

Interagency Ecological Program

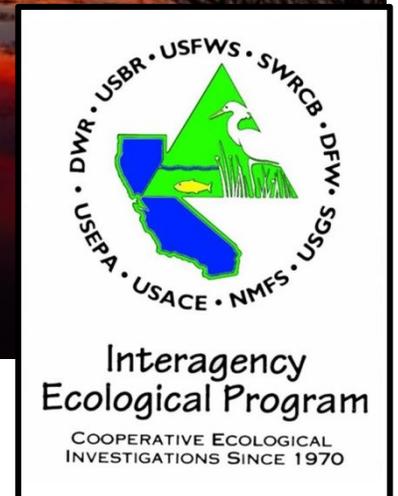
2016 Annual Work Plan

Approved December 2015

Modified March 2016



Photo: Courtesy of California Department of Water Resources



April 4, 2016

What is the Interagency Ecological Program (IEP)?

The IEP is a consortium of three state (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 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. This is accomplished through collaborative and scientifically sound monitoring, research, modeling, and synthesis efforts for various aspects of the aquatic ecosystem. The IEP addresses high priority management and policy science needs to meet the purposes of, and fulfill responsibilities under, State and Federal regulatory requirements. The IEP relies upon multidisciplinary teams of agency, academic, non-governmental organizations and other scientists to accomplish its mission.

What does the Work Plan represent?

This work plan reflects the planned work by IEP agencies to be conducted as part of the consortium within the Bay-Delta ecosystem during the 2016 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 and water rights decisions that cover the operations of the State Water Project (SWP) and the Central Valley Project (CVP).

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 Agenda, are eligible for inclusion in the Work Plan. Eligible monitoring, studies, research, and supporting activities, which are referred to as "elements" in the plan, are organized into 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, FWS, 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 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 and the value of data collected.
- **Solicited Research** – These are the studies that result from a possible solicitation for proposals if sufficient funding is available beyond what is needed for Compliance Monitoring, Baseline Status and Trends, or Synthesis, Modeling and Reviews.

- **Directed Studies** – Short-term "Directed Studies," funded by one or more IEP member agency, 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.)
- **Drought Operations** – These special studies defined in the *Central Valley Project and State Water Project (CVPSWP) Drought Contingency Biological Monitoring Plan for Water 2015 and Beyond* are conducted to inform approaches to mitigate the potential negative effects of the drought while allowing operational flexibilities to help balance multiple water uses during a drought.

What's not included?

The IEP work plan does not reflect all monitoring, studies, research, and synthesis work in the estuary. Specifically, it does not reflect that work which is conducted by other independent programs that are not directly part of the collaborative effort. Similarly, some efforts, such as support for project work teams, 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.

What are the priorities?

IEP member agencies have collectively identified drought monitoring as a priority for redirected or new resources going into 2016, including early warning of entrainment risk. Drought monitoring elements are specifically noted in the 2015 Drought Operations Plan monitoring. Many will be used as important data for analysis, and on-going synthesis will support understanding of the drought effects. Operational aspects of other elements may be temporarily modified to accommodate supplemental monitoring. However, the program will also continue to 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 in 2015, including:

- Synthesize existing data and studies to understand and increase the value of IEP long-term data sets.
- Improve the understanding of abundance, distribution, life history diversity, and life stage requirements of Delta smelt, Longfin smelt, salmon, steelhead and sturgeon to inform management decisions.
- Improve smelt, salmon and sturgeon real-time monitoring, indirect mortality, and entrainment prediction tools to reduce take and increase operational flexibility of the State and Federal Water Project pumps.
- Improve chinook and steelhead viability in the Delta with an initial emphasis on south Delta salmon survival through studies and modeling.
- Improve the understanding of the interaction of tidal, floodplain and channel margin restoration with species distribution and the Bay-Delta ecosystem to guide restoration.

- Improve understanding of the role of inflows/outflows to support target species, and ecological and physical processes in the estuary and inform adaptive management processes, such as the Fall Outflow Adaptive Management.
- Improve the understanding of baseline conditions for target species in Yolo Bypass and the Delta in advance of California WaterFix and California EcoRestore.
- Understand the factors impairing water beneficial uses to inform management decisions.

How is the Work Plan developed?

The IEP member agency staff initiated, led, and actively engaged 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 2016 work plan.

The information in this work plan is a summary of work plan elements that are more specifically defined in study plans, agency contracts and in some cases project charters. This plan uses updated information from principle investigators, funding and action agencies, and Science Management Team members. This plan is reviewed and recommended by the Program Support Team and member agency Coordinators, and then guided and approved by member agency Directors consistent with the Strategic Plan, Governance Framework, and the collaborative intent of IEP. Proposed work is shared with Stakeholders before adoption wherever feasible. Concurrently, representatives from funding agencies and the IEP Program Manager meet to optimize the exact mix of funding for each IEP program element to reduce contracting overhead and improve cost-share and grant matching opportunities.

The 2016 IEP Work Plan development followed general guidance by the IEP Directors provided during the development period to:

- Pursue goals and strategies in the IEP Strategic Plan and Governance Framework, considering actions in the Delta Science Plan and related Interim 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.
- Prioritize drought monitoring for redirected or new resources going into 2016, including early warning of entrainment risk.

Draft 2016 IEP Work Plan - Summary

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Category I. Compliance and Monitoring Elements

Sub Category A. Compliance

Element	Title	P.I.
2016-003	Fall Midwater Trawl Survey (FMWT)	R. Baxter, CDFW
2016-007	Summer Towntnet Survey (STN)	F. La Luz, CDFW
2016-011	Estuarine and Marine Fish Abundance and Distribution Survey (Bay Study)	K. Hieb, CDFW
2016-012	Bay Shrimp and Crab Abundance and Distribution Surveys (Bay Study)	K. Hieb, CDFW
2016-029	Bay Salinity Monitoring	G. Shellenbarger, USGS
2016-030	Delta Flow Measurement and Database Management	C. Ruhl, USGS
2016-033	20mm Delta Smelt Survey (20mm)	R. Fujimura, CDFW
2016-053	Juvenile Salmon Monitoring (DJFMP)	M. Dekar, USFWS
2016-059	Coleman Nat. Fish Hatchery Late-Fall-Run Production Tagging	M. Dekar, USFWS
2016-071	Mossdale Spring Trawl (Mossdale)	T. Heyne, CDFW
2016-072	Environmental Monitoring Program	S. Philippart, DWR
2016-073	San Joaquin River Dissolved Oxygen Monitoring	S. Lesmeister, DWR
2016-074	Knights Landing Juvenile Salmon Monitoring	C. Purdy, CDFW

Category I. Compliance and Monitoring Elements

2016-077	Upper Estuary Zooplankton Sampling	A. Hennessy, CDFW
2016-088	Spring Kodiak Trawl (SKT)	R. Fujimura, CDFW
2016-093	UCD Suisun Marsh Fish Monitoring	P. Moyle, T. O'Rear, UCD
2016-096	Smelt Larva Survey (SLS)	R. Fujimura, CDFW
2016-104	Operation of Thermograph Stations	A. Robledo, USGS
2016-195	6-year Steelhead Survival Study	J. Israel, USBR
2016-296	Investigation of the Distribution and Abundance of Longfin Smelt in the SFE	S. Acuna, MWD, Baxter & Fujimura, CDFW, J. Hobbs,
2016-301	Juvenile Salmon Emigration Real Time Monitoring (DJFMP)	M. Dekar, USFWS
2016-311	Tidal Wetland Monitoring Pilot Study - Phase 2	Dave Contreras, CDFW

22 Elements

Sub Category B. Baseline Status and Trends

Element	Title	P.I.
2016-002	Adult Striped Bass Population Estimates	M. Gingras, CDFW
2016-005	Adult sturgeon population estimates	M. Gingras, CDFW
2016-047	Yolo Bypass Fish Monitoring Program (YBFMP)	B. Schreier, DWR
2016-279	Liberty Island Fish Survey (DJFMP)	M. Dekar, USFWS
2016-302	Resident Fish Survey (DJFMP)	M. Dekar, USFWS
2016-303	Salmon Survival Studies (DJFMP)	M. Dekar, USFWS
2016-305	Quagga/Zebra Mussel Detection	K. Gehrts, DWR

7 Elements

Sub Category C. Drought Operations

Element	Title	P.I.
2016-306	Early Warning Sampling (Anticipated)	M. Dekar, USFWS
2016-307	Juvenile Salmon Emigration Real Time Monitoring (DJFMP) Augmentation (Anticipated)	M. Dekar, USFWS
2016-308	Spring Kodiak Trawl (SKT) Augmentation (Anticipated)	R. Fujimura, CDFW
2016-309	Tisdale and Knights Landing Rotary Screw Trap Augmentation (Anticipated)	C. Purdy, CDFW
2016-310	Drought Assessment (Anticipated)	L. Conrad, DWR
2016-313	Mycrocystis Monitoring	P. Lehman, DWR & S. Lesmeister, DWR
2016-316	Turbidity Transects (Boat Based Turbidity)	M. Dempsey, DWR

Category I. Compliance and Monitoring Elements

7 Elements

Category II. Special Study Elements

Sub Category A. Synthesis, Modeling and Reviews

Element	Title	P.I.
2016-020	Science Advisory Group (SAG)	K. Gehrts, DWR
2016-043	Estimation of Pelagic Fish Population Sizes	K. Newman, USFWS
2016-046	Ongoing Synthesis Analysis	L. Conrad, DWR
2016-208	Statistical Support (DJFMP)- Delta Smelt Life Cycle Model	K. Newman, USFWS
2016-249	Gear Efficiency in Support of Delta Smelt Modeling Efforts	R. Baxter, CDFW
2016-283	Delta Smelt Sampling Protocols and Ecological Interpretation	E. Laca, UCD
2016-304	Salmon/Steelhead/Sturgeon Assessment of Indicators by Life stages (S.A.I.L.)	R. Johnson, NMFS

7 Elements

Sub Category B. Solicited Research

Element	Title	P.I.
2016-253	Fish Community Analysis for the Spring Kodiak Trawl Survey -V2	G. Castillo, USFWS

1 Elements

Sub Category C. Directed Studies

Element	Title	P.I.
2016-062	Fish Diet and Condition	R. Baxter
2016-247	Evaluation of Natural Marking in Delta Smelt	G. Castillo, USFWS
2016-250	Knaggs Ranch Experimental Agricultural Floodplain Investigation	L. Conrad, DWR
2016-281	Pilot investigation of fall productivity export from Yolo Bypass	J. Frantzich, DWR and B.Schreier, DWR
2016-312	Estimating effective population size and long term-monitoring of Delta Smelt	A. Finger, UCD
2016-314	Delta Smelt Early Warning Studies: Application of the SmeltCam	F. Feyrer, USGS
2016-315	Physical and Biological Drivers of Fish Populations to Inform Management and Habitat Restoration Actions	F. Feyrer, USGS

7 Elements

Category III. Program Support Elements

Sub Category A. Program Management

Element	Title	P.I.
2016-019	Data Management and Utilization	Vacant
2016-OAC	IEP Oversight and Coordination	G. Erickson, CDFW
<i>2 Elements</i>		
<i>Program Summary is</i>		<i>53 Elements</i>

Draft 2015 IEP Work Plan - Element Details

I. Compliance and Monitoring Elements

A. Compliance

2016-003 Fall Midwater Trawl Survey (FMWT)

R. Baxter, CDFW

Fall Midwater Trawl sampling (since 1967) is conducted from San Pablo Bay through the Delta to monitor pelagic fish abundance and distribution. FMWT data are used to calculate abundance indices of several important species including Striped Bass, Delta Smelt, Longfin Smelt, American Shad and Threadfin Shad. POD and subsequently FLaSH funding allowed survey sampling to expand into Cache Slough and the Sacramento Deepwater Ship Channel and to add zooplankton sampling and processing to the survey (see #062). These data are used 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. Longfin Smelt abundance index values are used to calculate a combined salvage take limit for the Central Valley Project and the State Water Project as part of the Longfin Smelt Incidental Take Permit. Fish collected were also used to investigate Delta Smelt use of fall low salinity habitat, as well as investigate their growth and migration.

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
CAMT - Fall Outflow Processes
CAMT - OMR / Entrainment Processes
CAMT - Restoration Processes
CVPIA
FLASH

2016-007 Summer Townt Survey (STN)

F. La Luz, CDFW

The Summer Townt Survey (since 1959) monitors the annual abundance and distribution of juvenile fish and evaluates factors affecting abundance. Summer sampling is conducted from eastern San Pablo Bay upstream into the lower Sacramento River and the lower San Joaquin River. POD and subsequently FLaSH funding allowed survey sampling to expand into Cache Slough and the Sacramento Deepwater Ship Channel and to add zooplankton sampling and processing to the survey (see #062). Survey data are used to calculate annual Delta Smelt and Striped Bass abundance indices that inform long-term trends of relative abundance. Water quality measurements are also collected. Data from this element were used to help determine the conservation status of Delta Smelt and Splittail. Fish collected were also used to investigate Delta Smelt use of fall low salinity habitat, as well as investigate their growth and migration.

Compliance with the following:

2008 FWS BO RPA 5

May also inform or follows up on:

2010 POD Work Plan - Expanded Monitoring
CAMT - Fall Outflow Processes
CAMT - OMR / Entrainment Processes
CAMT - Restoration Processes

2016-011 Estuarine and Marine Fish Abundance and Distribution Survey (Bay Study)

K. Hieb, CDFW

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. Since 1980, 52 channel and shoal stations from South San Francisco Bay to the lower Sacramento and San Joaquin rivers have been sampled monthly with a midwater and otter trawl. In addition to tracking abundance trends and distributional changes of individual species, data from this element is used to determine changes in the fish communities over time. It is also used to determine how freshwater outflow, outflow related mechanisms, and other physical and biological factors affect the abundance and distribution of species and fish communities. Brachyuran crabs (e.g. Dungeness crab) are included in this element, while caridean shrimp are in element 2016-012. (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

2016-012 Bay Shrimp and Crab Abundance and Distribution Surveys (Bay Study)

K. Hieb, CDFW

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 2015-011 also includes the collection the shrimp samples. In addition to tracking abundance trends and distributional changes of individual shrimp species, data from this element is used to determine changes in the shrimp communities over time. It is also used to determine how freshwater outflow, outflow related mechanisms, and other physical and biological factors affect the abundance and distribution of individual shrimp species and shrimp communities. Finally, this data from this element can be used to determine if recently introduced shrimp have displaced or otherwise impacted other shrimp or fish. (Note: This is part of the CDFW Bay Study.)

Compliance with the following:

D-1641

May also inform or follows up on:

D-1485

2016-029 Bay Salinity Monitoring

G. Shellenbarger, USGS

Salinity and water temperature are collected in San Francisco Bay. Data is 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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2016-030 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; twelve of these stations are supported by the IEP. Data from this network of stations are used by Delta managers and scientists to make 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

CAMT - Fall Outflow Processes

CAMT - OMR / Entrainment Processes

CAMT - Restoration Processes

CAMT - South Salmon Delta Processes

D-1641

POD

2016-033 20mm Delta Smelt Survey (20mm)

R. Fujimura, CDFW

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 are conducted simultaneously; Sampling is conducted every two weeks from mid-March through mid-July at 47 stations from eastern San Pablo Bay through the Delta. The near real-time sample processing enables distribution data to be used by agency scientists in the Smelt Working Group to assess risk of Delta Smelt and Longfin Smelt entrainment which informs agency managers to adaptively management Delta water exports to protect these species from entrainment impacts.

Compliance with the following:

2008 FWS BO

RPA 5

CDFW LFS ITP

Cond. 8.1

May also inform or follows up on:

2010 POD Work Plan - Expanded Monitoring

CAMT - Fall Outflow Processes

CAMT - OMR / Entrainment Processes

CAMT - Restoration Processes

2016-053 Juvenile Salmon Monitoring (DJFMP)

M. Dekar, USFWS

The goal of the Delta Juvenile Fish Monitoring Program (DJFMP) is to document the relative abundance and distribution of juvenile salmonids in the lower Sacramento and San Joaquin Rivers, Delta and Bay for the protection, restoration and management of naturally produced salmonids and other native species in the Central Valley of California. 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. A seine efficiency study is included within the current work plan to test assumptions and make inferences regarding shallow habitats more robust.

(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

May also inform or follows up on:

CAMT - Fall Outflow Processes

CAMT - Restoration Processes

CAMT - South Salmon Delta Processes

**2016-059 Coleman Nat. Fish Hatchery Late-Fall-Run
Production Tagging**

M. Dekar, USFWS

A significant overlap in size is observed between late fall-run Chinook Salmon produced in hatcheries and naturally produced winter-run Chinook Salmon. In order to prevent Federal and State water pumping facilities from taking endangered winter-run Chinook Salmon, the facilities must be able to differentiate between the hatchery fish and naturally spawned fish. Late fall-run Chinook Salmon are marked with an adipose fin clip and have a coded wire tag inserted 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 Chinook Salmon is also part of the spring-run Chinook Salmon 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

2016-071 Mossdale Spring Trawl (Mossdale)

T. Heyne, CDFW

The Mossdale Spring Trawl is a long term juvenile Chinook salmon monitoring project helping to provide "near-time" information on the vulnerability of key fish species (primarily Chinook Salmon and Steelhead) to water project operations. Monitoring occurs two miles downstream of Mossdale Park, above the Old River confluence. Sampling is performed with Kodiak trawl net, and fish are processed for species and size. Sampling occurs five days a week in April-May and three days a week in June, and sampling consists of 10 tows of 20 minutes each. Data is processed by CDFW staff, and is available through the IEP website via transmission to USFWS data staff. This research addresses the following questions: What is the salmon smolt production, what is the steelhead smolt production, and do water quantity and quality conditions affect smolt production? Data on out-migrating salmon smolts has been monitored here since 1987, and this data is used in several management activities in the lower SJR/south Delta, including sonic tag research and State Water Board San Joaquin Flows planning for the Delta Water Quality Control Plan. CDFW also uses the data to refine the population model for the SJR Basin. This work provides a "platform" for inspiring and supporting other studies, such as evaluating the effects of tides on salmonid distribution and otoliths analysis to determine river-specific contributions to salmonid outmigrant abundance.

Compliance with the following:

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

May also inform or follows up on:CAMT - South Salmon Delta Processes

2016-072 Environmental Monitoring Program

S. Philippart, DWR

The Environmental Monitoring Program (EMP) was established in 1975 to collect environmental data for resource management and understanding estuarine processes. The EMP has over four decades of consistent and comprehensive environmental data; therefore, it is critically important to maintain the continuity of this dataset. To ensure compliance with State Water Resources Control Board Decision 1641, the EMP is responsible for collecting water quality, chlorophyll, phytoplankton, benthic, and zooplankton samples on a monthly basis. Sampling is conducted via research vessel and laboratory van at locations in San Pablo Bay, Suisun Bay, and the Sacramento-San Joaquin Delta. Continuous (15-minute) water quality data are telemetered to the California Data Exchange Network (CDEC) and is available on a near real-time basis for day-to-day Central Valley Project and State Water Project operational decisions. Water quality parameters telemetered to CDEC include: water temperature, specific conductance, dissolved oxygen, chlorophyll, and turbidity. Identification and enumeration of phytoplankton and benthic organisms, water quality constituents, and quality control samples are available to the scientific community and public after the data has been verified for accuracy.

Compliance with the following:

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

May also inform or follows up on:

CAMT - Fall Outflow Processes
CAMT - OMR / Entrainment Processes
CAMT - Restoration Processes
CAMT - South Salmon Delta Processes
FLASH
POD

2016-073 San Joaquin River Dissolved Oxygen Monitoring

J. Rinde, DWR

The Stockton Deep Water Ship Channel from the City of Stockton to Disappointment Slough experiences seasonal periods of low dissolved oxygen (DO). Low DO conditions stress aquatic species and can delay Chinook salmon migrating upstream on the San Joaquin River. SWRCB requires DO concentrations to be above 6.0 mg/L in the San Joaquin River (between Turner Cut and Stockton, September 1st through November 30th) and 5.0 mg/L in all other Delta waters. DWR Bay-Delta Monitoring and Analysis Section samples biweekly (typically June-November) at 14 sites from Prisoner's Point to the Stockton Turning Basin at low water slack. DWR measures DO using YSI multi-parameter 6600 V2 sonde and collects other environmental measurements from the top (about 1 meter from surface) and bottom (about 1 meter from bottom) of the water column at each station. Biweekly reports are generated to verify if each of the 14 sites meet the DO objective. These results guide water project operations and barrier placement to help improve water quality conditions for aquatic species.

Compliance with the following:

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

May also inform or follows up on:

CAMT - South Salmon Delta Processes

2016-074 Knights Landing Juvenile Salmon Monitoring

C. Purdy, CDFW

The data collected (since 1995) provides an early warning of juvenile salmon emigrating 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 marked and recaptured as part of calculating passage. Daily catch is summarized and distributed by e-mail to agency representatives and water operations managers.

Note: This element is supplemented for Drought Contingency Monitoring in 2015 by Element 2015-309.

Compliance with the following:

2009 NMFS BO 11.2.1.3 - 5), 11.2.1.3 - 5), IV.1.1, IV.3

2016-077 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 and is part of a D-1641 mandate to monitor water quality and related parameters (see element #72). Sampling with 3 gear types occurs monthly at 22 stations located throughout San Pablo Bay, Suisun Marsh, Suisun Bay, and the Delta. Zooplankton are an important trophic link between primary producers and fish. The Zooplankton Study provides abundance estimates and distributional data for fish food resources in the upper San Francisco Estuary. This information is used by aquatic ecologists to understand the lower food web and the biological drivers of the Delta Smelt population. The study also detects and monitors zooplankton recently introduced to the estuary and determines their effects on native zooplankton species. Research questions addressed by this study include:

1. What is the abundance and distribution of zooplankton in the upper San Francisco Estuary?
2. What are the relationships between species abundance and temperature, salinity, turbidity, and chlorophyll?
3. What are the long-term abundance trends for all species and do these trends show significant declines or increases?
4. Are introduced species becoming established in the estuary?

Compliance with the following:

D-1485 Term 10a

May also inform or follows up on:

CAMT - Fall Outflow Processes

CAMT - Restoration Processes

FLASH

POD

2016-088 Spring Kodiak Trawl (SKT)

R. Fujimura, CDFW

This program element monitors the distribution, relative abundance, and reproductive maturity of Delta Smelt from January through May. Monthly Kodiak trawl surveys sample at 40 discrete locations in the upper San Francisco Estuary, from the Napa River through Suisun Bay and west into the Delta. Real-time data from this survey are provided to agency scientists in the Smelt Working Group who assess the potential risk of entrainment to adult Delta Smelt at water export facilities and provide their advice to resource managers. The maturity data from this survey also informs resource scientists and managers as to when and where spawning is likely to occur, in order to trigger protection for young of the year Delta Smelt.

Note: This element is supplemented for Drought Contingency Monitoring in 2015 by Element 2015-308

Note: This element is supplemented for Drought Contingency Monitoring in 2015 by Element 2015-308.

Compliance with the following:

2008 FWS BO RPA 1,2,5

CDFW LFS ITP Cond. 8.1

May also inform or follows up on:

2010 POD Work Plan - Expanded Monitoring

CAMT - Fall Outflow Processes

CAMT - OMR / Entrainment Processes

CAMT - Restoration Processes

2016-093 UCD Suisun Marsh Fish Monitoring

P. Moyle, T. O'Rear, UCD

The study (since 1979) monitors the fish and macroinvertebrate populations in Suisun Marsh, especially in response to human modifications affecting water movement, salinity, temperature, and other factors. Monthly sampling is conducted at 21 sites throughout the marsh using otter trawls and beach seines. The study's objectives are to understand dynamics of the entire fish assemblage by (1) examining changes in fish and macroinvertebrate abundance and composition through time, (2) assessing habitat use, (3) evaluating nursery function for estuarine fishes, and (4) associating changes in fish assemblages with natural and anthropogenic changes. The study collects data on endangered and declining species, such as delta smelt, and documents new non-native invaders, such as the shokihazi goby. Because of the data base's huge size, data are analyzed using innovative multivariate and graphical techniques, with the objective of publishing results in peer-reviewed journals. This information informs management decisions and provides background needed to determine success of Suisun 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

May also inform or follows up on:

CAMT - Fall Outflow Processes
CAMT - Restoration Processes
D-1485
POD
Revised SMMA (#600000634)

2016-096 Smelt Larva Survey (SLS)

R. Fujimura, CDFW

This survey provides near real-time distribution data for Longfin Smelt (LFS) larvae in the Delta, Suisun Bay and Suisun Marsh. Data are used by agency scientists and managers to assess vulnerability of LFS 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 are used to assist CDFW, USFWS, and the Smelt Working Group in assessing the risks of entrainment by the SWP and CVP water export facilities and determining OMR levels designed to minimize take of larval and 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
CAMT - Fall Outflow Processes
CAMT - OMR / Entrainment Processes
CAMT - Restoration Processes
D-1485

2016-104 Operation of Thermograph Stations

A. Robledo, USGS

The purpose of this portion of the project is to provide continuous information on the temperature and sediment regimes 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. To accomplish the temperature portion of the project 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. To characterize the sediment portion of the project a daily suspended sediment station will be maintained at the San Joaquin River near Vernalis with two bed material samples will be collected from this location annually.

Compliance with the following:

2009 NMFS BO I.2.1 (performance measures) I.4, IV.1.1

May also inform or follows up on:

2008 FWS BO
CAMT - South Salmon Delta Processes

2016-195 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 to achieve the NMFS Biological Opinion RPA IV.2.2. 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 local and regional hydrodynamics, environmental covariates, and other factors. Multiple releases of approximately 500 steelhead have been completed annually. 2016 is the final year of the study, and three releases will occur between February and April. This information will be useful for understanding juvenile San Joaquin River Steelhead demographics as they migrate through the Delta and provide some comparison between water years, during different operational periods intra-annually, and under flood and drought conditions. A multistate branching mark recapture model is used to estimate reach specific survival rates and route entrainment probabilities. Route entrainment models for Head of Old River, Turner Cut, and Columbia Cut will be constructed. Reclamation works with an interagency team on this study including USFWS (Fish tagging, holding, and releases), USGS (acoustic array deployment, maintenance, and retrieval), University of Washington (data analysis).

Compliance with the following:

2009 NMFS BO 11.2.1.2, IV.2.2

May also inform or follows up on:

2009 NMFS BO

2016-296 Investigation of the Distribution and Abundance of Longfin Smelt in the SFE

S. Acuna, MWD, Baxter & Fujimura, CDFW, J. Hobbs,

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 2015: (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

2016-301 Juvenile Salmon Emigration Real Time Monitoring (DJFMP)

M. Dekar, USFWS

Beach seining and surface trawling 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 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.)

Note: This element is supplemented for Drought Contingency Monitoring in 2015 by Element 2015-307.

Compliance with the following:

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

2016-311 Tidal Wetland Monitoring Pilot Study - Phase 2

Dave Contreras, CDFW

The CDFW Fish Restoration Program will be conducting a pilot monitoring study to evaluate fish and invertebrate sampling gears and techniques to be included in a standardized monitoring plan for tidal wetland restoration in the Delta. Invertebrate comparisons using trawls, sweep nets, leaf packs, and benthic cores will be made in different habitat types to assess differences in colonization, community composition, and catch. Fish comparisons using trawls, lampara hauls, seines, cast nets, fyke nets, boat electrofishing, and gill nets will be made in various habitat types to assess differences in community composition, catch, and size. The data collected will be analyzed using Kolmogorov-Smirnov two-sample test, GLM, ANOVA, ANOSIM, MANOVA, or other multivariate statistic, where appropriate. The suite of gears that provide the best representation of the community in multiple wetland habitats will be chosen for the standardized monitoring plan.

This study will support the IEP Tidal Wetlands Monitoring Project Work Team in development of a standardized monitoring framework that will focus restoration monitoring in tidal wetlands on relevant questions and promote standard monitoring methods across projects. Standardized methods will increase data comparability, and thus the ability of the scientific community to assess the effects of restoration at the landscape scale.

B. Baseline Status and Trends

2016-002 Adult Striped Bass Population Estimates

M. Gingras, CDFW

This element tags and releases Striped Bass, monitors the Striped Bass fishery, monitors the tagged/untagged ratio of Striped Bass, and synthesizes. From those efforts, this element (a) estimates Striped Bass harvest rate, survival rate, abundance, and harvest, (b) determines relationships between Striped Bass abundance and environmental variables in preceding years, (c) evaluates laws and regulations governing the Striped Bass 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

2016-005 Adult sturgeon population estimates

M. Gingras, CDFW

This element tags and releases White Sturgeon, monitors the White Sturgeon fishery, monitors the tagged:untagged ratio of White Sturgeon, and synthesizes. From those efforts, this element (a) estimates White Sturgeon harvest rate, survival rate, abundance, and harvest, (b) determines relationships between White Sturgeon abundance and environmental variables in preceding years, (c) evaluates laws and regulations governing the White Sturgeon 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

2016-047 Yolo Bypass Fish Monitoring Program (YBFMP)

B. Schreier, DWR

The objectives of this interdisciplinary monitoring effort in the Yolo Bypass 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) analysis of data to inform appropriate management of the Yolo Bypass and how it connects to the broader Delta ecosystem. The specific environmental conditions that trigger migrations and enhanced survival and growth of native fishes (salmon, smelt, splittail, sturgeon) 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. The YBFMP 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

CAMT - OMR / Entrainment Processes

CAMT - Restoration Processes

CVPIA

2016-279 Liberty Island Fish Survey (DJFMP)

M. Dekar, USFWS

During 2003-2005, the Delta Juvenile Fish Monitoring Program (DJFMP) sampled fish at Liberty Island with CALFED support. In consultation with the IEP Science Management Team, larval fish trawls and beach seine sampling at Liberty Island were initiated again in 2010 and these sampling elements continue today as part of the baseline monitoring program. Therefore, the monthly DJFMP beach seine sampling and seasonal (February –July) larval fish and zooplankton sampling at Liberty Island provides baseline data and serves as a reference site for future restoration efforts in the Delta. Considering the uncertainty of biological responses to restoration, DJFMP sampling at Liberty Island provides important information regarding the design and implementation of restoration projects.

(Note: This is part of the US Fish and Wildlife Service Delta Juvenile Fish Monitoring Program.)

2016-302 Resident Fish Survey (DJFMP)

M. Dekar, USFWS

The Delta Juvenile Fish Monitoring Program conducts weekly beach seining 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 information on fish assemblage structure, invasive species, and on the ecology and status of species of management concern within the Estuary and lower rivers. When coupled with other IEP surveys, these data are valuable in the assessment of factors influencing fish assemblages or determining the relative importance of inter-specific interactions on fishes of management concern within the Estuary.

(Note: This is part of the US Fish and Wildlife Service Delta Juvenile Fish Monitoring Program.)

2016-303 Salmon Survival Studies (DJFMP)

M. Dekar, USFWS

The objective of this task is to contribute to assessing juvenile Chinook Salmon survival through the Delta and assessing the relative importance of factors influencing survival. The results are or were used to inform several management groups (i.e. south Delta Salmonid Collaborative Group, and the CAMT's SST workgroup). This task depends on funding from partners (Central Valley Project Improvement Act) and leverages purchases and activities from multiple sources (e.g. US Bureau of Reclamation; National Marine Fisheries Service; and CA Department of Water Resources) to conduct the tagging and release components of the study. These IEP funds contribute to the design of the study, labor and the purchase of equipment for completing field work associated with the fish tagging and release component of the project and for completing the report.

(Note: This is part of the US Fish and Wildlife Service Delta Juvenile Fish Monitoring Program)

2016-305 Quagga/Zebra Mussel Detection

K. Gehrts, DWR

As part of the Environmental Monitoring Program, an early warning monitoring program for Quagga and Zebra mussels is being conducted. Veliger tows are done during spring, summer, and fall. The samples are analyzed by microscope and DNA.

May also inform or follows up on:
Quagga/Zebra Mussel Action Plan

C. Drought Operations

2016-306 Early Warning Sampling (Anticipated)

M. Dekar, USFWS

This early warning monitoring will provide assessments of whether substantial movement of Delta Smelt occurs in response to transient hydrodynamic, turbidity, and/or weather conditions in order to better evaluate smelt movement into the interior Delta during critical migration periods. The 2016 effort will include Prisoners Point upstream from Jersey Point to increase sampling sensitivity relative to the risk of exposure to entrainment at the export facilities. This information will be used to inform management actions in near real-time and the seasonally accumulated data will be analyzed to inform future operations management. In addition, these data will better inform the relationship between OMR flows and their influence on the migration of salmonids towards and entrainment into the Federal and State fish facilities for both current drought year and future operational considerations and decisions.

The study will implement an initial three-day sampling event at each site in the first week of December. Following that event, sampling can be reduced to one day per week at each site, on consecutive days at the same tidal phase, until rain or other relevant environmental event is forecast. In the event storms are imminently forecast or other events indicate heightened risk of entrainment, then we propose switching multiple-haul sampling to daily frequency until circumstances indicate the event is over.

Note: This element is subject to revision pending drought status and agency consultation.

Compliance with the following:

CVPSWP Drought Contingency Monitoring

2016-307 Juvenile Salmon Emigration Real Time Monitoring (DJFMP) Augmentation (Anticipated) M. Dekar, USFWS

This element supplements Juvenile Salmon Emigration Real Time Monitoring (DJFMP) 2016-301 to help implement Drought Operation Plan monitoring needs. Additional monitoring was added to provide improved resolution of winter-run Chinook Salmon presence and outmigration behavior to inform DCC gate operations from December 1st through June 15th. Trawl sampling at Sherwood Harbor and the Sacramento area beach seine will be triggered three days prior to a DCC gate opening and throughout the time that the gate is open. The supplemental monitoring increases in trawl frequency from three days to seven days in December through April, and from two days to seven days in May through June (assuming full effort). The Sacramento area beach seine is normally conducted three days per week in December, one day per week in January, and the seine run is not conducted in February through June. Therefore, the supplemental monitoring reflects an increase from three days to seven days in December, one day to seven days in January, and from zero days to seven days in February through June.

Note: This element is subject to revision pending drought status and agency consultation.

Compliance with the following:

CVPSWP Drought Contingency Monitoring

2016-308 Spring Kodiak Trawl (SKT) Augmentation (Anticipated) R. Fujimura, CDFW

This element supplements the Spring Kodiak Trawl (2016-088) to help implement Drought Operation Plan monitoring needs. During December 2014 (i.e., a month before routine work was scheduled) the Drought Operation Plan was pursued with (1) concurrent SKT sampling at a subset of Fall Midwater Trawl Survey stations over the course of 3 days and then (2) completion of a full SKT survey. In December 2015, a supplemental full SKT survey was conducted. During 2016, the Drought Operation Plan will be pursued by continuing a full SKT survey in December and on the request of the lead agencies make replicate SKT tows at a few key stations each survey month (January-May). Note: This element is subject to revision pending drought status and agency consultation.

Compliance with the following:

CVPSWP Drought Contingency Monitoring

2016-309 Tisdale and Knights Landing Rotary Screw Trap Augmentation (Anticipated) C. Purdy, CDFW

This element that augments element 2016-074 and Operation's funded sampling at Tisdale to help implement Drought Operation Plan monitoring needs by (a) initiating continuous 24 hour sampling at Knights Landing and (b) installation of real-time monitoring receivers to support a 3-year acoustic tagging study to determine reach survival of hatchery winter-run throughout the Sacramento River and Delta that will help inform the (real-time) effects of operations and their influence on the timing and distribution of salmonids (and specifically winter-run) as they emigrate.

The Tisdale and Knights Landing rotary screw traps (since 1995) provide an early warning of juvenile salmon emigrating the Delta and allows for real-time adaptive management of water operations. To promote consistency in data collection and operations, the two monitoring projects are treated as one single element. In the 2009 OCAP BiOp, Tisdale fills a requirement for additional monitoring upstream of Knights Landing and Knights Landing data is incorporated into actual triggers for CVP/SWP operations. Data from both is used in real-time water operations groups to assess risk to listed species. This sampling effort uses paired 8-foot rotary screw traps starting 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 marked and recaptured as part of calculating passage. Daily catch is summarized and distributed by e-mail to agency representatives and water operations managers.

Note: This element is subject to revision pending drought status and agency consultation.

Compliance with the following:

CVPSWP Drought Contingency Monitoring

2016-310 Drought Assessment (Anticipated)

L. Conrad, DWR

This element is an augmentation to the On-going Synthesis and Analysis (2016-046) that in 2016 is focused on assessing the impacts of the drought on abiotic and biotic aspects of the Sacramento-San Joaquin Delta aquatic ecosystem, particularly as they relate to the Delta Smelt population. The framework of the analysis will be based on the updated Delta Smelt conceptual model described in the recent MAST report. The results will be informative to water and fisheries management in the Delta during a persistent drought. The study team includes scientists from IEP and additional staff from CDFW tasked with implementing the 2014 Drought Operations Plan.

Note: This element is subject to revision pending drought status and agency consultation.

Compliance with the following:

CVPSWP Drought Contingency Monitoring

2016-313 Mycrocystis Monitoring

P. Lehman & S. Lesmeister, DWR

This element is a temporary augmentation to the on-going Environmental Monitoring Program (2016-072) and will process 2015 sampling data and write deliverables related to the presence and distribution of the toxic cyanobacterium *Microcystis* spp. and accompanying toxic cyanobacteria and cyanobacteria toxins in the Sacramento-San Joaquin Delta. This element will also evaluate associated physical, chemical and biological variables, with a goal to understand what factors control bloom growth and toxin production. Information acquired will evaluate 1) the impacts of *Microcystis* on the aquatic food web, including primary producers, zooplankton and fishes; 2) the potential of *Microcystis* to adversely impact humans; and 3) explore the role of climate change on *Microcystis* distribution, abundance and toxin production within the Sacramento-San Joaquin Delta. In addition, surface water samples for DNA analysis may be added to the regular monitoring program during the bloom season.

Note: This element is subject to revision pending drought status and agency consultation.

2016-316 Turbidity Transects (Boat Based Turbidity)

M. Dempsey, DWR

The 2015-2016 Turbidity Transects will obtain a finer resolution of turbidity concentration in the South 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 water quality station network in the Central and South Delta. Daily transects, as needed, from December 1 through June 30, 2016 in the Central and South Delta will provide real-time data on changing turbidity conditions.

II. Special Study Elements

A. Synthesis, Modeling and Reviews

2016-020 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.

2016-043 Estimation of Pelagic Fish Population Sizes

K. Newman, USFWS

This pending element is focused on development of methods to calculate population estimates of many pelagic species will be investigated based on previous trawl sampling efforts. This effort will include particle tracking models to define boundaries of sampling regions, estimation of volumes represented by fixed stations in existing monitoring surveys and test the assumption of randomness in the data.

May also inform or follows up on:

2010 POD Work Plan - On-Going Studies

2016-046 Ongoing Synthesis Analysis

L. Conrad, DWR

Information useful for management decisions is developed from available data through analysis, synthesis and conceptual modeling to inform decision making. IEP synthesis efforts involve collaborative, interdisciplinary teams of scientists and scientific partners and vary over time according to the management questions and underlying science questions. Resources estimates reflect the potential need for timely collaborative analysis and synthesis of the latest data for those involved in planning, management and regulatory processes. The focus for 2015-2016 is on assessing impacts of the drought on abiotic and biotic aspects of the Sacramento-San Joaquin Delta aquatic ecosystem, particularly as they relate to the Delta Smelt population. The framework of the analysis will be based on the updated Delta Smelt conceptual model described in the recent MAST report.

Note: This element was supplemented for Drought Contingency Monitoring in 2015 by Element 2015-310.

May also inform or follows up on:

2008 FWS BO

2010 POD Work Plan - On-Going Studies

FLASH

2016-208 Statistical Support (DJFMP)- Delta Smelt Life Cycle Model K. Newman, USFWS

The DSLCM is a decision support tool for Delta Smelt management designed (a) to predict the effect of proposed management actions on the population dynamics of Delta Smelt, and (b) to assess, after-the-fact, the effects of actions that were implemented as well as the effects of historical environmental conditions. An interim product, the Delta Smelt Entrainment Estimation (DSEE), is being developed to analyze actions aimed to minimize entrainment related mortality. The DSEE relates to Reasonable and Prudent Alternatives (RPAs) in the 2008 Delta Smelt Biological Opinion which aim to protect adult Delta Smelt and protection of the larval and juvenile stages of Delta Smelt by controlling Old and Middle River flows just prior to and during the smelt breeding season. Results of an independent peer review of the DSEE will be included to refine the current DSCLM formulation. Extending the methodology for additional fish species, e.g., Longfin Smelt, is another aim. Relatedly, statistical support has been, and will continue to be, provided for design and analysis of studies for gear evaluation (contact selectivity) and fish availability, e.g., information on vertical and lateral distributions.

May also inform or follows up on:

FLASH

POD

2016-249 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, adjacent deployment of IEP fish sampling gears. This 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.

Note: This element leverages and improves information for long-term smelt-centric compliance elements 2016-003, 2016-007, 2016-033, and 2016-088. Supplemental funds were provided by USFWS in calendar years 2013 through 2015. Follow up work will occur in 2016 as part of those elements, but new 2016 funds have not been secured

May also inform or follows up on:

POD

2016-283 Delta Smelt Sampling Protocols and Ecological Interpretation E. Laca, UCD

This project will critically evaluate existing sampling programs and interpretation efforts, describe explicit management-driven information needs and anticipated data gaps, and provide updated or alternative protocols to match need, sampling/collection schemes, and interpretation constraints

May also inform or follows up on:

2008 FWS BO

**2016-304 Salmon/Steelhead/Sturgeon Assessment of Indicators R. Johnson, NMFS
by Life stages (S.A.I.L.)**

This effort will develop a scientific framework to document our current knowledge of winter-run Chinook salmon and green and white sturgeon by collating existing information to identify key uncertainties, and assist in prioritizing targeted studies and guide monitoring efforts. The new information gained will inform key water and fish-resource management decisions with the goal of improving long-term population viability. We propose modeling our Salmon and Sturgeon efforts after the IEP's multi-agency Delta Smelt framework and deliver 3 products: (1) Conceptual framework, (2) Prioritized data and information gaps with recommendations for future studies and analyses, and (3) Recommendations / work plans developed for monitoring needs to evaluate annual status of winter-run salmon and sturgeon at relevant life stages. With these products in-place, IEP will be well poised to efficiently evaluate resources for studies and monitoring efforts for winter-run Chinook salmon and sturgeon as well as shape future MAST team efforts. This scientific framework may be expanded in future years and applied to other runs of salmon and Central Valley steelhead.

B. Solicited Research

**2016-253 Fish Community Analysis for the Spring Kodiak G. Castillo, USFWS
Trawl Survey -V2**

The element will provide a better understanding on Winter-Spring community level patterns as revealed by the Spring Kodiak Trawl (SKT) survey through statistical analyses and community analyses for years 2002 to 2014. The objectives of this study are to determine: 1) species composition, relative abundance (RA), and spatio-temporal variation of native and introduced taxa, 2) association patterns among species's RA and stations, and 3) abiotic and spatio-temporal influence of abiotic factors on community structure. Potential conservation benefits of this element will be primarily inferred by evaluation of abiotic factors and likely perturbations influencing community structure.

May also inform or follows up on:
2008 FWS BO

C. Directed Studies

2016-062 Fish Diet and Condition Z. Burriss and R. Baxter, CDFW

This study examines differences in the diet and condition of fishes as related to species decline, extends STN and FMWT sampling into the north Delta and adds a zooplankton component to each survey, and provides field support (i.e., boats and operators) for related studies focused on contaminants, zooplankton and fish health indices. This study examines the stomach contents of several fishes, measures zooplankton abundances, and uses these data to look for changes in diet composition, feeding success, and food preferences. Weight at length of fishes will be examined regionally to look for effects of diet, food availability and environmental conditions such as conductivity, temperature, and water clarity. This study informs our understandings of pelagic organism decline (POD) and fall low salinity habitat (FLaSH).

Note: additional funding now part of this element supports FLaSH related work by extending STN (#007) and FMWT (#003) sampling into Cache Slough and the Sacramento Deepwater Ship Channel, by adding of zooplankton sampling and processing to STN and FMWT surveys, by providing boat operator/operations funding for shadow vessels and complementary sampling alongside STN and FMWT sampling (#089), and by supporting time for data synthesis

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

2016-247 Evaluation of Natural Marking in Delta Smelt

G. Castillo, USFWS

The objective of this pilot study is to evaluate whether natural skin pigmentation of cultured Delta Smelt can be used as a noninvasive method to reliably distinguish individual Delta Smelt within an age class, including subadults, spawning, and post-spawning individuals. We intend to evaluate the individual stability of natural marks on Delta Smelt over several months. The body area, or areas, of interest (AOI) showing the highest reliability in correctly identifying individual fish exposed to two low and high light levels over time will be based on skin pigmentation. Both naked eye analyses and image recognition software will be used to match images.

2016-250 Knaggs Ranch Experimental Agricultural Floodplain Investigation

L. Conrad, DWR

Since 2012, the Experimental Agricultural Floodplain Investigation has investigated the science needed to inform creation of a multi-benefit management paradigm in the Yolo Bypass. Centered on the 1,700 acre Knaggs Ranch, the study has investigated how to manage seasonal inundation in the Bypass to a win/win/win for farming, fish and waterbirds while maintaining the flood control capacity of the Yolo Bypass. Results have shown consecutive years of exceptional juvenile salmon growth in rice fields inundated in winter. 2016 research will investigate the feasibility of maintaining natural floodwaters on agricultural fields after they would normally drain in order to provide an opportunity for salmon rearing. Potential study locations include 1) Knaggs Ranch, 2) Conaway Ranch, 4) Swanston Ranch, and 4) CDFW Yolo Bypass Wildlife Area. Studies in each location are contingent on flood conditions and landowner coordination.

May also inform or follows up on:

2009 NMFS BO

2016-281 Pilot investigation of fall productivity export from Yolo Bypass

J. Frantzich, DWR and B.Schreier, DWR

This study will investigate the potential for elevated flow pulses in the Yolo Bypass Toe Drain during fall to trigger phytoplankton blooms in the lower estuary, such as those that occurred in 2011 and 2012. This research examines the relationship between fall agricultural flows from the Colusa Basin and their effect on nutrients, phytoplankton density and composition, zooplankton density and composition, and clam grazing in the Toe Drain and downstream. Due to the food-limited nature of the San Francisco Estuary, it is critical to understand mechanisms resulting in successful production of beneficial algal blooms. Food limitation is one of the primary hypothesized causes of the pelagic organism decline (POD) and the influence of food availability is a major question regarding the effect of fall low salinity habitat (FLaSH) on abundance of Delta Smelt.

May also inform or follows up on:

2008 FWS BO

2016-317 Methods Development for Environmental DNA A. Finger, UCD
Surveying of the Wild Delta Smelt Population (eDNA)

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.

III. Program Support Elements

A. Program Management

2016-019 Data Management and Utilization Vacant

Management and dissemination of data and information generated by IEP monitoring and special study activities.

Compliance with the following:

- | | |
|--------------|---------------------------------------|
| 1992 IEP MOU | Statement of Work 3 |
| 1971 IEP MOU | Pg 6. Technical Coordination Function |

2016-OAC IEP Oversight and Coordination G. Erickson, 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 agenda with overarching priorities, options and background; Scheduling, agenda, materials, facilitation, and notes for management team, coordinator 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 Research permits (NMFS, USFWS) with adaptive management and reporting of species "take".

Compliance with the following:

- | | |
|--------------|---------------------------------------|
| 1971 IEP MOU | Formal Management Structure |
| 1992 IEP MOU | Statement of Work 1,2 |
| 1985 IEP MOU | VIII. Program Coordination and Review |