Appendix G.

Endangered Species Act Compliance

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
650 Capitol Mall, Suite 5-100
Sacramento, California 95814-4700

Refer to NMFS #: WCR-2018-10008

JUN 15 2018

Mr. Mark Ziminske
Chief, Environmental Resources Branch
U.S. Army Corps of Engineers, Sacramento District
1325 J Street
Sacramento, California 95814-2922

Re: Endangered Species Act Section 7(a)(2) Concurrence Letter and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Sacramento-San Joaquin River Delta Island and Levees Feasibility Study

Dear Mr. Ziminske:

This letter responds to your May 17, 2018, request for concurrence from NOAA's National Marine Fisheries Service (NMFS) pursuant to Section 7 of the Endangered Species Act (ESA) for the subject action. Your request qualified for our expedited review and concurrence because it met our screening criteria and contained all required information on your proposed action and its potential effects to listed species and designated critical habitat.

We reviewed your consultation request document and related materials. Based on our knowledge, expertise, and the materials you provided, we concur with your conclusions that the proposed action is not likely to adversely affect the NMFS ESA-listed species and/or designated critical habitat.

This letter underwent pre-dissemination review using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The concurrence letter will be available through NMFS' Public Consultation Tracking System (https://pcts.nmfs.noaa.gov/pcts-web/homepage.pcts[1]). A complete record of this consultation is on file at the California Central Valley Office of NMFS.

Reinitiation of consultation is required and shall be requested by the U.S. Army Corps of Engineers or by NMFS, where discretionary Federal involvement or control over the action has been retained or is authorized by law and (1) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (2) the identified action is subsequently modified in a manner that causes an effect to the listed

[1] Once on the PCTS homepage, use the following PCTS tracking number within the Quick Search column: WCR-2018-10008, or search for the project by name: Sacramento-San Joaquin River Delta Island and Levees Feasibility Study

(2) the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this concurrence letter; or if (3) a new species is listed or critical habitat designated that may be affected by the identified action.

NMFS also reviewed the proposed action for potential effects on essential fish habitat (EFH) designated under the Magnuson-Stevens Fishery Conservation and Management Act (MSA), including conservation measures and any determination you made regarding the potential effects of the action. This review was pursuant to section 305(b) of the MSA, implementing regulations at 50 CFR 600.920, and agency guidance for use of the ESA consultation process to complete EFH consultation. In this case, NMFS concluded the action would not adversely affect EFH. Thus, consultation under the MSA is not required for this action.

Please direct questions regarding this letter to Douglas Hampton in the NMFS' California Central Valley Office at (916) 930-3610 or via email at douglas.hampton@noaa.gov.

Sincerely,

for Barry A. Thom
Regional Administrator

cc: To the file 151422-WCR2018-SA00450

United States Department of the Interior

FISH AND WILDLIFE SERVICE
San Francisco Bay-Delta Fish and Wildlife Office
650 Capitol Mall, Suite 8-300
Sacramento, California 95814

In Reply Refer To:
08FTBDT00-2018-F-0019

JUN 1 4 2018

Mark Ziminske
Acting Chief, Planning Division
U.S. Army Corps of Engineers, Sacramento District
1325 J Street
Sacramento, CA 95814

Subject: Biological Opinion on the Sacramento-San Joaquin River Delta Islands and Levees Feasibility Study

Dear Mr. Ziminske:

This is in response to your October 12, 2017, letter requesting formal consultation with the U.S. Fish and Wildlife Service (Service) on the Corps of Engineers' (Corps) Sacramento-San Joaquin River Delta Islands and Levees Feasibility Study (Delta Study). The Delta Study is a Federal project, with the Corps as the lead Federal agency and the State of California Department of Water Resources as the non-Federal sponsor. At issue are the effects of the proposed project on the federally listed as threatened Delta smelt (*Hypomesus transpacificus*) and giant garter snake (*Thamnophis gigas*), and Delta smelt critical habitat. Your request was received on October 20, 2017. This response is provided under the authority of the Endangered Species Act of 1973, as amended (16.U.S.C. 1531 *et seq.*) (Act).

The Federal action on which we are consulting is the Delta Study, an intertidal marsh restoration project located in an area of the western Delta known as Big Break, between the western end of Jersey Island and the town of Oakley, in Contra Costa County, California. Big Break was historically intertidal marsh that was diked and drained for farming. The perimeter levees have long since been breached, but the site remains open water due to subsidence that occurred during its past agricultural use. The Delta Study proposes to use dredged material from maintenance of the section of the Stockton Deepwater Ship Channel (DWSC) nearest to the site to raise elevations of the site to a level suitable for marsh vegetation establishment. The findings in this consultation are based on the Biological Assessment (BA) included with your letter, discussions and communications with Corps staff, and other information in our files.

Consultation History

April 17, 2013: Corps requests Service prepare a draft Fish and Wildlife Coordination Act (FWCA) report.

February 10, 2014: Service attends Tentatively Selected Plan presentation for the Delta Study at Corps' Sacramento District.

April 3, 2014: Service receives April 2, 2014, Corps letter requesting consultation on the Delta Study.

May 9, 2014: Service submits draft FWCA report for Delta Study to the Corps.

September 2014: Corps places Delta Study on inactive status (no formal notification on file; personal communication with Brian Hansen, Service).

November 18, 2016: Corps (Mark Ziminske; Josh Garcia) contact the Service (Dan Welsh) by phone to request a meeting on the use of hydraulic dredging rather than clamshell dredging for the purpose of use in the Delta Study.

December 15, 2016: Corps (David Colby) emails draft document entitled "O&M and Delta Study Issue Paper."

February 9, 2017: Corps (David Colby; Anne Baker) meets with resource agencies (Water Board, National Marine Fisheries Service, Service) to discuss dredging matters in relation to the Delta Study.

May 3, 2017: Corps (Anne Baker) emails Service that it is changing the proposed project alternative for the Delta Study and will be re-initiating consultation.

October 12, 2017: Corps transmits letter and BA requesting formal consultation (either concurrence with Not Likely to Adversely Affect determination, or Biological Opinion if the Service did not concur).

November 21, 2017: Service transmits letter of non-concurrence with the Not Likely to Adversely Affect determination and information request on specifics related to presence of and effects on listed species.

December 14, 2017: Service attends meeting with the Corps and other participants in which additional information on the proposed project plan is presented.

February 15, 2018: Corps staff (Anne Baker) emails updated project description.

February 27, 2018: Service staff (Steve Schoenberg) emails comments on the updated project description.

March 1, 2018: Corps Staff (Anne Baker) emails a draft Monitoring and Adaptive Management Plan for the project.

March 12, 2018: Corps staff (Anne Baker) emails revised project description to incorporate Service staff comments.

March 23, 2018: Service staff (Steve Schoenberg) emails comments on the updated project description and draft mitigation/management plan including potential needs for monitoring habitat, fish, and related parameters.

April 6, 2018: Corps staff (Anne Baker) emails responses to Service's November 21, 2107, information request, and additional details on road improvement and pipeline placement.

April 10, 2018: Service attends meeting with Corps and National Marine Fisheries Service to discuss monitoring for fish and related habitat parameters.

April 11, 2018: Corps staff (Tom Borrowman) emails monitoring plan summary table.

April 13, 2018: Corps staff (Anne Baker) emails updated revised project description.

May 9, 2018: Corps staff (Anne Baker) emails supplemental smelt analysis.

May 22, 2018: Corps staff (Anne Baker) emails recent photographs of remnant levee.

May 23, 2018: Corps staff (Tom Borrowman) emails draft engineering appendix, and other emails explaining the configuration of pipeline and submerged, overland, and floating sections.

May 24, 2018: Service staff (Steve Schoenberg) emails draft biological opinion with request for comments and concurrence with the project description. Corps staff (Anne Baker) responds by email with minor editorial comments and concurrence with the project description.

BIOLOGICAL OPINION

Description of the Action

The project area is located in the western Delta in a portion of Big Break. Most of the project area is a former, diked island, with subsided elevations such that it is currently shallow open water habitat except for a terrestrial part comprised of a remnant levee. The activities covered by this consultation include the placement of dredged material to create the surface elevations of the restored area, the construction of pipeline facilities to transport the dredged material from the dredge site to the placement site, plantings, non-native plant removal, monitoring, and - to the extent warranted by monitoring - adaptive management actions that may be needed to optimize environmental benefits.

The total quantity of dredged material placed for this project is estimated to be 1 million cubic yards (cy). The spatial extent of the project would be 340 acres, of which about 250 acres would be unvegetated underwater channels and shallow water habitat (i.e., shallower than existing) and approximately 90 acres would be planted with aquatic vegetation. In addition, a 50-acre remnant levee along the northern edge of Big Break would be treated as necessary to remove invasive species and planted with native riparian species.

The source of the material for the restoration is Operation and Maintenance (O&M) dredging of the DWSC roughly between station points 400+00 and 850+00. O&M dredging is not covered by this consultation, but is an ongoing Corps activity already covered by a prior consultation (July 31, 2017; Service file number 08FBDT00-2017-F-0098). With the proposed project, as O&M dredging in this section is occurring, the material would be pumped directly to the proposed restoration site rather than transporting it to usual land-based placement sites. The amount of material in any given year cannot be exactly predicted because it depends on variations in shoaling that are affected by weather and inflow. For the purpose of illustration, this description uses the anticipated average 100,000 cy volume to describe activities in a given year; however, the actual amount of dredged material and the associated restoration may vary from this amount. In general, 100,000 cy would be the minimum quantity of dredging that would initiate an O&M operation in a year, however, it could be much more than that if a wetter water year were to occur that brought more sediment into the DWSC. In that event, the dredging and associated restoration activities would be scaled up to ensure that dredging was sufficient to restore the authorized depth. This would involve a longer period of dredging for that year, but which would create more restored habitat. The estimated time for restoration activities to take place is 13 years (10 years placement and monitoring plus 3 years post-completion monitoring/adaptive management) but could be somewhat longer or shorter depending on the frequency of O&M and amount of O&M material. Project construction is estimated to begin in the fall of 2020.

This description is subject to verification and refinement as a result of additional study to be done at the Corps' Preconstruction Engineering and Design (PED) phase of project planning, which will take place after this biological opinion is issued.

Facilities: A hydraulic suction dredge would be used with a pipeline to transport material from the dredging site to the placement site at Big Break. On the San Joaquin River, the pipeline would be floating. As the ship channel is being dredged, this floating pipeline would be used to transfer materials to the placement site. There would be floating diesel repeater pump stations positioned about every 5,000 feet to aid slurry flow. Work boats would be needed to install, maintain, and remove the floating pipeline, and tender the position of the outfall slurry pipe to ensure correct placement of materials.

A section of the pipeline would be land-based, crossing Jersey Island. It would be installed adjacent to a north-south farm road. Before installation, the farm road would be improved with a layer of gravel to allow vehicular access. The pipeline would take 1 day to install and 1 day to remove each season. There would be a 1-acre staging area at the south end of this land-based section of the pipeline. The pipeline would then continue south, where it would be submerged for the 600-foot distance crossing of Dutch Slough. The pipeline would be placed on the ground of the remnant levee, before entering the placement area at Big Break, where it would be floating again.

Material Placement: Material placement would be simultaneous with the dredging period, which is estimated to average 15 days per year over a 10-year period, depending on the material volume. Regardless of variations in volume, all placement would be done entirely within the August 1 to November 30 time frame of each year. Dredging would be relatively continuous, with about 18 hours per day considered operational. The dredged material, in the form of a hydraulic slurry, would be pumped directly from the dredging vessel into the pipeline. The material would be released into shallow open water in Big Break to form a series of circular sand mounds, each roughly 300 feet in diameter, assuming the materials settle at a slope of about 1 on 20 below mean tide, and 1 on 10 above mean tide. The mounds would be placed so that the toes do not overlap, leaving channels between the mounds that are initially the same as existing conditions, but which are expected to become shallower in the future as they accrete sediment. The positioning of the mounds would be such that some larger channels would be formed to allow for kayak recreation after the site is restored. The target elevation of the top of the sand mounds would be +3 feet Mean Lower Low Water (MLLW), grading to the bed level at the toe of the mound, which would be -3 to -4 feet MLLW. The upper portion of the mound will be initially 1 to 3 feet higher than the target elevations for restoration to allow for losses of height due to several factors: compression of the underlying material, wave wash loss during storms, and sea level rise. At high tide, the mounds would be at least 1 foot below the water surface (i.e., Mean Higher High Water is +4 feet above MLLW). An estimated 6,000 cy would be placed per mound, or about 17 mounds for each 100,000 cy of dredged material, with each mound encompassing about 1.6 acres after settlement.

Several sets of straw bale lines would be placed around the placement area before dredged material placement as a barrier to the predominant flow paths to allow for sediment settling and initial mound stability. These straw bale lines are not anticipated to be fully enclosing so as to permit fish movement and water exchange. If initial monitoring reveals that enclosure is needed, the top of the straw bale lines would be set at mean low tide to allow fish an opportunity to escape the work area. These bales are anticipated to persist for 1-2 years, allowing sufficient time for vegetative establishment, after which the vegetation is assumed to provide adequate resistance. At this time, it is believed the bale lines would be installed on the western and eastern edges of the restoration area south of the remnant levee, with a total extent of about 3,600 feet for each bale line. The exact form of the bale lines will be determined during the PED phase.

Aquatic marsh vegetation plantings would be installed on the mounds in the spring following each season of material placement. There may be terrestrial riparian vegetation plantings made on the existing remnant levee section of the project area in the fall of the first season of construction. The most recent examination of the remnant levee indicates at least a margin of marsh vegetation, and that the existing terrestrial vegetation could be native species. During PED, the remnant levee would be inspected for the extent of invasive vegetation and ground surface elevations surveyed to verify the need and suitability for terrestrial plantings. If plantings are warranted, invasive vegetation on the remnant levee would be removed with a hedger, and the remaining rootstocks treated with herbicide, once a month for 3 months. The levee would be seeded with native grasses following invasive treatment and monitored to determine if treatment was successful. Assuming treatment success, riparian species would be planted in the fall, maintained for a 3-year establishment period via watering, caging, or other needed methods, and monitored. Initial densities would be 235 plants/acre, with 60% survival to the end of the 3-year period. This terrestrial planting would be native woody riparian species as described in the monitoring plan. The site would be fenced as needed to protect establishing habitat, and irrigated, for the 3 years. If the PED inspection reveals that the remnant levee does not have invasive species or enough to warrant action, or that the elevations are too low to support riparian plantings, then the terrestrial vegetation planting and associated monitoring elements of this project will be deleted.

Aquatic planting would be installed following an estimated 10-month settlement period after each season of dredged material placement has concluded. Existing Big Break sediments will be characterized by testing to predict physical behavior of placed sediment under loading of the mound, and further testing will be done during the PED phase. This will be done to verify the settlement and spread of the mounds. The placement and settlement period may be subject to further adjustment as warranted by the first year of monitoring, to balance the needs to plant after sufficient settlement, but before the surface is substantially colonized by non-native vegetation.

Based on the prior similar restoration project using dredged material at Donlan Island, the plantable zone on the sand mounds is assumed to be -0.5 to +3 feet MLLW (Corps and Service 1990). Vegetative elevation may vary with location and, therefore, will be verified during the PED phase by examination of natural marshes in the immediate project vicinity or by other means. The purpose of the planting is to establish desirable native aquatic vegetation before undesirable exotic vegetation can develop. Plant material could be nursery grown or collected from nearby sources and transplanted to the site but, for the purpose of this analysis, nursery grown stock is assumed. The dominant planted species would be common tule (*Schoenoplectus acutus occidentalis*). Other aquatic species to be planted would include various native sedge and rush species (e.g., *Cyperus eragrostis; Juncus effuseus; Juncus balticus; Eleocharis macrostachya*.). Cattail (*Typha* spp.) would not be planted, but is expected to colonize by natural recruitment. Since cattail often dominates, bulrush will be planted to give this species a head start. Ten percent of the target area would be planted with tule spaced at 3 feet on center, or about 100 plants for each mound, assuming a ~0.53 acre plantable area. The tules would be installed at the mid-elevation of the aquatic planting elevation zone. It would take about 11 days of work to install plants for each 100,000 cy of placed dredged material.

Monitoring and Adaptive Management

Monitoring and adaptive management would include both physical and biological elements. The following is a summary of the most current information from a draft monitoring and adaptive management plan as well as any further elements to be included to comply with a Term and Condition of this biological opinion. The plan will include necessary specifics such as success criteria, triggers for adaptive management action, example scenarios on the use of monitoring, implementation of actions, and reporting (report elements, report schedule). Reporting will at least include as-built topography and plantings for the current year, comparison of as-builts from the prior year with the current year for topography and plantings, summary information on water quality, quantities of listed species habitat effects compared to the allowable take as defined in this biological opinion, any adaptive management actions taken during that monitoring year, as well as any adaptive management actions recommended for the subsequent year. This monitoring will continue until success criteria are met for 3 years, or longer if these criteria are not met and adaptive management action is required. A final plan that includes all necessary elements described here will be submitted to and approved by the Service prior to the onset project implementation as a Term and Condition of this biological opinion.

Physical/Water Quality Monitoring

Physical monitoring of the sand mounds would occur at least annually, with additional monitoring occurring after major storms or high water events. Physical monitoring would be done by ground surveys or other appropriate methods in conjunction with annual vegetation monitoring, as well as dredged material placement the following year. It would include mound heights for the current year's material as well as the previously placed year. Water quality monitoring would be done by installing remote sondes in and around the restoration site. These sondes would take hourly readings of parameters such as temperature and dissolved oxygen to ensure that the restoration site is maintaining suitable water circulation. Turbidity and oxygen will also be measured during dredged material placement, at least initially. The need for consideration of action will be determined by developing quantifiable success criteria and triggers for possible action for topography and water quality, such as by stating allowable differences from expected topography in the case of elevation, or comparison of water quality parameters to a reference site.

Such monitoring can be used to verify the extent of settlement and suitable elevation locations for the plantings, assess any erosive losses due to wave wash or tidal currents, and detect significant movement of material from the mounds into the channels between the mounds. Adaptive management measures could include modest excavation of the channels, adjustment in the position of plantings, or adjustment in the height and quantity of material for future mounds, or the timing of planting, based on any monitored differences in the settlement and compression of sediment on existing mounds. The physical monitoring can also be used to adjust the dredged material placement quantities and elevations in future years based on information in prior years.

If a trigger condition for water quality occurs, the Corps would commence an evaluation of the cause of this condition by evaluating available history on meteorology, flows, and velocity trends. As deemed appropriate, the Corps may conduct additional on-site measurements. Example corrective measures may include placement of additional straw bales, or limited reshaping of sediment surface to restore adequate elevations. This reshaping would be done with a high-pressure pump and hose to excavate and move material around as needed. If it is determined that some channels are unsuccessful and cannot be rehabilitated, these could be abandoned and filled during the next dredged material placement season. While not expected, if prolonged or extensive turbidity plumes occur during construction of the first few mounds, silt curtains or fences may be used to contain this turbidity while the material settles.

Biological Monitoring

Riparian Vegetation (remnant levee): Maintenance activities as part of the riparian plant establishment process would begin after all installation is complete and would continue through the duration of the 3-year establishment period. Watering and weeding would ensure that individual plants are kept moist and free from competition. Mowing would ensure that the site and plants are accessible while minimizing undesirable seedhead development and potential fire danger. Spraying would reduce undesirable herbaceous competition, allowing the native grasses a greater opportunity to establish. Any herbicides used would be in compliance with water quality standards.

During the establishment period, all riparian plants would be surveyed in the fall before they lose their leaves. All dead terrestrial plants would be identified and replaced that same fall for the first two years of establishment. Based on historical data, it is expected that mortality would be below 20% for each of the first two years. Replacement plants would be with the same species that it is replacing, using the same size container as was originally planted, unless it is determined that another species would be more appropriate to the site. Where it becomes evident a particular species is not conducive to the site, a different species would be substituted to ensure success.

A riparian plant survival survey would be performed at the end of each establishment year and a report would be prepared. Information to be included in reporting would include the monthly maintenance records, plant survey totals, and observations and recommendations of how to improve the site. As-builts would be prepared and kept current of what was planted, how much was planted, and where it was planted.

Riparian plantings would be monitored for the percent cover of invasive plant species versus native plant species. Success would be based on maintaining dominance of native cover, and non-native species cover below a maximum allowable percentage for three years. Corrective measures would include an assessment of the monitoring results to identify cause(s). Adaptive management measures may include: replanting, additional non-native control actions involving physical removal or herbicide, supplemental irrigation, or caging or staking of individual plants.

Aquatic Vegetation (mounds): The restoration objective for the mounds is to have natural recruitment and plantings create a surface which would be diverse, resilient, and sustainable. The planted areas are expected to be able to resist erosion, while being capable of accreting sediment. Habitat benefits provided by the planted areas include food production, shelter, nesting, and foraging functions for both aquatic and water-associated wildlife. Success criteria and triggers for potential adaptive management action will be based on the percent vegetative cover of the plantable area, the maximum allowable percent non-native vegetative coverage in that plantable area, and water quality parameters. Though not yet included in the draft plan, potential non-native submerged or floating vegetation below the emergent plant zone will also be monitored in compliance with a Term and Condition of this biological opinion.

A monitoring and adaptive management plan has been prepared for the proposed action and will address challenges in meeting restoration success (i.e., lack of vegetative growth, increased turbidity, etc.). If a condition is observed or measured that may merit action, corrective measures would first involve an assessment of the monitoring results to identify cause(s), and a decision made whether or not to enact a measure, or to merely continue to monitor. Potential measures include but are not be limited to: replanting, additional non-native control actions, and physical adjustment to sand mound formations. In addition to the stated success criteria, the first year of dredged material placement and associated physical and biological monitoring is expected to inform implementation in the following years. This may include adjustments in the dredged material placed to form each mound, the spacing of mounds, the area of mounds, or additional fill on or between existing mounds.

For both riparian and aquatic vegetation, monitoring would involve sampling during the peak of the growing season, and would also include collecting a drone image which would be evaluated to estimate percent cover by native and non-native species. A general survey would be done by boat, during which general observations would be made of plant fitness/health, native species recruitment, drought stress, and other qualitative factors. Irrigation and fencing would also be checked. A general inventory of wildlife would be done. Annual monitoring reports would be submitted to the Service with any recommended adaptive management measures.

Food Web: Sampling of various metrics of the presence of food organisms produced in restored marsh is not yet proposed in the draft plan but will be included in the final monitoring plan in compliance with a Term and Condition of this biological opinion. The purpose of this monitoring is to assess how the restored marsh from this project compares to reference sites such as nearby unrestored areas or other functioning marsh areas. Typical parameters involve plankton (zooplankton, phytoplankton, chlorophyll a), and invertebrates within the benthos and on plant or sediment surfaces. Specifics are not available at this time.

Fish: Fish monitoring is not yet proposed in the draft plan, nor required by this biological opinion. If fish monitoring is included in the final plan, it will be with a non-intrusive method such as by visual observation or sonar that does not result in take of delta smelt.

Long Term Maintenance

Completed functional portions of the restoration site will be turned over to the non-Federal sponsor for oversight. Prior to being turned over, the Corps will prepare an Operation Maintenance Repair Replacement and Rehabilitation (OMRRR) manual that describes maintenance requirements. Because the goal of the project is to create self-sustaining habitat, significant maintenance needs are not expected. The types of activities within an OMRRR manual for this project would be minimal, such as signs, containment barriers, or other protective measures. There would be a periodic inspection of these areas on an annual or biannual basis to monitor them for any severe adverse effects. The East Bay Regional Park District will manage public recreational use of the site consistent with their resource protection mandate.

Conservation Measures

<u>General Measure</u>

- A monitoring and adaptive management plan would be implemented throughout construction and three years following completion, so that adjustments can be made to optimize environmental benefits and minimize unanticipated impacts.

Delta Smelt Measures

- All in-water work will be completed between August 1 and November 30.
- A qualified biologist would provide environmental awareness training to contractors and construction crews regarding listed fish species known to potentially occur near construction sites.
- Lines of hay bales installed for the purpose of limiting the effect of current or wave erosion would not be fully enclosing, and would be set at an elevation that allows for total submergence during high tide levels.

Giant Garter Snake Measures

- Land-based construction would be initiated during the giant garter snake active period (May 1 through October 1).
- Contractors and construction personnel will participate in Service-approved worker environmental awareness training by a qualified biologist.
- A giant garter snake survey will be conducted 24 hours prior to the onset of work in potential habitat (i.e., the footprints of levee roads to be improved, placement of the pipeline on land, and removal of vegetation on the remnant levee). If there is an interruption of work longer than two weeks, the area will be resurveyed again no later than 24 hours before the resumption of work.
- If a giant garter snake is found in the work area, work will be stopped and remain stopped until the snake leaves the work area. Construction staff must notify appropriate Corps environmental personnel immediately.
- No worker is to handle or otherwise move or harass a giant garter snake.
- Report any snake sightings and any incidental take to the Service immediately, by telephone at (916) 930-5604.
- Equipment or materials and the immediate ground surface in staging areas will be inspected for snakes before each day of use.
- Vehicles will be limited to a speed of not more than 15 mph on access roads.

Action Area

The action area is defined in 50 CFR § 402.02, as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." For the purposes of the effects assessment, the action area includes all areas where any activity associated with the project may occur, including construction, adaptive management, and monitoring as noted in the project description, as well as areas which are affected by these activities. This includes the activities of pipeline construction, dredged material placement, planting, staging activities, operation of equipment and vehicles, sampling for monitoring, and any additional construction deemed a necessary adaptive management measure as determined by consideration of the monitoring results. The areas where these activities occur are the initial dredged material placement locations, areas where dredged material may subsequently move through settlement, wave erosion, and/or tidal flows, terrestrial and aquatic footprints of the pipeline at any time during the placement period, access roads and staging areas, any part of the remnant levee of Big Break which would be subject to non-native removal and replanting, the aquatic area of Big Break including placement of both dredged material and straw bales, and any nearby aquatic area that may be affected in terms of turbidity or other water quality parameters, during placement (i.e., generally within ~100 feet of the outermost perimeter of disturbance).

Analytical Framework for the Jeopardy Determination

Section 7(a)(2) of the Act requires that Federal agencies ensure that any action they authorize, fund or carry out, is not likely to jeopardize the continued existence of listed species. "Jeopardize the continued existence of..." means to engage in an action that would reasonably be expected, either directly or indirectly, to appreciably reduce the likelihood of both the survival and recovery of a listed species in the wild by reducing reproduction, numbers, or distribution of that species (50 CFR § 402.02).

The jeopardy analysis in this biological opinion considers the effects of the proposed Federal action and any cumulative effects on the rangewide survival and recovery of the listed species being consulted on. There are four components of this analysis for each species: (1) the *Status of the Species*, which evaluates the species' range-wide condition, the factors responsible for that condition, and its survival and recovery needs; (2) the *Environmental Baseline*, which evaluates the condition of species in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the species; (3) the *Effects of the Action*, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the species; and (4) *Cumulative Effects*, which evaluates the effects of future, non-Federal activities in the action area on the species.

Analytical Framework for the Adverse Modification Determination

Section 7(a)(2) of the Act requires that Federal agencies ensure that any action they authorize, fund or carry out, is not likely to modify designated critical habitat. A final rule revising the regulatory definition of "destruction or adverse modification" was published on February 11, 2016 (81 FR 7214), and became effective March 14, 2016. The revised definition states:

> "Destruction or adverse modification means a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features."

The destruction or adverse modification analysis in this biological opinion relies on four components: (1) the *Status of Critical Habitat*, which evaluates the range-wide condition of critical habitat for the delta smelt in terms of primary constituent elements (PCEs), that provide for the conservation of the listed species, the factors responsible for that condition, and the intended value of the critical habitat overall for the conservation/recovery of the species; (2) the *Environmental Baseline*, which analyzes the condition of the critical habitat in the action area, the factors responsible for that condition, and the value of the critical habitat in the action area for the conservation/recover of the species; (3) the *Effects of the Action*, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the PCEs and how those impacts are likely to influence the conservation value of the affected critical habitat units and; (4) *Cumulative Effects*, which evaluates the effects on the PCEs of future non-Federal activities that are reasonably certain to occur in the action area and how those impacts are likely to influence the conservation value of the affected critical habitat units.

For purposes of the adverse modification determination, the Service evaluates if the effects of the proposed Federal action together with cumulative effects are likely to impair or preclude the capacity of delta smelt critical habitat in the action area to serve its intended function, to an extent that it appreciably diminishes the range-wide value of that critical habit for conservation of the species. The key to making this finding is understanding the value of the critical habitat in the action area for the conservation/recovery of the listed species based on the *Environmental Baseline* analysis.

Status of the Delta Smelt

Legal Status

The Service proposed to list the delta smelt (*Hypomesus transpacificus*) as threatened with proposed critical habitat on October 3, 1991 (Service 1991). The Service listed the delta smelt as threatened on March 5, 1993 (Service 1993), and designated critical habitat for the species on December 19, 1994 (Service 1994). The delta smelt was one of eight fish species addressed in the *Recovery Plan for the Sacramento–San Joaquin Delta Native Fishes* (Service 1996), and a revision addressing delta smelt is currently underway. A 5-year status review of the delta smelt was completed on March 31, 2004 (Service 2004). The 2004 review concluded that delta smelt remained a threatened species. A subsequent 5-year status review recommended uplisting delta smelt from threatened to endangered (Service 2010a). A 12-month finding on a petition to reclassify the delta smelt as an endangered species was completed on April 7, 2010 (Service 2010b). After reviewing all available scientific and commercial information, the Service determined that re-classifying the delta smelt from a threatened to an endangered species was warranted but precluded by other higher priority listing actions (Service 2010c). The Service annually reviews the status and uplisting recommendation for delta smelt during its Candidate Notice of Review (CNOR) process. Each year, the CNOR has recommended the uplisting from threatened to endangered. Electronic copies of these documents are available at http://ecos.fws.gov/docs/five_year_review/doc3570.pdf and http://www.gpo.gov/fdsys/pkg/FR-2013-11-22/pdf/2013-27391.pdf (Service 2010a; Service 2010b; Service 2012b).

Description and Life Cycle

The delta smelt is a small fish of the family Osmeridae. It is endemic to the San Francisco Bay-Delta where it primarily occupies open-water habitats in Suisun Bay and marsh and the Sacramento-San Joaquin Delta. The delta smelt is primarily an annual species, meaning that it completes its life cycle in one year which typically occurs from April to the following April plus or minus one or two months. In captivity delta smelt can survive to spawn at two years of age (Lindberg *et al.* 2013), but this appears to be rare in the wild (Bennett 2005). Very few individuals reach lengths over 3.5 inches (90 millimeters [mm]).

Population Numbers

The 2017 CDFW Fall Midwater Trawl (FMWT) Index was 2, the lowest on record. The CDFW Spring Kodiak Trawl (SKT) monitors the adult spawning stock of delta smelt and serves as an indication for the relative number and distribution of spawners in the system. Last year the 2017 SKT Abundance Index was 3.8, the third lowest on record. The 2018 SKT Abundance index was 2.1, the second lowest on record. All CDFW relative abundance indices show a declining trend following the extreme drought conditions in 2013-2015 and are discussed further below.

In 2016, the Service began calculating an absolute abundance estimate utilizing January and February SKT catch data. The data for each of the previous years was used to calculate a range of estimated adult spawner abundance for that year.[1] This calculation was modified in 2017 and resulting ranges and point estimates are shown in Table 3.

The 2018 absolute abundance estimate is the second lowest following 2016. The January through February 2016 point estimates were the lowest since the SKT survey began in 2002 and suggested delta smelt experienced increased mortality during the extreme drought conditions occurring during 2013-2015. While the estimate increased slightly in 2017, it has fallen again in 2018. The continued low parental stock of delta smelt relative to historical numbers suggest the population will continue to be vulnerable to stochastic events and operational changes that may occur in response until successive years of increased population growth results in a substantial increase in abundance.

In addition to these abundance estimates, the CDFW conducts four fish surveys from which it develops indices of delta smelt's relative abundance. Each survey has variable and unquantified capture efficiency, and in each, the frequency of zero catches of delta smelt is very high, largely due to the species' rarity (*e.g.,* Latour 2016; Polansky *et al.* 2017). The [summer] Townet Survey (TNS) is the longest running indicator of delta smelt relative abundance; it has been conducted since 1959. Although this survey was designed to index the relative abundance of metamorphosing juvenile striped bass (*Morone saxatilis)* (Turner and Chadwick 1972), delta smelt have been collected incidentally; most of the delta smelt captured are age-0 and about 20-40 mm in length (Miller 2000). The FMWT is the second longest running indicator of delta smelt relative abundance; it has been conducted since 1967. This survey was also designed to index the relative abundance of age-0 striped bass (Stevens 1977), but as with the TNS, delta smelt are collected incidentally (Stevens and Miller 1983). Most of the delta smelt captured by the FMWT are age-0 "subadults" and are about 50-70 mm in length (Sweetnam 1999). The 20-mm Survey is the third longest running indicator of delta smelt relative abundance; it has been conducted since 1995. This survey was designed to monitor the distribution of late larval or metamorphosing juvenile delta smelt to assess their distribution and risk of entrainment into the large water export diversions of the CVP and State Water Project (SWP) (Dege and Brown 2004). As its name suggests, most of the delta smelt collected by the 20-mm Survey are about

1 The Service completed a revised adult delta smelt abundance estimation procedure based on CDFW's SKT data for January and February (see Table 3). This procedure has been updated from that used in 2016. While these estimates likely represent a minimum population size due to the method reliance on survey data, this is our current best estimate of the annual population size. The actual delta smelt spawner population during January and February of any given year likely fell within the upper and lower confidence interval for that year identified in the final column above.

Table 3. Three indicators of adult delta smelt status for WYs 2002-2018. Column 2 is the CDFW FMWT Index by WY (*i.e.*, the indices for calendar years 2001-2017). Column 3 is the CDFW SKT Index. Column 4 is an estimate of adult delta smelt abundance during January and February that the Service calculates from the SKT survey.

WY	FMWT Index (unitless)	SKT Index (unitless)	January and February SKT Abundance Estimate (number of delta smelt) [Lower; Upper Confidence Interval]
2002	603	N/A	739,877 [506,889; 1,043,891]
2003	139	N/A	634,000 [340,811; 1,081,388]
2004	210	99.7	654,492 [370,200; 1,074,662]
2005	74	52.9	477,775 [308,015; 708,388]
2006	26	18.2	186,797 [133,663; 254,133]
2007	41	32.5	291,964 [155,148; 502,239]
2008	28	24.1	325,333 [147,533; 626,188]
2009	23	43.8	365,946 [151,439; 748,841]
2010	17	27.4	169,417 [106,837; 255,665]
2011	29	18.8	290,792 [99,502; 670,574]
2012	343	130.2	772,311 [420,904; 1,303,955]
2013	42	20.4	212,504 [95,804; 410,659]
2014	18	30.1	207,595 [110,373; 356,969]
2015	9	13.8	139,310 [66,314; 259,301]
2016	7	1.8	16,159 [7,403; 30,886]
2017	8	3.8	47,786 [21,709; 91,864]
2018	2	2.1	17,606 [3,433; 54,796]

10-30 mm in length, with a peak catch of fish just under 20 mm (Kimmerer 2008). The newest indicator of delta smelt relative abundance is the SKT Survey, which has been conducted since 2002. This survey was designed to monitor the distribution of pre-spawn and spawning adult delta smelt to assess their distribution and risk of entrainment. Most of the delta smelt captured in the SKT are 60-80 mm in length (Bennett 2005).

The TNS and FMWT abundance indices for delta smelt have documented the species' long-term decline, while the newer 20-mm and SKT abundance indices have generally confirmed the recent portions of the trends implied by the older surveys (Figures 7 and 8). During the period of record, juvenile delta smelt relative abundance has declined from peak levels observed during the latter 1970s (Figure 2), while subadult relative abundance was at its highest in 1970, and similarly high in 1980 (Figure 3). Juvenile and subadult abundance indices both declined rapidly during the early 1980s, increased somewhat during the 1990s, and then collapsed in the early variation than their 20-mm and SKT analogs, but overall, the trends in both sets of indices are similar. During the past decade, each index has frequently reached new record low levels. The TNS index was 0.0 in 2015 and 2016, and the 2015 FMWT index and subsequent 2016 SKT index were record lows (about one half of one percent of the relative abundance recorded in 1970-1971).

The abundance of adult delta smelt may have exceeded twenty million in 1980-1981 (Rose *et al.* 2013b). This may sound like a large number – and it is compared to the contemporary estimates listed in Table 4. However, decades of monitoring by CDFW has shown that the delta smelt has usually not been very abundant when compared to other pelagic (meaning offshore-oriented or open-water) fishes (Figure 4). In the TNS, delta smelt catches have usually been lower than age-0 striped bass, and in recent years, also lower than gobies and threadfin shad. In the FMWT, delta smelt catches have been persistently lower than at least five other species. Research and monitoring in shallower habitats like Suisun Marsh (Moyle *et al.* 1986; Matern *et al.* 2002), Delta beaches (Nobriga *et al.* 2005), and small tidal marshes in the upper estuary (Gewant and Bollens 2012) have reported even lower relative abundances of delta smelt. In each of the studies cited, the catches of delta smelt represented less than one percent of the total fish catch and there were usually more than a dozen more abundant fish species.

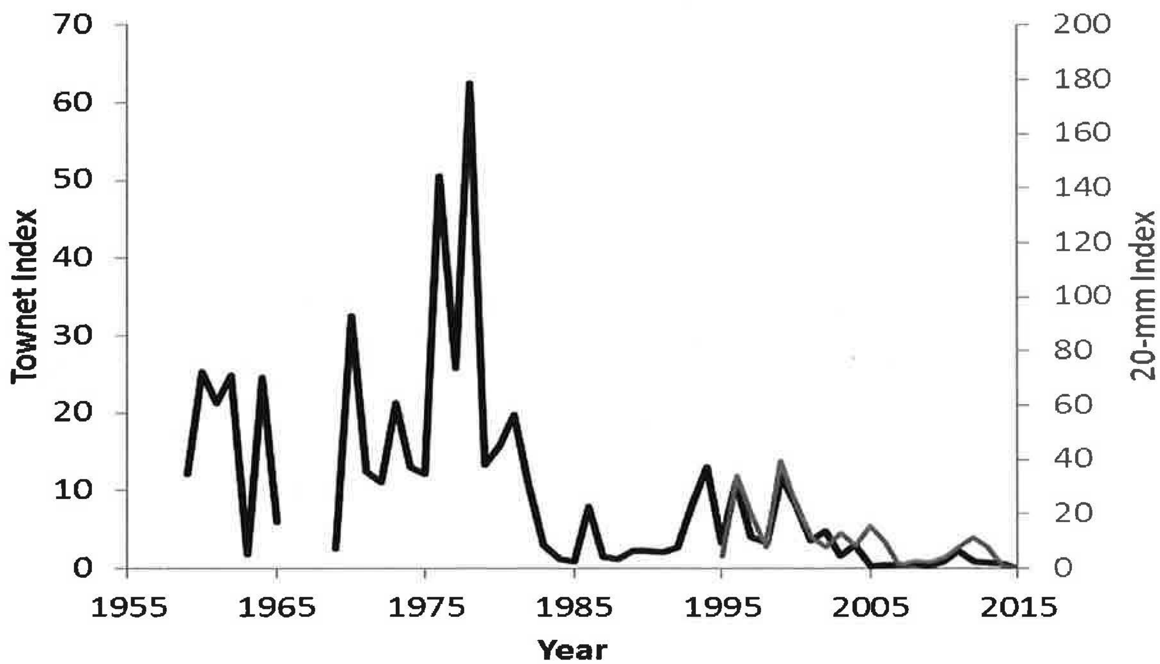

Figure 2. Time series of the CDFW's summer TNS (black line; primary y-axis) and 20-mm Survey (gray line; secondary y-axis) abundance indices for delta smelt.

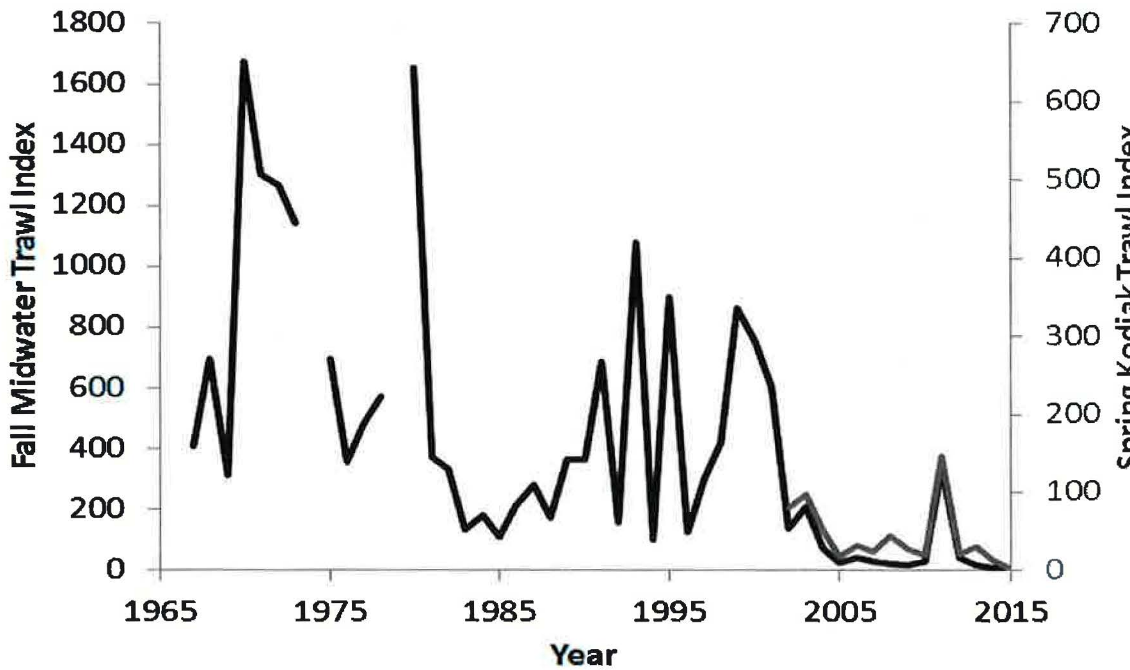

Figure 3. Time series of the CDFW's FMWT (black line; primary y-axis) and SKT (gray line; secondary y-axis) abundance indices for delta smelt.

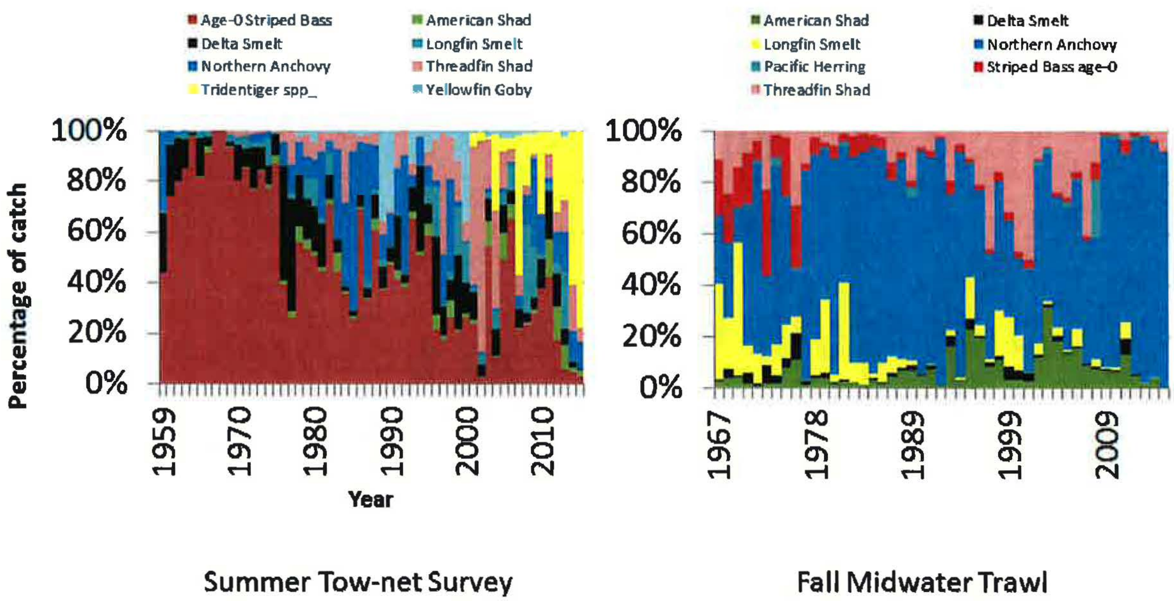

Figure 4. Fractional compositions of the eight most frequently collected fish species in the CDFW's summer TNS (1959-2015), and the seven most frequently collected fish species in the FMWT (1967-2015).

The long-term rarity of the delta smelt has had a consequence for understanding the reasons for their population decline, which generates uncertainty about how resource managers should intervene. Some pelagic fishes have shown long-term relationships between Delta inflow, Delta outflow and their abundance or survival (Stevens and Miller 1983; Jassby *et al.* 1995; Kimmerer

2002b; Kimmerer *et al.* 2009). There does seem to be some difference in the likelihood of whether the delta smelt population will increase or decrease in abundance from one year to the next based on hydrology (Figure 5), but there has never been any predictable relationship linking freshwater flow conditions to the relative abundance of delta smelt (Stevens and Miller 1983; Jassby *et al.* 1995; Kimmerer 2002b; Kimmerer *et al.* 2009). Recently, several teams of researchers have built several varieties of conceptual (Interagency Ecological Program [IEP] 2015) and mathematical (Thomson *et al.* 2010; Maunder and Deriso 2011; Miller *et al.* 2012; Rose *et al.* 2013a) life cycle models for the delta smelt that attempt to describe the reasons the population has declined. Some of these models have been able to recreate the trend observed in abundance indices very well (Figure 6), but they have all done so using different approaches and different variables to do so. Collectively, these modeling efforts have been helpful in that they generally support water temperature and changes in the estuary's food web as 'universally supported' factors affecting delta smelt. However, they have also come to very different conclusions about the conservation value of more readily manageable factors like water project operations.

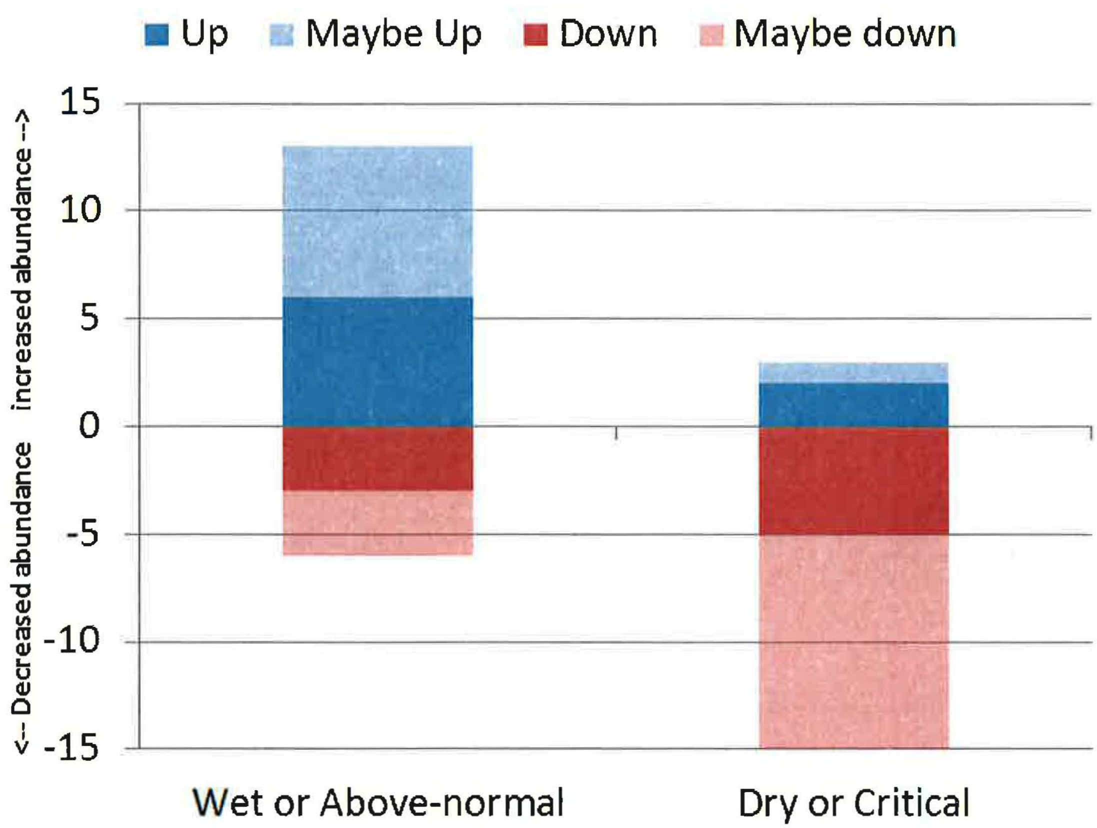

Figure 5. Frequencies of delta smelt population increases or decreases (red colored portions of each bar occurring below zero) based on the CDFW's FMWT Survey, 1967-2015. A population increase reflects an increase in relative abundance over the prior year's index and a population decrease reflects a decrease in relative abundance compared to the prior year's index. The Service performed bootstrap resampling on each year's catch per tow to generate a mean catch per tow with 95 percent confidence intervals. This resulted in four possible outcomes: (1) a statistically significant increase in relative abundance from one year to the next in which the confidence intervals of the two years did not overlap ("Up"; solid blue bar segments), (2) a statistically non-

significant increase in relative abundance from one year to the next in which the confidence intervals of the two years overlapped ("Maybe Up"; lighter blue bar segments), (3) a statistically significant decrease in relative abundance from one year to the next in which the confidence intervals of the two years did not overlap ("Down"; solid red bar segments), or (4) a statistically non-significant decrease in relative abundance from one year to the next in which the confidence intervals of the two years overlapped ("Maybe Down"; lighter red bar segments). The counts in each of the four categories were combined by Sacramento Valley WY types except that below-normal years were not plotted. The frequencies of population decline were converted into a negative number so that population increases would count up from the zero line on the y-axis and population decreases would count down from the zero line.

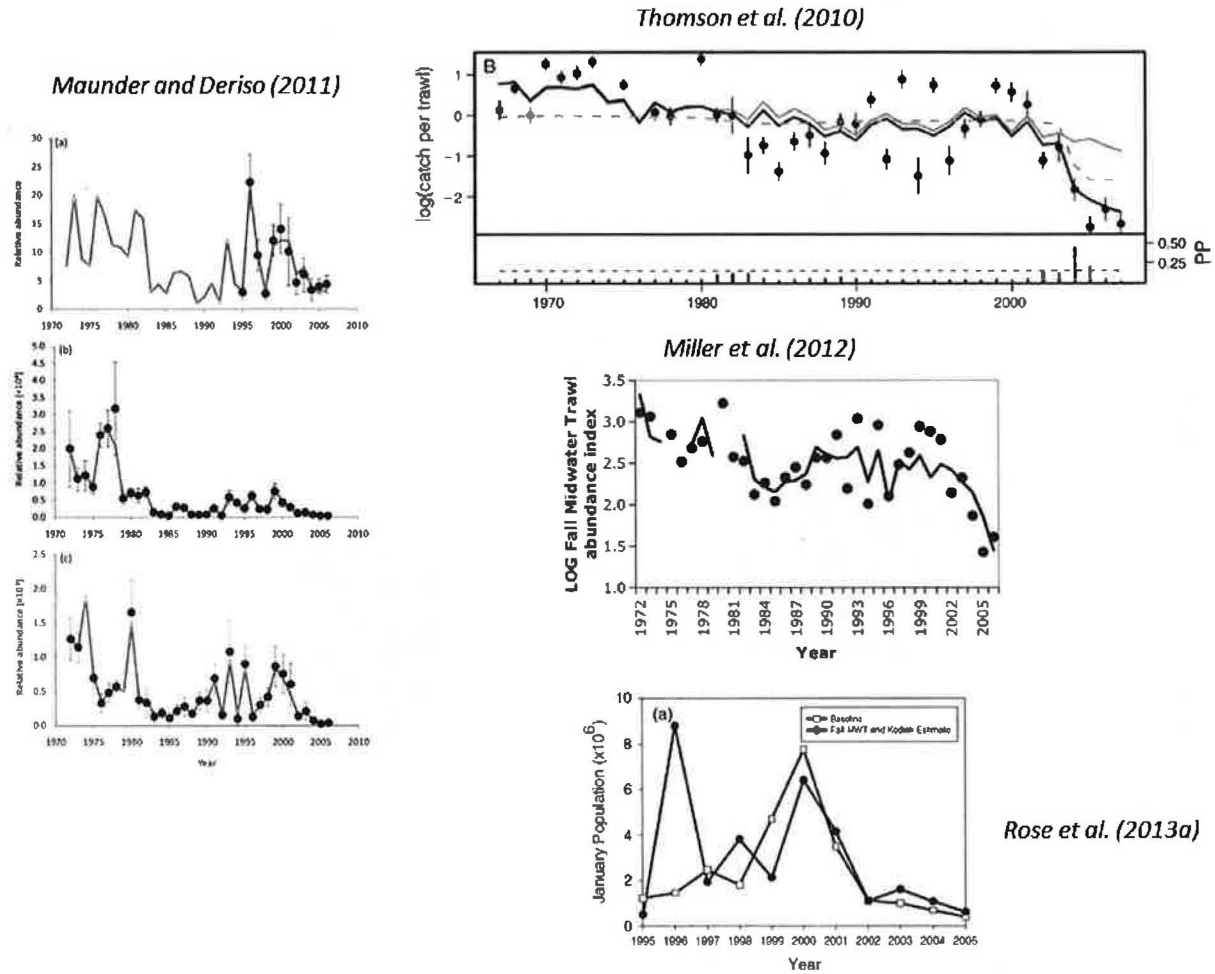

Figure 6. Examples of recent published model fits to time series of delta smelt relative abundance data. The source of each is referenced above or alongside each time series. In each plot, observed catches are depicted as black dots and model predictions of the data as gray or black lines. Model predictions from Rose *et al.* (2013a) are a black line with open symbols. In Maunder and Deriso (2011), the three panels represent the 20-mm Survey, summer TNS, and FMWT Survey from top to bottom, respectively. The other three studies are fit to estimates of adult delta smelt relative abundance (FMWT catch in Thomson *et al.* 2010 and the FMWT index in Miller *et al.* 2012) or absolute abundance (Rose *et al.* 2013a). See each study for further details on Methods, Results, and the authors' interpretations of their results.

Habitat and Distribution

Because the delta smelt only lives in part of one comprehensively monitored estuary, its general distribution is well understood (Moyle *et al.* 1992; Bennett 2005; Hobbs *et al.* 2006, 2007; Feyrer *et al.* 2007; Nobriga *et al.* 2008; Kimmerer *et al.* 2009; Merz *et al.* 2011; Murphy and Hamilton 2013; Sommer and Mejia 2013). There are both location-based (*e.g.*, Sacramento River around Decker Island) and conditions-based (low-salinity zone) habitats that delta smelt permanently occupy. There are habitats that delta smelt occupy seasonally (*e.g.*, for spawning), and there are habitats that delta smelt occupy transiently, which we define here as occasional seasonal use. These include distribution extremes from which delta smelt are not collected every year or even in most years.

Most delta smelt complete their entire life cycle within or immediately upstream of the estuary's low-salinity zone. The low-salinity zone is frequently defined as waters with a salinity range of about 0.5 to 6 parts per thousand (ppt) (Kimmerer 2004). The 0.5 to 6 ppt and similar salinity ranges reported by different authors were chosen based on analyses of historical peaks in phytoplankton and zooplankton abundance, but recent physiological and molecular biological research has indicated that the salinities that typify the low-salinity zone are also optimal for delta smelt (Komoroske *et al.* 2016). The low-salinity zone is a dynamic habitat with size and location that respond rapidly to changes in tidal and river flows. By local convention the location of the low-salinity zone is described as "X2" in terms of the distance from the 2 ppt isohaline to the Golden Gate Bridge. The U.S. Environmental Protection Agency (EPA) recently finished a comprehensive set of maps that show how the low-salinity zone changes in size and shape when freshwater flows change the location of X2[2]. The low-salinity zone expands and moves downstream when river flows into the estuary are high, placing low-salinity water over a larger and more diverse set of nominal habitat types than occurs under low flow conditions. During periods of low outflow, the low-salinity zone contracts and moves upstream. Due to its historical importance as a fish nursery habitat, there is a long research history into the physics and biology of the San Francisco Estuary's low-salinity zone (Kimmerer 2004).

The ecological function of the low-salinity zone also varies depending mainly on freshwater flow (Jassby *et al.* 1995; Kimmerer 2002a; Kimmerer 2004). Low outflow can decrease the capacity of the low-salinity zone and adjacent habitats to support the production of delta smelt by reducing habitat diversity and concentrating the fish with their predators and competitors (Service 1993, 1994). During the past four decades, the low-salinity zone ecosystem has undergone substantial changes in turbidity (Schoellhamer 2011) and food web function (Winder and Jassby 2011) that cannot be undone solely by increasing Delta outflow. These habitat changes, which extend into parts of the Delta where water is fresher than 0.5 ppt, have also decreased the ability of the low-salinity zone and adjacent habitats to support the production of delta smelt (Thomson *et al.* 2010; Rose *et al.* 2013b; IEP 2015).

Delta smelt have been observed as far west as San Francisco Bay, as far north as Knights Landing on the Sacramento River, as far east as Woodbridge on the Mokelumne River and

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[2]http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_Delta/docs/cmnt081712/karen_schwinn.pdf

Stockton on the Calaveras River, and as far south as Mossdale on the San Joaquin River. This distribution represents a range of salinity from essentially zero ppt up to about 20 ppt, which represents a salinity range well beyond definitions of the low salinity zone or mixing zone near a salinity of 2 ppt emphasized in the critical habitat rule (Service 1994). It is also well beyond the geographic extent of the critical habitat rule (described below). However, most delta smelt that have been collected in the extensively surveyed San Francisco Estuary have been collected from locations within the bounds defined in the critical habitat rule. In addition, all habitats known to be occupied year-around by delta smelt occur within the bounds defined in the critical habitat rule.

Delta smelt permanently occupy the Cache Slough 'Complex', including Liberty Island and the adjacent reach of the Sacramento Deepwater Shipping Channel (Sommer and Mejia 2013), Cache Slough to its confluence with the Sacramento River and the Sacramento River from that confluence downstream to Chipps Island, Honker Bay, and the eastern part of Montezuma Slough (Figure 7). The reasons delta smelt are believed to permanently occupy this part of the estuary are the year-round presence of fresh- to low-salinity water that is comparatively turbid and of a tolerable water temperature. These appropriate water quality conditions overlap an underwater landscape featuring variation in depth, tidal current velocities, edge habitats, and food production (Sweetnam 1999; Nobriga *et al.* 2008; Feyrer *et al.* 2011; Murphy and Hamilton 2013; Hammock *et al.* 2015; Bever *et al.* 2016). Field observations are increasingly supported by laboratory research that explains how delta smelt respond physiologically to variation in salinity, turbidity, water temperature, and other aspects of their habitat that can vary with changes in climate, freshwater flow and estuarine bathymetry (Hasenbein *et al.* 2014; 2016; Komoroske *et al.* 2014; 2016).

Each year, the distribution of delta smelt seasonally expands when adults disperse in response to winter flow increases that also coincide with seasonal increases in turbidity and decreases in water temperature (Figure 12). The annual range expansion of adult delta smelt extends up the Sacramento River to about Garcia Bend in the Pocket neighborhood of Sacramento, up the San Joaquin River from Antioch to areas near Stockton, up the lower Mokelumne River system, and west throughout Suisun Bay and Suisun Marsh. Some delta smelt seasonally and transiently occupy Old and Middle river in the south Delta each year, but face a high risk of entrainment when they do (Grimaldo *et al.* 2009).

The distribution of delta smelt occasionally expands beyond this area (Figure 6). For instance, during high outflow winters, adult delta smelt also disperse west into San Pablo Bay and up into the Napa River (Hobbs *et al.* 2007). Similarly, delta smelt have occasionally been reported from the Sacramento River north of Garcia Bend up to Knights Landing (*e.g.,* Merz *et al.* 2011; Vincik and Julienne 2012).

The expanded adult distribution initially affects the distribution of the next generation because delta smelt eggs are adhesive and not believed to be highly mobile once they are spawned. The distribution of larvae reflects a combination of where spawning occurred and freshwater flow conditions when the eggs hatched. Variation in Delta outflow affects the spatial distribution of the delta smelt population for most of its life. The ecological condition of the estuary's low-salinity zone has historically been indexed using a statistic called X2, a local name for the geographic location of 2 ppt salinity near the bottom of the water column (Jassby *et al.* 1995). During spring, larval delta smelt have centers of distribution in freshwater, typically 20-40 km upstream of X2 (Dege and Brown 2004). By July, as water temperatures in the Delta reach annual peaks, post-larval and juvenile delta smelt have centers of distribution very close to X2 (Dege and Brown 2004), but the fish are broadly distributed around that peak (Sweetnam 1999; Nobriga *et al.* 2008). During the fall, subadult delta smelt still have a center of distribution near X2 (Sommer *et al.* 2011), and remain broadly distributed around that peak (Feyrer *et al.* 2007; 2011). During the winter, maturing adult delta smelt disperse in connection with winter storms following the spread of turbid freshwater (Grimaldo *et al.* 2009; Sommer *et al.* 2011; Murphy and Hamilton 2013). Recent analyses suggest that after an initial dispersal in December, the

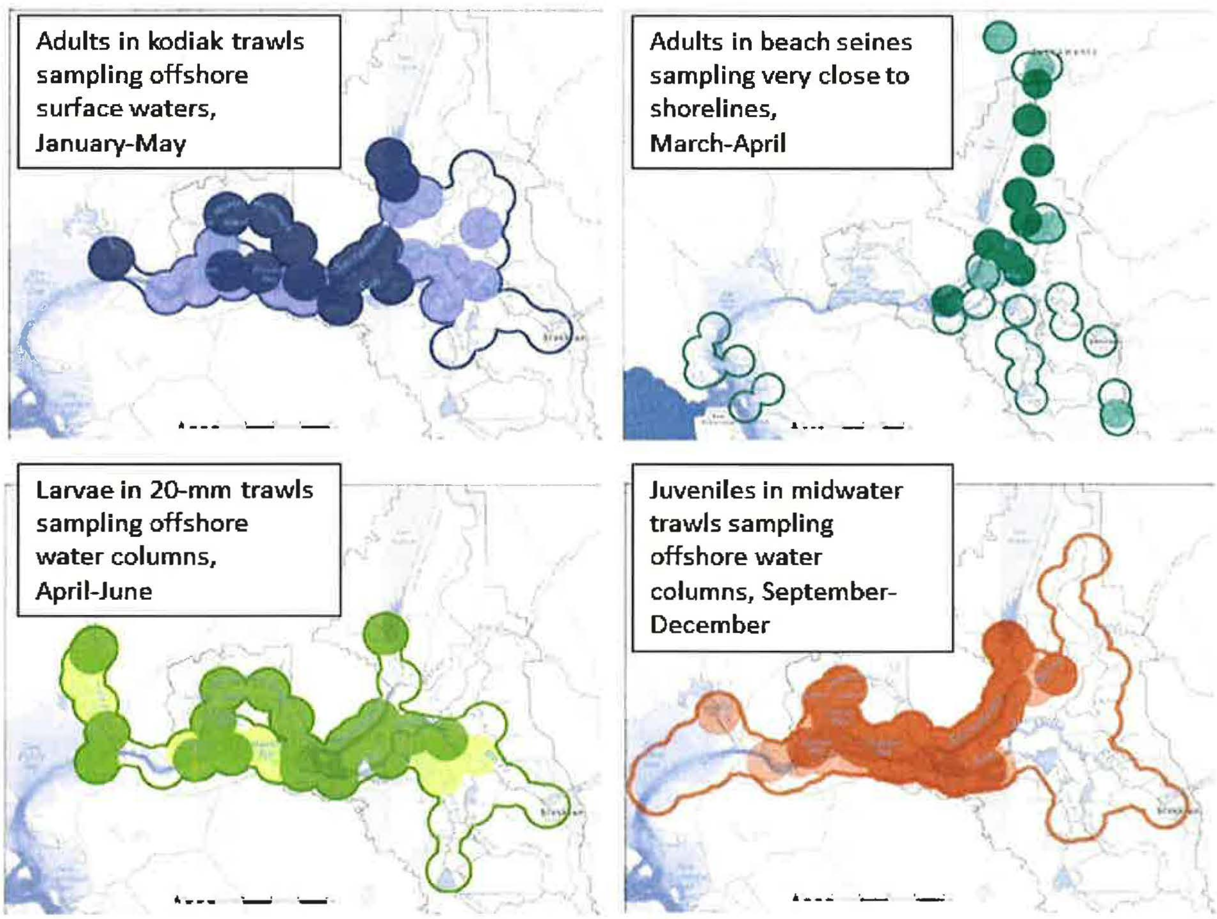

Figure 7. Maps of multi-year average distributions of delta smelt collected in four monitoring programs. The sampling regions covered by each survey are outlined. The areas with dark shading surround sampling stations in which 90 percent of the delta smelt collections occurred, the areas with light shading surround sampling stations in which the next 9 percent of delta smelt collections occurred. Source: Murphy and Hamilton (2013).

adult delta smelt population does not respond strongly to variation in Delta outflow during January to May (Polansky *et al.* 2017), though some individuals continue to move around in response to flow changes associated with storms (Polansky, unpublished analysis of Early Warning Survey data set).

Food

At all life stages, numerous small planktonic crustaceans, especially a group called calanoid copepods, make up most of the delta smelt diet (Nobriga 2002; Slater and Baxter 2014). Small crustaceans are ubiquitously distributed throughout the estuary, but which prey species are present at particular times and locations has changed dramatically over time (Winder and Jassby 2011; Kratina *et al.* 2014). This has likely affected delta smelt feeding success, particularly during Central California's warm summers.

Reproductive Strategy

The reproductive behavior of delta smelt is only known from captive specimens spawned in artificial environments and most of the information has never been published. Spawning likely occurs mainly at night with several males attending a female that broadcasts her eggs onto bottom substrate (Bennett 2005). Although preferred spawning substrate is unknown, spawning habits of delta smelt's closest relative, the surf smelt (*Hypomesus pretiosus*), as well as unpublished experimental trials, suggest that sand may be the preferred substrate (Bennett 2005). Hatching success peaks at temperatures of 15-16°C (59-61°F) and decreases at cooler and warmer temperatures. Hatching success nears zero percent as water temperatures exceed 20°C (68°F) (Bennett 2005). Water temperatures suitable for spawning occur most frequently during the months of March-May, but ripe female delta smelt have been observed as early as January and larvae have been collected as late as July. Delta smelt spawn in the estuary and have one spawning season for each generation, which makes the timing and duration of the spawning season important every year. As stated above, delta smelt are believed to spawn on sandy substrates in fresh and possibly low-salinity water (Bennett 2005). Therefore, freshwater flow affects how much of the estuary is available for delta smelt to spawn (Hobbs *et al.* 2007).

Delta smelt can start spawning when water temperatures reach about 10°C (50°F) and can continue until temperatures reach about 20°C (Bennett 2005). The ideal spawning condition occurs when water temperatures remain cool throughout the spring (*e.g.*, March-May). Few delta smelt ≤ 55 mm in length are sexually mature and 50% of delta smelt reach sexual maturity at 60 to 65 mm in length (Rose *et al.* 2013b). Thus, if water temperatures rise much above 10°C in the winter, the "spawning season" can start before most individuals are mature enough to actually spawn. If temperatures continue to warm rapidly toward 20°C in early spring, that can end the spawning season with only a small fraction of 'adult' fish having had an opportunity to spawn. Delta smelt were initially believed to spawn only once before dying (Moyle *et al.* 1992). It has since been confirmed that like many other ecologically similar forage fishes (Winemiller and Rose 1992), individual delta smelt can spawn more than once if water temperatures remain suitable for a sufficient length of time, and if the adults find enough food to support the production of another batch of eggs (Lindberg *et al.* 2013; Kurobe *et al.* 2016). As a result, the longer water temperatures remain cool, the more fish have time to mature and the more times individual fish can spawn.

Although adult delta smelt can spawn more than once, mortality is high during the spawning season and most adults die by May (Polansky *et al.* 2017). The egg stage averages about 10 days before the embryos hatch into larvae. The larval stage averages about 30 days. Metamorphosing "post-larvae" appear in monitoring surveys from April into July of most years. By July, most delta smelt have reached the juvenile life stage. Delta smelt collected during the fall are called "subadults", a stage which lasts until winter when fish disperse toward spawning habitats. This winter dispersal usually precedes sexual maturity (Sommer *et al.* 2011).

Recovery and Management

Following Moyle *et al.* (1992), the Service (1993) indicated that SWP and CVP exports were the primary factors contributing to the decline of delta smelt due to entrainment of larvae and juveniles and the effects of low flow on the location and function of the estuary mixing zone (now called the low-salinity zone). In addition, prolonged drought during 1987-1992, in-Delta water diversions, reduction in food supplies by nonindigenous aquatic species, specifically overbite clam and nonnative copepods, and toxicity due to agricultural and industrial chemicals were also factors considered to be threatening the delta smelt. In the 2008 Service biological opinion on the CVP and SWP operations (2018 Service BiOP), the Service's Reasonable and Prudent Alternative required protection of delta smelt from entrainment in December through June and augmentation of Delta outflow during the fall of Wet or Above-Normal years as classified by the State of California (Service 2008). The expansion of entrainment protection for delta smelt in the 2008 Service BiOp was in response to large increases in juvenile and adult salvage in the early 2000s (Kimmerer 2008). The fall X2 requirement was in response to increased fall exports that had resulted in greatly reduced variability in Delta outflow during the fall months (Feyrer *et al.* 2011).

Consistent with the 2008 Service BiOp, the Service's (2010c) recommendation to uplist delta smelt from threatened to endangered included reservoir operations and water diversions upstream of the estuary as mechanisms interacting with exports to restrict the low-salinity zone and concentrate delta smelt with competing fish species. In addition, Brazilian waterweed (*Egeria densa*) and increasing water transparency were considered new detrimental habitat changes. Predation was considered a low-level threat linked to increasing waterweed abundance and increasing water transparency. Additional threats considered potentially significant by the Service in 2010 were entrainment into power plant diversions, contaminants, and reproductive problems that can stem from small population sizes. Conservation recommendations included: establish Delta outflows proportionate to unimpaired flows to set outflow targets as fractions of runoff in the Central Valley watersheds; minimize reverse flows in Old and Middle river; and, establish a genetic management plan with the goals of minimizing the loss of genetic diversity and limiting risk of extinction caused by unpredictable catastrophic events. The Service (2012b) added climate change to the list of threats to the delta smelt.

Continued protection of the delta smelt from excessive entrainment, improving the estuary's flow regime, suppression of nonnative species, increasing zooplankton abundance, and improving water quality are among the actions needed to recover the delta smelt.

Climate Change

Climate projections for the San Francisco Bay-Delta and its watershed indicate that temperature and precipitation changes will diminish snowpack in the Sierra-Nevada, changing the timing and availability of natural water supplies (Knowles and Cayan 2002; Dettinger 2005). Warming may result in more precipitation falling as rain which will mean less water stored in spring snowpacks. This would increase the frequency of rain-on-snow events and increase winter runoff with an associated decrease in runoff for the remainder of the year (Hayhoe *et al.* 2004). Overall, these and other storm track changes may lead to increased frequency of flood and drought cycles during the 21st century (Dettinger *et al.* 2015). Thus far, the 21st century has been substantially drier than the 20th century (Figure 8) to which the frequency of WY type classifications are compared.

Sea level rise is also anticipated as a consequence of a warming global climate and if it is not mitigated, sea level rise will likely influence saltwater intrusion into the Bay-Delta. Salinity within the northern San Francisco Bay is projected to rise by 4.5 ppt by the end of the century (Cloern *et al.* 2011). Elevated salinity could push X2 further eastward in the estuary if outflows are not increased to compensate. Fall X2 mean values are projected to increase by about 7 km to the area near the City of Antioch approximately 90 km from the Golden Gate Bridge by 2100 (Brown *et al.* 2013). This projected change in the location of X2 in the fall is expected to decrease suitable physical habitat if current levees and channel structures are maintained.

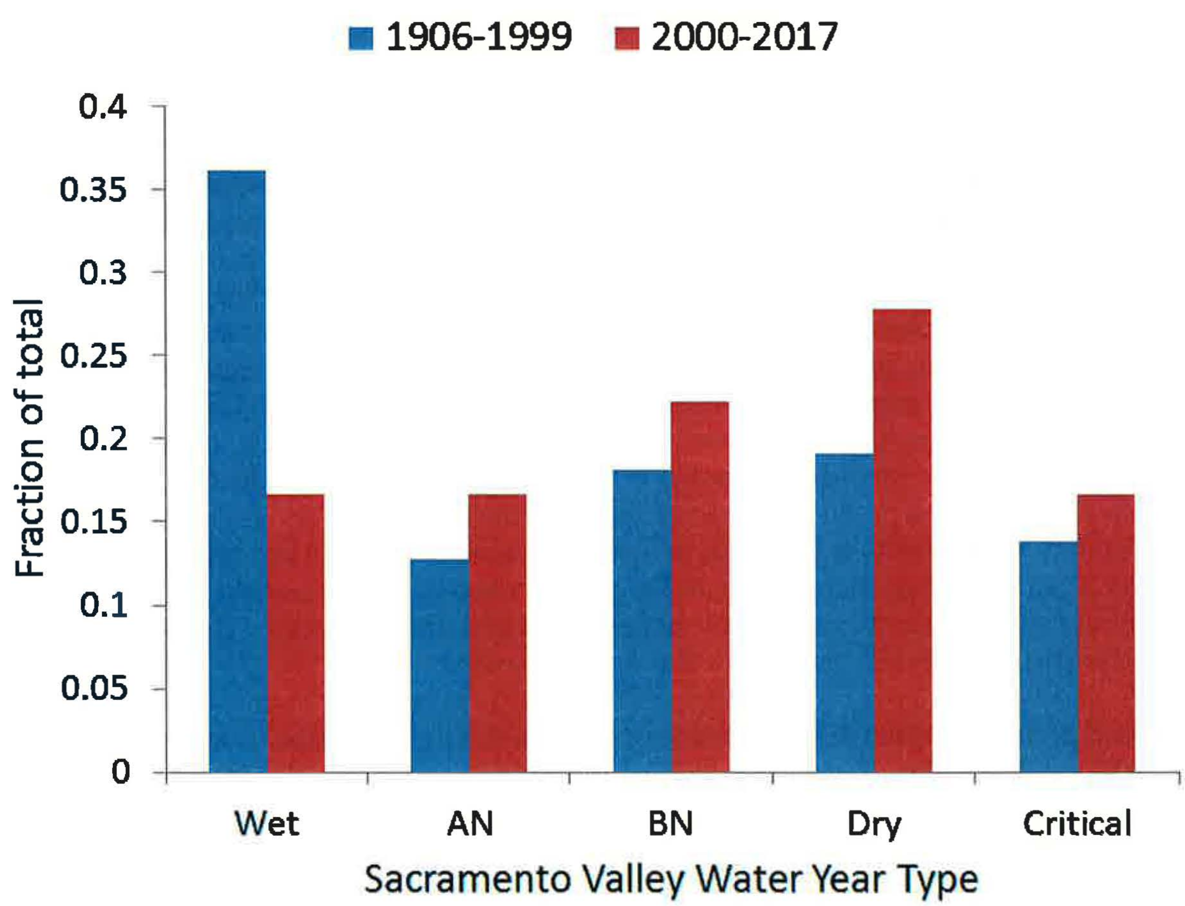

Figure 8. Frequency distribution of Sacramento Valley WY types for: blue=1906-1999 and red=2000-2017.

Central California's warm summers are already a source of energetic stress for delta smelt and warm springs already severely compress the duration of their spawning season (Rose et al. 2013a,b). Central California's climate is anticipated to get warmer (Dettinger 2005). We expect Warmer estuary temperatures to present a significant conservation challenge for delta smelt. Mean annual water temperatures within the Delta are expected to increase steadily during the second half of this century (Cloern *et al.* 2011). Warmer water temperatures could further reduce delta smelts pawning opportunities, decrease juvenile growth during the warmest months, an increase mortality via several food web pathways including: increased vulnerability to predators, increased vulnerability to toxins, and decreased capacity for delta smelt to successfully compete in an estuary that is energetically more optimal for warm-water tolerant fishes.

Recent research into the ecological effects of warming water temperatures suggests that delta smelt, depending on location, may be forced to spawn an average of ten to twenty-five days earlier in the season (Brown *et al.* 2013). The number of high mortality days (cumulative number of days of daily average water temperature >25°C (77°F) is expected to increase (Brown *et al.* 2013). The number of physiologically stressful days (cumulative number of days of daily average water temperature >20°C (68°F) is expected to be stable or decrease partly because many stressful days will become high mortality days. Thus, current modeling indicates that delta smelt will likely face a shorter maturation window and reduced habitat availability due to increased water temperatures. A shorter maturation window will likely have effects on reproduction (Brown *et al.* 2013). Growth rates have been shown to slow as water temperatures increase above 20°C (68°F), requiring delta smelt to consume more food to reach growth rates that are normal at lower water temperatures (Rose *et al.* 2013a). Delta smelt are smaller, on average, than in the past (Sweetnam 1999; Bennett 2005) and expected temperature increases due to climate change will likely slow growth rates further.

In summary, the delta smelt is currently at the southern limit of the inland distribution of the family Osmeridae along the Pacific coast of North America. Thus, increased temperatures associated with climate change may present a significant conservation challenge if they result in a Bay-Delta that is outside of the delta smelt's competitive limits. For the time being however, water temperatures are cool enough in the delta smelt's range for the species to complete its life cycle.

Summary of the Status of Delta Smelt

The relative abundance of delta smelt has reached very low numbers for a small forage fish in an ecosystem the size of the San Francisco Estuary. The extremely low recent relative abundance reflects decades of habitat change and marginalization by non-native species that prey on and out-compete delta smelt. The anticipated effects of climate change on the San Francisco Estuary and watershed such as warmer water temperatures, greater salinity intrusion, lower snowpack contribution to spring outflows from the Delta, and the potential for frequent extreme drought, which has been experienced for the 21st century thus far (Figure 10) indicate challenges to delta smelt survival will increase. A rebound in relative abundance during the very wet and cool conditions during 2011 indicated that delta smelt retained some population resilience (IEP 2015).

However, since 2012, declines to record low population estimates have been broadly associated with the remarkably dry hydrology occurring from 2012 to 2016.

Status of Delta Smelt Critical Habitat

The Service designated critical habitat for delta smelt on December 19, 1994 (Service 1994). The geographic area encompassed by the designation includes all water and all submerged lands below ordinary high water and the entire water column bounded by and contained in Suisun Bay (including the contiguous Grizzly and Honker Bays); the length of Goodyear, Suisun, Cutoff, First Mallard (Spring Branch), and Montezuma sloughs; and the existing contiguous waters contained within the legal Delta (as defined in section 12220 of the California Water Code). The Primary Constituent Elements (PCEs) are physical habitat (PCE #1), water (PCE #2), river flow (PCE #3), and salinity (PCE #4).

Status of the Giant Garter Snake

The Service published a proposal to list the GGS as an endangered species on December 27, 1991 (56 FR 67046). Critical habitat has not been designated for this species. The Service reevaluated the status of the GGS before adopting the final rule, and it was listed as a threatened species on October 20, 1993 (58 FR 54053). A Recovery Plan was proposed for the GGS on July 2, 1999 (Service 1999), which was later revised (Service 2015) and recently finalized (Service 2017). In the Recovery Plan for the species, the recovery strategy focuses on protecting existing occupied habitat, identifying and protecting areas for restoring habitat, and providing connectivity between populations (Service 2017). A 5-year review was conducted in 2006 where no change of status was recommended (Service 2006). An additional 5-year review was conducted in 2012 where no change of status was recommended (Service 2012). According to Halstead et al. (2015), habitat quality plays a central role in the population ecology of this species, depending on factors like refuge and prey availability, vegetation type and density, and scouring floods. Please refer to the 2017 Recovery Plan for the species' description, habitat preference, and life history.

Habitat Loss

Historical records suggest that the GGS inhabited freshwater marshes, streams, and wetlands along with their adjacent associated upland habitats throughout the length of the Sacramento and San Joaquin valleys in Central California. Today only about 5 percent of its historical wetland/upland habitat acreage remains. Nine populations were recognized in the Revised Draft Recovery Plan following an update of the thirteen populations described in the original listing. This change is based on recent surveys, which indicate that two populations were extirpated, and on genetic research, which lead to the grouping together of some of the previously described populations.

The loss and subsequent fragmentation of habitat is the primary threat to the GGS throughout the Central Valley of California. Habitat loss has occurred from urban expansion, agricultural conversion, and flood control. Habitat fragmentation has ultimately resulted in the GGS being extirpated from the southern one-third of its range in the San Joaquin Valley.

Other Threats

In addition to large landscape level habitat conversion, the Sacramento/ San Joaquin Delta populations of the GGS are subject to a number of other existing and potential threats which include roads and vehicular traffic, climate change, and predation by non-native species. The recovery strategy is primarily focused on protecting existing, occupied habitat and identifying and protecting areas for habitat restoration, enhancement, or creation including areas that are needed to provide connectivity between populations. This strategy ultimately supports the recovery goal of establishing and protecting self-sustaining populations of the GGS throughout the full ecological, geographical, and genetic range of the species.

Climate change has been linked to increases in the frequency and intensity of weather events, such as heat waves, droughts, and storms (Lenihan *et al.* 2003; California Climate Action Team 2006; IPCC 2007). Extreme events, in turn may cause mass mortality of individuals (by affecting habitat or ecosystem characteristics, for example) and significantly contribute to determining which species will remain or occur in natural habitats (Whitfield *et al.* 2007). As California's average temperature and precipitation change, species ranges tied to climate dependent habitats are moving northward and upward, but in the future, range contractions are more likely than simple northward or upslope shifts (Loarie *et al.* 2008, 2009). Research has already revealed correlations between climate warming and declines in amphibians and reptiles in different parts of the world (Whitfield *et al.* 2007; McMenamin *et al.* 2008; Mitchell *et al.* 2008; Huey *et al.* 2010).

The GGS is considered a semi-aquatic species and due to its habitat preferences, giant garter snake is subject to the detrimental effects of floods and drought. This is likely to be exacerbated with the increase in frequency and intensity of flood and drought events due to climate change. GGS may be displaced during a flood, buried by debris, exposed to predators, and subject to drowning when burrows and over-wintering sites become inundated with water. GGS are not known to occupy the area within the Sutter Bypass which is flooded regularly (Wylie *et al.* 2005); although snakes are known to occupy the Yolo Bypass during the active season when flooding is unlikely (E. Hansen 2009). GGS appear to survive at least some inundation of their burrows. Wylie observed GGS emerging from burrows after a period of inundation (G. Wylie, U.S. Geological Survey, personal communication).

Because of the GGS's dependence upon permanent wetlands, water availability will play a significant role in its survival and recovery. In a state where much of the wetland habitat is maintained by managed water regimes, the lack of sufficient water supply may preclude consistent and timely delivery of water to sustain suitable habitat for GGS. Drought conditions place additional strains on the water allocation system. Where populations currently persist on only marginal habitat, emergent drought or higher temperature conditions are likely to result in high rates of mortality in the short term with the effects of low fecundity and survivorship persisting after the drought has ceased (McMenamin *et al.* 2008; Mitchell *et al.* 2008). It is unknown how quickly GGS populations may rebound after severe climatic conditions, particularly since these conditions might further exacerbate the impact from existing threats to GGS, such as habitat loss and fragmentation, and small, isolated populations. GGS as a species has survived recorded historic droughts, but presumably under conditions where fewer cumulative threats existed.

Environmental Baseline in the Action Area

Delta Smelt

The action area of the proposed project includes tidal waterways of the Delta that are wholly within critical habitat for the species. Delta smelt is an estuarine fish species whose distribution is entirely within the Sacramento San Joaquin Delta, but it moves within this area seasonally, migrating east and upstream in the winter and early spring months, with spawning occurring during April through mid-May. Larval smelt move west in the spring and summer and rear in the low salinity zone. Shallow open subtidal waters within this low salinity zone have characteristic higher turbidity and food organism density needed for the successful rearing and growth of delta smelt. Big Break, the focus of the action area, is one such shallow open water area that occupies a position in the Delta that is used or potentially used at all times of the year by delta smelt. It is located roughly in the center of the low salinity zone, near major open waters of Suisun Bay immediately to the west, and is along the mainstem San Joaquin River close to its confluence with the Sacramento River. This low salinity zone is known to vary in position and extent depending on water year type and water management, however, Big Break is regularly within that zone under most conditions and as such is considered delta smelt habitat year round. The BA did not discuss threat factors specific to Big Break, however, this location has a reputation as a bass fishery (black bass and striped bass) and for the presence of Brazilian waterweed. Bass can prey on delta smelt, and Brazilian waterweed can have an indirect adverse effect on delta smelt by reducing turbidity. Hence, while Big Break is critical habitat for delta smelt, it is not considered the best quality habitat.

With the exception of 2015, an extremely dry and warm year with very low abundance and limited distribution of smelt, delta smelt have been detected at sampling stations in the general vicinity of the project area in most years (i.e., adult smelt in the Spring Kodiak Trawl Surveys and larval smelt in the Fall Midwater Trawl Surveys, conducted by the California Department of Fish and Wildlife). Although the species may sometimes by absent from particular stations nearest to Big Break, the distribution of smelt in the sampling area when considering all stations indicates that delta smelt occur throughout the year in the action area. Because of the presence of the PCEs needed for delta smelt, the location of the project area within critical habitat, and consistency of presence in sampling, we conclude that delta smelt are present in the action area.

Giant Garter Snake

The project is located in the western Delta. The population status of GGS in and around the project area is largely unknown. A large portion of the Sacramento-San Joaquin Delta area has not been comprehensively surveyed for GGS, primarily because the majority of land is privately owned and sightings within the last 10 years have been random and sporadic.

Most information on the status of the snake comes from work on agricultural and managed refuge lands in the Sacramento Valley, however, the snake apparently is capable of long distance dispersal to the Delta and may be reproducing there. Ideal aquatic habitat for giant garter snake includes, among other factors, absence of large predatory fish and absence of recurrent flooding (or where flooding is probable, the nearby presence of upland refugia), features not characteristic of the immediate vicinity of Big Break. It is nevertheless believed that historical Delta wetlands were suitable for giant garter snakes and that they historically occupied the Delta. The recovery plan designated a Delta Basin unit, which includes the action area for this project, as one of nine recovery units for the species

A few snakes have been documented more recently on lands near major waterways in the western Delta including: the Sacramento River (Sherman Island); Frank's Tract (Webb Island); Twitchell, Jersey and Bradford Islands; and the San Joaquin River (Little Venice Island). In the Little Venice Island sighting in 1996, several snakes were seen, including one which moved into riprap. The Jersey Island record, nearest to the project area and most recent (2017), involved seven snakes basking on riprap shoreline seen on two consecutive days, and collection of ten snake skin sheds in the vicinity. Recent photographs of the remnant levee in the project area indicate the presence of both marsh and upland vegetation, and aerial images show what appears may be some non-tidal water within the remnant levee, so that all habitat components sufficient to support the snake may be present in that location. The distribution of the snake and range of habitat types in which it has been observed, including records near the project area, lead us to conclude that the snake is present in the project area.

Effects of the Proposed Action

Delta smelt

For the purposes of this consultation, Shallow Water Habitat (SWH) - that habitat which is assumed to be used by delta smelt and for which direct effects may occur - is bounded by an upper limit at Mean High Water (MHW), and a lower limit 3 meters below MLLW. Under current conditions and without the project, the entirety of the 340 acres of Big Break is within this SWH zone, and is considered usable by delta smelt. With the project, with dredged material placement and planting, these depths would be reduced; about 90 acres would become vegetated, and the remainder (250 acre) would be initially unvegetated and shallower. Additionally, the mounds would be overfilled to allow for settling and spreading, so that approximately 20% of the mound would be above MHW and a small amount above MHHW. This would settle, with a small portion, perhaps a few percent of the area, remaining above MHW. Over time, accretion of organic matter and sediment could increase the proportion above MHW. Delta smelt typically use open, subtidal waters. Therefore, elevating the surface and allowing for vegetation on a portion of that surface would incrementally reduce the aerial extent and change the quality of SWH that may be occupied by delta smelt. However, this SWH and the region as a whole has limited diversity and productivity due to the historic loss of tidal marshes, past subsidence, and uniform depth. As explained further below, we expect the proposed project to result in a net benefit to delta smelt and other fish species, offsetting any losses in SWH.

Temporary effects on delta smelt could occur during actions in SWH, during placement of dredged material placement and submerged section of pipeline, and if adjustment to the mound elevation is needed by adaptive management. Any delta smelt present would likely at least be displaced during the placement activities, which involves a point of release and initial creation of sand mounds, each about 1.6 acre in area. Delta smelt could be injured or killed by the falling sediment, although this effect would be very localized.

Noise would be created by the pumps and generators associated with dredged material placement, and by the sound of material moving through the pipeline. As noted in the supplemental smelt analysis provided by the Corps (*see* Consultation History), this noise would not be at a level or frequency that could cause injury to any fish. Because dredging and dredged material placement could occur at night, light associated with these activities may modestly affect fish including delta smelt, perhaps attracting them towards the release point of dredged material. Both noise and light effects, if they occur, would be very limited in spatial extent at any one time (~2 acres). The duration of temporary effects during initial construction would total 150 days in 15+ day increments over about 10 years. The effect of adaptive management actions cannot be easily quantified, but probably would be on the order of 2-5 acres of surface reshaping of recently created mound habitat during the first 3-5 years of construction. Beyond then, it is assumed that any adjustments in mound creation will have been made so that the remainder of the project can be constructed with minimal further need for physical disturbance from adaptive management.

Over time, the restored area with its mix of vegetated and unvegetated shallower waters and channels will provide a greater diversity of habitat depths, velocities, and vegetative cover, than is currently present in Big Break. This would provide additional edge habitat that could be used by smelt as spawning habitat or current refuge. The marsh vegetation, while not the traditional habitat type for smelt, would produce plant material in the form of vascular plants as well as attached algae and surface invertebrates. The organic matter from senescence of marsh vegetation and the food organisms are all subject to transport by tidal flows into the surrounding waters, where they would contribute to the food base for delta smelt and other fishes. Turbidity, a factor required by delta smelt, could be locally reduced by marsh vegetation attenuating wind-based resuspension or trapping some of these sediments on the marsh plain. Predators on small fish (including smelt) such as larger fish and wading birds, may concentrate in and around the restored marsh and channels and result in some loss of delta smelt. Non-native plants may accumulate, which could affect turbidity and water quality.

Over the course of construction, implementing the monitoring and adaptive management plan and any needed corrective measures or adjustments in design would serve to minimize unanticipated project impacts and maximize benefits. However, these corrective measures could themselves have temporary impacts, such as may occur if there were a need to recontour the mounds or channels, or remove or retreat vegetation. Based on the results demonstrating the successful use of dredged material for restoration at Donlan and Venice Cut Islands (Corps and Service 1990) we believe the likelihood of such success at Big Break is at least as high, if not better, because it is not surrounded by remnant levees that might limit tidal circulation. Overall, we conclude that any adverse effects on delta smelt would be temporary and limited in area, while the longer term net effect of the restoration on delta smelt would be beneficial.

<u>Delta smelt critical habitat</u>

The project is entirely located within designated critical habitat for delta smelt. There would be temporary adverse effects of turbidity on PCE #2 (Water), during dredged material placement. There would be permanent modification of PCE #1 (Physical Habitat), due to the depths being shallower with the placed dredged material, and portions of these surfaces planted with or becoming colonized by emergent marsh vegetation. Initially, each dredged material mound would have a portion of the surface above MHW, which would reduce the critical habitat. This material would settle within 10 months such that the surface is returned to being entirely or almost entirely below MHW. Over the long term, the surface is expected to accrete sediment and organic matter, which could again reduce the proportion below MHW. The project is not expected to have any adverse effect on PCE #3 (river flow) or PCE #4 (salinity).

<u>Giant garter snake</u>

Snakes could be harassed, injured, or killed, during construction of the project or implementation of adaptive management measures that involve further construction or disturbance. Basking snakes may be encountered by vehicles traveling on access roads. Snakes may be affected in the areas of ground disturbance, namely, the surfacing of the access road and placement of the pipeline across Jersey Island, and any non-native treatment/removal and replanting of the remnant levee. Resting snakes may hide beneath or in crevices of construction equipment or materials in staging areas. Implementing the proposed conservation measures, involving checking staging area equipment and materials, limiting road vehicle speed, and checking construction areas, should serve to minimize these effects.

The dredged material placement and plantings will create marsh in the tidal waters of Big Break. These would contain some, but not all, of the habitat characteristics typical of giant garter snake habitat studied in the Central Valley, although little is known about its habits in the Delta. The marsh would start in small amounts, much less than an acre per mound initially, with no upland habitat component of the type believed to be required by snakes (i.e., above MHHW), and separated from other mounds by several hundred feet of tidal open water. The nearest upland, the remnant levee, would also be separated from the marsh by 600 feet of open water, and is vegetated in a manner that may limit basking areas there. Over a longer period of time (years), the restored shallow water habitat mounds and spaces between them may accrete enough sediment to allow additional marsh vegetation to grow together into a larger block of marsh, which would be more likely to harbor giant garter snakes. By then, however, all potential construction and adaptive management actions would have been completed, and the effect on any giant garter snakes present would be beneficial by providing additional marsh habitat.

Cumulative Effects

Cumulative effects include the effects of future State, Tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. The Dutch Slough Tidal Restoration Project is another tidal restoration on 1,178 acres immediately adjacent to and southeast of the action area, involving creating a large area of tidal marsh and channel complex favored by native Delta species. Taken together, the proposed project and the Dutch Slough project would amplify the types of net benefits of tidal restoration described above.

Conclusion

After reviewing the current status of delta smelt and giant garter snake, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the proposed Delta Study is not likely to jeopardize the continued existence of these species. This conclusion is based on: (1) implementation of the conservation measures to minimize adverse effects on listed species during construction and adaptive management; (2) the effects of construction, in each year, are expected to be limited in area and duration; and (3) the project will result in more diverse and more productive wetland and channel habitat that will enhance the food web in the vicinity, including food organisms used by delta smelt and other pelagic fish species.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harass is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to a listed species by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding or sheltering. Harm is defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act, provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the Corps so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, for the exemption in section 7(o)(2) to apply. The Corps has a continuing duty to regulate the activity covered by this incidental take statement. If the Corps (1) fails to assume and implement the terms and conditions or (2) fails to require an applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to any permit or grant document related to the Delta Study, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Corps must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR §402.14(i)(3)].

Amount or Extent of Take

Delta Smelt

The Service expects that incidental take of delta smelt will be difficult to detect or quantify for the following reasons: the small size of adults and larvae, the difficulty of detecting delta smelt in their turbid aquatic habitat, very low densities of delta smelt, and the low likelihood of finding dead or impaired specimens. Due to the difficulty in quantifying the number of delta smelt that will be taken as a result of the proposed action, the number of acres of affected habitat becomes a surrogate for the species that will be taken. The expected footprint of each dredged material mound is a 300-foot diameter circle (1.6 acres). The pipeline outfall would be moved, then the process and effect would be repeated for the next mound. Over the 10-year construction period, there would be a total of 340 acres of restoration. Each year, there would also be a temporary disturbance buffer around each set of mounds which could have elevated levels of turbidity or associated factors, that might temporarily affect any delta smelt present. Our best professional opinion is that this disturbance buffer would be no more than 15% of the restored area in a given year, or about 5 acres per year. Adaptive management actions may result in some additional disturbance and take of smelt, including localized recontouring of surfaces with machinery, or replanting. The extent of these adaptive management actions cannot be precisely estimated; in this case - we assume it to total more than 10% of the area of restoration (34 acres) over the 13-year construction and monitoring period.

Therefore for the purposes of this opinion, we estimate the level of take of delta smelt associated with all construction and management activities will be in the form of harm, harass, or kill of all those delta smelt present in 425 acres of temporary disturbance (<1 acre for the submerged pipeline including disturbance buffer; 340 acres of dredged material placement for restoration; up to 50 acres for disturbance buffer around those areas of restoration; and 34 acres of subsequent adaptive management within the 340 acres of restoration). Low fish mortality is anticipated because of the current low abundance of smelt, the limited spatial extent of placement at any one time, and the proposed work window.

There could be a small increment of incidental injury or death of delta smelt during the various sampling activities for monitoring, and the placement of the submerged section of pipeline. Our best judgment is that the level of take in the form of harm, harass, or kill from these other associated activities would be no more than two (2) adult or larval delta smelt.

Delta Smelt Critical Habitat

There would be 340 acres of permanent change in PCE #1 (physical habitat; 340 acres of uniform subtidal open water made shallow so it forms 340 acres of marsh and channels). The amount of shallow water habitat, as defined by MHW, will be initially reduced due to overfilling, but this would return as the material settles. It would remain shallower than existing, but the area would be the same due to settlement, and the restored marsh is expected to increase the quality of the critical habitat. Over a longer period of time, the area may accrete sediment and organic matter, so an increasing proportion of the site is above MHW. The site is nevertheless expected to remain some form of tidal habitat with minimal uplands (i.e., above MHHW).

Giant Garter Snake

The Service anticipates that incidental take of the snake will be difficult to detect or quantify for the following reasons: snakes are cryptically colored, secretive, and known to be sensitive to human activities. Snakes may avoid detection by retreating to burrows, soil crevices, vegetation, and other cover. Individual snakes are difficult to detect unless they are observed undisturbed at a distance. Most close-range observations represent chance encounters that are difficult to predict. For the proposed project, we expect incidental take to be associated with (1) harassment, through disturbance associated with project actions; or (2) injury or death, due to direct contact with construction equipment or vehicles. It is not possible to make an accurate estimate of the number of snakes that will be harassed during construction activities, including in staging areas and roads carrying vehicular traffic. In instances when take is difficult to detect, the Service may estimate take in numbers of species per acre of habitat lost or degraded as a result of the action as a surrogate measure for quantifying individuals. We estimate the area of suitable upland snake habitat to be temporarily or permanently impacted to be 56 acres (up to 50 acres remnant levee non-native removal/replanting, 4.91 acres access road improvement, 0.09 acre pipeline placement across remnant levee, 1 acre staging area creation). Due to the difficulty in determining the number of snakes that will be taken in the form of harm and harass, the Service is quantifying take as 56 acres of suitable upland habitat that will be temporarily or permanently impacted by construction, adaptive management, or monitoring activities. Although there have been snake records near the action area, densities are believed to be low. Moreover, the proposed conservation measures of worker training and equipment inspection should reduce the potential for take. Based on these factors and our best judgment, the Service expects the level of take in the form of harm, harass, or kill to be no more than one (1) giant garter snake killed or injured by contact with construction equipment or motor vehicles during all project activities.

Effect of the Take

In the accompanying biological opinion, the Service determined that the level of anticipated take is not likely to result in jeopardy to the delta smelt or giant garter snake.

Reasonable and Prudent Measure

1. The Corps shall minimize the impact of take of delta smelt and giant garter snake.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the Corps must comply with, or ensure compliance with, the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These Terms and Conditions are nondiscretionary.

The following Terms and Conditions implement the Reasonable and Prudent Measures:

1. The Corps must prepare and submit to the Service for approval, a final Monitoring and Adaptive Management Plan. This plan will describe methods, sampling frequencies, and reporting schedule. Elements of this final plan will at least include: topography, water quality, vegetation, other food web measures (water column plankton; invertebrates on/in benthos and plant surfaces), monitoring of subtidal areas for non-natives (e.g., Brazilian waterweed, water hyacinth), quantities of listed species habitat affected, and adaptive management process. Plan reporting will cover each of the plan elements, and will describe any adaptive management actions taken during the monitoring year as well as adaptive management actions proposed for the following year. This plan must be approved by the Service in writing, prior to the onset of construction.

2. The Corps shall not use aquatic herbicides to control invasive aquatic species in the study area, and shall only use mechanical removal methods where such control is deemed necessary.

3. The Corps shall not plant any invasive or non-native species.

Reporting Requirements

In order to monitor whether the amount or extent of incidental take anticipated from implementation of the project is approached or exceeded, the Corps shall adhere to the following monitoring requirements. Should this anticipated amount or extent of incidental take be exceeded, the Corps must reinitiate formal consultation as per 50 CFR 402.16.

1. The Service must be notified within one (1) working day of the finding of any injured or dead listed species or any unanticipated damage to its habitat associated with the proposed project. Notification will be made to the Assistant Field Supervisor of the Endangered Species Program at the Bay Delta Fish and Wildlife Office at (916) 930-5604, and must include the date, time, and precise location of the individual/incident clearly indicated on a U.S. Geological Survey 7.5 minute quadrangle or other maps at a finer scale, as requested by the Service, and any other pertinent information. When an injured or dead individual of the listed species is found, the Corps (during construction) or the local sponsor (during maintenance) shall follow the steps outlined in the Disposition of Individuals Taken section below.

2. The Corps will document, monitor, and report the actual amount of take of listed species and listed species habitat for project construction in an annual monitoring report to be submitted within 240 days of completion of each year's dredged placement activities. This document will include a summary table of construction monitoring to verify that the monitoring extent and frequency are consistent with that proposed, the sightings of any listed species, and the current year and cumulative areas of disturbance of listed species habitat.

Disposition of Individuals Taken

Injured listed species must be cared for by a licensed veterinarian or other qualified person(s), such as the Service-approved biologist. Dead individuals must be sealed in a resealable plastic bag containing a paper with the date and time when the animal was found, the location where it was found, and the name of the person who found it, and the bag containing the specimen must be frozen in a freezer located in a secure site, until instructions are received from the Service regarding the disposition of the dead specimen. The Service contact persons are the Assistant Field Supervisor of the Endangered Species Program at the Bay Delta Fish and Wildlife Office at (916) 930-5604; and the Resident Agent-in-Charge of the Service's Office of Law Enforcement, 5622 Price Way, McClellan, California 95562, at (916) 569-8444.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The Service recommends the following actions:

1. Develop and implement restoration measures in areas designated in the Delta Fishes Recovery Plan (Service 1996) and the Giant Garter Snake Recovery Plan (Service 2017).

REINITIATION—CLOSING STATEMENT

This concludes formal consultation on the Delta Study. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; (4) a new species is listed or critical habitat designated that may be affected by the action; or (5) the status of the delta smelt changes. In instances where the amount or extent of incidental take is exceeded, any additional take will not be exempt from the prohibitions of section 9 of the Act, pending reinitiation.

If you have any questions regarding this biological opinion on the proposed Delta Study, please contact Steven Schoenberg of my staff at (916) 930-5672.

Sincerely,

Kaylee Allen
Field Supervisor

cc:

Anne Baker, Corps of Engineers, Sacramento, CA
Doug Hampton, National Marine Fisheries Service, Sacramento, CA

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