon Monitoring Team as part of their risk assessment processes.

Compliance with the following:

2019 USFWS BO	
2020 CDFW ITP	3.13.1, 3.13.6, 8.1.5.1, 8.1.5.2, and 8.5.2
D-1485	Terms 10a, 10b, 10c
D-1641	Term 11b
USBR BA/ROD	Real-time Monitoring Table C-1[1]

May also inform or follows up on:
Delta Smelt Resiliency Strategy (DSRS)
Delta Science Strategy

Funding Agency	Amount in Thousands of Dollars
USBR	$3,759
Total	$3,759

2023-329 Extracting Better Information from Long-Term Monitoring Data: Estimating Occupancy and Abundance of Near Shore Fishes in the Sacramento-San Joaquin River Delta

PI: Eric Huber (USFWS)

The purpose of this study is to expand IEP monitoring and inference to other dominant near-shore, littoral habitats not sampled by beach seines using boat electrofishing. To accomplish this, we will sample key littoral fish species across various near-shore habitats to determine how best to estimate abundance, occupancy, capture probabilities, and related environmental drivers.

Compliance with the following:

D-1485	Terms 10a, 10b, 10c
D-1641	Term 11b

May also inform or follows up on:
Understanding Estuary Food Web Ecological Contributions of Restored Areas
Restoring Native Species and Communities
Impacts of Non-Native Species

Funding Agency	Amount in Thousands of Dollars
DWR	$360
USBR	$280
Total	$640

2023-333 Enhanced Acoustic Tagging, Analysis, and Real-Time Monitoring

PI: Cyril Michel, U. C. Santa Cruz (UCSC) / (NMFS)

Understanding the movement and survival rates of out-migrating salmonids in real-time is critical for resource managers to make informed decisions. Through the development of a website and deployment of real-time acoustic receivers, detections of acoustically tagged fish can be displayed in real-time at multiple locations in the Sacramento River, Delta and SF Bay (https://calfishtrack.github.io/real-time/index.html). Movement and survival rates are estimated between receiver sites and route selection is predicted at critical junctions in the Delta. ESA listed salmonids will be acoustic tagged and released at different locations during the winter and spring to track movement and survival rates in different regions, and relate survival to environmental factors such as flow, temperature, and turbidity.

Compliance with the following:

D-1485	Terms 10a, 10b, 10c
D-1641	Term 11b

May also inform of follows up on:
2009 NMFS BO

Funding Agency	Amount in Thousands of Dollars
USBR	$1,000
Total	$1,000

2023-335 Suisun Marsh Salinity Control Gate Study

PI: Rosemary Hartman (DWR)

The Suisun Marsh Salinity Control Gate (SMSCG) has been identified as a management tool to improve habitat conditions for Delta Smelt in summer-fall. The

proposed effort is the scientific evaluation of the project. Much of the evaluation will be based on existing IEP surveys and instrumentation (e.g., Environmental Monitoring Program, Summer Townet Survey, Fall Midwater Trawl, Enhanced Delta Smelt Monitoring), but we will include some additional evaluation tools such as the deployment of hatchery Delta Smelt in custom cages at strategic locations during the SMSCG action.

Compliance with the following:

D-1485	Terms 10a, 10b, 10c
D-1641	Term 11b

May also inform or follows up on:
Delta Smelt Resiliency Strategy (DSRS)

Funding Agency	Amount in Thousands of Dollars
DWR	$300
Total	$300

2023-346 Using Delta Smelt Enclosures to Support Species Recovery

PIs: Melinda Baerwald and Brian Schreier (DWR)

With the wild Delta Smelt population's continued decline, cultured Delta Smelt are being used to evaluate management actions and support species recovery through future population supplementation. In the summer of 2023, we propose to deploy enclosures to assist in collecting effectiveness data in association with the Suisun Marsh Salinity Control Gate (SMSCG) action. We will assess fish health, growth, diet, and survival over a four-week period during the SMSCG action, if one occurs.

Compliance with the following:

2019 USFWS BO	
2020 CDFW ITP	3.13.5
D-1485	Terms 10a, 10b, 10c
D-1641	Term 11b

May also inform or follows up on:
Suisun Marsh Salinity Control Gates

Funding Agency	Amount in Thousands of Dollars
DWR	$400
Total	$400

2023-349 Endangered winter-run Chinook salmon entrainment prediction tool: a machine learning approach to inform management

PI: Jereme Gaeta (IEP at CDFW)

The purpose of this project is to inform Science Requirement 7.5.3 of the 2020 CDFW Incidental Take Permit for State Water Project operations. More specifically, we propose developing a suite of statistical models (and an interactive web-tool) that provide the Salmon Monitoring Team with predicted winter-run Chinook salmon detection in salvage given current or hypothetical conditions. The primary deliverable of this effort will be an

interactive web-tool that provides the Salmon Monitoring Team with a time-series estimating the probability of winter-run Chinook salmon salvage given current and recent conditions in the San Francisco Estuary as well as a scenario tool predicting winter-run Chinook salmon salvage given a user selected suite of near-future conditions. We propose using a non-linear, non-parametric, ensemble regression tree approach to predict winter-run Chinook salmon detection in salvage as a function of numerous physical, limnological, biological, and temporal variables collected throughout the San Francisco Estuary with an emphasis on the Sacramento River-San Joaquin River Delta.

Compliance with the following:

2020 CDFW ITP	7.5.3 and 8.6.6
D-1485	Terms 10a, 10b, 10c
D-1641	Term 11b

May also inform or follows up on:
Restoring Native Species and Communities

Funding Agency	Amount in Thousands of Dollars
CDFW	In-Kind Contribution

2023-351 Drought Ecosystem Monitoring and Synthesis Plan

PI: Rosemary Hartman (DWR)

The Drought Ecosystem Monitoring and Synthesis project will evaluate ecosystem responses to the current drought in the Sacramento-San Joaquin Delta and Suisun Marsh, as well as the impacts of the Emergency Drought Barrier. Data collection will rely primarily on existing monitoring, with the addition of a few special studies. Data from the current drought will be integrated and compared to previous droughts and previous wet periods to detect ecosystem changes. The team working on this effort contains members from DWR, DSP, USBR, CDFW, USFWS, and USGS who are all committed to synthesis and monitoring of ecosystem drought impacts. The project started in March 2021 and is projected to conclude in June 2023 or potentially later if future years remain dry. Major deliverables of this project include annual progress reports summarizing major drought-related changes, at least two manuscripts to be published in peer-reviewed journals, and various science communication products including presentations and blog posts.

Compliance with the following:

2020 CDFW ITP	8.21
D-1641	Term 11b
D-1485	Terms 10a, 10b, 10c

May also inform or follows up on:
2021 Drought Contingency Plan
Drought Toolkit
Emergency Drought Barrier

Funding Agency	Amount in Thousands of Dollars
DWR	$550

Total	$550

2023-352 Larval Smelt Entrainment Monitoring Pilot Study (2022)

PI: Lauren Damon (CDFW)

Delta Smelt (*Hypomesus transpacificus*) and Longfin Smelt (*Spirinchus thaleichthys*) are protected under the Endangered Species Act. Water exports at the State Water Project (SWP) entrains fish and are a source of mortality, so take is authorized by the 2020 Incidental Take Permit (ITP) for the Long-Term Operation of the SWP in the Sacramento-San Joaquin Delta. Entrainment results in "loss" of fish from the population. To date, only juvenile and adult smelt (>20 mm) loss has been quantified, but given continued declines, larval loss is also a concern. No quantitative larval smelt monitoring currently occurs at the salvage facilities, the sensitivity of existing larval smelt monitoring at the salvage facilities is only appropriate for detecting presence. This project's primary purpose is to fulfill the 2020 ITP Condition of Approval (COA) 7.6.2, which states, "Permittee shall fund and implement a new Smelt Larval Entrainment Program to quantify larval DS and LFS entrainment into Clifton Court Forebay (CCF)." An interagency team has formed to complete this work, fulfill the multiple reporting and consultation requirements, and continue the pilot study in 2023. To fulfill the project purpose, physical sampling will be conducted using paired towed bongo nets targeting larval fish in West Canal outside the entrance to CCF.

Compliance with the following:

2020 CDFW ITP	7.6.2
D-1641	Term 11b
D-1485	Terms 10a, 10b, 10c

May also inform or follows up on:
Restoring Native Species and Communities

Funding Agency	Amount in Thousands of Dollars
DWR	$500
Total	$500

B. Non-Compliance Related Special Studies

2023-330 Aquatic Habitat Sampling Platform: Platform Utility and Delta Implementation Studies

PI: Joe Merz, Cramer Fish Sciences (CFS)

The purpose of this study is to quantify and characterize fish response to engineered levee slope attributes near setback levees with waterside habitat and to measure the fish community response to large scale tidal restoration at Dutch Slough Tidal Restoration Project. Analyzing environmental DNA (eDNA) coupled with observations by the Aquatic Habitat Sampling Platform (Sampling Platform) at sites in the Delta and Dutch Slough channels will provide an unprecedented assessment of fish community response to altered and restored environments.

The Sampling Platform is a 26-ft boat, with adjustable concentrator net and smaller drift net attached to an adjustable sample chamber, containing cameras, water sampling equipment, and water quality sensors integrated with fish finder, GPS, and other data recording equipment. The Sampling Platform is an integrated aquatic species and habitat sampling system that can effectively sample fish and invertebrates and reveal habitat associations while having minimal or no "take" of sensitive species. The sampling apparatus is suspended by hydraulic arms allowing fine-scale adjustments to sampling depth during operation. Wheels attached to the bottom of the net frame allow the frame to roll over obstacles, reducing impact and facilitating continued sampling across variable habitats. Additionally, collection of water during transects for the detection of environmental DNA (eDNA), the data collected by the AHSP gives an unprecedented view of fish use of various habitats. Deployment of this versatile sampling system expands data collection to shallow and off-channel habitat, while offering the capability to transition to deeper and open water habitats, providing for reliable estimates of sampling efficiency and "catch" per unit effort and improving our knowledge about populations, habitat associations and major stressors of key organisms.

Compliance with the following:

May also inform or follows up on:
Interagency Ecological Program Science Agenda

Funding Agency	Amount in Thousands of Dollars
DWR	$627
Total	$627

2023-342 Spatio-Temporal Community Patterns for Early Life Stages of Fishes and their Associations with Zooplankton in the Upper San Francisco Estuary

PI: Gonzalo Castillo (USFWS)

This study will generate new understanding on spatial and temporal community patterns for the larval-juvenile fishes and zooplankton in the upper San Francisco Estuary. This study will also help to evaluate potential trophic associations between fish and zooplankton. To accomplish this, the study will primarily make use of the long-term (1995-2017) CDFW 20 mm survey data. Covariates derived from other IEP programs will also be considered to evaluate their influence on fish and zooplankton communities.

Compliance with the following:

May also inform or follows up on:
Restoring Native Species and Communities
Effects of Climate Change and Extreme Events

Funding Agency	Amount in Thousands of Dollars
USBR	$60
Total	$60

2023-344 Developing an eDNA Metabarcoding Protocol to Improve Fish and Mussel Monitoring in the San Francisco Estuary

PI: Andrea Schreier (UCD)

We will develop an eDNA metabarcoding protocol to complement existing IEP monitoring surveys and assess the effects of management activities such as habitat restoration or flow alteration. We will develop a reference sequence database for native and invasive fish, mussels, and macroinvertebrates present in the San Francisco Estuary (SFE). We will optimize a molecular and computational pipeline for metabarcoding and ground truth the method against three SFE monitoring efforts, each using different sampling gear. We will investigate the relationship between eDNA sequence read count and biomass or abundance. Finally, we will determine the ability of metabarcoding to detect fish and macroinvertebrate assemblages across large and small spatial scales and over time. Study activities will include sampling, laboratory work, and data analysis/interpretation. Sampling will occur at multiple locations in the SFE: Yolo Bypass, Suisun Marsh, and multiple other locations (to be determined in conjunction with the enhanced delta smelt monitoring survey (EDSM)). Lab work and data analysis will take place at the Genomic Variation Laboratory at UC Davis. Results will be published open access in peer reviewed journals and the reference sequence database will be made publicly available.

Compliance with the following:

May also inform or follows up on:
Understanding Food Webs
Restoring Native Species and Communities
Impacts of Non-Native Species

Funding Agency	Amount in Thousands of Dollars
CDFW	$80
Total	$80

2023-347 Survey Design Review for IEP Long-term Monitoring Efforts, Year 1 (smelts)[1] (On Hold)

PI: Steve Culberson (IEP at DSC)

In 2020 a pilot effort was conducted to evaluate the feasibility, develop analytical tools, and establish procedures for more routinely evaluating the usefulness and applicability of core IEP long-term fish and environmental surveys. The pilot effort is focusing on community-based survey design and existing dataset characterization more so than ecological interpretation. A final report to the IEP Directors was delivered in December 2020. Only minimal progress has been made thus far in 2021 due to the emergence of a “6-Agency Redesign” effort being directed external to the IEP; that effort is using personnel resources that had been envisioned for the present review effort. In 2022 we propose to continue our review efforts as a regular and routine feature of the IEP Annual Work Plan, targeting core Delta and Longfin Smelt surveys.

Compliance with the following:

May also inform or follows up on:

IEP Science Strategy

Funding Agency	Amount in Thousands of Dollars
Other	In-kind contributions

2023-348 Ecosystem Engineering Impacts of Water Primrose (*Ludwigia spp.*) in the Delta

PI: Erin Hestir, U. C. Merced (UCM)

Water primrose (*Ludwigia* spp.) is a highly invasive, non-native floating macrophyte in the Delta. In recent years, water primrose has extended its niche into marsh habitat, causing extensive mortality of marsh macrophytes including tules and cattails. The goal of this project is to determine whether the growth strategy of water primrose, its allelopathic properties, or factors related to plant community structure are the cause of marsh loss following water primrose invasion in the Delta. As part of our study we will identify and map the marshes most vulnerable to loss and quantify the spatial trajectory of marsh loss during the past 15 years. The ultimate benefit of this work will be an improved understanding of the water primrose invasion processes in the Delta, which can be used to prioritize herbicide treatment of this highly invasive plant in marshes most vulnerable to invasion and with the highest habitat value.

Compliance with the following:

May also inform or follows up on:
Delta Water Quality and Ecosystem Restoration Program
Delta Science Plan
Interagency Ecological Program Science Strategy

Funding Agency	Amount in Thousands of Dollars
CDFW	$500
Total	$500

2023-354 Physical and Biological Drivers of Fish Distribution in Suisun Bay (New Study)

PI: Matthew Young (USGS)

Species distributions in San Francisco Estuary are controlled by factors acting at multiple spatiotemporal scales, including physical habitat (e.g., channels, shoals, wetlands, vegetation), water quality conditions (e.g., salinity, temperature, turbidity), and hydrodynamics (site-specific tidal velocities). The interactions of these factors in time and space influence the distribution of individual species. Because long-term monitoring programs are not robust to highly variable environmental drivers, additional information on fine-scale distribution patterns of San Francisco Estuary fishes is needed to assess the impact of spatiotemporally discrete management actions, such as dredging. The United States Army Corps of Engineers needs higher resolution information on fish distribution to inform their estimates of dredging impacts and to assess alternate methods of data collection.

Compliance with the following:

May also inform or follows up on:

Funding Agency	Amount in Thousands of Dollars
USACE	$157
Total	$157

2023-355 Phytoplankton Enumeration Synthesis Project (New Study)

PIs: Sarah Perry (DWR) and Jenna Rinde (CDFW)

Phytoplankton community composition is an important driver of zooplankton productivity and food supply for higher trophic levels. However, many questions remain as to which taxa are “best” food for zooplankton, what drives abundance of different phytoplankton taxa, and the relationship between chlorophyll fluorescence data and phytoplankton biomass. Answering these questions have been hindered by lack of access to existing phytoplankton datasets and lack of a standardized way of combining and analyzing these datasets. Having datasets combined in a standardized format will lay the framework for a better understanding of productivity in the estuary.

Compliance with the following:

May also inform or follows up on:

Funding Agency	Amount in Thousands of Dollars
CDFW	In-Kind Contribution
DWR	In-Kind Contribution

2023-356 An Assessment of a Novel Framework to Identify Within-Year Spatial and Temporal Sampling Redundancies in Long-Term Community Monitoring Programs (New Study)

PI: Jereme Gaeta (IEP at CDFW)

Long-term monitoring programs not only contribute disproportionately to our understanding of ecological processes (relative to shorter-term studies) but contribute disproportionately to environmental policy. An omnipresent challenge these critical long-term monitoring programs face, however, is determining which stations and events to maintain when confronted with infrastructure stressors such as unexpected reductions in personnel (e.g., retirements or illness), unanticipated mechanical issues (i.e., boats lost from the fleet for maintenance or repair), or even unpredictable global pandemics (e.g., the ongoing COVID-19 pandemic). While sensitivity analysis methods to assess the implications of reduced sampling effort on a single variable, such as a catch of a single species, have been developed, many IEP surveys were developed directly due to mandates to survey biological communities or are considered to fulfill mandates to survey biological communities (e.g., see Water Rights Decision 1641); sensitivity analyses, therefore, require multi-species analytical methods. Yet, the only sensitivity analysis methods to assess the implications of reduced sampling effort on community data involve condensing a community down to a single metric, such as species richness or an index (e.g., Simpson’s or Shannon’s index), and then performing a sensitivity analysis on that single metric. However, these univariate community metrics are fraught

with shortcomings and often criticized by the scientific community with limited applicability to management actions.

Compliance with the following:

May also inform or follows up on:

Funding Agency	Amount in Thousands of Dollars
CDFW	In-Kind Contribution

2023-357 Submersed Aquatic Vegetation in the Delta: Composition, Niche Occupancy and Response to Climatic Factors (New Study)

PI: Shruti Khanna (IEP at CDFW)

This project will focus on Submersed Aquatic Vegetation (SAV) with an IEP Synthesis effort that will integrate a historical and an ongoing dataset of Delta SAV coverage since 2004 with existing hydrodynamic model outputs such as water speed, salinity, and depth, turbidity derived from remote sensing imagery, and temperature and outflow observations to build a realized niche occupancy model for SAV. This study will also analyze field SAV data collected since 2004 to determine characteristics of different SAV species to grow as monocultures or form community assemblages and determine how the SAV community has changed from 2004 to present. We anticipate that the integration and assessment of these field data in conjunction with the niche occupancy model will allow us to define species-specific niche space within the SAV community and evaluate whether the invasive SAV niche space differs from the native niches. Finally, we will combine our niche model with climate change projections of temperature, solar radiation, inflow and outflow scenarios during drought and wet years to predict whether and, if so, how SAV niche space and cover may change or expand as we move toward an increasingly altered Delta ecosystem.

Compliance with the following:

May also inform or follows up on:

Funding Agency	Amount in Thousands of Dollars
CDFW	In-Kind Contribution

2023-358 Zooplankton Monitoring Design Review: Gaps, Strength, and Redundancies (New Study)

PI: Kristi Arend (USBR) and Daniel Ellis (IEP at CDFW)

Zooplankton are critical components of estuarine ecosystems because they link primary producers with upper levels of the food web. To conserve the San Francisco Estuary (SFE), its listed fish, and the flora and fauna it supports, we need to develop better models that integrate zooplankton into our understanding of the food web. SFE monitoring focused primarily on fishes before the importance of zooplankton as prey was recognized. This recognition led to the addition of zooplankton surveys to monitor status and trends in, and the effects of, water operations on environmental conditions and fish prey resources. Since the Environmental Monitoring Program began monitoring zooplankton in the SFE in 1972, additional long-term zooplankton surveys have been

added, typically to pre-existing or new fish surveys. When synthesized, these datasets cover a broad area of the SFE but vary in spatial and temporal coverage through time. Despite a sizable dataset, we do not know its limitations in answering important ecological and management questions. In this study, we seek to evaluate the gaps, strengths, and redundancies of the zooplankton monitoring program to characterize the status and trends of the community. The ultimate goal of this project is to inform an improved zooplankton monitoring design that will allow scientists and managers to document and understand changes in community and population dynamics over time and space and in response to potential drivers such as flow, temperature, or salinity. This project will use existing datasets and modelling approaches to evaluate zooplankton monitoring design.

Compliance with the following:

May also inform or follows up on:

Funding Agency	Amount in Thousands of Dollars
CDFW	In-Kind Contribution
USBR	In-Kind Contribution
DWR	In-Kind Contribution
DSC	In-Kind Contribution

III. Teams and Outreach

A. Technical Teams (TTs)

2023-T20 IEP Data Utilization Work Group (DUWG)

Chairs: David Bosworth (DWR) and Sam Bashevkin (SWRCB)

The Data Utilization Workgroup (DUWG) is a multi-agency technical team established to address the IEP's data management needs by setting internal procedures and guidelines, defining and implementing shared data standards across member agencies, facilitating data sharing in a timely manner, and coordinating with other data management teams in the Delta science community. Studies that are included in the IEP Work Plan would follow any guidelines set up by DUWG; studies conducted by IEP partners could use these guidelines as they see fit. The DUWG's activities include (1) developing data standards and best practices, including minimum standards for data descriptions, definitions, and documentation, (2) increasing efficiency and openness of data sharing and interoperability among datasets, and (3) providing support for IEP member agencies. Membership in the DUWG is limited to individuals representing IEP member agencies and affiliated groups.

2023-T21 Central Valley Fish Facilities Review Team

Chairs: John Carl (Carl) Dealy (USBR) and Javier Miranda (DWR)

The main objective of the Central Valley Fish Facilities Review Team is to review, coordinate activities, and provide oversight for Central Valley fish screen and fish

passage projects. The team is comprised of scientists and engineers who generally meet two to three times per year but will meet more frequently if necessary. Meetings are used to introduce and provide guidance for new fish screen related study programs, provide updates for ongoing programs, and disseminate information on new fish screen technologies.

2023-T27 Salmon Assessment of Indicators by Life Stage (SAIL)

Chair: Rachel Johnson (NOAA)

California's Central Valley Interagency Ecology Program (IEP) formed multi-agency Salmon and Sturgeon Assessment of Indicators by Life Stage (SAIL) synthesis teams to develop a scientific framework for evaluating existing information on endangered Sacramento River winter-run Chinook salmon (SRWRC; *Oncorhynchus tshawytscha*), green sturgeon (*Acipenser medirostris*), and white sturgeon (*A. transmontanus*) and provide recommendations to improve the management value of life stage monitoring. Developing the SAIL framework for SRWRC and sturgeon followed parallel approaches that included three steps. First, existing conceptual models (CMs) were reviewed and modified to characterize specific environmental and management factors that drive SRWRC responses within discrete geographic domains and life stages. Second, the existing monitoring network was compared to fish demographic responses in the CMs to identify deficiencies. The deficiencies were interpreted as gaps in the existing network that prevent annual, quantitative, population-level metrics from being developed that are needed to support water management actions, assess population viability, and prioritize population recovery actions among geographic domains across the freshwater landscape. Lastly, identified absences were used to develop recommendations on ways to improve the scientific and management value of the current monitoring network.

2023-T28 Longfin Smelt Technical Team

Chair: Michael Eakin (CDFW)

On March 31, 2020, CDFW issued an Incidental Take Permit (ITP) to the California Department of Water Resources (DWR) for the long-term operations of the State Water Project (SWP) in the Sacramento-San Joaquin Delta (ITP No. 2081-2019-066-00). As part of the Conditions of Approval for the ITP, DWR is required to implement a Longfin Smelt Science Program and develop a Longfin Smelt Science Plan (LFSSP) for the term of the ITP. The LFSSP is expected to inform scientific priorities identified within Condition of Approval 7.6.3 of the ITP. The LFSSP was approved in writing by the California Department of Fish and Wildlife (CDFW) on December 8, 2020 and contains seven Priority Areas to address the science priorities identified in the ITP. The Longfin Smelt Technical Team (LFSTT) was established to coordinate implementation of the LFSSP through a collaborative forum between DWR, CDFW, the United States Fish and Wildlife Service (USFWS), and the State Water Contractors (SWC). This process is expected to ensure advancement in Longfin Smelt scientific understanding over the term of the ITP (10 years).

B. Project Work Teams (PWTs)

2023-T03 Sturgeon PWT

Chairs: John Kelly (CDFW)

The Sturgeon Project Work Team encourages, facilitates, and coordinates sturgeon monitoring, research, and information dissemination, and provides a technical forum for Central Valley sturgeon issues. The objectives of the Sturgeon Project Work Team are to 1) Encourage, facilitate, and assist development of research on life history, distribution, population dynamics, abundance, and ecology of Central Valley sturgeon, 2) Encourage, facilitate, and assist development of monitoring and research to evaluate the effects of water development/management and other stressors on Central Valley sturgeon, 3) Identify research questions and data gaps, 4) Provide technical review of sturgeon research, monitoring, and restoration proposals and recommendations on technical issues related to the protection, restoration, and management of sturgeon, 5) Promote dissemination of project updates, research results, and current literature among scientists, resource managers, restoration specialists, and constituent organizations, and 6) Promote sustainable management of California's sturgeon species. The Sturgeon PWT meets twice a year, with occasional special sessions or subcommittee meetings, as needed.

2023-T04 Estuarine Ecology Team (EET) PWT

Chair: Karen Kayfetz (DSC)

The Estuarine Ecology Team (EET) is an interdisciplinary forum to improve understanding of the Bay-Delta ecosystem, by fostering communication and collaboration among scientists. The purpose of the group is to provide a forum for emerging scientific ideas and problems and improve scientific communication. There are many other project work teams in the IEP landscape, generally focused on specific species, habitats, or management actions. The EET is a place to take on broader ecological issues with an interdisciplinary group. Some characteristics that make EET unique are that it explicitly makes connections with ecosystems upstream and downstream of the Delta, considers linkages and interactions between species across trophic levels, and fosters interdisciplinary partnerships.

2023-T05 Biotelemetry PWT

Chairs: Kevin Clark (DWR) and John Kelly (CDFW)

The mission of the IEP Biotelemetry PWT is to provide a conduit for communication and coordination among scientists engaged in biotelemetry activities in the Central Valley, Delta, Estuary and near shore Pacific Ocean. This communication entails regular meetings, identification and discussion of current and future projects, and proposal review as solicited to facilitate collaboration, standardization of methods and technologies where possible and the leveraging of resources. The purpose of the Biotelemetry PWT is to coordinate Biotelemetry Projects taking place in the Central Valley and provide a forum for collaboration between Biotelemetry projects within the

Central Valley (sharing equipment, tagged fish, etc.). In the coming year, the Biotelemetry PWT will focus on communicating the need for stable funding for the Core 69 khz receiver array and soliciting volunteers to help maintain some 69 khz receivers at core locations. The Biotelemetry PWT meets twice per year.

2023-T06 Spring Run Salmon PWT

Chairs: Flora Cordoleani (NOAA) and Matt Johnson (CDFW)

Since 1999 Central Valley spring-run Chinook (CVSC) salmon ESU is state and federally listed as a threatened species and is currently faced with three primary threats: (1) loss of most historic spawning habitat; (2) degradation of the remaining rearing and migration habitats; and (3) genetic introgression with the Feather River Fish Hatchery spring-run Chinook salmon strays (NMFS 2014). While a large amount of monitoring occurs in the Central Valley, the understanding of CVSC dynamics is still very data limited, and the existing CVSC salmon monitoring programs seem to be fragmented and lack a common thread. Therefore, the goal of the IEP spring-run Chinook salmon PWT is to provide a venue for scientists from diverse agencies/groups to coordinate and synthetize findings, which will in turn inform research and monitoring needs in the future. Key roles and activities include: 1) coordination on in-season status and trend monitoring updates, 2) technical guidance to IEP Lead Scientist, Coordinators and Directors on science priorities, 3) development, coordination, and technical review of management-relevant research and studies for IEP and other partners (e.g., modeling, manipulation, and monitoring). The PWT meet twice a year, in the spring and the fall of each year. Sub-teams that will potentially be created to tackle a specific PWT question will meet on a more regular basis (not determined yet) and report their conclusions to the PWT during the bi-annual meeting.

2023-T07 Resident Fishes PWT

Chairs: Nicole Kwan (DWR) and Adam Nanninga (USFWS)

The IEP Resident Fishes Project Work Team (PWT) is a forum for information exchange, discussion, synthesis, and exploring and recommending next steps in research and monitoring activities related to populations of resident fishes in the San Francisco Estuary. Resident fishes are defined rather loosely to include fishes spending all or part of their life cycle as residents in the San Francisco Estuary. This definition will exclude salmonids and sturgeons because PWTs dedicated to these taxa already exist; however, we encourage members of these salmonid and sturgeon PWTs to share their information with the Resident Fishes PWT as certain topics are likely to be of interest to both groups. In the upcoming year, a few members of the Resident Fishes PWT is planning to initiate a synthesis study on the native cypriniform fish species of San Francisco Estuary that have received little attention in the past. The Resident Fishes PWT will serve as an avenue for feedback and information/data exchange for this particular study. In addition to the continual update of the native cypriniform synthesis study, the Resident Fishes PWT will continue to highlight any important or management-relevant work on resident fish species that are not covered by the IEP workshop or other PWTs. The Resident Fishes PWT meets anywhere between 3-4 times a year depending on need and availability of presenters.

2023-T09 Tidal Wetland Monitoring PWT

Chair: Stacy Sherman (CDFW)

The IEP Tidal Wetland Monitoring Project Work Team (TWM PWT) facilitates collaboration in the design of monitoring and research programs to evaluate the effectiveness of tidal wetland restoration in providing habitat and food web resources to native fishes, particularly Delta Smelt and juvenile Chinook Salmon. The geographic focus of the team's work is the Sacramento-San Joaquin Delta and Suisun Marsh, but we strive to coordinate and collaborate with scientists who work in other areas of the estuary or watershed and with those who focus on non-fish aspects of wetland ecology. TWM PWT membership is open to all and currently includes experts in a wide variety of wetland-related disciplines as well as representatives of many agencies, universities, non-profits, and private interests. The team acts as a forum for the discussion of monitoring and research proposals and for presentation of preliminary results. The full team currently meets approximately quarterly, with sub-team meetings called as needed.

2023-T11 Winter-Run Salmon PWT

Chair: Erica Meyers (CDFW)

The Winter-run Project Work Team coordinates research, monitoring and management activities for the state and federally listed endangered Sacramento River winter-run Chinook salmon. The team facilitates communication and information exchange on technical issues among the agencies and stakeholders. The team also provides advice, peer review, and recommendations on technical issues related to the protection, restoration, and management of winter-run Chinook. Each year the PWT submits a recommendation letter to the National Marine Fisheries Service for the calculation of the Winter Run Juvenile Production and Central Valley Project and State Water Project Take Estimates.

Team members currently include staff from the California Departments of Fish and Wildlife and Water Resources, The Metropolitan Water District of Southern California, National Marine Fisheries Service, Bureau of Reclamation, the U.S. Fish and Wildlife Service and other Stakeholders. The team meets bi-monthly or as needed.

2023-T12 Juvenile Monitoring PWT

Chair: Bill Poytress (USFWS)

The Juvenile Monitoring Project Work Team (JMPWT) is a satellite team of the Central Valley Salmonid Project Work Team. The goal of the JMPWT is to bring together biologists to collaborate in a manner that will benefit juvenile monitoring activities in the Central Valley. The specific objectives of the group include, but are not limited to increase the quality and utility of juvenile monitoring data, standardize sampling techniques (where applicable), improve methods for analyzing and presenting monitoring data, identify research questions and data gaps, provide expert recommendation and/or review of issues affecting juvenile salmonids, and collaborate on data compilation projects in an effort to expand the knowledge of fisheries biology within the Central Valley of California. Team members currently include staff from the

California Department of Fish and Game and Water Resources, East Bay Municipal Utility District, United States Fish and Wildlife Service and Bureau of Reclamation, and various private consulting groups. Team meetings are held quarterly throughout the year.

2023-T13 Central Valley Salmonid Hatchery PWT (Dormant)

Chairs: Jon Nelson (CDFW)

The Central Valley Hatchery Project Work team, a satellite team of the Central Valley Salmonid Project Work Team, facilitates communication and information exchange related to the propagation, marking and tagging, distribution, research, and monitoring of Chinook salmon and steelhead from Central Valley Hatcheries, including Livingston Stone National Fish Hatchery, Coleman National Fish Hatchery, Feather River Hatchery, Nimbus Fish Hatchery, Mokelumne River Hatchery, Merced River Hatchery, and the San Joaquin Conservation Hatchery. The team provides a forum for interagency coordination among hatchery managers and supervisors, and between hatchery managers and agency and stakeholder biologists involved in the management of Central Valley fisheries and recovery of listed stocks. The team will review issues related to Central valley hatchery production and discuss recommendations for improved hatchery management.

2023-T14 Aquatic Vegetation PWT

Chairs: Shruti Khanna (IEP at CDFW) and Nick Rasmussen (DWR)

The IEP Project Work Team (PWT) for Aquatic Vegetation formed to address a gap within the IEP science program for coordination of science efforts related to aquatic vegetation, and the lack of a consistent monitoring program for aquatic vegetation coverage. The goals of the PWT are to provide a forum for research and monitoring activities, help guide and evaluate management efforts, and support development of work plans for new studies. In 2018, key activities include (1) development of a monitoring framework that, if implemented, would provide information that would address key management questions regarding aquatic vegetation and their ecology; (2) producing draft technical reports or manuscripts that synthesize current knowledge of aquatic vegetation ecology in the Delta, to accompany conceptual model schematics created in Winter 2016-2017; (3) provide feedback for ongoing research activities in the Delta, including support of the Delta Smelt Resiliency Strategy's action for enhanced control of aquatic vegetation in Delta Smelt habitat. The Aquatic Vegetation PWT meets on quarterly basis, with subcommittee meetings (e.g., Monitoring Framework Subcommittee) occurring more frequently.

2023-T15 Steelhead PWT

Chairs: Michael Beakes (USBR) and Robyn Bilski (CDFW)

The primary goal of the Steelhead PWT is to serve as an open forum for information exchange, discussion, synthesis, and exploring and recommending next steps in research and monitoring activities related to coastal rainbow trout/steelhead populations in the Central Valley. Specific objectives include Identifying research questions and data

gaps, standardizing sampling techniques and data collection, serving as technical advisory group to IEP, CVPIA, and other enhancement programs, collaborating on data compilation projects in an effort to expand the knowledge of fisheries biology within the Central Valley of California Team members currently include staff from the California Department of Fish and Wildlife and Water Resources, East Bay Municipal Utility District, United States Fish and Wildlife Service and Bureau of Reclamation, and various private consulting groups and partners.

2023-T16 Upper Sacramento River Salmon PWT

Chair: Kevin Niemela (USFWS)

The Upper Sacramento River Monitoring Project Work Team mission statement is "to meet on an annual basis to facilitate communication and information exchange among the agencies monitoring Chinook salmon and steelhead in the Upper Sacramento River Basin." The team traditionally meets in March to coordinate exchange of study plans prior to the upcoming field season. Since its formation, we have extended data sharing to include Green Sturgeon studies and ecological monitoring in the Upper River. In more recent years, at least half of the annual meeting has focused on informal oral presentations of the results of the monitoring activities conducted in previous years. The annual meeting chair rotates each year among US Fish and Wildlife Service (USFWS), California Department of Fish and Wildlife, National Marine Fishery Service, US Bureau of Reclamation, and the California Department of Water Resources. The year-to-year primary contact for the PWT is James G. Smith - USFWS, Red Bluff Fish and Wildlife Office.

2023-T17 Contaminants PWT

Chair: Krista Hoffmann (CDFW) and Tricia Lee (DSC)

Although the IEP POD CWT was originally formed to investigate the role of contaminants in the POD, more recently, it has evolved to primarily be a forum for contaminant issues (including meetings to give input to the ISB for their Water Quality Review and to develop partnerships for developing grant proposals). The group continues to be a place to vet study ideas and share study results from various contaminant-related studies in the Delta. Subcommittees from the group have organized a biomarker workshop and contributed to the Tidal Wetland PWT’s conceptual model.

2023-T18 Flow Alteration PWT

Chairs: Rosemary Hartman (DWR) and Marissa Wulf (USGS)

The main objective of the Flow Alteration (FLOAT) Project Work Team is to facilitate strong study design, data collection, data quality, data analysis, and communication with regard to flow alterations being considered by management agencies to improved conditions for Delta Smelt. FLOAT-MAST (Management Analysis and Synthesis Team) has been organized to Analyze and synthesize data and information through 2017. The FLOAT-PWT serves as a review body for FLOAT-MAST and as the main conduit of communication to the IEP community. The FLOAT-PWT meets approximately

bimonthly. The FLOAT-MAST and sub teams within it will meet monthly or more frequently as needed.

2023-T22 Predation PWT

Chairs: Tyler Pilger (FISHBIO) and Geoffrey Steinhart (USFWS)

The intent of the Predation Project Work Team is to provide a forum to examine impacts of predators on native fish species. A Project Work Team can provide guidance on collaboration and coordination of predation studies, so existing work can become more productive and can better inform fisheries management. Specific functions of the team include the following: 1) provide a forum for discussion of current or planned projects related to predation upon fishes, 2) provide guidance on the development of work plans and studies, and 3) foster collaboration among different organizations currently working on predation studies.

2023-T23 Water Quality and Phytoplankton PWT

Chairs: Keith Bouma-Gregson (USGS), Janis Cooke, Central Valley Water Board (CVWB), and TBD (CDFW)

The IEP Water Quality and Nutrients PWT will provide a venue for scientists from diverse agencies and groups to coordinate and synthesize data and information that will inform IEP research and monitoring needs for water quality and phytoplankton in the future.

2023-T24 Genetics PWT

Chairs: Melinda Baerwald (DWR), Evan Carson (USFWS), and Jeff Rodzen (CDFW)

The Genetics PWT will provide a venue to communicate and coordinate current and proposed genetic activities in the SFE. Previously, a salmonid genetics PWT met to focus on coordinating research and monitoring of Central Valley salmon and steelhead genetics. Herein we propose to redirect and broaden the scope of the Salmon Genetics PWT to include genetic research and monitoring for any species found, at any point in its life cycle, in the San Francisco Estuary (SFE). Genetic analysis is a powerful and well-established tool that can be used to enhance the information content provided by existing monitoring programs and directly inform managers of biological effects from proposed and existing activities, such as restoration actions and modifications to water operations.

2023-T25 Data Science PWT

Chairs: Rosemary Hartman (DWR) and Travis Hinkelman, Environmental Science Associates (ESA)

The Data Science PWT is a forum for IEP Scientists and their partners to share resources and skills for dealing with complex data sets. The PWT provides opportunities to teach advanced data science skills to new users, connect data scientists with subject-matter experts, provides a forum for feedback on draft analyses, and hosts a repository for resources. The team has quarterly meetings with a variety of presentations covering

any aspect of statistics, data science, data analysis, and computer science, and also facilitates training in data science skills.

2023-T26 Climate Change PWT

Chair: Sam Bashevkin (SWRCB) and Denise Colombano (UC Berkeley)

The primary purpose of the CC PWT is to provide a forum and framework for addressing climate change issues within the upper SFE. More specific, technical issues will be addressed by a CC MAST (Management, Analysis, and Synthesis Team) that will include selected PWT members and outside experts who can commit to substantive work for the team.

2023-T29 Zooplankton PWT

Chair: Christina Burdi (CDFW)

The 2020-2024 IEP science strategy (Interagency Ecological Program 2019) recommends improved zooplankton monitoring as well as increased research into the growth, production, abundance, and biomass of zooplankton to restore food webs. Currently, there is no IEP forum for discussion and collaboration around issues of concern for zooplankton monitoring and research. The Zooplankton PWT will fill that gap by increasing coordination among zooplankton research and monitoring in the upper SFE.

C. Workshop

2023-T01 2023 IEP Annual Workshop

Chair: Stephanie Fong (IEP at CDFW)

The IEP Annual Workshop is an informal event for sharing new research results and technical analyses that advance the understanding of scientific topics important to the IEP and the larger Delta science community. The informal nature of the workshop is intended to encourage and support junior staff participation, sharing of preliminary results, and open discussion. The workshop consists of sessions featuring a panel of speakers, with each panel dedicated to a specific topic of interest to IEP research needs. Priority is given to presentations that are required as “deliverables” in IEP contracts, but relevant work from other researchers working in the Bay-Delta is also featured. The workshop also hosts a substantial poster session, poster and presentation competition, and mentoring luncheon.

IV. Program Support Element

A. Program Management

2023-OAC IEP Oversight and Coordination

PI: Stephanie Fong (IEP at CDFW)

The Lead Scientist, Coordinator Chair and Program Management staff provide support to participants in the areas of program governance, administration, and oversight to facilitate: Strategic leadership for the program and the guidance of science with collaboration and outreach to stakeholders, science forums and agency programs; Annual work planning of collaborative studies with introduction development, schedule, element descriptions, summaries, budget and nexus, and tracking of deliverables; Program analysis, reviews, documentation and recordation for governance, strategic planning and outreach including updates to program documents and MOUs; Internal and external communication of IEP priorities, activities, information, events; Science Strategy with overarching priorities, options and background; Scheduling, agenda, materials, facilitation, and notes for Science Management Team, Coordinator Team and Director meetings as well as team workshops, and offsite meetings as well as registration, hosting, poster session and mentoring of an annual workshop; and ESA permits (NMFS, USFWS) with adaptive management and reporting of species "take".

Compliance with the following:
1971 IEP MOU Formal Management Structure
1992 IEP MOU Statement of Work 1,2
1985 IEP MOU VIII. Program Coordination and Review
2015 Business Practices Review

Funding Agency	Amount in Thousands of Dollars
DWR	$402
USBR	$411
DSP	$179
CDFW	$244
Total	$1,236

V. Closed Work Plan Elements

A. Closed Elements

2022-005 The Adult Sturgeon Population Study

PI: Dylan Stompe (CDFW)

This element provides population metrics such as harvest rate, survival rate, population age structure, and abundance estimates of white sturgeon through a mark-recapture study. These metrics and survey catch per unit effort allow for tracking the trends in abundance and age-structured population dynamics. Using this information, this element makes recommendations regarding water management as well as the management of the white sturgeon fishery, including bycatch of Green Sturgeon.

Compliance with the following:

D-1485	Terms 10a, 10b, 10c
D-1641	Term 11b

May also inform or follows up on:
CVPIA

Funding Agency	Amount in thousands of dollars
USBR	$683
Total	$683

2022-323 Synthesis of Juvenile Salmon Growth, Condition, and Delta Habitat Use Among Extreme Hydrologic Conditions

PI: Carson Jeffres (UCD)

This study aims to fill critical data gaps regarding the use of the Sacramento-San Joaquin Delta by juvenile Chinook salmon in 2014-2021, primarily to determine the annual outmigrant portfolio (proportion of different populations and life stages) entering and leaving the Delta, and the relative success of Delta vs. natal rearing (inferred by rearing duration, growth rate, diet and condition). This project quantifies the extent to which Delta rearing contributes to salmon population resiliency under different environmental conditions, including drought (2014-15) and flood (2017, 2019), and provides baseline data to provide insights into population-level responses to future habitat restoration and climate change.

Compliance with the following:

D-1485	Terms 10a, 10b, 10c
D-1641	Term 11b

May also inform or follows up on:
Delta Smelt Resiliency Strategy (DSRS)
2008 USFWS BO

Funding Agency	Amount in Thousands of Dollars
DSP	$373
CDFW	$800
Total	$1,173

2022-327 Status, Trends and Distribution of Cypriniform Fishes Native to the Sacramento-San Joaquin Delta, CA

PI: Ryan McKenzie (USFWS)

Aside from the previously listed Sacramento Splittail (*Pogonichthys macrolepidotus*), little is known about the current status, trends, and distribution of the native cypriniform fish species in the Sacramento-San Joaquin Delta. The historical distributions of Sacramento Pikeminnow (*Ptychocheilus grandis*), Hitch (*Lavinia exilicauda*), and Sacramento Sucker (*Catostomus occidentalis*) cover a fairly broad geographic area in the San Francisco Estuary. However, there has been no systematic investigation of the abundance and distribution trends for these cypriniform species and there is some evidence suggesting that these native species today exist only in scattered, small populations around the Delta. This effort will address knowledge gaps associated with these species.

Compliance with the following:

D-1485	Terms 10a, 10b, 10c
D-1641	Term 11b

May also inform or follows up on:
Restoring Native Species and Communities

Funding Agency	Amount in Thousands of Dollars
DWR	$10
USBR	$10
Total	$20

2022-337 Forecasting Nutria Invasion in the Sacramento-San Joaquin Delta

PI: Vanessa Tobias (USFWS)

Nutria (*Myocastor coypus*) are an invasive species that were recently discovered in the southern San Joaquin River watershed. This project will help the IEP agencies to identify impacted and at-risk habitats and to quantify the rate of advancement in the Delta. To do this, this program element will identify habitat and forecast distributions of nutria in the Delta. This synthesis project uses existing data to produce models and maps, with the goal of informing plans for detection and eradication.

May also inform or follows up on:
Impacts of Non-Native Species

Funding Agency	Amount in Thousands of Dollars
USFWS	In-kind Contribution
CDFW	In-kind Contribution

2022-340 Understanding Climate Change Tools for San Francisco Estuary Analyses and Investigation of Thermal Refugia in Warming Waters

PI: Rosemary Hartman (DWR)

This element will form an IEP Climate Change Project Work Team, which will conduct a synthesis of completed research relevant to climate change and an assessment of available modeling tools for future research. In a quantitative effort, a sub-team of the Project Work Team will analyze spatial and temporal patterns in water temperature using continuously collected data. The latter effort will include assessments of water temperature conditions as they relate to individual species' physiology and identify areas that may offer thermal refugia while other areas may exceed thermal thresholds for heat stress or lethal limits.

May also inform or follows up on:
Effects of Climate Change and Extreme Events

Funding Agency	Amount in Thousands of Dollars
DWR	In-kind Contribution

2022-343 Patterns of Biodiversity and Biotic Homogenization of the Sacramento-San Joaquin Delta

PI: Ryan Mckenzie (USFWS)

Habitat alteration and introduction of alien species have substantially changed communities and food webs of the Sacramento-San Joaquin Delta. This study will

evaluate how fish community diversity of the Delta has changed over time and assess whether fish communities in the various regions within the Delta have become more homogeneous in recent years.

Compliance with the following:

D-1485	Terms 10a, 10b, 10c
D-1641	Term 11b

May also inform or follows up on:
Restoring Native Species and Communities

Funding Agency	Amount in Thousands of Dollars
DWR	$40
USBR	$15
Total	$55

2022-345 Predation Dynamics Across Reach-Specific Gradients in Juvenile Salmon Survival

PI: Fred Feyrer (USGS)

The overarching goal of this project is to determine if predation by piscivorous fishes is an important explanatory driver of survival of juvenile Chinook Salmon emigrating through the north Delta. To achieve this goal, we seek to determine if variation in reach-specific characteristics of predation dynamics covary with survival of acoustic-tagged juvenile Chinook Salmon collected during the study period. This will be accomplished by comparing reach-specific characteristics of the piscivore community and its observed and modeled consumption of juvenile Chinook Salmon across a range of environmental conditions.

Compliance with the following:

D-1485	Terms 10a, 10b, 10c
D-1641	Term 11b

May also inform or follows up on:
Understanding Food Webs
Restoring Native Species and Communities
Impacts of Non-Native Species

Funding Agency	Amount in Thousands of Dollars
USGS	$131
Total	$131

2022-350 Assessing prevalence, pathways, and impacts of selenium exposure for fish species of concern in the Sacramento-San Joaquin Bay-Delta

PI: Fred Feyrer (USGS)

Dynamic river-estuary ecosystems provide invaluable habitat for fish and wildlife. Yet, they are under threat from a range of stressors including climate change, eutrophication, freshwater diversions, invasive species, and contaminants. River-estuary environments are arguably among the most challenging systems in which to

evaluate and manage contaminant risk due to complexities of physical transport in a tidal environment, movement of species between interconnected habitats, biogeochemical gradients, and competing resource needs of fish and wildlife with economic development. Selenium (Se) is both an essential element and potent teratogen and its contamination is strongly tied to core economic activities (e.g., agriculture, mining, and energy production). In the Sacramento-San Joaquin Bay-Delta, Se is concentrated primarily through the import of agriculturally irrigated salinized soils containing high levels of geologically derived Se in the San Joaquin Valley and within estuary point-source loading from oil refining and wastewater treatment effluents leading to elevated levels in fish and wildlife. How the movements of fish across the landscape influence Se exposure at different points during their life history has been difficult to resolve due to the complexity of the system and the diverse sources of Se.

Compliance with the following:

D-1485	Terms 10a, 10b, 10c
D-1641	Term 11b

May also inform or follows up on:
Understanding Food Webs
Restoring Native Species and Communities
Impacts of Non-Native Species

Funding Agency	Amount in Thousands of Dollars
CVRWQCB	$100
Total	$100