Interagency Ecological Program
2024 Annual Work Plan

Mossdale Survey on the San Joaquin River with staff from USFWS and CDFW. Natasha Mayo (CDFW) and Adriana Arrambide (USFWS) from left to right). Photo credit Erika Holcombe (USFWS).

Interagency
Ecological Program
COOPERATIVE ECOLOGICAL
INVESTIGATIONS SINCE 1970

March 28, 2024

A few comments from IEP Lead Scientist as we finalize the 2024 Annual Work Plan:

"Let's get the science nailed down."

Dr. Randy Brown simply but effectively articulated the aim of the Interagency Ecological Program (IEP), solidifying the path forward for a science-directed effort to effectively monitor the Bay-Delta and set the groundwork for understanding water project operational impacts to our regional ecology.

The IEP Annual Work Plan represents yearly priority-setting for our 10 Agency collaborations, coordinating on-the-water activities and monitoring requirements with agency resources, setting general directions for analysis efforts, suggesting synthesis topics, scheduling core team meetings and tasks, and ensuring coverage for our many obligations to stakeholders and the Estuary science community.

The Annual Work Plan provides an outline of the monitoring science activities the IEP is required or asked to conduct and details the analytical and staff resources necessary to fulfill its mission to "provide and integrate relevant and timely ecological information for management of the San Francisco Bay-Delta ecosystem and the water that flows through it."

Principal Investigators, Program Leads, cooperating scientists, supporting staff, and regulatory check-ins are described via IEP Annual Plan Program Elements. Project Work Teams and Special Studies are detailed regarding their places in our annual working efforts to create and maintain a quality monitoring science enterprise supporting informed water resources management. The "scopes of work" contained within the IEP Annual Plan describe the annual effort we make to provide relevant, credible, and robust science to manage California's public resources.

The IEP Core Team works as the only bona fide group (composed of four full-time positions) dedicated to the administrative and organizational responsibilities of the IEP – all other duties, while perhaps described in individual Agencies' duty statements for a given personnel position, are voluntarily assigned. The work we do is largely collective because we choose to make it so. This Annual Plan document is our yearly testament to that collective idea.

We assert that over the years the spirit of the IEP has been well-served because the staff, managers, and scientists who are drawn to this kind of resource management work see the value in diversified viewpoints, in overcoming internecine conflict, in sharing experiences, and in placing the development of a robust, outwardly-looking monitoring and analytical Program above what can be achieved by any one agency, or in the pursuit of any one regulatory requirement. We do this as a collective not because we must, but because we think it makes a more robust science product. We think giving all agencies a voice in the collective decision-making process of crafting our science makes it not only more defensible, but more interesting and more enjoyable to be a part of as well. We enjoy interdisciplinary and interagency assignments. We enjoy our community of scientists.

I am, humbly, in your service.

Respectfully,

Steve Culberson, Ph.D.
IEP Lead Scientist
October 19, 2023

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What is the Interagency Ecological Program?

The Interagency Ecological Program (IEP) is a consortium of three state agencies [California Department of Fish and Wildlife (CDFW), California Department of Water Resources (DWR), and California State Water Resources Control Board (SWRCB)] and six federal agencies [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 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 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 is not one of the four broad elements of the Work Plan. Instead, 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.

Table 1: 2024 IEP Work Plan Summary.

The work plan contains 68 elements across 4 categories with 3 of those elements having costs totaling $35,170,000.

Category	Number of Elements	Elements with Cost	Category Cost ($1,000s)
Compliance Monitoring Elements	23	23	$24,282
Special Study Elements	20	14	$10,228
Teams and Outreach Elements	24	0	$0
Program Support Element	1	1	$660

Table 2: Summary Across Sub-Categories.

The work plan contains 68 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	22	22	$23,082
Long-term Ecological Monitoring	1	1	$1,200
Compliance Related Directed Studies	13	10	$9,375
Non-Compliance Related Special Studies	7	4	$853
Technical Teams	3	0	$0
Project Work Teams	20	0	$0
Workshop	1	0	$0
Program Management	1	1	$660

Table 3: Compliance Monitoring Elements: Operational Monitoring.

The 2024 work plan contains 22 elements in the Operational Monitoring sub-category with costs totaling $23,082,000.

Element	Project Title	Principal Investigator	Amount ($1,000s)
2024-003	Fall Midwater Trawl Survey (FMWT)	S. Slater, CDFW	$842
2024-007	Summer Townet Survey (STN)	S. Slater, CDFW	$842
2024-011	Estuarine and Marine Fish and Crab Abundance and Distribution Survey (Bay Study)	K. Hieb, CDFW	$1,164
2024-012	Bay Shrimp Abundance and Distribution Surveys (Bay Study)	K. Hieb, CDFW	$234
2024-029	San Francisco Bay Salinity and Temperature Monitoring	D. Hart, USGS	$393
2024-030	Delta Flows Network	C. Ruhl, USGS	$947
2024-033	20-mm Delta Smelt Survey (20-mm)	V. Mora, CDFW	$1,115
2024-047	Yolo Bypass Fish Monitoring Program (YBFMP)	N. Kwan, DWR	$894
2024-053	Juvenile Salmon Monitoring (DJFMP)	A. Nanninga, USFWS	$4,326
2024-059	Coleman National Fish Hatchery Late-Fall Run Production Tagging	K. Niemela, USFWS	$294
2024-071	Mossdale Trawl (Mossdale)	E. Huber, USFWS S. Tsao, CDFW	$295
2024-072	Environmental Monitoring Program	T. Flynn, DWR	$6,000
2024-073	San Joaquin River Dissolved Oxygen Monitoring	J. Manning, DWR	$51
2024-074	Central Valley Juvenile Salmon and Steelhead Monitoring (Knights Landing)	N. Bauer, CDFW	$660

Element	Project Title	Principal Investigator	Amount ($1,000s)
2024-077	Upper Estuary Zooplankton Sampling	K. Hieb, CDFW	$350
2024-093	UCD Suisun Marsh Fish Monitoring	T. O'Rear, UC Davis	$300
2024-096	Smelt Larva Survey (SLS)	V. Mora, CDFW	$496
2024-104	Operation of Thermograph Stations	T. Hiett, USGS	$61
2024-296	Investigation of the Distribution and Abundance of Longfin Smelt in the SFE	L. Lewis, UC Davis	$375
2024-301	Juvenile Salmon Emigration Real Time Monitoring (DJFMP)	A. Nanninga, USFWS	$240
2024-311	Tidal Wetland Monitoring Study	C. Bowles, CDFW	$2,203
2024-353	Fish Facilities Monitoring	V. Afentoulis, CDFW	$1,000

Table 4: Compliance Monitoring Elements: Long-term Ecological Monitoring.

The 2024 work plan contains 1 element in the Long-term Ecological Monitoring sub-category with a cost totaling $1,200.

Element	Project Title	Principal Investigator	Amount ($1,000s)
2024-322	Estimating Abundance of Juvenile Winter-run Chinook Salmon Entering and Exiting the Delta (SAIL)	B. Matthias, USFWS	$1,200

Table 5: Special Study Elements: Compliance Related Directed Studies.

The 2024 work plan contains 13 elements in the Compliance Related Directed Studies sub-category; 10 of the 13 elements have costs totaling $9,375,000.

Element	Project Title	Principal Investigator	Amount ($1,000s)
2024-043	Estimation of Pelagic Fish Population Sizes	L. Mitchell, USFWS	$0

Element	Project Title	Principal Investigator	Amount ($1,000s)
2024-062	Quantitative Analysis of Stomach Contents and Body Weight for Pelagic Fishes	S. Slater, CDFW	$208
2024-208	Statistical Support (DJFMP) Delta Smelt Life Cycle Model	L. Mitchell, USFWS	$0
2024-249	Gear Efficiency Evaluations in Support of Modeling Efforts for Delta Smelt	L. Mitchell, USFWS	$0
2024-281	North Delta Flow Action: Role of Improved Yolo Bypass Flows on Delta Food Web Dynamics	E. Holmes, DWR	$616
2024-325	Enhanced Delta Smelt Monitoring (EDSM)	D. Goodman, USFWS	$4,060
2024-329	Extracting Better Information from Long-Term Monitoring Data: Estimating Occupancy and Abundance of Near Shore Fishes in the Sacramento-San Joaquin River Delta	A. Nanninga, USFWS	$672
2024-333	Enhanced Acoustic Tagging, Analysis and Real-Time Monitoring	C. Michel, UCSC/NMFS	$1,000
2024-335	Suisun Marsh Salinity Control Gate Study	R. Hartman, DWR	$300
2024-346	Using Delta Smelt Enclosures to Support Species Recovery	B. Schreier, DWR	$400
2024-352	Larval Smelt Entrainment Monitoring	M. Gilbert and T. Malinich, CDFW	$522
2024-359	Trends in the Distribution and Abundance of Large Estuarine Fishes “Enhanced Large Fish Study” UNDER FURTHER DEVELOPMENT	D. Stompe, CDFW	$355

Element	Project Title	Principal Investigator	Amount ($1,000s)
2024-360	Genetic Analysis and Storage of Listed Species to Inform Multiple Studies for State Water Project Operations (NEW STUDY)	M. Baerwald and D. Gille, DWR	$1,242

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

The 2024 work plan contains 7 elements in the Non-Compliance Related Synthesis, Modeling, and Reviews sub-category; 4 of the 7 elements have costs totaling $853,000.

Element	Project Title	Principal Investigator	Amount ($1,000s)
2024-330	Aquatic Habitat Sampling Platform: Platform Utility and Delta Implementation Studies	J. Merz, CFS	$627
2024-342	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
2024-354	Physical and Biological Drivers of Fish Distribution in Suisun Bay	M. Young, USGS	$157
2024-355	Phytoplankton Enumeration Synthesis Project (PESP)	S. Perry, DWR	$0
2024-357	Submersed Aquatic Vegetation in the Delta: Composition, Niche Occupancy and Response to Climatic Factors	S. Khanna, IEP at CDFW	$0
2024-358	Zooplankton Monitoring Design Review: Gaps, Strength, and Redundancies	K. Arend, USBR D. Ellis, IEP at CDFW	$0
2024-361	Evaluation of morphological characteristics used in identification of larval Delta Smelt *Hypomesus transpacificus* in the San Francisco Estuary (NEW STUDY)	D. Goodman, and E. Carson, USFWS	$9

Table 7: Teams and Outreach Elements: Technical Teams.

The 2024 work plan contains 3 elements in the Technical Team sub-category; none of these elements have costs associated with them beyond staff time.

Element	Project Title	Principal Investigator	Amount ($1,000s)
2024-T20	IEP Data Utilization Work Group (DUWG)	D. Bosworth, DWR S. Bashevkin, SWRCB	$0
2024-T21	Central Valley Fish Facilities Review Team	J.C. Dealy, USBR	$0
2024-T28	Longfin Smelt Technical Team	M. Eakin, CDFW	$0

Table 8: Teams and Outreach Elements: Project Work Teams (PWTs).

The 2024 work plan contains 20 elements in the Project Work Team sub-category; none of these elements have costs associated with them beyond staff time.

Element	Project Title	Principal Investigator	Amount ($1,000s)
2024-T03	Sturgeon PWT	J. Kelly, CDFW A. Seesholtz, DWR	$0
2024-T04	Estuarine Ecology Team (EET) PWT	R. Hartman, DWR	$0
2024-T05	Biotelemetry PWT	C. Yip, DWR J. Kelly, CDFW	$0
2024-T06	Spring Run Salmon PWT	F. Cordoleani, NOAA R. Revnak, CDFW	$0
2024-T07	Resident Fishes PWT	N. Kwan, DWR A. Nanninga, USFWS	$0
2024-T09	Tidal Wetland Monitoring PWT	S. Sherman, CDFW	$0
2024-T11	Winter Run Salmon PWT	T. Grimes, CDFW	$0
2024-T12	Juvenile Monitoring PWT	B. Poytress, USFWS	$0
2024-T13	Central Valley Salmonid Hatchery PWT (Dormant) (Satellite team of Central Valley Salmonid PWT)	J. Nelson, CDFW	$0

Element	Project Title	Principal Investigator	Amount ($1,000s)
2024-T14	Aquatic Vegetation PWT	S. Khanna, IEP at CDFW N. Rasmussen, DWR	$0
2024-T15	Steelhead PWT	M. Beakes, USBR E. Ferguson, CDFW	$0
2024-T16	Upper Sacramento River Salmon PWT	K. Niemela, USFWS	$0
2024-T17	Contaminants PWT	K. Hoffmann, CDFW T. Lee, DSC	$0
2024-T18	Flow Alteration PWT	R. Hartman, DWR M. Wulf, USGS	$0
2024-T22	Predation PWT	T. Pilger, FISHBIO G. Steinhart, USFWS	$0
2024-T23	Water Quality and Phytoplankton PWT	S. Angles, DWR K. Bouma-Gregson, USGS J. Cooke, CVWB E. Preece, DWR	$0
2024-T24	Genetics PWT	B. Barney, CDFW E.W. Carson, USFWS D. Gille, DWR J. Rodzen, CDFW	$0
2024-T25	Data Science PWT	R. Hartman, DWR T. Hinkelman, ESA	$0
2024-T26	Climate Change PWT	S. Bashevkin, SWRCB D. Colombano, DSC	$0
2024-T29	Zooplankton PWT	C. Burdi, DWR	$0

Table 9: Teams and Outreach Elements: Workshop.

The 2024 work plan contains one element in the Workshop sub-category; this element does not have a cost associated with it beyond staff time.

Element	Project Title	Principal Investigator	Amount ($1,000s)
2024-T01	2024 IEP Annual Workshop	S. Fong, IEP at CDFW	$0

Table 10: Support Elements: Program Management.

The 2024 work plan contains one element in the Program Management sub-category with costs totaling $660,000.

Element	Project Title	Principal Investigator	Amount ($1,000s)
2024-OAC	IEP Oversight and Coordination	S. Fong, IEP at CDFW	$660

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 was initiated to satisfy terms in the 2021 cooperative agreement USBR had with CDFW to provide monitoring services that fulfill USBR permit requirements. That work is ongoing, and any changes approved through the redesign effort could modify the monitoring design, monitoring data produced, and the budget of surveys described in the 2024 IEP Workplan as presented to the IEP Directors in December 2023. In addition, the redesign effort has resulted in adjustments to the IEP Survey Design Review for Long-term Monitoring Efforts (Project Element Number-347), which has been paused. 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 2024 Workplan.

Superscript “1” has been attached to the following active IEP elements:

2024-003 Fall Midwater Trawl Survey[1] FMWT S. Slater, CDFW

2024-007 Summer Townet Survey (STN)[1] S. Slater, CDFW

2024-033 20-mm Delta Smelt Survey (20 mm) [1] V. Mora, CDFW

2024-096 Smelt Larva Survey (SLS) [1] V. Mora, CDFW

Superscript “2”: This is nexus information that is provided for convenience by the California Department of Water Resources and State Water Resources Control Board staff.

2024 IEP Work Plan – Element Details

I. Compliance Monitoring Elements

A. Operational Monitoring

2024-003 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 Project (DOP)

Funding Agency	Amount in thousands of dollars
DWR	$404
USBR	$438
Total	$842

2024-007 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 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 (*Morone saxatilis*) and Delta Smelt (*Hypomesus transpacificus*). 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, specific conductivity and ranks station conditions (i.e., weather, wave height, etc.) and Microcystis spp. presence. Managers and researchers use the data collected by STN to inform water project operations and flow actions to manage 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 Project (DOP)

Funding Agency	Amount in thousands of dollars
DWR	$404
USBR	$438
Total	$842

2024-011 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 requirements of fish, crabs, and shrimp downstream of the delta, as related to the Bay-Delta Water Quality Standards. 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	$582
USBR	$582
Total	$1164

2024-012 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 requirements of fish, crabs, and shrimp downstream of the delta, as related to the Bay-Delta Water Quality Standards. 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	$117
USBR	$117
Total	$234

2024-029 San Francisco Bay Salinity and Temperature Monitoring

PI: David Hart (USGS)

The USGS collects specific conductance (related to salinity) and water temperature data on a 15-minute interval at six continuous monitoring stations in San Francisco Bay – San Francisco Bay at Dumbarton Bridge, San Francisco Bay at San Mateo Bridge near Foster City, San Francisco Bay at Alcatraz, San Francisco Bay at Richmond Bridge, Carquinez Strait at Carquinez Bridge, and Suisun Bay at Benicia Bridge.

The stations are currently installed, and regular maintenance includes approximately monthly visits to the sites for sensor calibration and cleaning, along with other routine maintenance of the water-quality sondes and infrastructure. All stations except Alcatraz include instruments located at two depths, typically one each in the lower and upper half of the water column. The Alcatraz station has a single instrument located roughly at mid-depth. All equipment, travel expenses, supplies, and labor are provided by the USGS. This project does not include data interpretation.

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	$367
USGS	$26
Total	$393

2024-030 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	$861
USGS	$86
Total	$947

2024-033 20-mm Delta Smelt Survey[1] (20-mm)

PI: Vanessa Mora (CDFW)

The 20-mm Survey samples the upper San Francisco Estuary every other week from March through July at 61 fixed stations to determine the distribution and abundance of juvenile Delta and Longfin Smelts. Results from this survey are provided in near-real time to assess the entrainment risk of these species.

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	$571
USBR	$544
Total	$1,115

2024-047 Yolo Bypass Fish Monitoring Program (YBFMP)

PI: Nicole Kwan (DWR)

The objectives of this interdisciplinary monitoring effort are to collect baseline data on juvenile and adult fish, lower trophic levels (phytoplankton, zooplankton, and aquatic insects), 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	$894
Total	$894

2024-053 Juvenile Salmon Monitoring (DJFMP)

PI: Adam Nanninga (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 Chipps 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	$2,704
USBR	$1,622
Total	$4,326

2024-059 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. The Late Fall Chinook Salmon Tagging effort is broken into two tasks within the US Fish and Wildlife Service's Delta Juvenile Fish and Monitoring Program. Task 5 is the sub-contracting and equipment costs for marking and tagging operations. Task 6 is the USFWS personnel costs for tagging coordination and tag recovery. The coded wire tags are purchased separately by USBR. DWR contract costs are for the tagging of fish. Operation costs include operational oversight and recovery of tags from adults at the hatchery.

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	$185
USBR	$109
Total	$294

2024-071 Mossdale Trawl (Mossdale)

PIs: Erik 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 NGOs 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

2024-072 Environmental Monitoring Program

PI: Theodore Flynn (DWR)

The Environmental Monitoring Program's (EMP) monitoring and reporting mandates are described in Water Right Decision D-1641. Under this decision, the permit holders (DWR and USBR) must conduct a comprehensive environmental monitoring program to determine compliance with the stated water quality standards. The EMP is also mandated in the Incidental Take Permit for operation of the State Water Project. The EMP collects monthly samples of discrete water quality, nutrients, phytoplankton, zooplankton and benthic samples and continuous water quality data throughout the San Francisco Bay-Delta estuary. The program objectives are as follows:

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

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	$3,000
USBR	$3,000
Total	$6,000

2024-073 San Joaquin River Dissolved Oxygen Monitoring

PI: Julianna Manning (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 average 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	$51
Total	$51

2024-074 Central Valley Juvenile Salmon and Steelhead Monitoring (Knights Landing)

PI: Nick Bauer (CDFW)

The project at Knights Landing (rkm 144) consists of paired, 8-ft rotary screw traps secured to one another and anchored in-river. Juvenile salmonid emigration data collected at this site provides an early warning of fish emigrating toward the Delta and allows for near real-time adaptive management of CVP and SWP water operations.

Monitoring begins when water temperatures begin to decrease in August/September and salmonids can be handled more safely, then ceases when temperatures rise in May/June and handling of juvenile salmonids becomes detrimental to their health. At each trap check, fish are enumerated, identified to species, length measured, and weighed. Salmon are assigned to a run based on length-at-date criteria. To assess emigration rates of fish released upstream, a sub-sample of adipose fin-clipped (hatchery origin) Chinook salmon are held and euthanized for coded wire tag extraction and reading. Natural origin fall-run Chinook salmon as well as Chinook released from Coleman National Fish Hatchery are utilized for assessing trap capture efficiency through mark and recapture trials. Trap capture efficiency data are then used in calculating passage estimates. Daily catch and environmental conditions are summarized and made publicly available on the CalFish website.

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	$330
USBR	$330
Total	$660

2024-077 Upper Estuary Zooplankton Sampling

PI: Kathy Hieb (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 from upper San Pablo Bay through the delta, including Suisun Marsh.

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	$175
USBR	$175
Total	$350

2024-093 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 the aquatic ecosystem 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. 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

2024-096 Smelt Larva Survey[1] (SLS)

PI: Vanessa Mora (CDFW)

SLS survey samples the upper San Francisco Estuary every other week from December 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	$254
USBR	$242
Total	$496

2024-104 Operation of Thermographic Stations

PI: Travis Hiett (USGS)

The Water-quality work at these sites, 11389500 and 11303500 consists of continuous monitoring of water temperature. Measurements are recorded at fifteen-minute intervals during the entire water year. Sediment sampling conducted at site 11303500. Samples are normally collected once each day by the observer along with recording the water

temperature and gage height. . Additional sampling is conducted by USGS crews on a regular basis as part of the sampling protocols.

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. Measurements are recorded at fifteen minute intervals during the entire water year. Sediment sampling is conducted at site 11303500 (San Joaquin River at Vernalis, CA). Samples are normally collected once each day by the observer along with recording the water temperature and gage height. Additional sampling is conducted by USGS crews on a regular basis as part of the sampling protocols.

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	$6
Total	$61

2024-296 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	$75
Total	$375

2024-301 Juvenile Salmon Emigration Real Time Monitoring (DJFMP)

PI: Adam Nanninga (USFWS)

Beach seining is 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	$89
USBR	$151
Total	$240

2024-311 Tidal Wetland Monitoring Study

PI: Christy Bowles (CDFW)

The CDFW Fish Restoration Program will collect fish, invertebrate, and water quality 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 composition in 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	$2,203
Total	$2,203

2024-353 Fish Facilities Monitoring

PI: Virginia Afentoulis (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. Staff participates, gives input, and feedback in multiagency SWP and CVP project work teams meetings (the Tracy Technical Advisory Team and Central Valley Fish Facilities Review Team, and Salvage Biology Meetings) where fish facility and water project report documents, SOPs, permit document changes, and project work plans are presented.

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
DWR	$600
USBR	$400
Total	$1,000

B. Long-term Ecological Monitoring

2024-322 Estimating Abundance of Juvenile Winter-run Chinook Salmon Entering and Exiting the Delta (SAIL)

PI: Bryan Matthias (USFWS)

This is a long-term 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 2023 and 2024. The project will (1) develop statistical models for estimating trawl efficiencies using 2016-2023 data for paired AT-CWT releases of winter run and fall-run Chinook Salmon; (2) use 2016-2023 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 2016-2023; (3) implement trawl efficiency studies for multiple salmon runs in 2023-2024 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 2016-2023.

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	$600
USBR (CVPIA)	$600
Total	$1,200

II. Special Study Elements

A. Compliance Related Directed Studies

2024-043 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

2024-062 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 (2024-007), FMWT (2024-003), 20-mm (2024-033), Smelt Larva Survey (2024-096), Bay Study (2024-011), SKT (2024-088), and USFWS EDSM (2024-325).

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)
USBR Directed Outflow Project (DOP)
Suisun Marsh Salinity Control Gate
North Delta Food Web

Funding Agency	Amount in Thousands of Dollars
DWR	$104
USBR	$104
Total	$208

2024-208 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

2024-249 Gear Efficiency Evaluations in Support of Modeling Efforts for Delta Smelt

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

2024-281 North Delta Flow Action: Role of Improved Yolo Bypass Flows on Delta Food Web Dynamics

PI: Eric Holmes (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 on net flow to downstream areas and lower trophic food web dynamics. Using both continuous and discrete sampling approaches, this study will relate hydrologic patterns to chlorophyll-a, nutrients and primary productivity, 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	$616
USBR	In-Kind Contribution
Total	$616

2024-325 Enhanced Delta Smelt Monitoring (EDSM)

PI: Denise Goodman (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	$4,060
Total	$4,060

2024-329 Extracting Better Information from Long-Term Monitoring Data: Estimating Occupancy and Abundance of Near Shore Fishes in the Sacramento-San Joaquin River Delta

PI: Adam Nanninga (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 through the use of boat electrofishing. To accomplish this, we will sample key littoral fish species across various near-shore habitats in order 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	$378
USBR	$294
Total	$672

2024-333 Enhanced Acoustic Tagging, Analysis, and Real-Time Monitoring

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

Understanding the movement and survival rates of outmigrating salmonids in real-time is critical for resource managers to make informed decisions. Through the development of the CalFish Track 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. 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

2024-335 Suisun Marsh Salinity Control Gate Action

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

2024-346 Using Delta Smelt Enclosures to Support Species Recovery

PIs: Melinda Baerwald, Brian Schreier, and Trishelle Tempel (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 2024, 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 4–6-week period during the SMSCG action, if one occurs. In addition, we propose to deploy a larval enclosure in the North Delta Arc in the spring of 2024. This deployment will assess the survival of larval Delta Smelt in enclosures in a naturalized environment.

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

2024-352 Larval Smelt Entrainment Monitoring

PI: Morgan Gilbert and Tim Malinich (CDFW)

This was formerly called the Larval Smelt Entrainment Pilot Survey (LEPS). Delta Smelt and Longfin Smelt are protected under the Endangered Species Act. Water exports at the State Water Project (SWP) entrain 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. 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, and existing larval smelt monitoring is only appropriate for detecting presence. This project’s primary purpose fulfills the 2020 ITP Condition of Approval (COA) 7.6.2; “Permittee shall fund and implement a new Smelt Larval Entrainment Program to quantify larval DS and LFS entrainment into Clifton Court Forebay (CCF).” In 2024, the pilot efforts of the Larval Entrainment project will continue annual monitoring of larval fishes outside CCF as well as special studies to examine gear efficiency and impacts of night-day bias in Smelt catch.

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	$522
Total	$522

2024-359 Trends in the Distribution, Abundance, and Community Structure of Estuarine Fishes “Enhanced Large Fish Study” (ELFS) (UNDER FURTHER DEVELOPMENT)

PI: Dylan Stompe (CDFW)

This study will sample large fishes in the San Francisco Estuary via gillnets using generalized random tessellation stratified (GRTS) site selection to maximize spatial representation and site distribution and minimize bias in site selection (Stevens and

Olsen 2004). GRTS sampling is currently being implemented as part of the Fall Midwater Trawl Special Study and site selection for the Enhanced Large Fish Study will follow similar draw procedures.

Captured fishes will be enumerated, measured, and PIT tagged prior to release, providing regional indices of large fish abundance and population size structure, as well as the potential for mark-recapture analysis. Indices will be calculated based on gillnet catch per unit effort and using model-based approaches such as spatially explicit generalized linear mixed models. Gillnet data will also be synthesized in an integrated format, leveraging monitoring from other IEP project elements to describe holistic fish communities.

The first several years of the Enhanced Large Fish Study are proposed as a pilot project, with the goal of determining project feasibility, scale, and to establish robust sampling procedures for future sampling years. During the pilot phase the proposed project will be reviewed annually by the SMT and CT for scientific merit and to ensure the implementation of a robust long-term monitoring program that meets regulatory requirements.

Compliance with the following:

D-1485	Term 10a

May also inform or follows up on:
CVPIA
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	$355
Total	$355

2024-360 Genetic Analysis and Storage of listed species to Inform Multiple Studies for State Water Project Operations (NEW STUDY)

PI: Melinda Baerwald (DWR) and Daphne Gille (DWR)

The Department of Water Resources Genetic Monitoring (GeM) program focuses on using genetic approaches to inform continued operation of the State Water Project. For all studies, the work directly supports fulfillment of Incidental Take Permit (ITP) mandates. Overview information for each directed study currently in progress is outlined below. These studies align with current IEP science priorities including accurate salmon run identification (including those at salvage facilities) and improvement of existing monitoring surveys for smelt species.

The three studies are the Rapid Genetics of Chinook Salmon Runs at SWP and CVP Salvage Facilities (pilot study), Run Identification for Spring-run Chinook Salmon Juvenile Production Estimate (JPE), and the Larval Smelt Entrainment Monitoring (Near Clifton Court Forebay and Barker Slough Pumping Plant).

Compliance with the following:
2020 ITP

May also inform or follows up on:

Funding Agency	Amount in Thousands of Dollars
DWR	$1,242
Total	$1,242

B. Non-Compliance Related Special Studies

2024-330 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

2024-342 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)

The purpose of the element is to advance the ecological knowledge on spatial and temporal community patterns for the larval-juvenile fishes and zooplankton in the upper San Francisco Estuary. Two major tasks are considered in this plan:

1) Utilize Delta outflow and X2 to evaluate the hydrodynamic influence on dominant species of fish and listed fish species. Changes in upstream fish distribution will be based on the river kilometer index (weighted by species relative abundance across stations). We will also evaluate the hydrodynamic influence on the salinity habitat component for Delta Smelt and other pelagic fish species throughout most of the study period.

2) Evaluate whether survival of Delta Smelt and Longfin Smelt are associated to zooplankton abundance, we will examine the coupling between relative abundance of fish (larval and juvenile stages) and potential zooplankton prey. Anticipated products include two IEP workshop presentations and two manuscripts. Agencies involved include USFWS, CDFW, USBR. IEP management could use the generated information to further inform three IEP science strategy areas (non-native species, food webs and climate change).

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

2024-354 Physical and Biological Drivers of Fish Distribution in Suisun Bay

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), water quality conditions (e.g., salinity, turbidity), hydrodynamics (tidal velocities), and species-specific behavioral responses to these factors in time and space. Multiple tools can be used to assess the distribution of fish with respect to these factors, but extensive work is needed to determine if trends observed with techniques other than net-based sampling can provide insight to inform specific management actions. Vertical and lateral distribution studies will be conducted at various locations in the central San Francisco Estuary, using a combination of net-based and hydroacoustic sampling methods.

Compliance with the following:

N/A

May also inform or follows up on:
Distribution patterns of fish species in the San Francisco Estuary

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

2024-355 Phytoplankton Enumeration Synthesis Project

PIs: Sarah Perry (DWR)

Phytoplankton community composition is an important driver of zooplankton productivity and food supply for higher trophic levels. However, research involving the organisms has been hindered by lack of access to existing phytoplankton datasets and a lack of a standardized way to combine and analyze them. Having a synthesized dataset will facilitate further research into productivity in the estuary.

Compliance with the following:

N/A

May also inform or follows up on:
Zooplankton productivity and higher trophic food web dynamics

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

2024-357 Submersed Aquatic Vegetation in the Delta: Composition, Niche Occupancy and Response to Climatic Factors

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

2024-358 Zooplankton Monitoring Design Review: Gaps, Strength, and Redundancies

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

2024-361 Evaluation of morphological characteristics used in identification of larval Delta Smelt *Hypomesus transpacificus* in the San Francisco Estuary (NEW STUDY)

PI: Denise Goodman (USFWS) and Evan Carson (USFWS)

This collaborative study is an initial step towards improving reliable identification of larval SFE *Osmeridae* (Delta Smelt, Longfin Smelt, and Wakasagi) to species by establishing a baseline of key morphological and phenotypic attributes of cultured larval Delta Smelt. We will evaluate morphological and phenotypic variation in relation to age and size of 600 cultured larval Delta Smelt from the UC Davis Fish Conservation and Culture Laboratory to establish a baseline of key attributes in fish born and reared in a controlled (hatchery) environment. Through coordinated methods development between

USFWS and CDFW staff we also hope to improve standardization of larval *Osmeridae* identification methods and account for effects of different preservative-formulations used between the programs. The first phase (approximately November 2023 through early 2024) we will further develop study methods including an attribute table of phenotypic characteristics of larval *Osmeridae* used during fish identification and a standardized protocol for taking images of each larva. USFWS and CDFW will photograph and analyze phenotypic attributes of larval fish as they are received and as time allows for the first half of 2024. Between approximately August through October 2024, we will analyze variation in attributes identified in the morphology-phenotype attribute table and potentially conduct a morphometric analysis on photos. If needed, the morphometric analysis will be pushed back to 2025.

Compliance with the following:

May also inform or follows up on:

2020-2024 IEP Science Priority of Restoring Bay-Delta Native Fishes and Community Interactions (Smelts)
USFWS and CDFW long-term smelt monitoring (Enhanced Delta Smelt Monitoring Program, Smelt Larva Survey, 20mm Survey)
Smelt Monitoring Team/Water Operations Management Team
Cultured and Supplementation of Smelt (CASS) steering committee

Funding Agency	Amount in Thousands of Dollars
USFWS	$9
CDFW	In-Kind Contribution
USBR	$0
DWR	$0

III. Teams and Outreach

A. Technical Teams

2024-T20 IEP Data Utilization Work Group (DUWG)

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

The Data Utilization Work Group (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.

2024-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.

2024-T28 Longfin Smelt Technical Team

Chair: Michael Eakin (CDFW) and Brian Schreier (DWR)

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). Because the LFSSP is part of the re-consultation on the Long-Term Operations of the SWP, we anticipate the description of the LFSTT to be modified upon issuance of a new ITP in the spring of 2024. Such changes will be reflected in the 2025 IEP Work Plan.

B. Project Work Teams (PWTs)

2024-T03 Sturgeon PWT

Chairs: John Kelly (CDFW) and Alicia Seesholtz (DWR)

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.

2024-T04 Estuarine Ecology Team (EET) PWT

Chair: Rosemary Hartman (DWR)

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.

2024-T05 Biotelemetry PWT

Chairs: Curtis Yip (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.). The Biotelemetry PWT meets twice per year.

2024-T06 Spring Run Salmon PWT

Chairs: Flora Cordoleani (NOAA) and Ryan Revnak (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.

2024-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 the 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. Currently, members of the Resident Fishes PWT are working on an update to the Stompe et. al. 2020 Table 2, which describes how well each of the 14 fish monitoring programs in the San Francisco Estuary capture the 36 most prevalent fish species. Two new tables will be created from the project, one for adults and the other for juveniles. There are also two synthesis studies underway: one looking at 3 native and 3 non-native cypriniforms in the San Francisco Estuary and the other focused on catfish trends seen across various monitoring programs. Members can also choose to participate in sub teams which are focused on exploring key topics in further detail. The Resident Fishes PWT will serve as an avenue for feedback and information/data exchange for these studies and sub teams. The Resident Fishes PWT will also continue to highlight any important or management-relevant work on resident fish species that are not covered by the IEP workshop or other PWTs. This PWT meets every two months, year-round.

2024-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 team currently meets on an ad-hoc basis according to need, typically semi-annually.

2024-T11 Winter-Run Salmon PWT

Chair: Tracy Grimes (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.

2024-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 Wildlife 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.

2024-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. This team is currently dormant.

2024-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 2023-24, key activities will include (1) continued development of an integrated SAV dataset updating the current version published on EDI; (2) producing draft technical reports or manuscripts that synthesize current knowledge of aquatic vegetation ecology in the Delta and advancing knowledge of treatment efficacy of floating and submerged invasive species; (3) provide feedback for ongoing research activities in the Delta, including support of the Water Primrose Ecoengineering project spearheaded by Dr. Erin Hestir, the Delta Invasive Species Mapping project led by Dr. Susan Ustin, and any other ongoing aquatic vegetation studies; (4) continued development of aquatic plant identification resources. The Aquatic Vegetation PWT meets on a quarterly basis, with subcommittee meetings occurring more frequently.

2024-T15 Steelhead PWT

Chairs: Michael Beakes (USBR) and Erin Ferguson (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.

2024-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." Since its formation, we have extended data sharing to include Green Sturgeon studies and ecological monitoring in the Upper River. The team traditionally meets in March to coordinate exchange of study plans prior to the upcoming field season. In more recent years, at least half of the annual meeting has focused on informal oral presentations of the results of the monitoring activities from 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 Matt Brown - USFWS, Red Bluff Fish and Wildlife Office.

2024-T17 Contaminants PWT

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

The Contaminants PWT (CWT) was originally formed to investigate the role of contaminants in the Pelagic Organism Decline; however, more recently, it has evolved to primarily be a forum for sharing information on current contaminant research and contaminant management practices. The group continues to be a place for dialogue on emerging contaminants of interest to the Bay-Delta ecosystem, vetting ideas for research needs, and sharing study results. The CWT has also served in an advisory role to Bay-Delta contaminants-related research projects and structured decision-making processes. The CWT strives to work across PWTs to promote more widespread adoption of contaminant considerations in IEP work.

2024-T18 Flow Alteration PWT

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

The Flow Alteration (FLOAT) Project Work Team is a forum for communication and engagement on flow alterations being considered by management agencies to improve conditions for Delta Smelt. In particular, it provides opportunities for engagement with work being done by the Delta Coordination Group on the Summer-Fall Habitat Action, including Suisun Marsh Salinity Control Gates, Fall X2, and the North Delta Flow Action. The FLOAT-PWT meets approximately twice per year, once in the spring to discuss the upcoming Summer-Fall Habitat Action, and once in the winter to hear a report-out on the results of the action.

2024-T22 Predation PWT

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

The Predation Project Work Team provides a forum to examine impacts of predators in the Delta and its tributaries. The Project Work Team can provide guidance on collaboration and coordination of predation studies, so existing work can become more productive and can better inform resource 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.

2024-T23 Water Quality and Phytoplankton PWT

Chairs: Silvia Angles (DWR), Ellen Preece (DWR, Keith Bouma-Gregson (USGS), and Janis Cooke, Central Valley Water Board (CVWB)

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. A small workgroup within the PWT is working on a Phytoplankton Enumeration Synthesis Project, which will create a standardized and integrated phytoplankton dataset for use by Delta researchers.

2024-T24 Genetics PWT

Chairs: Bryan Barney (CDFW), Evan Carson (USFWS), Daphne Gille (DWR) 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.

2024-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.

2024-T26 Climate Change PWT

Chairs: Sam Bashevkin (SWRCB) and Denise Colombano (DSP)

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.

2024-T29 Zooplankton PWT

Chair: Christina Burdi (DWR)

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. The Zooplankton PWT is a forum for discussion and collaboration around issues of concern for zooplankton monitoring and research in the upper SFE. In addition to regular meetings, the Zooplankton PWT also holds yearly symposiums based on identification, ecology, and utilization of emerging data.

C. Workshop

2024-T01 2024 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

2024-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	$152
USBR	$152
DSP	$183
CDFW	$173
Total	$660

V. Closed Work Plan Elements

A. Closed Project Elements and Teams

2023-002 Adult Striped Bass Population Estimates

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

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

PI: Vanessa Mora (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

2023-303 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
Total	In-Kind Contribution

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)

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

2023-349 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

2024-356 An Assessment of a Novel Framework to Identify Within-Year Spatial and Temporal Sampling Redundancies in Long-Term Community Monitoring Programs

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:

N/A

May also inform or follows up on:

IEP monitoring programs that survey biological communities

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

2024-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.

This Technical Team concluded their effort in 2021 and published two NOAA Technical Memorandums and one publication in the San Francisco Estuary & Watershed Science. The implementation of SAIL recommendations in IEP is still on-going.

- NOAA Technical Memorandum (August 2017) Scientific Framework for Assessing Factors Influencing Endangered Sacramento River Winter-Run Chinook Salmon (*Oncorhynchus tshawytscha*) Across the Life Cycle
- NOAA Technical Memorandum NMFS (September 2017) Improved Fisheries Management Through Life Stage Monitoring: The Case for the Southern Diistinct Population Segment of North American Green Sturgeon and the Sacramento-San Joaquin River White Sturgeon.
- Johnson, R.C.; Windell, S.; Brandes, P.L.; Conrad, J.; Ferguson, J.; Goertler, P.A., et al. (2017). Science Advancements Key to Increasing Management Value of Life Stage Monitoring Networks for Endangered Sacramento River Winter-Run Chinook Salmon in California. *San Francisco Estuary and Watershed Science*, 15(3).