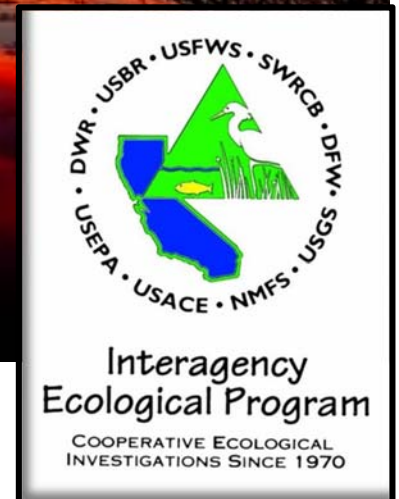


# Interagency Ecological Program

## 2019 Annual Work Plan



December 11, 2018

## A few words from the IEP Lead Scientist on the 2019 Annual Work Plan

We've had a challenging year building the work plan in 2018. Changes at the Interagency Ecological Program Coordinators Chairperson position and the Program Support Team Lead position resulted in some Program administration delays and a shifting of responsibilities to support the transition to new leadership. We're now thrilled to have Stephanie Fong (replacing Gregg Erickson as Coordinator Chair) and Lynn Takata (replacing Sakura Evans as Program Support Team Lead) in our midst – they are stationed at the California Department of Fish and Wildlife in Stockton, CA. We're mostly back on track and set to resume progress in 2019! Welcome to you both!

The IEP Annual Work Planning process went smoothly this year, in spite of continuing declines in several of our most critical species – Delta Smelt most notably. With the decline in Delta Smelt abundance and the commensurate reduction in endangered species take allotment to projects in the Estuary, we were still able to reduce our overall project take footprint while maintaining our directed and long-term sampling efforts. Although reducing impacts can come at a cost of reducing data collection and information provided to Agency Directors and decision-makers, the IEP worked successfully between the Science Management, Coordinators, and Directors teams to create an informative Annual Work Plan while minimizing our impact to endangered species. Thanks to all who helped achieve this outcome.

We're thankful to have the resources to track some interesting new initiatives this year, including supporting the Delta Smelt Resiliency Strategy (Suisun Marsh Salinity Control Gate Pilot Study (2019-335), forecasting the invasive Nutria outbreak (2019-337), and working to understand how Delta Smelt might be responding to domestication (2019-338). We also are increasing our efforts at management-relevant synthesis, including a look at zooplankton sampling and variability across several Estuary habitats (2019-336) and landscape-scale response to aquatic vegetation treatment (2019-339). We have added efforts that begin to look deeper into existing Program Element datasets – thermal refugia of fishes with warming waters (2019-340), early life stage patterns in juvenile fish communities (2019-342), and using Enhanced Delta Smelt Monitoring (EDSM) samples to further understand Chinook salmon caught as a result (2019-341).

I hope you'll agree that the program of sampling, data collection, analysis, and information creation described herein forms a robust foundation of ecological process documentation and understanding that the people of the Estuary and California deserve. We work hard to serve the varied interests represented at the IEP table. We look forward to continuing partnerships with our stakeholders to improve the science we need to successfully manage and conserve the ecological and physical resources we are all responsible for maintaining.

Collegially,

Steven Culberson, Ph.D.  
IEP Lead Scientist  
November 2018

### What is the Interagency Ecological Program?

The Interagency Ecological Program (IEP) is a consortium of three state agencies (California Department of Fish and Wildlife, California Department of Water Resources, State Water Resources Control Board) and six federal agencies (Bureau of Reclamation, U.S. Fish and Wildlife Service, U.S. Environmental Protection Agency, U.S. Army Corps of Engineers, National Marine Fisheries Service, and U.S. Geological Survey). 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, 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 (3-5 years and beyond) outlined by the IEP Science Strategy.

### What's included?

Monitoring, research, and synthesis focused on the Bay-Delta aquatic ecosystem that meets the IEP mission and vision, and fulfills one or more of the IEP's goals and objectives as outlined in the Science Strategy, are eligible for inclusion in the Work Plan. This draft includes six broad categories:

- **Compliance** – Agencies that run the federal and State water projects (CDWR and USBR, respectively) or implement other actions (e.g. ACOE) are obligated to implement "compliance monitoring" of fish populations and water quality to satisfy requirements (e.g. permits, licenses, orders, settlements, and agreements) issued by the resource and regulatory agencies (e.g., CDFW, USFWS, NMFS, SWRCB) for the operation of the water projects.
- **Baseline Status and Trends** – The federal and State agencies 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.
- **Synthesis, Modeling and Reviews** – These elements provide synthesis and analysis of trend information, study and research results, and activities necessary to update conceptual models that are the basis of regulatory requirements. This category also includes reviews of current studies and programs to improve methods, the value of data collected, and the contextual setting of IEP environmental monitoring.

- **Directed Studies** – Directed Studies are those studies proposed and funded by one or more IEP Agencies to inform a specific management-articulated information need or specifically-identified data gap. The request for a Directed Study can come from within a particular agency or from any IEP Governance entity, but must be funded in order to be included in an Annual IEP Work Plan. Directed Studies typically address specific scientific questions and areas of critical uncertainty regarding species of interest, natural communities, and landscape-scale processes to inform management actions.
- **Program Management** – These activities are necessary to implement the program, including staff time and expenses in each agency responsible for IEP activities (program and project management, data management, etc.)
- **Project Work Teams, Technical Teams, and Workshop** – A summary to capture the variety and scope of venues to communicate and coordinate monitoring and research of IEP and related efforts. The annual workshop facilitates sharing of IEP findings with the larger estuary science community.
- **Solicited Research** – These studies can be funded from a common, competitive pool that may result from solicitation for proposals if funding is available beyond what is needed for Compliance Monitoring, Baseline Status and Trends, Directed Studies, or Synthesis, Modeling and Reviews.
  - No funding for Solicited Research is identified for 2019.

#### What's 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.

# 2019 IEP Work Plan - Summary

<b><i>Category Overview and Summary</i></b>	<b><i>(Elements with Costs)</i></b>	<b>Amount</b> <sup>#</sup> (\$1000)
<b><i>Category I. Compliance and Monitoring Elements</i></b>		
A. Compliance	22 of 22	\$18,418
B. Baseline Status and Trends	6 of 6	\$2,125
	<b>Subtotal</b>	<b>\$20,543</b>
<b><i>Category II. Special Study Elements</i></b>		
A. Synthesis, Modeling and Reviews	6 of 14	\$1,827
C. Directed Studies	21 of 21	\$14,528
	<b>Subtotal</b>	<b>\$16,355</b>
<b><i>Category III. Program Support Elements</i></b>		
A. Program Management	1 of 1	\$770
	<b>Subtotal</b>	<b>\$770</b>
<b><i>Category IV. Teams and Outreach</i></b>		
A. Project Work Team (PWT)	0 of 17	\$0
B. Technical Team (TT)	0 of 1	\$0
C. Workshop	0 of 1	\$0
	<b>Subtotal</b>	<b>\$0</b>
<b><i>Program Summary</i></b>	<b>56 of 83</b>	<b>Total \$37,668</b>

## ***Category I. Compliance and Monitoring Elements***

### **Sub Category A. Compliance**

<b>Element</b>	<b>Pg</b>	<b>Title</b>	<b>P.I.</b>	<b>Amount</b> <sup>#</sup> (\$1000)
2019-003	8	Fall Midwater Trawl Survey (FMWT)	J. White, CDFW	752
2019-007	8	Summer Towntnet Survey (STN)	F. La Luz, CDFW	751
2019-011	9	Estuarine and Marine Fish Abundance and Distribution Survey (Bay Study)	K. Hieb, CDFW	784
2019-012	9	Bay Shrimp and Crab Abundance and Distribution Surveys (Bay Study)	K. Hieb, CDFW	218
2019-029	10	Bay Salinity Monitoring	M. Downing-Kunz, USGS	304
2019-030	10	Delta Flow Measurement and Database Management	C. Ruhl, USGS	854
2019-033	11	20mm Delta Smelt Survey (20mm)	R. Fujimura, CDFW	730
2019-053	11	Juvenile Salmon Monitoring (DJFMP)	B. Holden, USFWS	3,263
2019-059	12	Coleman Nat. Fish Hatchery Late-Fall-Run Production Tagging	B. Holden, USFWS	228
2019-071	12	Mossdale Spring Trawl (Mossdale)	S. Tsao, CDFW	135
2019-072	13	Environmental Monitoring Program	S. Lesmeister, DWR	4,670

## Category I. Compliance and Monitoring Elements

### Sub Category A. Compliance

Element	Pg	Title	P.I.	Amount (\$1000) #
2019-073	13	San Joaquin River Dissolved Oxygen Monitoring	J. Rinde, DWR	74
2019-074	14	Central Valley Juvenile Salmon and Steelhead Monitoring (Knights Landing)	J. Julianne, CDFW	546
2019-077	14	Upper Estuary Zooplankton Sampling	A. Hennessy, CDFW	474
2019-088	15	Spring Kodiak Trawl (SKT)	R. Fujimura, CDFW	450
2019-093	15	UCD Suisun Marsh Fish Monitoring	P. Moyle, UCD, T. O'Rear, UCD, and J. Durand, UCD	1,003
2019-096	16	Smelt Larva Survey (SLS)	R. Fujimura, CDFW	330
2019-104	16	Operation of Thermograph Stations	D. Parker, USGS	53
2019-195	17	6-year Steelhead Survival Study	J. Israel, USBR	150
2019-296	17	Investigation of the Distribution and Abundance of Longfin Smelt in the SFE	R. Baxter, CDFW	1,450
2019-301	18	Juvenile Salmon Emigration Real Time Monitoring (DJFMP)	B. Holden, USFWS	199
2019-311	18	Tidal Wetland Monitoring Pilot Study - Phase 4	D. Contreras, CDFW	1,000
22 of 22 Elements with Costs of \$18,418				

### Sub Category B. Baseline Status and Trends

Element	Pg	Title	P.I.	Amount (\$1000) #
2019-002	19	Adult Striped Bass Population Estimates	M. Gingras, CDFW	345
2019-005	19	Adult sturgeon population estimates	M. Gingras, CDFW	345
2019-047	20	Yolo Bypass Fish Monitoring Program (YBFMP)	B. Schreier, DWR	764
2019-279	20	Liberty Island Fish Survey (DJFMP)	D. Barnard, USFWS	205
2019-302	21	Resident Fish Survey (DJFMP)	B. Holden, USFWS	366
2019-303	21	Salmon Survival Studies (DJFMP)	B. Holden, USFWS, and G. Castillo, USFWS	100
6 of 6 Elements with Costs of \$2,125				

## Category II. Special Study Elements

### Sub Category A. Synthesis, Modeling and Reviews

Element	Pg	Title	P.I.	Amount (\$1000) #
2019-020	22	Science Advisory Group (SAG)	K. Gehrts, DWR	80
2019-043	22	Estimation of Pelagic Fish Population Sizes	V. Tobias, USFWS	150
2019-208	23	Statistical Support (DJFMP)- Delta Smelt Life Cycle Model	V. Tobias, USFWS	267

## Category II. Special Study Elements

### Sub Category A. Synthesis, Modeling and Reviews

Element	Pg	Title	P.I.	Amount (\$1000) #
2019-249	23	Gear Efficiency in Support of Delta Smelt Modeling Efforts	R. Baxter, CDFW	-
2019-318	24	Effects of Aquatic Macrophyte Control on Delta Smelt Habitat (MAST)	T. Sommer, DWR, and L. Conrad, DWR	1,190
2019-320	24	Longfin Smelt Conceptual Model and Synthesis (MAST)	R. Baxter, CDFW	-
2019-327	25	Status, Trends and Distribution of Cypriniform Fishes Native to the Sacramento-San Joaquin Delta, CA	F. La Luz, CDFW	-
2019-334	25	FLoAT MAST Synthesis Effort	B. Mahardja, USFWS	-
2019-336	26	Synthesis of IEP Zooplankton Sample Methodologies and Variation in Zooplankton Communities across Habitats	K. Kayfetz, DSP	-
2019-337	26	Forecasting Nutria Invasion in the Sacramento-San Joaquin Delta	V. Tobias, USFWS	-
2019-339	27	Landscape-Scale Analysis of Aquatic Vegetation Response to Treatment in Terms of Growth Rates, Persistence, Community Composition, and Biodiversity in the Delta	S. Khanna, CDFW	-
2019-340	27	Understanding Climate Change Tools for San Francisco Estuary Analyses and Investigation of Thermal Refugia in Warming Waters	L. Conrad, DWR	-
2019-341	28	Feasibility of Improving Juvenile Chinook Salmon Monitoring in the upper San Francisco Estuary through Enhanced Delta Smelt Monitoring	B. Mahardja, USFWS and G. Castillo, USFWS	80
2019-342	28	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

6 of 14 Elements with Costs of \$1,827

### Sub Category C. Directed Studies

Element	Pg	Title	P.I.	Amount (\$1000) #
2019-062	29	Fish Diet and Condition	R. Baxter, CDFW	340
2019-089	29	Directed Field Collections	R. Baxter, CDFW	38
2019-281	30	Yolo Bypass Productivity Export Studies	J. Frantzich, DWR, and B. Schreier, DWR	1,500
2019-312	30	Estimating effective population size and long term-monitoring of Delta Smelt	A. Finger, UCD	114
2019-314	31	Delta Smelt Early Warning Studies: Application of the SmeltCam	F. Feyrer, USGS	319
2019-315	31	Physical and Biological Drivers of Fish Populations to Inform Management and Habitat Restoration Actions	F. Feyrer, USGS	1,200
2019-316	32	Turbidity Transects (Boat Based Turbidity)	M. Dempsey, DWR	76
2019-317	32	Methods Development for Environmental DNA Surveying of the Wild Delta Smelt Population (eDNA)	A. Finger, UCD	15

## Category II. Special Study Elements

### Sub Category C. Directed Studies

Element	Pg	Title	P.I.	Amount (\$1000) #
2019-321	33	Monitoring Sacramento River Winter-run Chinook Salmon Life History Diversity, Growth, and Habitat Use (SAIL)	P. Morais, DSP, and R. Johnson, NMFS	130
2019-322	33	Estimating Abundance of Juvenile Winter-run Chinook Salmon Entering and Exiting the Delta (SAIL)	B. Holden, USFWS	1,208
2019-323	34	Reconstructing Juvenile Salmon Growth, Condition, and Delta Habitat Use in 2014-15 Drought and Beyond (SAIL)	A. Sturrock, and M. Miller, UCD	476
2019-325	34	Enhanced Delta Smelt Monitoring (EDSM)	D. Barnard, USFWS	2,600
2019-326	35	Effect of Outflow Alteration upon Delta Smelt Habitat, Condition and Survival (Year 2)	A. Schultz, USBR	3,500
2019-328	35	Integrating Measurement of Fish Body Condition within the Delta Juvenile Fish Monitoring Program (DJFMP)	Cory Graham, USFWS	42
2019-329	36	Extracting Better Information from Long-Term Monitoring Data: Estimating Occupancy and Abundance of Near-Shore Fishes in the Sacramento-San Joaquin River Delta	B. Mahardja, USFWS	130
2019-330	36	Aquatic Habitat Sampling Platform: Standardized Fish Community Sampling Across Habitat Types	J. Merz, Cramer Fish Sciences, and E. Van Nieuwenhuyse, USBR	275
2019-331	37	Central Valley Salmonid Coordinated Genetic Monitoring (Year 3)	J. Israel, USBR	325
2019-332	37	Comparative Predation Risk of Juvenile Chinook Salmon among River, Floodplain and Wetland Rearing Habitats in the North Delta	L. Takata, DWR	97
2019-333	38	Enhanced Acoustic Tagging, Analysis, and Real-Time Monitoring	E. Danner, NOAA	2,000
2019-335	38	Suisun Marsh Salinity Control Gate Study	T. Sommer, DWR and L. Conrad, DWR	100
2019-338	39	Physiological and Behavioral Effects of Domestication on Delta Smelt	B. Davis, DWR	43

21 of 21 Elements with Costs of \$14,528

## Category III. Program Support Elements

### Sub Category A. Program Management

Element	Pg	Title	P.I.	Amount (\$1000) #
2019-OAC	39	IEP Oversight and Coordination	S. Fong, CDFW	770

1 of 1 Elements with Costs of \$770



## Category IV. Teams and Outreach

### Sub Category A. Project Work Team (PWT)

Element	Pg	Title	P.I.	Amount (\$1000)	#
2019-T03	40	Sturgeon PWT	A. Seesholtz, DWR, and J. Heublein, NMFS	-	
2019-T04	40	Estuarine Ecology (EET) PWT	B. Herbold, and K. Kayfetz, DSC	-	
2019-T05	41	Biotelemetry PWT	K. Clark, DWR	-	
2019-T06	41	Spring Run Salmon PWT	F. Cordoleani, H. Brown, NOAA, and M. Johnson, CDFW	-	
2019-T07	42	Resident Fishes PWT	B. Mahardja, USFWS, and M. Young, USGS	-	
2019-T09	42	Tidal Wetland Monitoring PWT	S. Sherman, CDFW	-	
2019-T11	43	Winter Run Salmon PWT	D. Kratville, CDFW	-	
2019-T12	43	Juvenile Monitoring PWT	B. Poytress, USFWS	-	
2019-T13	44	Central Valley Salmonid Hatchery PWT	K. Niemala, USFWS, and M. Workman, EBMUD	-	
2019-T14	44	Aquatic Vegetation PWT	L. Conrad, DWR	-	
2019-T15	45	Steelhead PWT	J. Nelson, CDFW	-	
2019-T16	45	Upper Sacramento River Salmon PWT	K. Niemala, USFWS	-	
2019-T17	46	Contaminants PWT	K. Hoffmann, DWR	-	
2019-T18	46	Flow Alteration PWT	L. Brown, USGS, and A. Schultz, USBR	-	
2019-T22	47	Predation PWT	A. Schultz, USBR, and S. Ainsley, FISHBIO	-	
2019-T23	47	Water Quality and Nutrients PWT	S. Lesmeister, DWR, and J. Cooke, CVRWCB	-	
2019-T24	48	Genetics PWT	M. Baerwald, DWR, E. W. Carson, USFWS and J. Rodzen, CDFW	-	
0 of 17 Elements with Costs of				\$0	

### Sub Category B. Technical Team (TT)

Element	Pg	Title	P.I.	Amount (\$1000)	#
2019-T20	48	IEP Data Utilization Work Group (DUWG)	Vacant	-	
0 of 1 Elements with Costs of				\$0	

## Category IV. Teams and Outreach

### Sub Category C. Workshop

Element	Pg	Title	P.I.	Amount <sup>(\$1000)</sup> #
2019-T01	49	2019 IEP Annual Workshop	S. Fong, CDFW	-
0 of 1 Elements with Costs of				\$0
Program Summary is 56 of 83 Elements with Costs of \$37,668				

#### Footnotes:

“-”: 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 actually planned and implemented in the budgets of the participating agencies, not through the IEP as a separate agency.

The “Drought Operations” Monitoring category has been removed in the 2017 IEP Work Plan because the State Drought Funding expired June 30, 2016.

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# 2019 IEP Work Plan - Element Details

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## ***I. Compliance and Monitoring Elements***

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### ***A. Compliance***

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#### **2019-003      Fall Midwater Trawl Survey (FMWT)**

J. White, CDFW

The Fall Midwater Trawl Survey (FMWT) provides long-term abundance trend information for age-0 Striped Bass, age-0 American Shad, Splittail Threadfin Shad, Delta Smelt, and Longfin Smelt. These data will be used by CDFW personnel in conjunction with other survey data to determine species status and to evaluate the success of various mitigation and restoration plans for fishes in the estuary. Delta Smelt data are used to calculate a recovery index as described in the Delta Smelt Biological Opinion (USFWS 2008) and by the US Fish and Wildlife Service to set salvage limits for the Central Valley Project and State Water Project.

#### Compliance with the following:

2008 FWS BO                      RPA 1,5  
CDFW LFS ITP                      Cond. 8.1

#### May also inform or follows up on:

2010 POD Work Plan - Expanded Monitoring  
CVPIA  
FLASH

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
DWR	\$381
USBR	\$371
	<u>\$752</u>

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#### **2019-007      Summer Townet Survey (STN)**

F. La Luz, CDFW

Summer Townet Survey (STN) samples throughout the summer with a towed, small mesh net from eastern San Pablo Bay throughout the Delta to monitor the annual abundance and distribution of juvenile fish in the upper estuary, and evaluate factors affecting abundance. Annual delta smelt and striped bass indices are used to track long-trends of relative abundance. Water quality profile and simultaneous zooplankton samples are collected as well. Data from this element was used to help determine the conservation status of Delta Smelt, Longfin Smelt and Splittail.

#### Compliance with the following:

2008 FWS BO                      RPA 5

#### May also inform or follows up on:

2010 POD Work Plan - Expanded Monitoring

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
DWR	\$380
USBR	\$371
	<u>\$751</u>

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**2019-011      Estuarine and Marine Fish Abundance and Distribution      K. Hieb, CDFW**  
**Survey (Bay Study)**

The primary objective of this element is to determine the effects of freshwater outflow and outflow related mechanisms on the abundance and distribution of estuarine and marine fishes, and brachyuran crabs. The monthly mid-water and otter trawling survey (since 1980) samples at 52 channel and shoal stations from South San Francisco Bay to the lower Sacramento and San Joaquin rivers, and tracks abundance and distribution trends of marine and estuarine fishes. Data is used to assess the status of marine and estuarine fishes in the estuary as required by D-1641. (Note: This is part of the CDFW Bay Study.)

Compliance with the following:

CDFW LFS ITP                      Cond. 8.1  
D-1485                              Term 10a, Term 10c  
D-1641                              Term 11b

May also inform or follows up on:

2008 FWS BO

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
DWR	\$392
USBR	\$392
	\$784

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**2019-012      Bay Shrimp and Crab Abundance and Distribution      K. Hieb, CDFW**  
**Surveys (Bay Study)**

The primary objective of this element is to determine the effects of freshwater outflow and outflow related mechanisms on the abundance and distribution of caridean shrimp. The trawling survey described for 2019-011 also includes the collection and processing of Caridean shrimp to track abundance and distribution trends of Bay and estuarine shrimp species. Data is used to assess the status of shrimp in the estuary. (Note: This is part of the CDFW Bay Study.)

Compliance with the following:

D-1641

May also inform or follows up on:

D-1485

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
DWR	\$109
USBR	\$109
	\$218

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**2019-029 Bay Salinity Monitoring****M. Downing-Kunz, USGS**

This element samples salinity and water temperature in San Francisco Bay. Data are used to better understand the hydrodynamics of the estuary and calibration of multi-dimensional flow and transport models. Understanding how these variables are distributed around the Bay leads to a better understanding of habitat types and distribution in the Bay. Time series of water temperature and specific conductance (salinity is calculated from conductivity and water temperature) are needed (1) to improve our understanding of the hydrodynamics of the estuary (e.g., gravitational circulation), (2) for calibration of multi-dimensional flow and transport models of the Bay, (3) to better understand the distribution of physio-chemical habitat types throughout the Bay, and (4) to provide supporting data for numerous estuarine studies of the Bay and Delta.

**Compliance with the following:**

D-1485 Term 10b, Term 10c

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
DWR	\$276
USGS	\$28
	<u>\$304</u>

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**2019-030 Delta Flow Measurement and Database Management****C. Ruhl, USGS**

The Delta Flow Network consists of 35 flow and water quality monitoring stations located throughout the Sacramento-San Joaquin Delta; eleven of these stations are supported by the IEP. Data from this network of stations are used by Delta managers and scientists to make real-time decisions and plan for future events such as climate change, water operations, restoration projects, evaluate fish transport, and migration issues. In addition, these data are used to calibrate and validate numerical models that are used to predict water levels, flow speeds, and spatial and temporal evolution of salinity in the Delta. 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 understanding the impacts of proposed major infrastructure projects and regulatory actions being taken to protect endangered species in the Delta.

**Compliance with the following:**

D-1485 Term 10b, Term 10c

**May also inform or follows up on:**

2008 FWS BO

D-1641

POD

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
USGS	\$78
DWR	\$776
	<u>\$854</u>

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**2019-033      20mm Delta Smelt Survey (20mm)****R. Fujimura, CDFW**

This element is a fine-mesh trawl survey that monitors larval and juvenile Delta Smelt and Longfin Smelt distribution throughout its historical spring range in the Sacramento-San Joaquin Delta and San Francisco Estuary. Zooplankton and water quality sampling is conducted simultaneously. Sampling is conducted every two weeks from mid-March through mid-July at 35-40 stations from eastern San Pablo Bay through the Delta. The near real-time sample processing enables distribution data to be used by agency managers in the Smelt Working Group to assess risk of Delta smelt and Longfin smelt entrainment.

**Compliance with the following:**

2008 FWS BO                      RPA 5  
CDFW LFS ITP                      Cond. 8.1

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**May also inform or follows up on:**

2010 POD Work Plan - Expanded Monitoring

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
DWR	\$402
USBR	\$328
	<hr/> \$730

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**2019-053      Juvenile Salmon Monitoring (DJFMP)****B. Holden, USFWS**

This element will conduct weekly beach seining (year-round) within the lower Sacramento River and Delta, weekly seining in the lower San Joaquin River (January through June), and bi-weekly seining in San Francisco Bay and San Pablo Bay (November through June) to monitor the relative abundance and distribution of juvenile Chinook Salmon in unobstructed near-shore habitats. In addition, year-round surface trawling is conducted at Chipps Island and Sacramento to monitor juvenile Chinook Salmon abundance entering and exiting the Delta, and surface trawling at Mossdale from July to March to monitor the abundance and temporal distribution of juvenile Chinook Salmon entering the Delta. The surface trawling at Mossdale is conducted in cooperation with the California Department of Fish and Wildlife who monitor at Mossdale from April to June. (Note: This is part of the US Fish and Wildlife Service Delta Juvenile Fish Monitoring Program.)

**Compliance with the following:**

2009 NMFS BO                      11.2.1.3 (8) d. pg 586

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
USBR	\$1,446
DWR	\$1,817
	<hr/> \$3,263

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<b>2019-059</b>	<b>Coleman Nat. Fish Hatchery Late-Fall-Run Production Tagging</b>	<b>B. Holden, USFWS</b>
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This element consists of coded-wire tagging of all Coleman National Fish Hatchery late-fall run production to ensure proper race identification during subsequent recovery of fish at Delta export facilities, and in juvenile and adult sampling programs. Approximately 1,100,000 late fall-run Chinook salmon will be marked and tagged each year. Recovery of tagged late-fall run fish is also part of the spring-run recovery plan. (Note: This is part of the US Fish and Wildlife Service Delta Juvenile Fish Monitoring Program.)

Compliance with the following:

2009 NMFS BO IV.4

May also inform or follows up on:

2009 NMFS BO

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<u>Funding Agency</u>	<u>Amount (1000's) <sup>#</sup></u>
DWR	\$69
DWR	\$58
USBR	\$101
	<u>\$228</u>

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<b>2019-071</b>	<b>Mossdale Spring Trawl (Mossdale)</b>	<b>S. Tsao, CDFW</b>
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This study is part of an overall effort to provide "near-time" information on the relative vulnerability of key fish species (primarily Chinook salmon and steelhead) to water project operations. This supports DFG's Region 4 field work, as well as collation and reporting of data from the Mossdale trawl sampling program during April through June. Sampling results are made available within 48-hours via the Internet.

Compliance with the following:

2009 NMFS BO 11.2.1.3 - 5), 11.2.1.3 - 8)

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<u>Funding Agency</u>	<u>Amount (1000's) <sup>#</sup></u>
DWR	\$135
	\$135

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**2019-072      Environmental Monitoring Program****S. Lesmeister, DWR**

This element monitors water quality at 22 sites in San Pablo Bay, Suisun Bay, and the Delta in compliance with D-1641. In addition to basic water quality parameters, chlorophyll, phytoplankton, benthic and zooplankton samples are collected. Continuous collection of water quality data for multiple parameters including electrical conductivity or salinity is telemetered to the California Data Exchange Network and is available on a near real-time basis for day-to-day CVP and SWP operational decisions.. Identification and enumeration of phytoplankton and benthic organisms, water quality constituents, and quality control samples should be available within two months after collection.

Compliance with the following:

D-1641                      Term 1, 3  
2008 FWS BO              RPA 5

May also inform or follows up on:

FLASH  
POD

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
DWR	\$2,380
USBR	\$2,290
	<hr/> \$4,670

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**2019-073      San Joaquin River Dissolved Oxygen Monitoring****J. Rinde, DWR**

DWR's Bay-Delta Monitoring and Analysis Section has been monitoring dissolved oxygen (DO) levels in the Stockton Ship Channel (channel) during the late summer and fall since 1968. As low DO levels can have adverse impacts on fisheries and other beneficial uses of the waters within the Bay-Delta, the SWRCB established specific water quality objectives to protect these uses. This objective is established to protect fall-run Chinook salmon and applies to the lower San Joaquin River between Stockton and Turner Cut, which includes the eastern channel. Data is used to guide water project operations and barrier placement recognizing the baseline objectives.

Compliance with the following:

D-1641                      Term 1, 3, 11a, 11d, 11e

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
DWR	\$74
	<hr/> \$74



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**2019-074 Central Valley Juvenile Salmon and Steelhead  
Monitoring (Knights Landing)****J. Julienne, CDFW**

The data collected (since 1995) provides an early warning of when juvenile salmon emigrate from the Delta, and allows for real-time adaptive management of water operations. This sampling effort uses paired 8-foot rotary screw traps located near the town of Knights Landing. The season begins in October and continues through June of the following year. For salmonids specifically, data collection includes enumeration by life stage, race, fork lengths and wet weight for assessing condition factor of individual fish. A sub-sample of captured adipose fin-clipped (hatchery origin) Chinook salmon are held for coded wire tag reading to assess emigration rates of fish released from upstream hatcheries. Additionally, a percentage of fall-run Chinook salmon are marked and recaptured as part of calculating passage. Daily catch is summarized and distributed by e-mail to agency representatives and water operations managers.

**Compliance with the following:**

2009 NMFS BO 11.2.1.3 - 5), 11.2.1.3 - 5), IV.1.1, IV

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
DWR	\$276
USBR	\$270
	<u>\$546</u>

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**2019-077 Upper Estuary Zooplankton Sampling****A. Hennessy, 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 (See element #72). Sampling with three gear types occurs monthly at 22 stations located throughout San Pablo Bay, Suisun Marsh, Suisun Bay and the delta.

**Compliance with the following:**D-1485 Term 10a  
D-1641 Term 11a**May also inform or follows up on:**FLASH  
POD

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
USBR	\$237
DWR	\$237
	<u>\$474</u>

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**2019-088      Spring Kodiak Trawl (SKT)****R. Fujimura, CDFW**

This program element provides detection of mature and maturing Delta Smelt from January through May. Improved detection of Delta Smelt will better inform water export facility operators of the potential to entrain adult Delta Smelt in subsequent weeks, as well as their offspring later in the year. Monthly Kodiak trawl sampling occurs from the Napa River and Carquinez Straight through the Delta. Data collected indicates the distribution and maturity status of adult delta smelt and the occurrence of spent female Delta Smelt, as an indication of the onset of larval recruitment in the Delta. Data is provided shortly after sampling to the Smelt Working Group and Water Operations Management Team.

**Compliance with the following:**

2008 FWS BO                      RPA 1,2,5  
CDFW LFS ITP                      Cond. 8.1

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**May also inform or follows up on:**

2010 POD Work Plan - Expanded Monitoring

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
USBR	\$202
DWR	\$248
	<hr/> \$450

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**2019-093      UCD Suisun Marsh Fish Monitoring****P. Moyle, UCD, T. O'Rear,  
UCD, and J. Durand, UCD**

The study (since 1979) monitors fish populations in Suisun Marsh, especially in response to modifications being made on the way water moves through the marsh. Monthly sampling is conducted within 21 sites among nine sloughs in Suisun Marsh, using a combination of otter trawls and beach seines. The objectives of the study are to understand the entire assemblage of fishes in the marsh by examining such factors as, changes in species abundance and composition through time, fish use of various habitats within the marsh, and changes in fish assemblages in association with natural and anthropogenic change. This study informs management decisions and provides the key background information needed to determine success of marsh restoration projects.

**Compliance with the following:**

BCDC 4-84(M) Special Condition B  
ACOE Permit 16223E58B Special Condition 1  
Suisun Marsh Salinity Gates 1602

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**May also inform or follows up on:**

D-1485  
POD  
Revised SMMA (#600000634)

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
DWR	\$1,003
	<hr/> \$1,003

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**2019-096 Smelt Larva Survey (SLS)****R. Fujimura, CDFW**

This survey provides near real-time distribution data for Longfin (LFS) smelt larvae in the Delta, Suisun Bay and Suisun Marsh. Data are used by agency managers to assess vulnerability of longfin smelt larvae to entrainment in south Delta export pumps. Sampling begins within the first two weeks in January and repeats every other week through the second week in March. The data is used to assist CDFW, FWS, and the Smelt Working Group in assessing the risks of entrainment by the SWP and CVP and determining OMR levels designed to minimize take of juvenile LFS at these facilities.

**Compliance with the following:**

CDFW LFS ITP                      2081-2009-001-03

**May also inform or follows up on:**

2010 POD Work Plan - Expanded Monitoring

D-1485

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**Funding Agency****Amount (1000's)**<sup>#</sup>

DWR

\$182

USBR

\$148

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\$330

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**2019-104 Operation of Thermograph Stations****D. Parker, USGS**

The USGS will maintain temperature stations at the San Joaquin River near Vernalis and the Sacramento River below Wilkens Slough near Grimes. Measurements are recorded at fifteen minute intervals during the entire water year. The purpose is to provide continuous information on the temperature regime in the river to help evaluate effects on fisheries, amphibian, and other aspects of the aquatic ecosystem and better understand the transition from cold water to warm water regimes and how flow magnitude interacts to control the transition. A daily suspended sediment station also will be maintained at the San Joaquin River near Vernalis and two bed material samples will be collected from this location annually. This is to provide data on the role of sediment loading in the Delta.

**Compliance with the following:**

2009 NMFS BO                      I.2.1 (performance measures) I.4, IV.

**May also inform or follows up on:**

2008 FWS BO

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**Funding Agency****Amount (1000's)**<sup>#</sup>

DWR

\$40

USGS

\$13

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\$53

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**2019-195      6-year Steelhead Survival Study****J. Israel, USBR**

The program estimates survival and route entrainment of juvenile San Joaquin River steelhead during the spring under a range of river and Delta operation conditions. The objective of this program is to understand how survival and route entrainment of juvenile steelhead along the San Joaquin River and South Delta is related to regional hydrodynamics. The study was designed to use the results from the six-year steelhead telemetry study during 2011-2016 to evaluate juvenile steelhead route selection at channel divergences in the south Delta and along the mainstem San Joaquin River, and how these behaviors influence survival in specific reaches and through the Delta to Chipps Island.

**Compliance with the following:**

2009 NMFS BO      11.2.1.2, IV.2.2

**May also inform or follows up on:**

2009 NMFS BO

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
USBR	\$150
	\$150

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**2019-296      Investigation of the Distribution and Abundance of  
Longfin Smelt in the SFE****R. Baxter, CDFW**

The overarching goal of these studies is to provide additional information about Longfin Smelt that is expected to improve management and protection of this species in the SFE. They aim to enhance our knowledge of the life history and ecology of Longfin Smelt, and to refine our understanding of the drivers of population distribution and abundance, including the relationship between freshwater outflow and the abundance of Longfin Smelt. A Technical Team is proposed as part of this work, and they will provide guidance and assistance for the proposed studies, review of analyses and results, and assist in identifying refinements or additions to the proposed scope of investigations.

There are three components being implemented in 2019: (1) Sampling Bay tributaries for larvae, ripe adults and otolith chemistry baseline; (2) Expansion of the Smelt Larva Survey (SLS) into Napa River and estimation of the Napa River contribution to upper estuary larva abundance; and (3) investigation of potential sampling bias in current FMWT and Bay Study surveys using Bay Study trawl data, such as examining the vertical and lateral distributions of LFS and relationships between catch and Secchi depth, and catch and channel depth.

**Compliance with the following:**

Longfin Smelt Settlement      Final Study Plan

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
DWR	\$724
DWR	\$205
OTHER	\$190
OTHER	\$331
	\$1,450

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**2019-301      Juvenile Salmon Emigration Real Time Monitoring  
(DJFMP)****B. Holden, USFWS**

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

**Compliance with the following:**

2009 NMFS BO                      11.2.1.3 (8) d. pg. 586

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
USBR	\$88
DWR	\$111
	<u>\$199</u>

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**2019-311      Tidal Wetland Monitoring Pilot Study - Phase 4****D. Contreras, CDFW**

The Fish Restoration Program Monitoring Team is tasked with monitoring fish and food web resources in restored tidal wetland sites. These restored sites are located in the Sacramento-San Joaquin Delta and Suisun Marsh pursuant to requirements in the 2008/2009 Biological Opinions for state and federal water project operations. In our initial pilot studies (conducted July 2015-June 2016), the primary goal was to determine which methods were reliable and effective for sampling fish and macroinvertebrates in tidal wetlands. The objective moving forward will be obtaining baseline monitoring data on existing and planned tidal wetlands using the recommended gear types from previous pilot studies. In addition, we will evaluate the variability of the biotic community in and near wetlands to determine the most effective timing and replication of sampling for long-term monitoring. Understanding how invertebrate and fish communities change pre- to post-restoration is essential to evaluating the benefits of tidal wetlands to native fish species.

**Compliance with the following:**2008 FWS BO                      RPA 4, Attachment B Action 6  
2009 NMFS BO                      RPA Action I.2.6, I.6  
CDFW LFS ITP                      Condition 7.1

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
DWR	\$1,000
	<u>\$1,000</u>

## *B. Baseline Status and Trends*

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### **2019-002     Adult Striped Bass Population Estimates**

M. Gingras, CDFW

This element tags and releases striped bass, monitors the fishery, monitors the tagged/untagged ratio of striped bass, and conducts syntheses. From those efforts, this element (a) estimates harvest and survival rates, abundance, and harvest of striped bass, (b) determines relationships between striped bass abundance and environmental variables in preceding years, (c) evaluates laws and regulations governing the fishery, (d) disseminates the results of the study to fisheries researchers and managers, and (e) makes recommendations for management of the striped bass population and fishery.

May also inform or follows up on:

CVPIA

D-1485

FLASH

Striped Bass Settlement

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
DWR	\$345
	<u>\$345</u>

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### **2019-005     Adult sturgeon population estimates**

M. Gingras, CDFW

This element tags and releases sturgeon, monitors the fishery, monitors the tagged:untagged ratio of sturgeon, and conducts synthesis. From those efforts, this element (a) estimates harvest and survival rates, abundance, and harvest of sturgeon, (b) determines relationships between sturgeon abundance and environmental variables in preceding years, (c) evaluates laws and regulations governing the fishery, (d) disseminates the results of the study to fisheries researchers and managers, and (e) makes recommendations for management of the white sturgeon population and fishery, including bycatch of green sturgeon.

May also inform or follows up on:

CVPIA

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
DWR	\$345
	<u>\$345</u>

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**2019-047 Yolo Bypass Fish Monitoring Program (YBFMP)****B. Schreier, DWR**

The objectives of this interdisciplinary monitoring effort are to: (1) collect baseline data on lower trophic levels (phytoplankton, zooplankton and aquatic insects), juvenile fish and adult fish, hydrology and physical conditions; 2) conduct pilot investigations of the temporal and seasonal patterns in chlorophyll-a concentrations, including whether high concentrations are exported from the Bypass during fall flow events after rice field drainage, and 3) investigate the possibility of manipulating bypass flows to benefit listed species like Delta Smelt. The specific environmental conditions that trigger migrations and enhanced survival and growth of native fishes (esp. salmon) have yet to be described in detail. In addition, the mechanisms through which lower trophic organisms reach higher abundance in the Yolo Bypass are not understood. This program 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, and by the Bay Delta Conservation Plan (BDCP). The Yolo program informs the restoration actions that are mandated or recommended in these plans, and provides critical baseline data on bypass ecology.

May also inform or follows up on:

2009 NMFS BO

CVPIA

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
DWR	\$764
	\$764

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**2019-279 Liberty Island Fish Survey (DJFMP)****D. Barnard, USFWS**

Liberty Island is a restoring wetland that provides important habitat for species of management concern, including delta smelt and Chinook salmon. This element conducts beach seining every month, and larval and zooplankton trawls from February through July to provide baseline data and serve as a reference site for future restoration efforts at Liberty Island and in conjunction with BDCP. (Note: This is part of the US Fish and Wildlife Service Delta Juvenile Fish Monitoring Program.)

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
USBR	\$83
DWR	\$122
	\$205

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**2019-302      Resident Fish Survey (DJFMP)****B. Holden, USFWS**

This element conducts beach seining weekly from July through December within the lower San Joaquin River, and bi-weekly from July through October in San Francisco Bay and San Pablo Bay to monitor the abundance and distribution of resident fishes in unobstructed littoral habitats. This survey provides status and trends information on fishes occurring within unobstructed littoral habitats. (Note: This is part of the US Fish and Wildlife Service Delta Juvenile Fish Monitoring Program.)

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
DWR	\$204
USBR	\$162
	\$366

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**2019-303      Salmon Survival Studies (DJFMP)****B. Holden, USFWS, and G.  
Castillo, 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 CAMT's SST workgroup).

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
DWR	\$100
	\$100



## II. Special Study Elements

### A. Synthesis, Modeling and Reviews

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#### 2019-020 Science Advisory Group (SAG)

K. Gehrts, DWR

The IEP Science Advisory Group (SAG) is a standing panel of independent external experts that was established in the 1990s. IEP regularly calls on the SAG to review IEP elements and provide advice on scientific issues. In addition to its permanent members, the SAG often includes additional "special members" with complementary expertise for individual reviews. Funding supports travel and meeting costs for the Science Advisory Group.

"PLACEHOLDER for 2019, Funding estimate based on 2018"

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
TBD	\$80
	<hr/> \$80

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#### 2019-043 Estimation of Pelagic Fish Population Sizes

V. Tobias, USFWS

This element will refine our design- and model-based estimates of the abundances of different life stages of Delta Smelt needed to assess the effectiveness of management actions on the population dynamics and the likelihood of population recovery. Previous work produced estimates for post-larvae, juveniles, sub-adults, and adults. This element will finalize and apply gear efficiency measures used to account for gear selectivity bias in catch data and consequently standardize data across surveys, incorporate improved estimates of Bay-Delta water volumes that are needed to calculate abundances, formally compare the abundance estimates produced by two methods (design- and model-based), extend our estimates to other life stages (e.g., larvae), and extend the estimates further back in time for life cycle modeling purposes (right now the model cover the period from 1990 to 2015).

#### May also inform or follows up on:

2010 POD Work Plan - On-Going Studies

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
DWR	\$75
USBR	\$75
	<hr/> \$150

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**2019-208      Statistical Support (DJFMP)- Delta Smelt Life Cycle Model****V. Tobias, USFWS**

The Delta Smelt Life Cycle Model (DSLCLM) is a state-space model designed (a) to provide a quantitative, empirically-based decision support tool for assessing the effects of management actions and environmental conditions on the population dynamics of Delta Smelt, (b) to suggest management actions, (c) to provide guidance and recommendations for future data needs and data collection procedures, and (d) to carry out Population Viability Analysis (PVA) to predict the long term consequences of particular actions. The work this year will refine Delta Smelt Life Cycle Model(s) and assess data gaps, assess factors that may influence reproductive success and survival processes, and carry out a Population Viability Analysis to investigate the effects of potential recovery efforts.

May also inform or follows up on:

FLASH

POD

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
DWR	\$110
USBR	\$157
	<hr/> \$267

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**2019-249      Gear Efficiency in Support of Delta Smelt Modeling Efforts****R. Baxter, CDFW**

Gear selectivity evaluations are helping 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 during the tidal cycle will permit the estimation of selection curves relating the relative capture probability of delta smelt (and possibly other species) of a given size across gears. Relative gear selectivity will be modeled statistically following Millar and Fryer (1999) based on data from proposed simultaneous and adjacent deployment of IEP fish sampling gears. These evaluations will also provide more information on relative gear selectivity, gear sampling volume by depth, vertical and lateral distribution of smelt by life stage, quantification of sampling variation due to tidal fluctuation, bias of fixed stations, estimates of contract selectivity with covered cod-end trawls, and insights on herding effects.

May also inform or follows up on:

POD

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
USFWS	\$0
	<hr/> \$0

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<b>2019-318</b>	<b>Effects of Aquatic Macrophyte Control on Delta Smelt Habitat (MAST)</b>	T. Sommer, DWR, and L. Conrad, DWR
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The Department of Water Resources, State Parks, Division of Boating and Waterways, and the California Department of Fish & Wildlife will complete monitoring work that assesses the effect of herbicide treatment of invasive aquatic plants on aquatic habitat. Monitoring work includes the response of the vegetation, water quality, local hydrodynamics, the plankton, and the fish community to herbicide treatments. In 2019, this element will report the results of the multi-year monitoring program, providing novel information on the impact of treatment on multiple aspects of habitat. This work will inform development of a management plan for macrophyte treatment in critical habitat areas for Delta Smelt

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
CDFW	\$340
DWR	\$250
DWR	\$600
	\$1,190

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<b>2019-320</b>	<b>Longfin Smelt Conceptual Model and Synthesis (MAST)</b>	R. Baxter, CDFW
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This synthesis effort will endeavor to identify and describe the factors and processes influencing Longfin Smelt survival, abundance and distribution in the San Francisco Estuary. Similar to the MAST conceptual modeling work for Delta Smelt, this synthesis effort will fully develop a Longfin Smelt life cycle conceptual model, describe its life history and identify testable hypotheses about the drivers and/or habitat attributes most likely influencing survival or growth at each life stage.

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
OTHER	\$0
	\$0

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**2019-327      Status, Trends and Distribution of Cypriniform Fishes      F. La Luz, CDFW**  
**Native to the Sacramento-San Joaquin Delta, CA**

We will conduct data analysis using data from existing Interagency Monitoring Program (IEP) monitoring programs (USFWS DJFMP, etc.) to better understand the trends in population and distribution of the native cyprinid species in the Delta, and their associations with environmental factors (water quality, flow, etc.). Results from this study will also allow us to identify knowledge gaps for each cyprinid species, and how we can improve our monitoring efforts to include these lesser known species.

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
USBR	\$0
DWR	\$0
CDFW	\$0
	<hr/> \$0

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**2019-334      FLoAT MAST Synthesis Effort      B. Mahardja, USFWS**

This synthesis effort will evaluate how the flow augmentations in 2018 have affected the abiotic and biotic habitat of Delta Smelt through the use of data from existing long-term monitoring programs and new studies.

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
OTHER	\$0
OTHER	\$0
USFWS	\$0
DSP	\$0
OTHER	\$0
USBR	\$0
USGS	\$0
DWR	\$0
CDFW	\$0
	<hr/> \$0

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**2019-336      Synthesis of IEP Zooplankton Sample Methodologies and Variation in Zooplankton Communities across Habitats      K. Kayfetz, DSP**

The objective of this IEP Synthesis project is to assess and describe the variation in sampling and lab processing methodologies used for zooplankton across different IEP monitoring programs and special studies. Multiple field sampling programs within the IEP collect zooplankton with various methodologies and it is unclear how much these different sampling regimens are inter-comparable. This is a concern for integrating datasets from different projects, and for detecting and quantifying changes over time and space. Our project is to review the various field collection, lab processing, and organism identification methodologies employed by different programs, to devise procedures to better integrate datasets, and to create and publish an integrated dataset. An integrated dataset may be useful for performing comparative analyses that are not possible using data from single surveys. If possible, we will use the integrated dataset to explore variation in zooplankton communities across habitat types (open-water channels, shoals, marsh edges, vegetated areas, etc.) and Delta regions.

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
DWR	\$0
	\$0

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**2019-337      Forecasting Nutria Invasion in the Sacramento-San Joaquin Delta      V. Tobias, USFWS**

Nutria (*Myocastor coypus*) is an invasive species that was recently discovered in the southern San Joaquin River watershed. The goal of this project is to help IEP agencies identify impacted and at risk habitats and to quantify the rate of species advancement in the Delta. To do this, we will identify currently impacted habitat and track and forecast distributions of nutria in the Delta before they can impact sensitive habitats or water operations. This project will use existing data to produce models, maps, and tools for detection. No new data will be collected, but data from public sightings and trapping will be incorporated. IEP's water quality data, fish distribution data, and products from prior synthesis efforts will also be incorporated. Tasks included in this project include identifying potential habitat, summarizing vital rates, and forecasting dispersal through potential habitats.

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
TBD	\$0
	\$0

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**2019-339      Landscape-Scale Analysis of Aquatic Vegetation  
Response to Treatment in Terms of Growth Rates,  
Persistence, Community Composition, and Biodiversity  
in the Delta**

S. Khanna, CDFW

Floating, submerged and emergent invasive plant species are now ubiquitous in the Delta, and may have profound effects on physical habitat as well as food web dynamics for fish species of management concern. This study is an IEP Synthesis effort that will integrate a historical and ongoing dataset of the Delta invasive aquatic vegetation (IAV) coverage and Division of Boating and Waterways (DBW) IAV treatment records for the past 14 years. It seeks to determine if treatment efficacy differs across space (e.g., different habitat types) and time. It will assess the impact of IAV control effort on the distribution, growth rate, spread and persistence, and species richness and community composition of the IAV communities.

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
TBD	\$0
	<hr/> \$0

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**2019-340      Understanding Climate Change Tools for San Francisco  
Estuary Analyses and Investigation of Thermal Refugia  
in Warming Waters**

L. Conrad, DWR

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

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
TBD	\$0
	<hr/> \$0

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<b>2019-341</b>	<b>Feasibility of Improving Juvenile Chinook Salmon Monitoring in the upper San Francisco Estuary through Enhanced Delta Smelt Monitoring</b>	B. Mahardja, USFWS and G. Castillo, USFWS
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This study aims to evaluate the extent to which the EDSM can be leveraged to enhance the IEP salmon monitoring network and to synthesize data collected from IEP long-term monitoring programs related to juvenile salmon outmigration in the lower SFE. We propose a synthesis of juvenile Chinook Salmon data collected from various monitoring programs in the lower SFE to better understand the species' migration in the estuary and its behavioral diversity. Higher variability in juvenile size and timing during downstream migration to the ocean can help ensure that some portion of the salmon population survive well in a dynamic marine environment. We will conduct comparison of salmon catch data from two contrasting water years: 2017 and 2018, with the expectation that wet year conditions would lead to higher variability in juvenile salmon size and timing in the lower estuary (i.e. higher life history diversity). We will incorporate data from other monitoring programs to fill any data gaps in EDSM data and for comparison purposes. As part of this effort, we will also note the limitations of the EDSM data given that the program was designed to target Delta Smelt and not Chinook Salmon. Results from this synthesis effort will allow us to better understand juvenile salmon outmigration in the estuary and may help inform the development of future salmon monitoring program.

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
USBR	\$50
DWR	\$30
	\$80

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<b>2019-342</b>	<b>Spatio-Temporal Community Patterns for Early Life Stages of Fishes and their Associations with Zooplankton in the Upper San Francisco Estuary</b>	G. Castillo, USFWS
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This study will generate new understanding on spatial and temporal community patterns for the larval-juvenile fishes and zooplankton in the upper San Francisco Estuary (SFE) and help evaluate potential trophic associations between fish and zooplankton. To accomplish this, the study will primarily make use of the long-term (1995-2017) CDFW 20-mm Survey data. Covariates derived from other IEP programs will also be considered to evaluate their influence on fish and zooplankton communities. The objectives of the study include evaluating potential associations between community metrics for early life stages of fishes and interannual changes in environmental conditions in the upper SFE, assessing the community response to environmental factors and spatio-temporal gradients in the upper SFE, evaluating the hydrological influence on the distribution and relative abundance of early life stages of fishes in the upper SFE, evaluating the temporal and spatial patterns in zooplankton metrics and their relation to interannual changes in abiotic conditions in the upper SFE and, investigating the extent to which the relative abundance and survival of early life stages of Delta Smelt and Longfin Smelt could be linked to the relative abundance of co-occurring potential zooplankton prey in the upper SFE. This study will improve understanding of spatial or temporal community patterns before and after the POD.

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
USBR	\$60
	\$60

## C. Directed Studies

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### 2019-062 Fish Diet and Condition

R. Baxter, CDFW

This study examines differences in the diet and condition of fishes with respect to species decline and provides field support (i.e., boats and operators) for related studies focused on contaminants, zooplankton and fish health indices. This study will examine the stomach contents of several fishes and zooplankton for changes in diet composition, feeding success and parasite load. Weight at length of fishes will be examined regionally to look for effects of diet, food availability and environmental conditions, such as specific conductance, water temperature, and water clarity. This study informs understandings of pelagic organism decline and fall low salinity habitat.

May also inform or follows up on:

2010 POD Work Plan - On-Going Studies

FLASH

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
DWR	\$170
USBR	\$170
	<u>\$340</u>

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### 2019-089 Directed Field Collections

R. Baxter, CDFW

The Direct Field Collections element provides support for expanded field collections, allowing CDFW to provide other – non-CDFW researchers access to boats and operators needed to sample the upper estuary. Access to this service, requires pre-proposal coordination with CDFW to ensure field time needed is possible and subsequent proposal approval by IEP. This element was initiated during the POD study period and most recently associated with investigations for the Fall Low Salinity Habitat Studies (FLaSH).

May also inform or follows up on:

2008 FWS BO

2010 POD Work Plan - Expanded Monitoring

FLASH

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
DWR	\$18
USBR	\$20
	<u>\$38</u>



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**2019-281 Yolo Bypass Productivity Export Studies****J. Frantzich, DWR, and  
B.Schreier, DWR**

This study investigates the potential for flow pulses through the Yolo Bypass to trigger phytoplankton blooms in the lower estuary, such as those that occurred in 2011 and 2012. Primarily, we will examine the effects of fall rice field drainage flows, but we will also investigate the effects of routing water through the Yolo Bypass during other times of the year to produce food for listed species such as Delta Smelt. This study uses phytoplankton, zooplankton, nutrients, contaminants, and water quality sampling to answer questions about the mechanisms surrounding food production within the bypass and what aspects of the exported water trigger further production lower in the estuary. Due to the food-limited nature of the San Francisco Estuary, it is critical to understand the mechanisms resulting in successful production of beneficial algal blooms, which in turn support enhanced food resources for fish. Food limitation is one of the primary hypothesized causes of the Pelagic Organism Decline. This research has the potential to provide an efficient new management tool for improving the habitat and food resources for listed fish species, particularly during drought periods.

May also inform or follows up on:

2008 FWS BO

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
USBR	\$375
DWR	\$375
TBD	\$750
	<u>\$1,500</u>

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**2019-312 Estimating effective population size and long term-monitoring of Delta Smelt****A. Finger, UCD**

The Effective Population Size Study will estimate the effective population size ( $N_e$ ) of wild Delta Smelt using genomic data from recently completed work from the authors' lab. The scope of this work includes two tasks: Reanalyzing archived Delta Smelt samples (dating back to the 2003 cohort) using Rapture sequencing, and developing and implementing an ongoing genetic monitoring plan using SNPs for the wild Delta Smelt population. The results and analysis from each year will be compiled into an annual report for managers, and publications for the broader scientific community.

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
DWR	\$114
	\$114

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**2019-314      Delta Smelt Early Warning Studies: Application of the SmeltCam**      F. Feyrer, USGS

This study will generate information that will contribute to a more complete understanding of Delta Smelt distribution in the water column and the processes driving Delta Smelt behavior and movements. Data collected will help to expand the utility and comparability of long-term IEP fish monitoring programs, data support for management of water project operations, and the continued research and development of non-lethal sampling methods for Delta Smelt and other fishes. In particular, this research will 1) estimate the vertical and lateral distribution of Delta Smelt in the water column in relation to physical and biological habitat features before and during upstream migration; 2) estimate a standardized spatial distribution of Delta Smelt with respect to tidal stage along the San Joaquin River corridor; and 3) advance the application and development of the SmeltCam through (a) improved species identification, (b) calibration of observations, and © assessment of indirect mortality.

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
DWR	\$274
USGS	\$45
	<u>\$319</u>

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**2019-315      Physical and Biological Drivers of Fish Populations to Inform Management and Habitat Restoration Actions**      F. Feyrer, USGS

The overall goal of this study is to relate fish and zooplankton populations with local flow dynamics and habitat characteristics associated with a variety of shallow water habitats across the Delta and Estuary. The work will be coordinated with other USGS efforts characterizing physical and biological conditions in these habitats to provide a broad understanding of the functions and benefits of tidal wetland habitats for fishes. Together, the work will provide a broad understanding of the mechanisms supporting physical-biological coupling, including marsh/wetland-open water linkages that drive habitat use and trophic ecology of fishes.

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
USBR	\$1,200
	\$1,200

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**2019-316      Turbidity Transects (Boat Based Turbidity)****M. Dempsey, DWR**

The 2019-2020 Turbidity Transects element will obtain a fine resolution of turbidity in the Delta. As turbidity is a key environmental trigger in the USFWS and NMFS Biological Opinions for anadromous fish and Delta Smelt, this mid-channel turbidity monitoring will be an important supplement to the existing continuous fixed-station water quality network in the Central and South Delta. This element assists Delta Smelt assessments and water management decisions that minimize fish entrainment at the State and federal south Delta pumping facilities. The Environmental Monitoring Program will conduct twice-weekly turbidity transects December 2019 through March 2020, and will create a necessary 'early warning' system for improved efficiency between State and Federal Water Project operations and Delta Smelt trawl efforts.

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
DWR	\$76
	<hr/> \$76

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**2019-317      Methods Development for Environmental DNA  
Surveying of the Wild Delta Smelt Population (eDNA)****A. Finger, UCD**

The purpose of this project is to develop methods to sample environmental DNA (eDNA) to detect the presence of Delta Smelt (and ultimately of any desired target species) in the Sacramento/San Joaquin Delta. Currently, traditional surveys (e.g. Fall Midwater Trawl, Spring Kodiak Trawl) are detecting very few to no Delta Smelt, leaving managers with questions regarding not only abundance, but persistence in certain areas of the Delta. Environmental DNA sampling involves detecting the DNA of a particular species in environmental samples, such as water (Ficetola et al. 2008). This technology could provide a highly sensitive sampling method to complement traditional long-term survey methods, enabling an updated and more targeted approach for monitoring this sensitive species.

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
CDFW	\$15
	<hr/> \$15

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<b>2019-321</b>	<b>Monitoring Sacramento River Winter-run Chinook Salmon Life History Diversity, Growth, and Habitat Use (SAIL)</b>	P. Morais, DSP, and R. Johnson, NMFS
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Managing for life history diversity in regulated rivers is a central element in salmon recovery plans, yet it is a metric that remains difficult to measure. Currently, no monitoring exists to detect impacts of the drought or hydroclimatic variation on the diversity or success of different juvenile rearing behaviors (SAIL 2016). Here, we propose to examine key metrics of life history diversity in endangered Sacramento winter-run Chinook salmon (SRWRC) over a 12 year time series, which includes the 2012-2015 drought using otoliths available through the CDFW Central Valley Tissue Archive.

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
DSP	\$130
	<u>\$130</u>

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<b>2019-322</b>	<b>Estimating Abundance of Juvenile Winter-run Chinook Salmon Entering and Exiting the Delta (SAIL)</b>	B. Holden, USFWS
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This is a continuation of a five year project funded by CDWR and CDFW and the Central Valley Project Improvement Act in 2017. The objective of the project is to improve estimates of population abundances for fall, winter and spring run juvenile Chinook Salmon at Sacramento and Chipps Island by improving trawl efficiency estimates using data from releases of coded wire tags (CWT), acoustic tags (AT), and by genetically sampling the trawl catch in 2018. The project will (1) develop statistical models for estimating trawl efficiencies using 2016-2018 data for paired AT-CWT releases of winter run and fall-run Chinook Salmon; (2) use 2018 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 in 2018; (3) implement trawl efficiency studies for multiple salmon runs in 2018 informed by the 2016 and 2017 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 2018.

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
USBR	\$621
DWR	<u>\$587</u>
	\$1,208

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**2019-323      Reconstructing Juvenile Salmon Growth, Condition, and      A. Sturrock, and M. Miller,  
Delta Habitat Use in 2014-15 Drought and Beyond (SAIL)      UCD**

This study aims to fill critical data gaps regarding the use of the Sacramento-San Joaquin Delta by juvenile Chinook salmon – primarily to determine “who” is using the Delta (which populations and life stages) and how “successfully” they are doing so (inferred by rearing duration, growth rates, diet and condition). We will quantify the extent to which Delta rearing contributes to salmon population resiliency under different environmental conditions, including drought (2014-15) and flood conditions (2017), and provide baseline data to provide insights into population level responses to future habitat restoration and climate change. The study will use annual collections of fall & late fall run salmon samples from sites upstream (Mossdale/Sherwood Harbor), within, and downstream (Chippis Island) of the Delta sampled by the IEP Delta Juvenile Fish Monitoring Program (DJFMP).

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
OTHER	\$82
USFWS	\$127
CDFW	\$267
	<u>\$476</u>

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**2019-325      Enhanced Delta Smelt Monitoring (EDSM)      D. Barnard, USFWS**

The Enhanced Delta Smelt Monitoring (EDSM) program is a year-round monitoring project tasked with investigating alternative methods of generating higher resolution estimates of Delta Smelt abundance, distribution, and, for selected life stages and times of year, estimates of the proportion of the population at risk of entrainment. The EDSM program will provide an early warning of entrainment events in a broader context than the previous Early Warning Survey, and will employ a stratified sampling design that includes multiple crews trawling concurrently at multiple sites in pre-defined density strata within the low- and/or high-risk zones of entrainment in the San Francisco Estuary. EDSM data is provided to the Smelt Working Group and other managers in near real-time to help inform management decisions.

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
USBR	\$2,600
	\$2,600

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**2019-326      Effect of Outflow Alteration upon Delta Smelt Habitat,      A. Schultz, USBR**  
**Condition and Survival (Year 2)**

The Directed Outflow Project (DOP) is a continuing collaborative effort among a dozen state, federal and non-governmental groups, which will employ a focused spatial and temporal approach to evaluate the benefit of outflow alteration for Delta Smelt and its habitat in the fall resulting from the summer Delta outflow and Yolo Bypass Toe Drain actions. Paired data collections (same location and time) of abiotic and biotic habitat constituents will be used to test specific hypotheses that will assist in avoiding shortcomings of using data collected for different studies/hypotheses and/or across variable spatial/temporal scales. Sampling will occur during the Delta Smelt juvenile rearing-stage, a period known to be associated with the location of the low salinity zone (LSZ). Results from this and other related studies will inform evaluations on which particular outflow-related action or group of actions provides the most benefit for Delta Smelt.

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
USBR	\$3,500
	\$3,500

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**2019-328      Integrating Measurement of Fish Body Condition within      Cory Graham, USFWS**  
**the Delta Juvenile Fish Monitoring Program (DJFMP)**

The Delta Juvenile Fish Monitoring Program (DJFMP) obtains year-round catch counts and length frequencies of juvenile fish from established beach seine and trawl sites across the lower Sacramento-San Joaquin Rivers, Delta and San Francisco Bay in order to understand the effects of environment and other fish species on juvenile fish survival.

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
USFWS	\$42
	\$42

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<b>2019-329</b>	<b>Extracting Better Information from Long-Term Monitoring Data: Estimating Occupancy and Abundance of Near-Shore Fishes in the Sacramento-San Joaquin River Delta</b>	B. Mahardja, USFWS
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The purpose of this project is to expand DJFMP monitoring and inference to other dominant habitats not sampled by beach seines through the use of boat electrofishing. To accomplish this we will investigate the utility of electrofishing to estimate abundance, occupancy, capture probabilities, and related environmental drivers of key littoral fish species across Delta habitats.

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
USGS	\$65
USFWS	\$65
	<hr/> \$130

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<b>2019-330</b>	<b>Aquatic Habitat Sampling Platform: Standardized Fish Community Sampling Across Habitat Types</b>	J. Merz, Cramer Fish Sciences, and E. Van Nieuwenhuysse, USBR
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The Aquatic Habitat Sampling Platform (AHSP) is an integrated aquatic species and habitat sampling system that will monitor aquatic organisms and reveal habitat associations, while having minimal or no “take” of sensitive species. Further development and deployment of the AHSP will expand data collection to shallow and off-channel habitat, while offering the capability to transition to deeper and open water habitats. This sampling element will provide reliable sampling efficiency estimates (e.g., probability fish detection) and “catch” per unit effort (i.e., number of individual species per volume of water sampled), and improve our knowledge about populations, habitat associations and major stressors of key organisms within the San Francisco Estuary (Estuary).

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
USBR	\$275
	<hr/> \$275

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**2019-331      Central Valley Salmonid Coordinated Genetic Monitoring      J. Israel, USBR**  
**(Year 3)**

This work will include tasks to rapidly identify winter-run Chinook juvenile salmon at the CVP/SWP salvage facilities, process juvenile salmonid tissues from various CVPIA and IEP fish monitoring stations, and support coordination of genetic monitoring across the CVP and SJRRP programs.

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
USBR	\$325
	<u>\$325</u>

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**2019-332      Comparative Predation Risk of Juvenile Chinook Salmon      L. Takata, DWR**  
**among River, Floodplain and Wetland Rearing Habitats**  
**in the North Delta**

This study will examine the relative predation on juvenile Chinook salmon in the Yolo Bypass, a region of high restoration priority, to inform restoration design and management. It will also generate baseline data which can be used as a comparison for effects following restoration. This study will also refine and adapt stationary tethering methods so they can be used to evaluate relative predation risk within and amongst restored and altered habitats such as the dead end sloughs and tidal wetlands found throughout the north Delta.

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
DWR	\$97
	<u>\$97</u>



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<b>2019-333</b>	<b>Enhanced Acoustic Tagging, Analysis, and Real-Time Monitoring</b>	E. Danner, NOAA
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This project tracks the movement and survival of wild juvenile Chinook salmon with a large acoustic receiver network (JSATS), including real-time receivers, and the development of real-time metrics and retrospective modeling of juvenile salmon migration data. There is a well-documented need for improved detection and associated modeling of salmon migration and survival in the Central Valley and understanding salmon survival and movement dynamics in the Delta and its tributaries is critical to the operation of state and federal water projects, recovery of ESA-listed species, and sport and commercial fisheries management.

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
USBR	\$2,000
	\$2,000

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<b>2019-335</b>	<b>Suisun Marsh Salinity Control Gate Study</b>	T. Sommer, DWR and L. Conrad, DWR
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The Suisun Marsh Salinity Control Gates (SMSCG), pending provision of the necessary permits, will be operated in Summer 2019 in order to reduce salinities in the Suisun Marsh to levels that are appropriate for Delta Smelt. The goal of this action is to open the Suisun Marsh area as viable rearing habitat to Delta Smelt during the summer period, which is currently a stressful period for Delta Smelt rearing because of high temperatures and a low food supply. This element includes evaluation of the 2018 pilot action, modeling to inform the potential benefit and water cost for a 2019 action, and monitoring and evaluation of the 2019 action.

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

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
OTHER	\$100
	\$100

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**2019-338      Physiological and Behavioral Effects of Domestication on      B. Davis, DWR**  
**Delta Smelt**

This program element aims to provide a better understanding of the effects of domestication on captive Delta Smelt (*Hypomesus transpacificus*) by assessing the refuge population at the Fish Conservation and Culture Laboratory (FCCL) in Byron, CA. Objectives of the study include characterizing domestication effects on hatchery Delta Smelt by synthesizing existing/historical datasets on growth and reproduction of fish at the FCCL since the start of the hatchery program; identifying the impacts of domestication on the physiological stress response of Delta Smelt following handling stress; determining the effects of domestication index on individual and group swimming behavior, responses to predation, and responses within the context of climate change factors including warming and increased salinity. This project will provide relevant and timely information for conservation managers and adaptive restoration strategies and dovetail with the recommendations from the 2017 Delta Smelt Supplementation Workshop.

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
DWR	\$43
	\$43

### ***III. Program Support Elements***

#### ***A. Program Management***

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**2019-OAC      IEP Oversight and Coordination      S. Fong, 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 Revi

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
CDFW	\$161
USBR	\$169
DSP	\$201
DWR	\$239
	\$770

## IV. Teams and Outreach

### A. Project Work Team (PWT)

#### 2019-T03 Sturgeon PWT

A. Seesholtz, DWR, and J. Heublein, NMFS

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.

<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
OTHER	\$0
	<u>\$0</u>

#### 2019-T04 Estuarine Ecology (EET) PWT

B. Herbold, and K. Kayfetz, DSC

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

<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
OTHER	\$0
	<u>\$0</u>

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**2019-T05      Biotelemetry PWT****K. Clark, DWR**

The mission of the IEP Biotelemetry PWT is to provide a conduit for communication and coordination among scientists engaged in biotelemetry activities in the Central Valley, Delta, Estuary and near shore Pacific Ocean. This communication entails regular meetings, identification and discussion of current and future projects, and proposal review as solicited to facilitate collaboration, standardization of methods and technologies where possible and the leveraging of resources. The purpose of the Biotelemetry PWT is to coordinate Biotelemetry Projects taking place in the Central Valley and provide a forum for collaboration between Biotelemetry projects within the Central Valley (sharing equipment, tagged fish, etc.). In the coming year, the Biotelemetry PWT will focus on communicating the need for stable funding for the Core 69 khz receiver array and soliciting volunteers to help maintain some 69 khz receivers at core locations. The Biotelemetry PWT meets twice per year.

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
OTHER	\$0
	<hr/> \$0

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**2019-T06      Spring Run Salmon PWT****F. Cordoleani, H. Brown,  
NOAA, and M. Johnson, CDFW**

Since 1999 Central Valley spring-run Chinook (CVSC) salmon ESU is state and federally listed as a threatened species, and is currently faced with three primary threats: (1) loss of most historic spawning habitat; (2) degradation of the remaining rearing and migration habitats; and (3) genetic introgression with the Feather River Fish Hatchery spring-run Chinook salmon strays (NMFS 2014). While a large amount of monitoring occurs in the Central Valley, the understanding of CVSC dynamics is still very data limited, and the existing CVSC salmon monitoring programs seem to be fragmented and lack a common thread. Therefore, the goal of the IEP spring-run Chinook salmon PWT is to provide a venue for scientists from diverse agencies/groups to coordinate and synthesize 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.

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
OTHER	\$0
	<hr/> \$0

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**2019-T07     Resident Fishes PWT****B. Mahardja, USFWS, and M. Young, USGS**

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

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
OTHER	\$0
	<hr/> \$0

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**2019-T09     Tidal Wetland Monitoring PWT****S. Sherman, CDFW**

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

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
OTHER	\$0
	<hr/> \$0

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**2019-T11 Winter Run Salmon PWT****D. Kratville, 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.

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
OTHER	\$0
	\$0

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**2019-T12 Juvenile Monitoring PWT****B. Poytress, USFWS**

The Juvenile Monitoring Project Work Team (JMPWT) is a satellite team of the Central Valley Salmonid Project Work Team. The goal of the JMPWT is to bring together biologists to collaborate in a manner that will benefit juvenile monitoring activities in the Central Valley. The specific objectives of the group include, but are not limited to increase the quality and utility of juvenile monitoring data, standardize sampling techniques (where applicable), improve methods for analyzing and presenting monitoring data, identify research questions and data gaps, provide expert recommendation and/or review of issues affecting juvenile salmonids, and collaborate on data compilation projects in an effort to expand the knowledge of fisheries biology within the Central Valley of California. Team members currently include staff from the California Department of Fish and Game and Water Resources, East Bay Municipal Utility District, United States Fish and Wildlife Service and Bureau of Reclamation, and various private consulting groups. Team meetings are held quarterly throughout the year.

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
OTHER	\$0
	\$0

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**2019-T13 Central Valley Salmonid Hatchery PWT****K. Niemala, USFWS, and M.  
Workman, EBMUD**

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.

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
OTHER	\$0
	<u>\$0</u>

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**2019-T14 Aquatic Vegetation PWT****L. Conrad, DWR**

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

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
OTHER	\$0
	<u>\$0</u>

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**2019-T15 Steelhead PWT****J. Nelson, 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.

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
OTHER	\$0
	\$0

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**2019-T16 Upper Sacramento River Salmon PWT****K. Niemala, USFWS**

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

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
OTHER	\$0
	\$0



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**2019-T17     Contaminants PWT****K. Hoffmann, DWR**

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

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
OTHER	\$0
	<u>\$0</u>

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**2019-T18     Flow Alteration PWT****L. Brown, USGS, and A.  
Schultz, USBR**

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

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
OTHER	\$0
	<u>\$0</u>

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**2019-T22     Predation PWT****A. Schultz, USBR, and S.  
Ainsley, FISHBIO**

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

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
OTHER	\$0
	<hr/> \$0

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**2019-T23     Water Quality and Nutrients PWT****S. Lesmeister, DWR, and J.  
Cooke, CVRWCB**

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 nutrients in the future.

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
OTHER	\$0
	<hr/> \$0

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**2019-T24     Genetics PWT**

M. Baerwald, DWR, E. W.  
Carson, USFWS and J.  
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.

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
OTHER	\$0
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### *B. Technical Team (TT)*

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**2019-T20     IEP Data Utilization Work Group (DUWG)**

Vacant

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

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
OTHER	\$0
	<hr/> \$0

## C. Workshop

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### 2019-T01 2019 IEP Annual Workshop

S. Fong, 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.

Chairpersons for the 2019 IEP Annual Workshop are Steve Culberson (DSP) and Ian Smith (USBR).

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<u>Funding Agency</u>	<u>Amount (1000's)</u> <sup>#</sup>
OTHER	\$0
	<hr/> \$0

#### Footnotes:

“-”: 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 actually planned and implemented in the budgets of the participating agencies, not through the IEP as a separate agency.

The “Drought Operations” Monitoring category has been removed in the 2017 IEP Work Plan because the State Drought Funding expired June 30, 2016.

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