



DEPARTMENT OF THE ARMY  
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT  
1325 J STREET  
SACRAMENTO CA 95814-2922

May 20, 2022

Regulatory Division (SPK-1994-00393)

DMB Associates  
Attn: Mr. Nick Taratsas  
7600 East Doubletree Ranch Road, Suite 300  
Scottsdale, Arizona 85258-2137

Dear Mr. Taratsas:

We are enclosing with this letter a draft copy of the initially proffered Department of the Army Permit SPK-1994-00393. Please read the terms and conditions of this permit carefully. To accept this permit, please complete the following:

- a. Sign and date the permit. You should include your printed name and title. Your signature will indicate acceptance of all permit conditions.
- b. Mail a check or money order in the amount of \$100.00 made payable to FAO-USAED Sacramento.
- c. Return the signed permit to me, either via email or hard copy at the address below. Please note while the signed permit may be submitted by email, the check or money order must be sent by mail.

After we receive the above item(s), we will sign and return the fully executed permit to you. If you object to the terms or special conditions of this permit, please see the enclosed Notification of Appeal Options and Process (NAP) fact sheet and Request for Appeal (RFA) form.

Please refer to identification number SPK-1994-00393 in any correspondence concerning this project. If you have any questions, please contact me at 1325 J Street Room 1350, Sacramento, CA, 95814, by email at [erin.m.campbell@usace.army.mil](mailto:erin.m.campbell@usace.army.mil), or telephone at (916) 557-5263. For more information regarding our program, please visit our website at [www.spk.usace.army.mil/missions/regulatory.aspx](http://www.spk.usace.army.mil/missions/regulatory.aspx).

Sincerely,

Erin Campbell  
Senior Project Manager  
California Delta Section

Enclosures

cc: (w/o encls)

Mr. Joseph Morgan, U.S. EPA Region 9, [morgan.joseph@epamail.epa.gov](mailto:morgan.joseph@epamail.epa.gov)

National Marine Fisheries Service, [ccvo.consultationrequests@noaa.gov](mailto:ccvo.consultationrequests@noaa.gov)

U.S. Fish and Wildlife Service, [kim\\_squires@fws.gov](mailto:kim_squires@fws.gov)

Ms. Stephanie Tadlock, Central Valley Regional Water Quality Control Board,  
[stephanie.tadlock@waterboards.ca.gov](mailto:stephanie.tadlock@waterboards.ca.gov)

Mr. Christopher Waterson, Glenn Lukos Associates Inc,  
[cwaterston@wetlandpermitting.com](mailto:cwaterston@wetlandpermitting.com)

## NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL

Applicant: DMB Associates, Attn: Mr. Nick Taratsas	File No.: SPK-1994-00393	Date: May 20, 2022
Attached is:		See Section below
→	INITIAL PROFFERED PERMIT (Standard Permit or Letter of permission)	A
	PROFFERED PERMIT (Standard Permit or Letter of permission)	B
	PERMIT DENIAL	C
	APPROVED JURISDICTIONAL DETERMINATION	D
	PRELIMINARY JURISDICTIONAL DETERMINATION	E

**SECTION I** - The following identifies your rights and options regarding an administrative appeal of the above decision. Additional information may be found at [http://www.usace.army.mil/cecw/pages/reg\\_materials.aspx](http://www.usace.army.mil/cecw/pages/reg_materials.aspx) or Corps regulations at 33 CFR Part 331.

**A: INITIAL PROFFERED PERMIT:** You may accept or object to the permit.

- **ACCEPT:** If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- **OBJECT:** If you object to the permit (Standard or LOP) because of certain terms and conditions therein, you may request that the permit be modified accordingly. You must complete Section II of this form and return the form to the district engineer. Your objections must be received by the district engineer within 60 days of the date of this notice, or you will forfeit your right to appeal the permit in the future. Upon receipt of your letter, the district engineer will evaluate your objections and may: (a) modify the permit to address all of your concerns, (b) modify the permit to address some of your objections, or (c) not modify the permit having determined that the permit should be issued as previously written. After evaluating your objections, the district engineer will send you a proffered permit for your reconsideration, as indicated in Section B below.

**B: PROFFERED PERMIT:** You may accept or appeal the permit

- **ACCEPT:** If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- **APPEAL:** If you choose to decline the proffered permit (Standard or LOP) because of certain terms and conditions therein, you may appeal the declined permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer (address on reverse). This form must be received by the division engineer within 60 days of the date of this notice.

**C: PERMIT DENIAL:** You may appeal the denial of a permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer (address on reverse). This form must be received by the division engineer within 60 days of the date of this notice.

**D: APPROVED JURISDICTIONAL DETERMINATION:** You may accept or appeal the approved JD or provide new information.

- **ACCEPT:** You do not need to notify the Corps to accept an approved JD. Failure to notify the Corps within 60 days of the date of this notice, means that you accept the approved JD in its entirety, and waive all rights to appeal the approved JD.
- **APPEAL:** If you disagree with the approved JD, you may appeal the approved JD under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer (address on reverse). This form must be received by the division engineer within 60 days of the date of this notice.

**E: PRELIMINARY JURISDICTIONAL DETERMINATION:** You do not need to respond to the Corps regarding the preliminary JD. The Preliminary JD is not appealable. If you wish, you may request an approved JD (which may be appealed), by contacting the Corps district for further instruction. Also you may provide new information for further consideration by the Corps to reevaluate the JD.

**SECTION II - REQUEST FOR APPEAL or OBJECTIONS TO AN INITIAL PROFFERED PERMIT**

**REASONS FOR APPEAL OR OBJECTIONS:** (Describe your reasons for appealing the decision or your objections to an initial proffered permit in clear concise statements. You may attach additional information to this form to clarify where your reasons or objections are addressed in the administrative record.)

**ADDITIONAL INFORMATION:** The appeal is limited to a review of the administrative record, the Corps memorandum for the record of the appeal conference or meeting, and any supplemental information that the review officer has determined is needed to clarify the administrative record. Neither the appellant nor the Corps may add new information or analyses to the record. However, you may provide additional information to clarify the location of information that is already in the administrative record.

**POINT OF CONTACT FOR QUESTIONS OR INFORMATION:**

If you have questions regarding this decision and/or the appeal process you may contact:

U.S. Army Corps of Engineers

Phone: (916) 557-5263, FAX (916) 557-7803

Email: [erin.m.campbell@usace.army.mil](mailto:erin.m.campbell@usace.army.mil)

If you only have questions regarding the appeal process you may also contact:

Thomas J. Cavanaugh  
Administrative Appeal Review Officer

U.S. Army Corps of Engineers  
South Pacific Division

1455 Market Street, 2052B

San Francisco, California 94103-1399

Phone: (415) 503-6574, FAX: (415) 503-6646

Email: [thomas.j.cavanaugh@usace.army.mil](mailto:thomas.j.cavanaugh@usace.army.mil)

**RIGHT OF ENTRY:** Your signature below grants the right of entry to Corps of Engineers personnel, and any government consultants, to conduct investigations of the project site during the course of the appeal process. You will be provided a 15-day notice of any site investigation, and will have the opportunity to participate in all site investigations.

\_\_\_\_\_  
Signature of appellant or agent.

Date: \_\_\_\_\_

Telephone number: \_\_\_\_\_



**DEPARTMENT OF THE ARMY**  
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT  
1325 J STREET  
SACRAMENTO CA 95814-2922

**DEPARTMENT OF THE ARMY PERMIT**

Permittee: DMB Associates  
Attn: Mr. Nick Taratsas  
7600 East Doubletree Ranch Road, Suite 300  
Scottsdale, Arizona 85258-2137

Permit Number: SPK-1994-00393

Issuing Office: U.S. Army Engineer District, Sacramento  
Corps of Engineers  
1325 "J" Street  
Sacramento, California 95814-2922

NOTE: The term "you" and its derivatives, as used in this permit, means the permittee or any future transferee. The term "this office" refers to the appropriate district or division office of the Corps of Engineers having jurisdiction over the permitted activity or the appropriate official of that office acting under the authority of the commanding officer.

You are authorized to perform work in accordance with the terms and conditions specified below. A notice of appeal options is enclosed.

**Project Description:**

The project involves the construction of reconfiguration and/or repair of all 416 existing docks to multi-slip docks and the new construction of 78 elbow docks, which will increase the total slip count from 416 to 811. Approximately 300 of the existing docks would have their anchors replaced with a newer four-cable anchor system developed by Sea Flex. The remaining docks would be secured to the lagoon floor with two hundred forty-five (245) 10-inch steel tube piles installed via vibratory hammer. The project also proposes the installation of 300 boat lifts with covers.

All work is to be completed in accordance with the Delta Coves Reconfiguration plans dated March 5, 2019 (Enclosure 1).

**Project Location:**

The approximately 6.35-acre project site is located in the Delta Coves Residential Development at 21 Seaward Court, Latitude 38.04484°, Longitude -121.50993°, Bethel Island, San Joaquin County, California. The affected waterway is a manmade lagoon attached to Sand Mound Slough.

**Permit Conditions:**

*General Conditions:*

1. The time limit for completing the work authorized ends on **May 20, 2027**. If you find that you need more time to complete the authorized activity, submit your request for a time extension to this office for consideration at least one month before the above date is reached.

2. You must maintain the activity authorized by this permit in good condition and in conformance with the terms and conditions of this permit. You are not relieved of this requirement if you abandon the permitted activity, although you may make a good faith transfer to a third party in compliance with General Condition 4 below. Should you wish to cease to maintain the authorized activity, or should you desire to abandon it without a good faith transfer, you must obtain a modification of this permit from this office, which may require restoration of the area.

3. If you discover any previously unknown historic or archeological remains while accomplishing the activity authorized by this permit, you must immediately notify this office of what you have found. We will initiate the federal and state coordination required to determine if the remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.

4. If you sell the property associated with this permit, you must obtain the signature of the new owner in the space provided and forward a copy of the permit to this office to validate the transfer of this authorization.

5. If a conditioned water quality certification has been issued for your project, you must comply with the conditions specified in the certification as special conditions to this permit. For your convenience, a copy of the certification is attached if it contains such conditions.

6. You must allow representatives from this office to inspect the authorized activity at any time deemed necessary to ensure that it is being or has been accomplished in accordance with the terms and conditions of your permit.

*Special Conditions:*

1. This Corps permit does not authorize you to take an endangered species, in particular delta smelt (*Hypomesus transpacificus*). In order to legally take a listed species, you must have separate authorization under the Endangered Species Act (ESA) (e.g., an ESA Section 10 permit, or a Biological Opinion (BO) under ESA Section 7, with "incidental take" provisions with which you must comply). The enclosed U.S. Fish and Wildlife Service (USFWS) BO (08FBDT00-2022-F-0002, dated November 9, 2021) (Enclosure 2) and National Marine Fisheries Service (NMFS) Letter of Coordination (LOC) (Number WCRO-2022-00414, dated May 4, 2022) (Enclosure 3), contain mandatory terms and conditions to implement the reasonable and prudent measures that are associated with "incidental

take" that is also specified in the BO and LOC. Your authorization under this Corps permit is conditional upon your compliance with all of the mandatory terms and conditions associated with "incidental take" of the attached BO and LOC, which terms and conditions are incorporated by reference in this permit. Failure to comply with the terms and conditions associated with incidental take of the BO and LOC, where a take of the listed species occurs, would constitute an unauthorized take, and it would also constitute non-compliance with your Corps permit. The USFWS and the NMFS are the appropriate authority to determine compliance with the terms and conditions of their BOs, and with the ESA.

To ensure your project complies with the Magnuson-Stevens Fishery and Consultation Act, you must implement all of the mitigating measures and Essential Fish Habitat Recommendations identified in the above NMFS document, including those ascribed to the Corps therein.

2. You and your authorized contractor shall allow representatives from this office to inspect the activity authorized by this permit at any time deemed necessary to ensure that work is being or has been accomplished in accordance with the terms and conditions of this permit.

3. You shall not convert or use the structure built under the authority of this permit as a recreation room, residence, or temporary dwelling, nor shall you use the structure to moor a recreation room or floating residence.

4. Your use of the permitted activity must not interfere with the public's right to free navigation on all navigable waters of the United States.

5. You understand and agree that, if future operations by the United States require the removal, relocation, or other alteration of the structure or work herein authorized, or if, in the opinion of the Secretary of the Army or his authorized representative, said structure or work shall cause unreasonable obstruction to the free navigation of the navigable waters, you will be required, upon due notice from this office, to remove, relocate, or alter the structural work or obstructions caused hereby, without expense to the United States. No claim shall be made against the United States on account of any such removal or alteration.

6. Within 60 days following completion of the authorized work or at the expiration of the construction window of this permit, whichever occurs first, you shall submit as-built drawings and a description of the work conducted on the project site) to this office for review. The drawings shall include the following:

a. The Department of the Army Permit number.

b. A plan view drawing of the location of the authorized work footprint (as shown on the permit drawings) with an overlay of the work as constructed in the same scale as the attached permit drawings.

c. A description and list of all minor deviations between the work as authorized by this permit and the work as constructed. Clearly indicate on the as-built drawings the location of any deviations that have been listed.

**Further Information:**

1. Congressional Authorities: You have been authorized to undertake the activity described above pursuant to:

2. (X) Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403).

3. ( ) Section 404 of the Clean Water Act (33 U.S.C. 1344).

4. ( ) Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972 (33 U.S.C. 1413).

5. Limits of this authorization.

a. This permit does not obviate the need to obtain other federal, state, or local authorizations required by law.

b. This permit does not grant any property rights or exclusive privileges.

c. This permit does not authorize any injury to the property or rights of others.

d. This permit does not authorize interference with any existing or proposed federal projects.

6. Limits of Federal Liability. In issuing this permit, the Federal Government does not assume any liability for the following:

a. Damages to the permitted project or uses thereof as a result of other permitted or unpermitted activities or from natural causes.

b. Damages to the permitted project or uses thereof as a result of current or future activities undertaken by or on behalf of the United States in the public interest.

c. Damages to persons, property, or to other permitted or unpermitted activities or structures caused by the activity authorized by this permit.

d. Design or construction deficiencies associated with the permitted work.

e. Damage claims associated with any future modification, suspension, or revocation of this permit.

7. Reliance on Applicant's Data. The determination of this office that issuance of this permit is not contrary to the public interest was made in reliance on the information you provided.

8. Reevaluation of Permit Decision. This office may reevaluate its decision on this permit at any time the circumstances warrant.

9. Circumstances that could require a reevaluation include, but are not limited to, the following:

a. You fail to comply with the terms and conditions of this permit.

b. The information provided by you in support of your permit application proves to have been false, incomplete, or inaccurate (see 4 above).

c. Significant new information surfaces which this office did not consider in reaching the original public interest decision.

Such a reevaluation may result in a determination that it is appropriate to use the suspension, modification, and revocation procedures contained in 33 CFR 325.7 or enforcement procedures such as those contained in 33 CFR 326.4 and 326.5. The referenced enforcement procedures provide for the issuance of an administrative order requiring you comply with the terms and conditions of your permit and for the initiation of legal action where appropriate. You will be required to pay for any corrective measures ordered by this office, and if you fail to comply with such directive, this office may in certain situations (such as those specified in 33 CFR 209.170) accomplish the corrective measures by contract or otherwise and bill you for the cost.

Extensions. General Condition 1 establishes a time limit for the completion of the activity authorized by this permit. Unless there are circumstances requiring either a prompt completion of the authorized activity or a reevaluation of the public interest decision, the Corps will normally give favorable consideration to a request for an extension of this time limit.

Your signature below, as permittee, indicates that you accept and agree to comply with the terms and conditions of this permit.

\_\_\_\_\_  
Name \_\_\_\_\_  
Title \_\_\_\_\_  
Permittee

\_\_\_\_\_  
Date

This permit becomes effective when the Federal official, designated to act for the Secretary of the Army, has signed below

\_\_\_\_\_  
(For the District Engineer)

\_\_\_\_\_  
Date

When the structures or work authorized by this permit are still in existence at the time the property is transferred, the terms and conditions of this permit will continue to be binding on the new owner(s) of the property. To validate the transfer of this permit and the associated liabilities associated with compliance with its terms and conditions, have the transferee sign and date below.

\_\_\_\_\_  
Name \_\_\_\_\_  
Title \_\_\_\_\_  
Transferee

\_\_\_\_\_  
Date

Source: ESRI World Street Map



Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013



**DELTA COVES  
DOCK RECONFIGURATION PROJECT**

Regional Map

GLENN LUKOS ASSOCIATES



Exhibit 1

Adapted from USGS Brentwood & Jersey Island, CA quadrangles



Copyright: © 2013 National Geographic Society, i-cubed

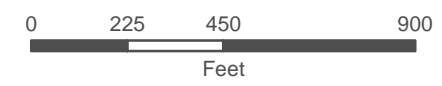
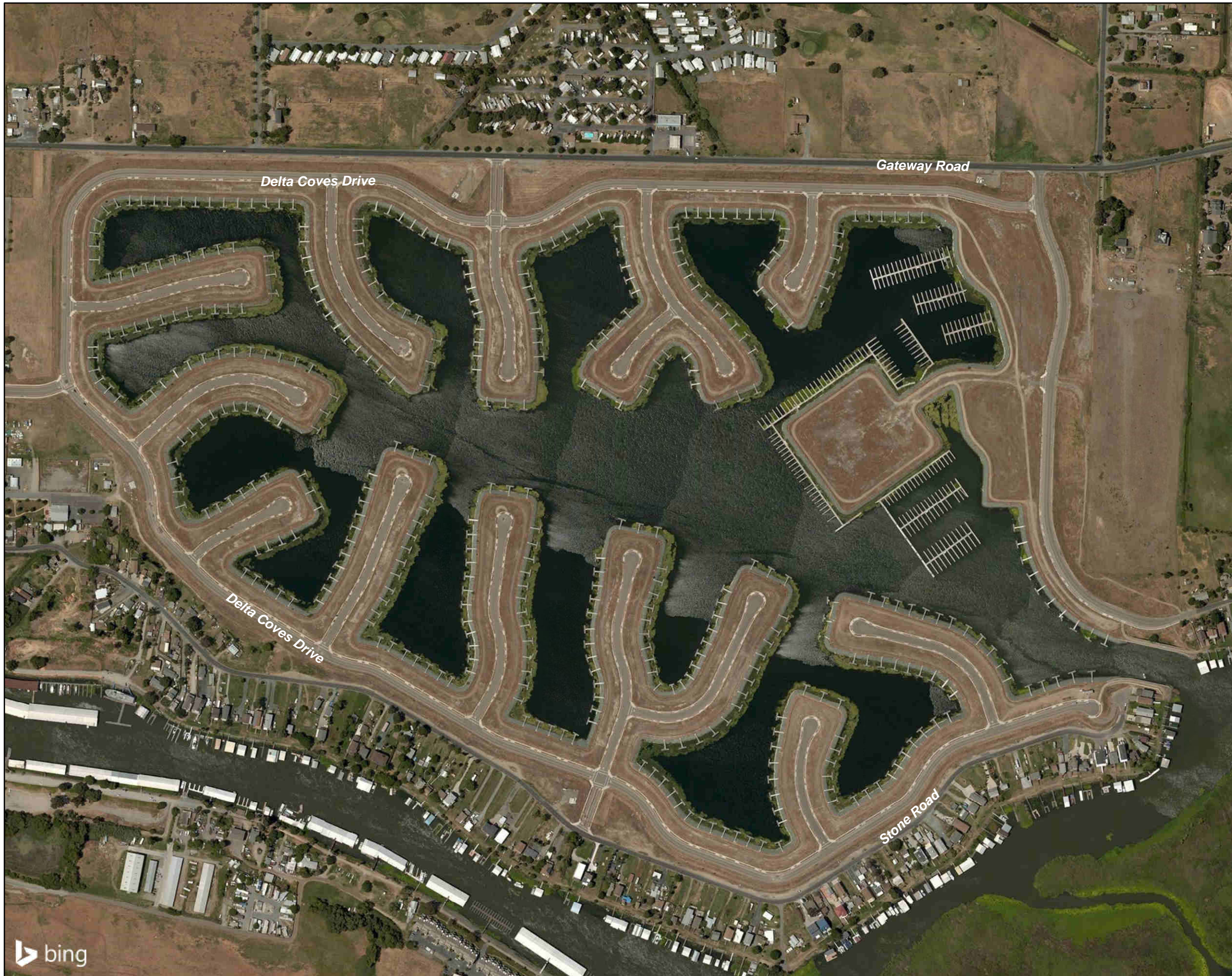
**DELTA COVES  
DOCK RECONFIGURATION PROJECT**

Vicinity Map

GLENN LUKOS ASSOCIATES



Exhibit 2



1 inch = 450 feet

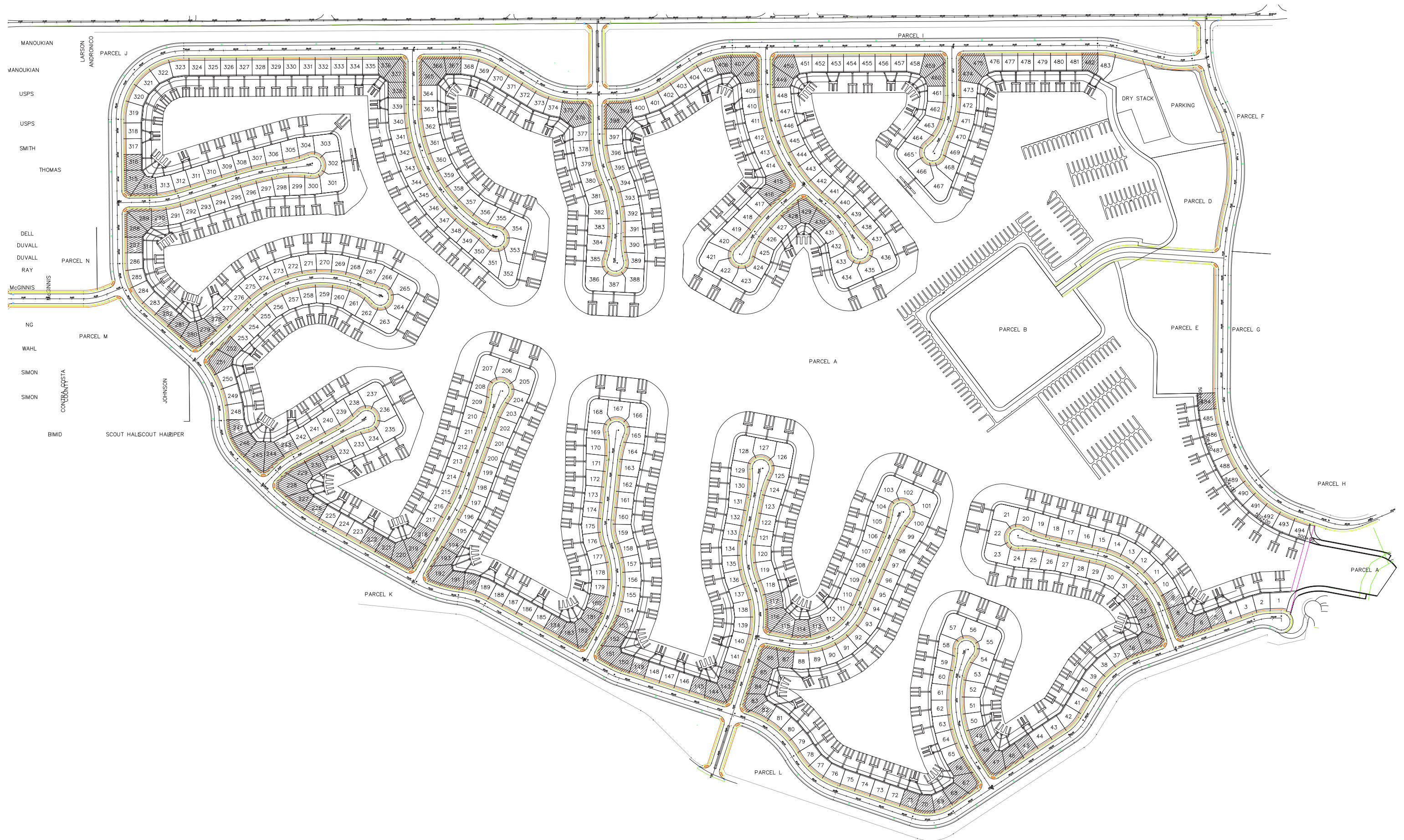
### DELTA COVES

Existing Development Map

GLENN LUKOS ASSOCIATES



Exhibit 3



**EXHIBIT 4 - PROPOSED PROJECT  
DOCK RECONFIGURATION WITH MULTI-SLIP DOCKS**



# 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:  
08FBDT00-2022-F-0002

Erin Campbell  
Senior Project Manager  
U.S. Army Corps of Engineers, Sacramento District  
1325 J Street  
Sacramento, California 95814-2922

Subject: Reinitiation of Formal Consultation on the Delta Coves Project, Bethel Island, San Joaquin County, California (U.S. Army Corps of Engineers file number SPK-1994-00393)

Dear Ms. Campbell:

This letter is in response to the U.S. Army Corps of Engineers' (Corps) October 1, 2021 letter to the U.S. Fish and Wildlife Service (Service) requesting reinitiation of consultation on the biological opinion for the Delta Coves Project (Service file number 1-1-95-F-0065) (project) on Bethel Island, San Joaquin County, California. The Service received the email transmittal on October 1, 2021. At issue are the proposed project's effects on the federally threatened delta smelt (*Hypomesus transpacificus*) and its critical habitat. This response is in accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (Act) and in accordance with the implementing regulations pertaining to interagency cooperation (50 CFR 402).

In reviewing this request, the Service has relied upon: (1) the Corps' October 1, 2021 initiation letter; (2) the May 2020 *Biological and Essential Fish Habitat Assessment for the Delta Coves Dock Reconfiguration Project*; (3) meetings and email correspondence between the Corps, the Corps' applicant and representatives, and the Service; and (4) other information available to the Service.

This reinitiation pertains to reconfiguration of the docks from the original construction and compliance with the original consultation. The *Status of the Species*, *Status of Critical Habitat*, *Environmental Baseline*, *Effects of the Proposed Action*, and *Incidental Take Statement* have changed since the 1995 biological opinion and are updated in this reinitiation.

## Consultation History

- June 26, 1995: The Service issued a biological opinion for the Delta Coves Harbor Project, a created lagoon for a waterfront residential development with boat docks on Bethel Island.
- June 23, 2003: The Corps issued a permit amendment to Delta Coves, L.P. The permit modified special conditions 3a and 3d as follows:

3. The permittee shall implement the terms and conditions of the attached Biological Opinion from the U.S. Fish and Wildlife Service.

a. Filling of the harbor may occur, unscreened, from August 1 through November 30. Filling may occur from December 1 through January 31, provided the intake pump is screened according to Service specifications (see Opinion for details). If delta smelt are not found near the project site (as determined from the closest 20mm and fall midwater trawl sites to the project site), filling of the harbor may occur outside of these time periods, not to exceed 6 months of continuous filling.

d. The permittee shall create 1.25 acres of shallow water habitat, either on-site adjacent to the landward recreation area (tennis courts) or other area with minimal boat traffic, or at an off-site location to be approved by the Corps and Service. The permittee shall develop a detailed on-site or off-site mitigation plan. Two copies of the plan will be submitted to the Corps of Engineers, one of which will be forwarded to the Service for approval prior to implementation. Upon approval from the Service through the Corps, the onsite mitigation area will be graded and prepared for planting prior to breaching the levee. The area may be planted once the lagoon is filled or after the levee breach occurs, but must be completed within 60 days of breaching the levee. As an alternative, the off-site mitigation option may also include the purchase of 1.25 acres of shallow water emergent habitat at a Corps and Service-approved mitigation bank.

- August 10, 2018: The Service received the Corps' request for formal consultation on the Delta Coves Dock Replacement and Maintenance Project (Corps file number SPK-2016-00938).
- August 2018: The Service, Corps, and National Marine Fisheries Service discussed the project and its history via email and conference calls.
- September 4, 2018: The Service sent the Corps a request letter for more information and a comment that the created lagoon is not functioning as habitat as described in the biological opinion and is infested with *Egeria densa* that requires annual herbicide treatment from the California Division of Boating and Waterways.
- December 23, 2020: The Service received the Corps' request for informal consultation on the Delta Coves Project (Corps file number SPK-1994-00393).
- December 28, 2020: The Service sent the Corps a request for more information and a request to clarify the 2020 consultation request with regard to the outstanding 2018 consultation request. The Service provided the 2018 request and the 1995 biological opinion.

- January 5, 2021: The Service participated in a video meeting with the Corps and the applicant's representatives.
- February 12, 2021: The Service received, via email, the Corps' withdrawal of the August 2018 consultation request.
- June 11, 2021: The Service received, via email, an addendum to the 2020 biological assessment from the applicant's representative.
- July 7, 2021: The Service sent an email to the applicant's representative and the Corps providing comments on the biological assessment addendum. Several emails were exchanged.
- July 14, 2021: The Service participated in a conference call with the Corps and the applicant's representatives.
- August 2021: The Service and the applicant's representative exchanged emails regarding conservation bank credits and the consultation process.
- September 2021: The Service and the Corps exchanged emails regarding the consultation process.
- October 1, 2021: The Service received, via email, a letter from the Corps withdrawing the December 2020 consultation request and requesting reinitiation of the original consultation.
- October 19, 2021: The Service received an email from applicant's representative regarding the applicant's proposal of purchasing delta smelt conservation bank credits.

## **BIOLOGICAL OPINION**

### **Description of the Proposed Action**

#### Background

The Service issued a biological opinion on June 26, 1995 for the original construction of the Delta Coves Harbor project, which created a man-made lagoon on Bethel Island. The Delta Coves development was constructed beginning in 2006 and completed in 2008. Due to the economic downturn, construction of residences and commercial/recreational structures was significantly delayed until present. At this time, the lagoon and levee have been constructed, along with 494 single family residential graded lots, multi-family residential graded lots, commercial/recreational areas, and internal roadways.

The current project proposes to reconfigure the single-slip design of the docks to provide

multiple-slip capacity in order to meet the demands of the current market. Some of the original docks have become degraded over the years and will be examined and repaired. Those in extremely poor condition will be removed from the lagoon.

The original consultation also addressed loss of habitat for the delta smelt from construction with onsite mitigation or purchase of bank credits. Currently, the created lagoon is infested with invasive aquatic vegetation, *Egeria* and water hyacinth (*Eichhornia crassipes*), and requires annual treatment by the California Department of Parks and Recreation Division of Boating and Waterways and no longer functioning as a beneficial use for delta smelt or other native fish species. Bank credits have not been purchased.

### Current Proposed Action

Approximately 300 of the existing docks would have their anchors replaced with a newer four cable anchor system developed by Sea Flex. This new system would use the existing lagoon floor anchorage and replace the cable system between the anchorage and the dock.

The remaining docks would either be constructed within elbow areas of the lagoon or at the point lots at the end of the cul-de-sacs. Because of the geometry of these docks it is easier to secure them to the lagoon with the use of 10-inch steel tube piles. These piles have a lifespan of 100+ years and are not deleterious for use in aquatic environments. Using piles reduces the risk of future docks becoming untied, floating away, and damaging other docks.

### *Demolition of Existing Docks*

All 416 existing individual docks will be examined, cleaned, and repaired in place. Those in extremely poor condition will be removed from the lagoon. All spoils will be removed from water to land and transported to a legal dumpsite; materials that can be reused or repurposed, such as metal gangways, will be stored on land. Where existing gangways are in the same location as the proposed multi-slip docks they will be left in place. This project component will occur over the life of the Corps permit and will take place as portions of the residential development go under contract with homebuilders.

### *Construction of Multi-Slip Docks*

Implementation of the proposed project will provide each homeowner with private access to either one or two slips. Whereas the existing dock configurations are t-shaped, the proposed docks will have fingers that extend perpendicularly from the dock in order to create multiple slips within each dock. The docks will be set into the water with a crane and bolted together. The maximum distance that docks will extend into the lagoon is 48 feet.

To secure the docks, new 10-inch hollow core steel pilings will then be driven into the lagoon with a vibratory hammer, onto which the docks will be bolted. The total number of piles for all multi-slip docks is 245: two for each 2-slip dock, three for each 3-slip dock, and four for each 4-slip dock. Each pile is 10 inches in diameter and approximately 30-40 feet in length. Addition of the multi-slip docks would add 6.35 acres of surface area coverage over the lagoon.

### *Addition of Shade Canopies and Center-Mount Boat Lifts*

Up to two shade canopies may be added to each dock. The canopies would be removable and may extend up to 15 feet over the water, beyond the dock. All attachment parts for the canopy would be located on the dock.

A maximum of two center-mount boat lifts per dock would be attached to internal sides of the fingers/dock. This would allow for dry-storage of boating vessels and is a necessary feature required by homeowners in this market.

Neither the shade canopies nor the boat lifts would result in surface area coverage as they would be above water permanently, or in the case of the boat lifts, only be lowered into the water while the vessel is going into or coming out of the water.

### *Demobilization*

Upon the completion of project construction, the contractor would return staging areas to their original, or better, condition. Areas disturbed by construction would be revegetated, as required by the project's stormwater pollution prevention plan.

### *Construction Equipment*

The project would be carried out using both land-based equipment, where feasible, and equipment would be mounted on a barge within the lagoon, where necessary. Construction would require the use of one or more of the following pieces of equipment: a backhoe, a barge-mounted crane, a crawler crane, vibratory driver, pile driving rig, a generator, a tandem roller, haul trucks, a concrete pump truck, and a loader, as well as at least one of either a clamshell excavator, a long-arm excavator, or a dragline excavator.

### *Construction Schedule, Sequence, and Phasing*

Construction phasing would be dictated by the sale of the lots.

There would be two primary periods for construction, depending on the type of work being done.

- **In-Water Work.** All work in water would be conducted during an approximately 12-week period from mid-July to mid-October each year. This timeframe is the only time when work that may disturb aquatic habitat can be completed. During that time, work activities would be conducted 10 hours a day, from 7:00 a.m. to 5:00 p.m., up to 7 days per week.
- **Dry Land Work.** Work on dry land would be conducted year-round, depending on weather. Work hours would be 9 hours per day, from 7:00 a.m. to 4:00 p.m., Monday through Friday.

## *Operation and Maintenance*

### *Multi-Slip Docks*

Operation of the docks will include boat traffic, docking, and maintenance of boats. Docks will be used as the lots are sold. Once completed, maintenance to individual docks will not be expected for the first few years. If needed, maintenance activities may include walk-way cleaning, railing and wood support replacement, hardware tightening and/or replacement, and other repairs.

### *Shade Canopies and Center-Mount Boat Lifts*

The boat lifts will lift boats out of the water and suspend them out of the water. Once completed, major maintenance to individual shade canopies and boat lifts will not be expected for the first few years. If needed, maintenance activities may include canopy fabric cleaning/replacement, tightening and/or replacement of hardware, replacement of pulleys and/or lift cables, and lubrication of moving parts. Operation will vary as the lots are sold.

### *Floating Debris Removal*

Floating debris such as trash that has accumulated in the lagoon would be regularly removed. The frequency of debris removal would depend on the rate of accumulation, to be determined by regular visual monitoring of the site. Based on the information gathered, the applicant would schedule and implement a regular debris removal program, removing debris from the project site as frequently as needed to comply with the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins' direction that "[w]ater shall not contain floating material in amounts that cause nuisance or adversely affect beneficial uses."

### *Invasive Aquatic Vegetation Maintenance*

Water hyacinth also would be regularly removed from lagoon areas through development and implementation of a water hyacinth control program to ensure that the cover of water hyacinth in the project area does not increase beyond existing conditions at the time that the work is completed. The frequency of water hyacinth removal would depend on the rate of vegetation growth and accumulation, to be determined by regular visual monitoring of the site. Based on the information gathered, the applicant would schedule and implement a regular removal program, removing hyacinth from the project site during the growing season, which is generally from March to early December. During the growing season, mechanical harvesting would be conducted using an aquatic weed harvester whenever cover of water hyacinth reaches 20% in the most affected areas in the lagoon. The percent cover would be visually estimated from the shoreline.

## Conservation Measures

- Prior to any construction activities onsite, a review of all required permits and notifications will be performed to ensure requirements for environmental compliance are fully understood, specific limits of activities and work are defined and understood, and all environmental clearances and access, encroachment agreements, and permissions have been obtained from the appropriate agencies and parties.
- Prior to any construction activities, a job briefing will be held to discuss the activities that will be performed that given day.

- An approved biological monitor will be onsite during all construction activities (if required by resource agencies) which occur within the lagoon. The biological monitor shall be approved prior to work. Biological monitors will be notified in advance of all work activities and locations.
- To clearly demarcate the project boundary and protect sensitive natural communities, the applicant or its contractor will install temporary exclusion fencing (i.e., minimum 4-foot tall high visibility orange construction fencing) around sensitive biological resource areas 1 week prior to the start of construction activities.
- Before any work occurs in the action area, including grading, a qualified biologist will conduct mandatory contractor/worker awareness training for construction personnel (if required). The awareness training will be provided to all construction personnel to brief them on the need to avoid impacts on sensitive biological resources and the penalties for not complying with permit requirements.
- Prior to construction activities, environmentally sensitive areas will be flagged or fenced in order to clearly delineate the extent of the construction. All crews will also have a set of environmental drawings showing the locations of the known environmental areas. The plans will also define the fencing installation procedure. The project's special provisions package will provide clear language regarding acceptable fencing material and prohibited construction related activities, vehicle operation, material and equipment storage, and other surface disturbing activities within sensitive areas.
- Access routes and work areas will be limited to the minimum amount necessary to achieve the project goals. Unpaved routes and boundaries will be clearly marked prior to initiating construction.
- All foods and food-related trash items will be enclosed in sealed trash containers and removed from the site at the end of each workday.
- No pets will be allowed in the project area.
- No more than a maximum speed of 15 miles per hour will be permitted for any vehicle.
- All equipment will be maintained such that there will be no leaks of machine fluids such as gasoline, diesel, or oils.
- Hazardous materials such as fuels and oils will be stored in sealable containers in a designated location that is at least 200 feet from any aquatic habitat.
- The number of access routes, size of staging areas, and the total area of the activity will be limited to the minimum necessary to achieve the project goal. Project limits will be established and defined with physical markers to define access routes and maintenance areas to the minimum area necessary to complete the project; this includes locating access routes and maintenance areas outside of any drainages or creeks.
- Construction access, staging, storage, and parking areas shall be located on ruderal or developed lands to the extent possible. Vehicle travel adjacent to wetland areas shall be limited to existing roads and designated access paths. Sensitive natural communities (e.g., wetlands and water zones) shall be conspicuously marked in the field to minimize impacts on those communities, and work shall be limited to outside the marked areas.
- Only tightly woven fiber netting or similar material may be used for erosion control. No plastic mono-filament matting will be used for erosion control, as this material may ensnare wildlife.
- The applicant or its contractor will inspect and clean all equipment being used for brush clearing to minimize the spread of invasive plant species.

- Upon completion of the project, all temporarily disturbed natural areas, including banks, shall be returned to original contours to the extent feasible. Affected wetlands, banks or stream channels shall be stabilized prior to the rainy season and/or prior to reestablishing flow. Native wetland vegetation shall be reestablished as appropriate.
- The applicant or its contractor will implement one or more of the following actions to avoid and minimize the spread or introduction of terrestrial invasive plant species. In addition, the applicant will coordinate with the appropriate agencies to ensure that the appropriate Best Management Practices (BMPs) are implemented for the duration of the construction of the proposed project.
  - Educate construction supervisors and managers about the importance of controlling and preventing the spread of invasive plant infestations.
  - Use eradication methods that have been approved by or developed in conjunction with the appropriate agencies during terrestrial invasive species removal to prevent dispersal of the species and/or destroy viable plant parts or seeds. Methods may include use of herbicides approved for use in and near waterways and seasonal removal (i.e., prior to flower and fruit production).
  - Minimize surface disturbance to the greatest extent feasible to complete the work.
  - Use native, noninvasive species or nonpersistent hybrids in erosion-control plantings to stabilize site conditions and prevent invasive plant species from colonizing.
  - Use erosion-control materials that are weed-free or contain less than 1% weed seed.
- Vegetation will be cleared only where necessary and will be cut approximately 4 inches above soil level. This will allow plants to resprout after construction. All clearing and grubbing of woody vegetation will be done using hand tools, small mechanical tools, or backhoes and excavators. All cleared vegetation will be removed from the project footprint to prevent attracting animals to the project site.
- All slopes or unpaved upland areas temporarily disturbed by construction activities will be revegetated at least 3 days prior to a forecasted rain event with an erosion control seed mix that consists of grasses and herbaceous species that are native or naturalized to the region. The temporarily disturbed areas will be restored to pre-project topography and hydrology to the greatest extent possible.
- To prevent introduction and/or transport of aquatic invasive species into or from sloughs or other wetted channels in the Action Area, any equipment that comes into contact with the channel will be inspected and cleaned before and after contact, according to the most current Inspection Standards and Cleaning and Decontamination Procedures (DiVittorio *et al.* 2012).
- Subject to requirements of Section 402 of the federal Clean Water Act, and the National Pollutant Discharge Elimination System permitting process, all construction projects that disturb more than 1 acre of land are required to prepare and implement a stormwater pollution prevention plan. See the 2020 biological assessment for details.
- In-water work, including all bank modifications, will be restricted to the minimum necessary to support dock construction. In-water work will be limited to the dry season (mid-July to mid- October) to minimize release of sediments into the waterways surrounding Bethel Island. Work within the lagoon will not begin before July 15, unless approved by the resource agencies. This window can be extended based on waterway

conditions, if approved in writing by the Service and National Marine Fisheries Service. Work from the banks can occur year-round.

- Lighting at the docks will be directed away from the water surface as much as possible in order to decrease the attraction of fish to the area.
- To the extent feasible, all in-water work will be done by equipment operating from dry areas outside the lagoon. Silt fences, fiber rolls, silt curtains, and other appropriate sediment control measures will be used to minimize sediment input to the water, consistent with the project's stormwater pollution prevention plan.
- The applicant will purchase 1.25 acres worth of delta smelt credits from the North Delta Fish Conservation Bank when credits are available.

### **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 analysis, the Action Area includes the approximately 140-acre open water lagoon on the southeastern tip of Bethel Island.

### **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 reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the 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. It relies on four components: (1) the *Status of the Species*, which describes the current rangewide condition of the species, the factors responsible for that condition, and its survival and recovery needs; (2) the *Environmental Baseline*, which analyzes the current condition of the species in the Action Area without the consequences to the listed species caused by the proposed action, 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 includes all effects that are caused by the proposed Federal action; and (4) the *Cumulative Effects*, which evaluates the effects of future, non-Federal activities in the Action Area on the species. The *Effects of the Action* and *Cumulative Effects* are added to the *Environmental Baseline* and in light of the status of the species, the Service formulates its opinion as to whether the proposed action is likely to jeopardize the continued existence of listed 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 destroy or to adversely modify designated critical habitat. A final rule revising the regulatory definition of “destruction or adverse modification” (DAM) was published on August 27, 2019 (84 FR 44976). The final rule became effective on October 28, 2019. The revised definition states:

“*Destruction or adverse modification* means a direct or indirect alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species.”

The DAM analysis in this biological opinion relies on four components: (1) the *Status of Critical Habitat*, which describes the current range-wide condition of the critical habitat in terms of the key components (i.e., essential habitat features, primary constituent elements, or physical and biological features) 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 listed species; (2) the *Environmental Baseline*, which analyzes the current condition of the critical habitat in the Action Area without the consequences to designated critical habitat caused by the proposed action, the factors responsible for that condition, and the value of the critical habitat in the Action Area for the conservation/recovery of the listed species; (3) the *Effects of the Action*, which determines all consequences to designated critical habitat that are caused by the proposed Federal action on the key components of critical habitat that provide for the conservation of the listed species, and how those impacts are likely to influence the conservation value of the affected critical habitat; and (4) *Cumulative Effects*, which evaluate the effects of future non-Federal activities that are reasonably certain to occur in the Action Area on the key components of critical habitat that provide for the conservation of the listed species and how those impacts are likely to influence the conservation value of the affected critical habitat. The *Effects of the Action* and *Cumulative Effects* are added to the *Environmental Baseline* and in light of the status of critical habitat, the Service formulates its opinion as to whether the action is likely to destroy or adversely modify designated critical habitat. The Service’s opinion evaluates whether the action is likely to impair or preclude the capacity of critical habitat in the Action Area to serve its intended conservation function to an extent that appreciably diminishes the rangewide value of critical habitat for the conservation of the listed species. The key to making that finding is understanding the value (i.e., the role) 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 Species and Critical Habitat**

### Delta Smelt

#### *Species Legal Status and Life Cycle Summary*

The Service proposed to list the delta smelt 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). A 5-year status review of the delta smelt was completed on March 31, 2004 (Service 2004). The 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

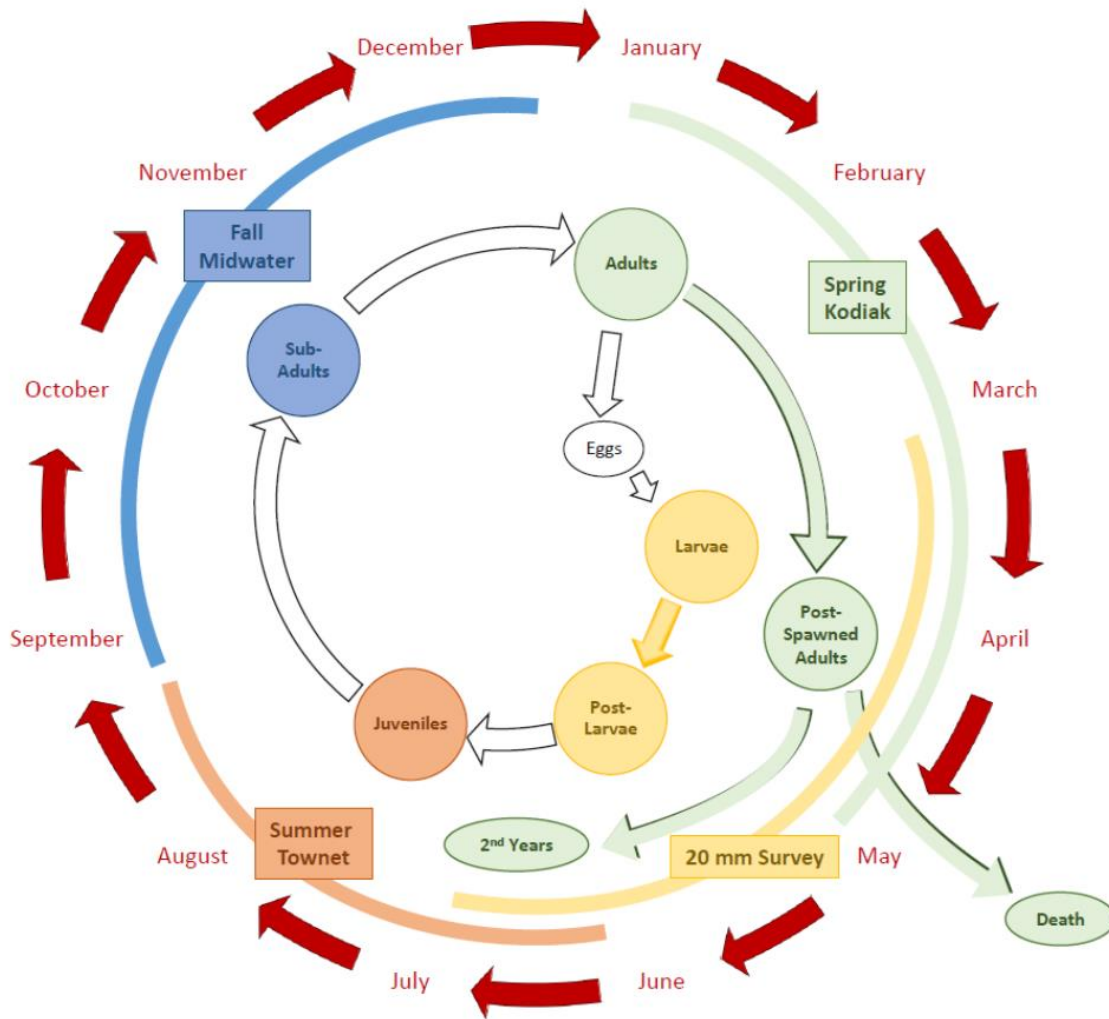
reviews the status and uplisting recommendation for delta smelt during its Candidate Notice of Review (CNOR) process. Each year it has been published, the CNOR has recommended the uplisting from threatened to endangered. Electronic copies of these documents are available at <https://ecos.fws.gov/ecp0/profile/speciesProfile?sId=321>.

The delta smelt is a small fish of the family Osmeridae. In the wild, very few individuals reach lengths over 3.5 inches (90 mm; Damon *et al.* 2016). At the time of its listing, only the basics of the species' life history were known (Moyle *et al.* 1992). In the intervening 26 years, it has become one of the most studied fishes in the United States. Enough has been learned about the delta smelt to support its propagation in captivity over multiple generations (Lindberg *et al.* 2013), to support the development of complex conceptual models of the species life history (Interagency Ecological Program (IEP) 2015), and mathematical simulation models of its life cycle (Rose *et al.* 2013a). Any synthesis of the now extensive literature on the delta smelt requires drawing conclusions across studies that had disparate objectives, but several syntheses have been compiled from existing information (Moyle *et al.* 1992; Bennett 2005; IEP 2015; Moyle *et al.* 2016). In this biological opinion, the Service relied on these previous syntheses where it remains appropriate to do so. We also relied on source study results and analyses of our own to synthesize across a rapidly growing body of scientific information.

The delta smelt has a fairly simple life history because a large majority of individuals live only one year (Bennett 2005; Moyle *et al.* 2016) and because it is an endemic species (Moyle 2002), comprising only one genetic population (Fisch *et al.* 2011), that completes its full life cycle in the northern reaches of the San Francisco Bay-Delta (Merz *et al.* 2011; Figure 1). The schematic of this simple life cycle developed by Moyle *et al.* (2016) and published again by Moyle *et al.* (2018) is shown in Figure 2. Most spawning occurs from February through May in various places from the Napa River and locations to the east including much of the Sacramento-San Joaquin Delta. Larvae hatch and enter the plankton primarily from March through May, and most individuals have metamorphosed into the juvenile life stage by June or early July. Most of the juvenile fish continue to rear in habitats from Suisun Bay and marsh and locations east principally along the Sacramento River-Cache Slough corridor (recently dubbed the 'North Delta Arc'; Moyle *et al.* 2010). The juvenile fish (or 'sub-adults') begin to develop into maturing adults in the late fall. Thereafter, the population spatial distribution expands with the onset of early winter storms and the first individuals begin to reach sexual maturity by January in some years, but most often in February (Damon *et al.* 2016; Kurobe *et al.* 2016). Delta smelt do not reach sexual maturity until they grow to at least 55 mm in length (~ 2 inches) and 50% of individuals are sexually mature at 60 to 65 mm in length (Rose *et al.* 2013b). 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; Damon *et al.* 2016; Figure 2). The spawning microhabitats of the delta smelt are unknown, but based on adult distribution data (Damon *et al.* 2016; Polansky *et al.* 2018) and the evaluation of otolith microchemistry (Hobbs *et al.* 2007a; Bush 2017), most delta smelt spawn in freshwater to slightly brackish-water habitats under tidal influence. Most individuals die after spawning, but as is typical for annual fishes, when conditions allow, some individuals can spawn more than once during their single spawning season (Damon *et al.* 2016). In a recent study spanning 2 to 3 months, captive males held at a constant water temperature of 12°C (54°F) spawned an average of 2.8 times and females spawned an average of 1.7 times (LaCava *et al.* 2015).



Figure 1. Delta smelt range map. Waterways colored in purple depict the delta smelt distribution described by Merz *et al.* (2011). The Service has used newer information to expand the transient range of delta smelt further up the Napa and Sacramento rivers than indicated by Merz *et al.* (2011). The red polygon depicts the boundary of delta smelt’s designated critical habitat. The inset map shows the region known as the North Delta Arc shaded light green.



**Figure 2. Schematic representation of the delta smelt life cycle. This conceptual model crosswalks delta smelt life stages with calendar months and current monitoring programs (prior to Enhanced Delta Smelt Monitoring) used to evaluate the species' status. Source: Moyle *et al.* 2016**

### *Detailed Review of the Reproductive Biology of Delta Smelt*

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. Delta smelt are believed to spawn in fresh and low-salinity water (Hobbs *et al.* 2007a; Bush 2017). Therefore, freshwater flow affects how much of the estuary is available for delta smelt to spawn (Hobbs *et al.* 2007a). This is one mechanism in which interannual variation in Delta outflow could play a role in the population dynamics of delta smelt. Given the timing of delta smelt reproduction, Delta outflow during February through May would be most important for this mechanism. During this time of year, variation in Delta outflow is largely driven by weather variation and regulated by the California State Water Resources Control Board (SWRCB) Decision-1641 (D-1641).

The locations of delta smelt spawning are thought to be influenced by salinity (Hobbs *et al.* 2007a), but the duration of the spawning season is thought to be driven mainly by water

temperature (Bennett 2005; Damon *et al.* 2016), which is largely a function of regional air temperature (Wagner *et al.* 2011). Thus, the spawning season duration does not appear to be a freshwater flow mechanism, but rather, a climate-driven mechanism (Brown *et al.* 2016a). Delta smelt can start spawning when water temperatures reach about 10°C (50°F) and can continue until temperatures reach about 20°C (68°F; Bennett 2005; Damon *et al.* 2016). The ideal spawning condition occurs when water temperatures remain between 10°C and 20°C throughout February through May. Few delta smelt  $\leq 55$  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). During January and February, many delta smelt are still smaller than these size thresholds (Damon *et al.* 2016). Thus, if water temperatures rise much above 10°C in January, the “spawning season” can start before many 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, and perhaps only one opportunity to do so. Delta smelt were initially believed to spawn only once before dying (Moyle *et al.* 1992). It has since been confirmed that delta smelt can spawn more than once if water temperatures remain suitable for a long enough time, and if the adults find enough food to support the production of another batch of eggs (Lindberg *et al.* 2013; Damon *et al.* 2016; Kurobe *et al.* 2016). In a recent study spanning 2 to 3 months, captive males held at a constant water temperature of 12°C (54°F) spawned an average of 2.8 times and females spawned an average of 1.7 times (LaCava *et al.* 2015). As a result, the longer water temperatures remain cool, the more fish have time to mature and the more times individual fish can spawn. Most adults disappear from monitoring programs by May, suggesting they have died (Damon *et al.* 2016; Polansky *et al.* 2018).

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, but is currently being revisited in new research. 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*), are sand or small gravel (Hirose and Kawaguchi 1998; Quinn *et al.* 2012).

The duration of the egg stage is temperature-dependent and averages about 10 days before the embryos hatch into larvae (Bennett 2005). It takes the fish about 30-70 days to reach 20-mm in length (Bennett 2005; Hobbs *et al.* 2007b). Similarly, Rose *et al.* (2013b) estimated that it takes delta smelt an average of slightly over 60 days to reach the juvenile life stage. 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. Thus, subtracting 60 days from April and July indicates that most spawning occurs from February-May.

Hatching success is highest at temperatures of 15-16°C (59-61°F) and lower at cooler and warmer temperatures and hatching success nears zero percent as water temperatures exceed 20°C (Bennett 2005). Water temperatures suitable for spawning occur most frequently during the months of February-May, but ripe female delta smelt have been observed as early as January and larvae have been collected as late as July, suggesting that spawning itself may extend into June in years with exceptionally cool spring weather.

*Detailed Review of the Habitat Use and Distribution of Delta Smelt*

Because the delta smelt only lives in one part of one comprehensively monitored estuary, its general distribution and habitat use are well understood (Moyle *et al.* 1992; Bennett 2005; Hobbs *et al.* 2006; 2007b; Feyrer *et al.* 2007; Nobriga *et al.* 2008; Kimmerer *et al.* 2009; Merz *et al.* 2011; Murphy and Hamilton 2013; Sommer and Mejia 2013; Mahardja *et al.* 2017a; Simonis and Merz 2019). The delta smelt has been characterized as a semi-anadromous species (Bennett 2005; Hammock *et al.* 2017) and Sommer *et al.* (2011) characterized the species as a partial diadromous migrant, recognizing individual variation in its life-history. However, both terms emphasize a life cycle in which delta smelt spawn in freshwater and volitionally move 'downstream' into brackish water habitat, which is only one endpoint among several individual life cycle strategies that have recently been confirmed through the use of otolith microchemical analyses (Bush 2017). In addition, semi-anadromy and partial diadromy are scale-dependent terms which have caused confusion among researchers and managers alike. For instance, some individual delta smelt clearly migrate between fresh and brackish water during their lives (Bush 2017). Other individuals could appear to have done so based on otolith microchemistry but in reality have moved very little and simply experienced annual salinity variation, which can be very high in much of the range of delta smelt (see Hammock *et al.* 2019). Other individual delta smelt are clearly freshwater and brackish-water resident throughout their lives (Bush 2017). As a result, 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 some delta smelt occupy seasonally (*e.g.*, for spawning), and there are habitats that a few delta smelt occupy transiently, which we define here as occasional use. Transient habitats include distribution extremes from which delta smelt have occasionally been collected, but were not historically collected every year or even in most years. Thus, the Service suggests the delta smelt may be best characterized as an upper estuary resident species with a population-scale distribution that expands and contracts as freshwater flow seasonally (and interannually) decreases and increases, respectively. This influence of freshwater flow inputs on delta smelt distribution could in turn influence mechanisms that affect the species' population dynamics when those mechanisms are linked to where the fish reside or how they are distributed in the estuary. We note that water temperature, turbidity, water diversion rates, prey availability, and possibly other factors would also affect these spatial recruitment and survival mechanisms.

Delta smelt have been observed as far west as San Francisco Bay near the City of Berkeley, as far north as Knight's Landing on the Sacramento River, as far east as Woodbridge on the Mokelumne River and Stockton on the Calaveras River, and as far south as Mossdale on the San Joaquin River (Merz *et al.* 2011; Figure 1). These extremes of the species' distribution extend beyond the geographic boundaries specified in the critical habitat rule. However, most delta smelt have been collected from locations within the critical habitat boundaries. In other words, observations of delta smelt outside of the critical habitat boundaries reflect transient habitat use rather than permanent or seasonal habitat use. The Napa River is the only location outside of the critical habitat boundaries that may be used often enough to be considered a seasonal habitat rather than a transient one.

The fixed-location habitats that delta smelt permanently occupy span from the Cache Slough complex down into Suisun Bay and Suisun Marsh (Figure 3). The reasons delta smelt are believed to permanently occupy this part of the estuary are the presence of fresh- to low-salinity water year-round 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 (Nobriga *et al.* 2008; Feyrer *et al.* 2011; Murphy and Hamilton 2013; Sommer and Mejia 2013; Hammock *et al.* 2015; 2017; 2019; Bever *et al.* 2016; Mahardja *et al.* 2019; Simonis and Merz 2019). Field observations are increasingly being supported by laboratory research that explains how delta smelt respond physiologically and behaviorally to variation in water quality that can vary with changes in climate, freshwater flow and estuarine bathymetry (e.g., Hasenbein *et al.* 2013; 2016b; Komoroske *et al.* 2014; 2016).

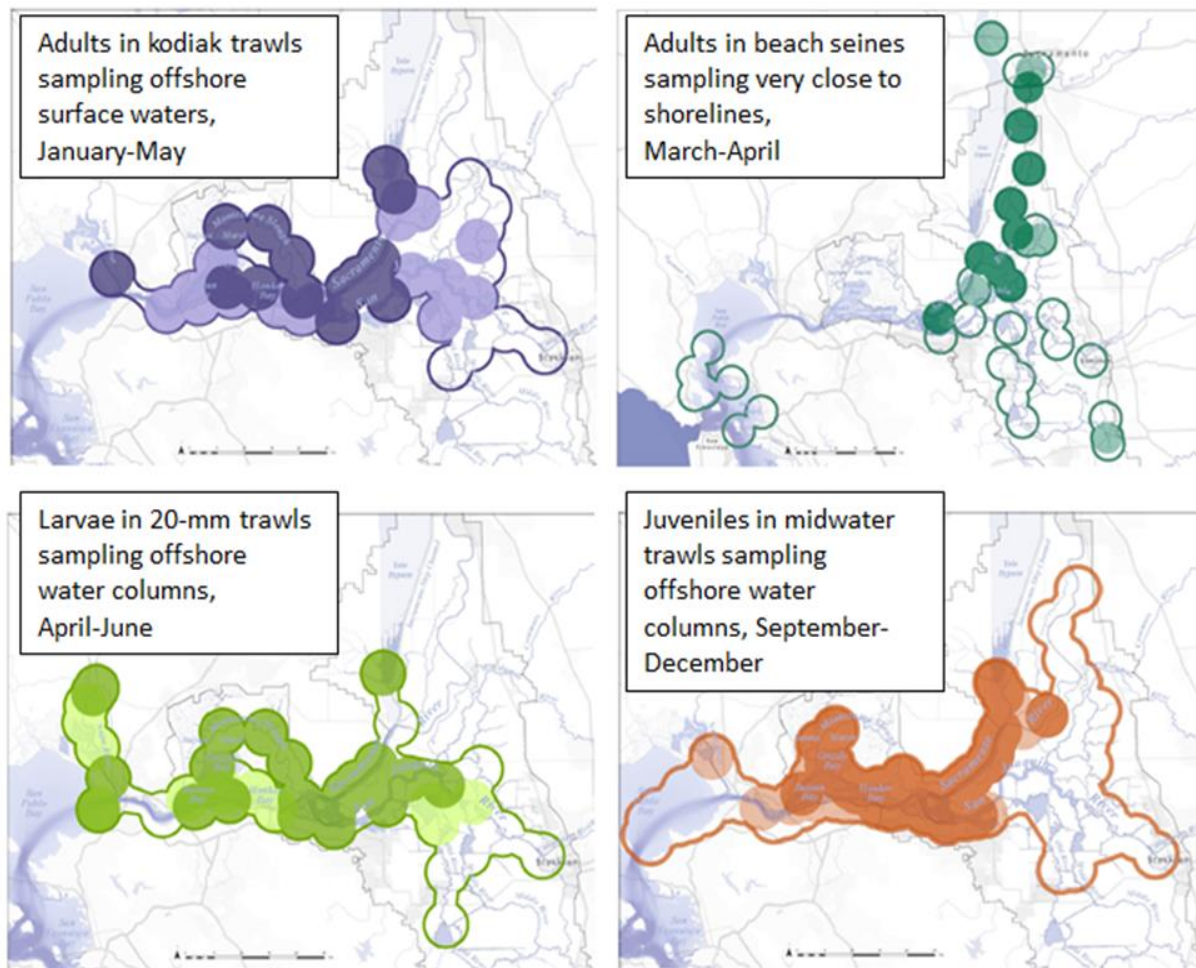
The principal variable-location habitat that delta smelt permanently occupy is the low-salinity zone (LSZ) (Moyle *et al.* 1992; Bennett 2005). The LSZ is a dynamic habitat with size and location that respond to changes in tidal and river flows (Jassby *et al.* 1995; Kimmerer *et al.* 2013; MacWilliams *et al.* 2015; 2016; Bever *et al.* 2016). The LSZ generally expands and moves downstream as river flows into the estuary increase, placing low-salinity water over a larger and more diverse set of nominal habitat types than occurs under lower flow conditions. As river flows decrease, the LSZ contracts and moves upstream. This is perhaps the most frequently assumed freshwater flow mechanism in discussions about X2 regulations, but as shown by Kimmerer *et al.* (2009; 2013), it does not appear to be a major explanatory mechanism for most fishes including the delta smelt.

The LSZ often encompasses many of the permanently occupied fixed locations discussed above. It is treated separately here because delta smelt distribution tracks the movement of the LSZ somewhat (Moyle *et al.* 1992; Dege and Brown 2004; Feyrer *et al.* 2007; 2011; Nobriga *et al.* 2008; Sommer *et al.* 2011; Bever *et al.* 2016; Manly *et al.* 2015; Polansky *et al.* 2018; Simonis and Merz 2019). Due to its historical importance as a fish nursery habitat, there is a long research history into the physics and biology of the LSZ. The LSZ is frequently defined as waters with a salinity range of about 0.5 to 6 ppt (Kimmerer 2004). This and similar salinity ranges reported by different authors were chosen based on analyses of historical peaks in chlorophyll concentration and zooplankton abundance. Most delta smelt collected in California Department of Fish and Wildlife's (CDFW) 20-mm Survey and Summer Townet Survey (TNS) have been collected at salinities of near 0 ppt to 2 ppt and most of the (older) delta smelt in the Fall Midwater Trawl (FMWT) have been collected from a salinity range of about 1 to 5 ppt (Kimmerer *et al.* 2013). These fish of different life stages do not tend to be in dramatically different places (Murphy and Hamilton 2013; Figure 3), suggesting that some of the change in occupied salinity with age is due to the seasonal increases in salinity that accompany lower outflow in the summer and fall.

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 (Sommer *et al.* 2011; Figure 3). 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 the larger sloughs of Suisun Marsh. Some delta smelt seasonally and transiently occupy Old and Middle rivers in the south Delta each year, but face a high risk of entrainment when they do (Kimmerer 2008; Grimaldo *et al.* 2009). 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 (Mager *et al.* 2004). Thus, the distribution of larvae reflects a combination of where spawning occurred and freshwater flow when the eggs hatch.

In summary, the delta smelt population spreads out in the winter and then retracts by summer into what is presently a bi-modal spatial distribution with a peak in the LSZ and a separate peak in the Cache Slough complex. Most individuals occur in the LSZ at some point in their life cycle and the use of the Cache Slough complex diminishes in years with warm summers (Bush 2017). *Microhabitat Use*: The delta smelt has been historically characterized as a pelagic fish, meaning one with a spatial distribution that is skewed away from shorelines (Moyle *et al.* 1992; Sommer *et al.* 2007). This has led to some confusion among researchers and managers alike – usually perpetuating a strawman argument that delta smelt either occupy deep-water habitats or shallow-water habitats. Then, catch data from shallow habitats get used to refute the pelagic characterization, but catches in shallow-water say nothing more about a pelagic tendency than catches in deep water would say about a nearshore habitat tendency. The long-term monitoring programs used to characterize delta smelt status and trend are offshore sampling programs – meaning pelagic sampling programs, and surface-trawling appears to be particularly effective at capturing delta smelt away from shorelines (Mitchell *et al.* 2017). However, numerous studies have reported collecting delta smelt from nearshore environments using fishing gear like beach seines and fyke nets from locations that often had a water depth less than or equal to 1 meter (just over three feet) (e.g., Matern *et al.* 2002; Nobriga *et al.* 2005; Gewant and Bollens 2012; Mahardja *et al.* 2017b). Further, it has been established that onshore-offshore movements are one behavior option delta smelt and other fishes can use to maintain position or move upstream in a tidal-flow influenced estuary (Bennett *et al.* 2002; Feyrer *et al.* 2013; Bennett and Burau 2015). Captive delta smelt have been shown to avoid in-water structure like submerged aquatic vegetation (SAV) (Ferrari *et al.* 2014). SAV tends to grow where tidal current velocities are low, which is a habitat attribute that has also been associated with wild delta smelt (Hobbs *et al.* 2006; Bever *et al.* 2016). Thus, the proliferation of SAV in areas that might otherwise be attractive to delta smelt represents a significant habitat degradation, not only because it creates structure in the water column, but also because it is associated with higher water transparency (Hestir *et al.* 2016), and a fish fauna that delta smelt does not seem to be able to coexist with (Nobriga *et al.* 2005; Conrad *et al.* 2016). Based on our review, the Service suggests that the characterization of delta smelt as an open-water fish appears to be accurate and does not imply occupation of a particular water column depth. The species does appear to have some affinity for surface waters (Bennett and Burau 2015; Mitchell *et al.* 2017), but like any microhabitat descriptor, this is not intended to reflect the location of all individuals because delta smelt are not limited to surface waters (Feyrer *et al.* 2013).

Although the delta smelt is generally an open-water fish, depth variation of open-water habitats is an important habitat attribute (Moyle *et al.* 1992; Hobbs *et al.* 2006; Bever *et al.* 2016). In the wild, delta smelt are most frequently collected in water that is somewhat shallow (4-15 ft deep) where turbidity is often elevated and tidal currents exist, but are not excessive (Moyle *et al.* 1992; Bever *et al.* 2016). For instance, in Suisun Bay, the deep shipping channels are poor quality habitat because tidal velocity is very high (Hobbs *et al.* 2006; Bever *et al.* 2016), but in the Delta where tidal velocity is slower, offshore habitat in Cache Slough and the Sacramento Deepwater Shipping Channel is used to a greater extent (Feyrer *et al.* 2013; CDFW unpublished data).



**Figure 3. 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. Note the lack of sampling sites in Suisun Bay and marsh for the beach seine (upper right panel). Source: Murphy and Hamilton (2013).**

### *Environmental Setting and History of Ecological Change in the Bay-Delta*

This section briefly reviews environmental changes that have occurred since 1850; i.e., the California Gold Rush to the present. This section is subdivided into three parts. The first describes the condition that is believed to have existed in 1850. The second covers a period from about 1920 to 1967, which is the year prior to the initiation of State Water Project (SWP) water exports from the Delta. The third sub-section covers 1968, the first year of Central Valley Project (CVP) and SWP dual operations, to the present.

Over the past few years, the scientific information developed to understand pre- and post-water project changes to the estuary's landscape and flow regime has grown substantially. However, as with most scientific endeavors, there are some discrepancies that may affect some conclusions. For instance, Whipple *et al.* (2012) showed the difference between contemporary estimates of unimpacted Delta outflow that were used in the modeling studies reviewed below and measured data from the latter 19<sup>th</sup> century. These discrepancies can affect the conclusions about the natural

hydrograph of the Bay-Delta ecosystem and should be kept in mind when reviewing what follows. The information on ecosystem changes that have accrued through time provides context for the current status of the delta smelt.

The 1850 Bay-Delta estuary: The historical Delta ecosystem was a large tidal marsh at the confluence of two floodplain river systems (Whipple *et al.* 2012; Andrews *et al.* 2017; Gross *et al.* 2018; Figure 4). The Delta itself experienced flooding over spring-neap tidal time scales and seasonal river runoff time scales. This variability in freshwater input to the estuary was likely important to seasonal and interannual variability in the productivity of the ecosystem for the same reasons that smaller-scale tidal marsh plain and floodplain inundation are today. Specifically, these flood cycles deliver organic carbon, but also increase the production of lower trophic levels due to lengthened water residence times and greater shallow, wetted surface areas (Sommer *et al.* 2004; Grosholz and Gallo 2006; Howe and Simenstad 2011; Enright *et al.* 2013). When freshwater flows out of the Delta and into the estuary, it can generate currents that aggregate particulate matter like sediment and phytoplankton (Monismith *et al.* 1996; 2002; MacWilliams *et al.* 2015) – and presumably also did so in the pre-development ecosystem. Prior to the invasion of the overbite clam, these sediment and phytoplankton aggregations, which occurred near the 2 ppt isohaline, demarcated an important fish nursery region (Turner and Chadwick 1972; Jassby *et al.* 1995; Bennett *et al.* 2002).

The estuary's natural hydrograph reached its annual base flows (annual minimum inputs of fresh water) in August or September toward the end of California's dry summers (Figure 5). Freshwater inputs would generally increase during the fall as precipitation in the watershed resumed. Delta outflow reached a broad winter through spring peak fueled first by precipitation followed by additional contributions from melting snow. The annual peak of Delta outflow often spanned January through May before declining back to base flow conditions by the late summer. The year-to-year variation in Delta outflow was considerable, often varying by about an order of magnitude during each month of the year. Water flowing from the Delta mixed into larger open-water habitats in Suisun and San Pablo bays, which themselves were fringed with marshes and tidal creeks. This pre-development ecosystem was shallower than the modern system. As a result, salinity responded more rapidly to changes in freshwater flow than it does now and less freshwater flow was needed to move salinity isohalines than is presently the case (Andrews *et al.* 2017; Gross *et al.* 2018). Like most native fish, the delta smelt evolved its life history to take advantage of this flow regime (Moyle 2002). In particular, its spawning period and early life stages overlap the months in which historical marsh-floodplain inundation and freshwater inputs to the estuary were highest, and water temperatures were cool, but not as cold as they are in the winter before spawning commences (see above for details of what is known about spawning and early life stages of delta smelt).

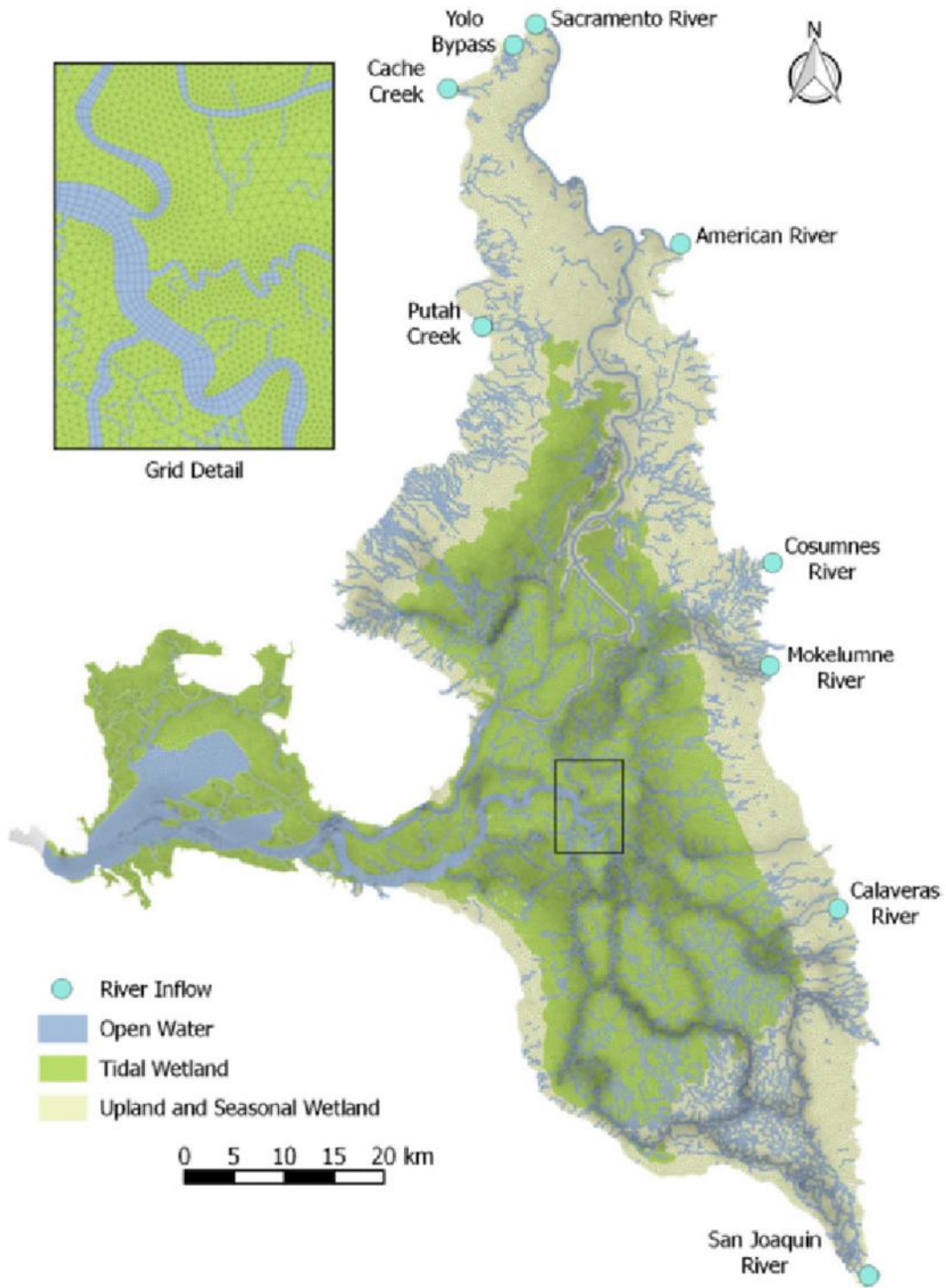
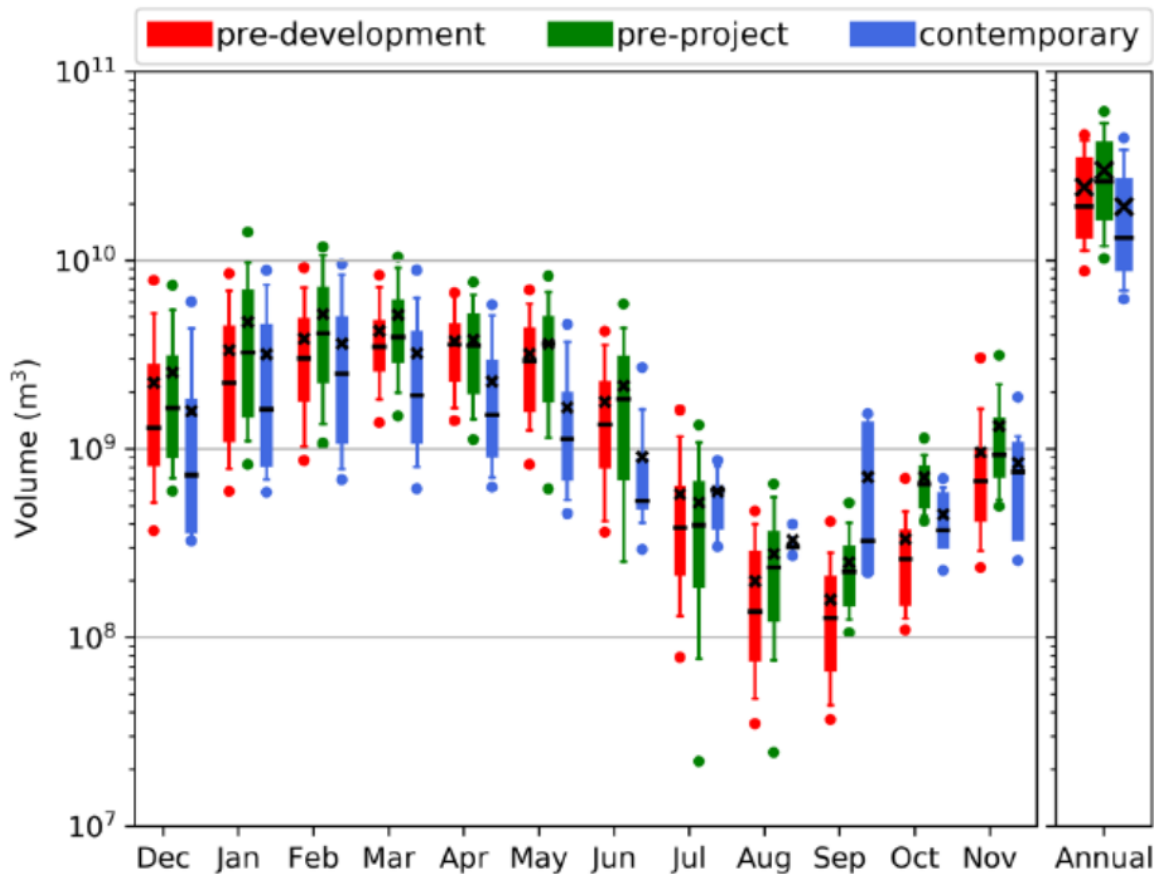


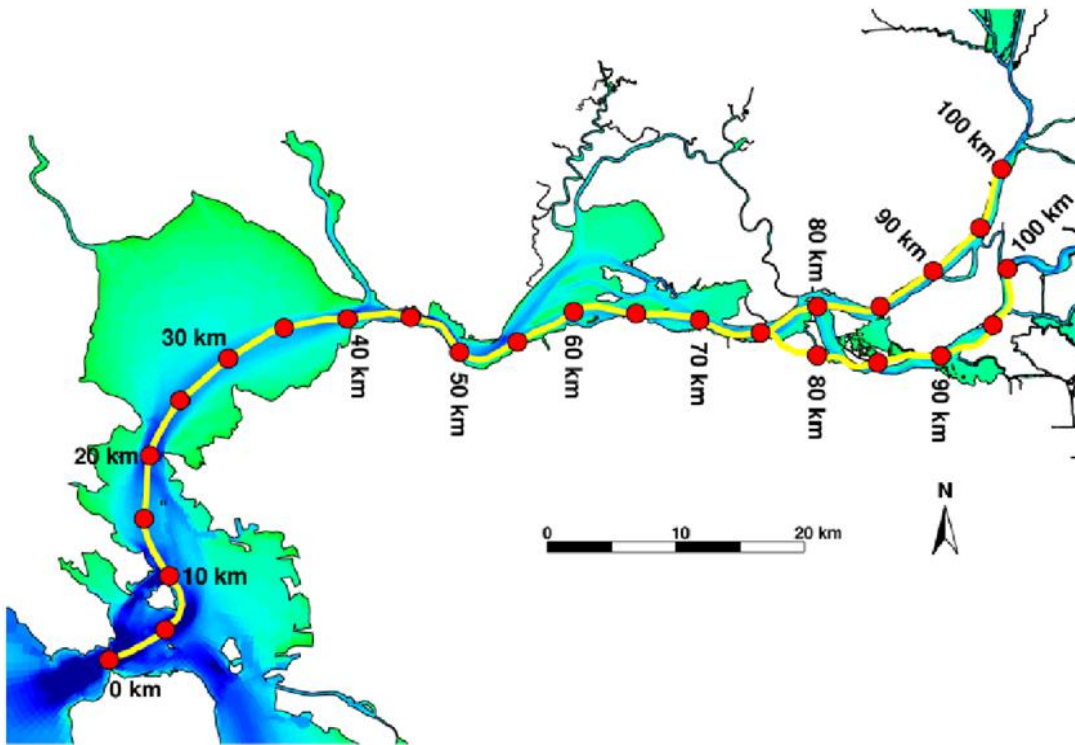
Figure 4. The circa 1850 Delta as depicted in the version of the UnTRIM 3-D hydrodynamic model described by Andrews *et al.* (2017). The model depicts an expansive tidal marsh area of approximately 2,200 square kilometers (km) or 850 square miles. Source: Andrews *et al.* (2017).



**Figure 5.** Boxplots of estimated Delta outflow by month for a pre-development Bay-Delta (circa 1850; red boxes), a pre-CVP and SWP Bay-Delta (circa 1920; green boxes), and a contemporary Bay-Delta (blue boxes; precise year not stated by the authors). Source: Gross *et al.* (2018). The inset labeled “Annual” on the x-axis is the boxplot summary of the sum of monthly outflows. Gross *et al.* (2018) attributed the higher outflow in the pre-project era relative to the pre-development era to the levees that had been constructed in the system by 1920.

Many tidal river estuaries form frontal zones where inflowing fresh water begins mixing with seawater (Peterson 2003). In the Bay-Delta, a frontal zone of biological importance is the LSZ (Jassby *et al.* 1995). The LSZ is a mobile and variable habitat region that frequently overlaps the parts of the estuary where many delta smelt reside (as described above). In the Bay-Delta the location and associated function of the LSZ have historically been indexed using a statistic called X2, which is the geographic location of 2 ppt salinity near the bottom of the water column measured as a distance from the Golden Gate Bridge (Jassby *et al.* 1995; MacWilliams *et al.* 2015; Figure 6). When Delta outflow is high, saline water is pushed closer to the Golden Gate, resulting in a smaller distance from the Golden Gate Bridge to X2. Conversely, when Delta outflow is low, salinity intrudes further into the estuary resulting in a larger distance from the Golden Gate Bridge to X2. These changes in how salinity is distributed affect numerous physical and biological processes in the estuary (Jassby *et al.* 1995; Kimmerer 2002a,b; Kimmerer 2004; MacWilliams *et al.* 2015).

X2, rather than another salinity isohaline, was chosen as the low-salinity zone habitat metric because it is a frontal zone or boundary upstream of which, salinity tends to be the same from the surface of the water to the bottom, and downstream of which, salinity varies from top to bottom (Jassby *et al.* 1995). That variability in the vertical distribution of salinity is indicative of currents that help to aggregate sinking particles like sediment and phytoplankton, and as recently modeled, zooplankton (Kimmerer *et al.* 2014a), near X2.



**Figure 6.** The northern reach of the Bay-Delta as depicted in the UnTRIM 3-D contemporary Bay-Delta model; greener colors represent shallower water and bluer colors represent deeper areas. The yellow lines depict the transect along which the location of X2 is estimated in the model and the associated red circles depict selected km distances from the Golden Gate Bridge along the northern axis of the estuary into the Sacramento and San Joaquin rivers for use in interpreting the variable locations of X2. Source: MacWilliams *et al.* (2015).

Pre-development outflows from the Delta were higher in the winter and spring than they are now while summer and fall outflows may have been lower (Andrews *et al.* 2017; Gross *et al.* 2018; Figure 5). Thus, X2 also varied more within years in the circa 1850 estuary than it now does. In the pre-development estuary, X2 would remain in San Pablo Bay for months at a time in the winter-spring of Above Normal and wetter water year types before retreating landward (upstream) in the summer-fall. In the contemporary estuary, X2 primarily lies in Suisun Bay during the wet season (landward or ‘upstream’ of historical) and between Collinsville and Rio Vista during the dry season (~ 80 to 95 km; Figure 6). These contemporary dry season locations of X2 may be seaward or ‘downstream’ of historical locations (Gross *et al.* 2018).

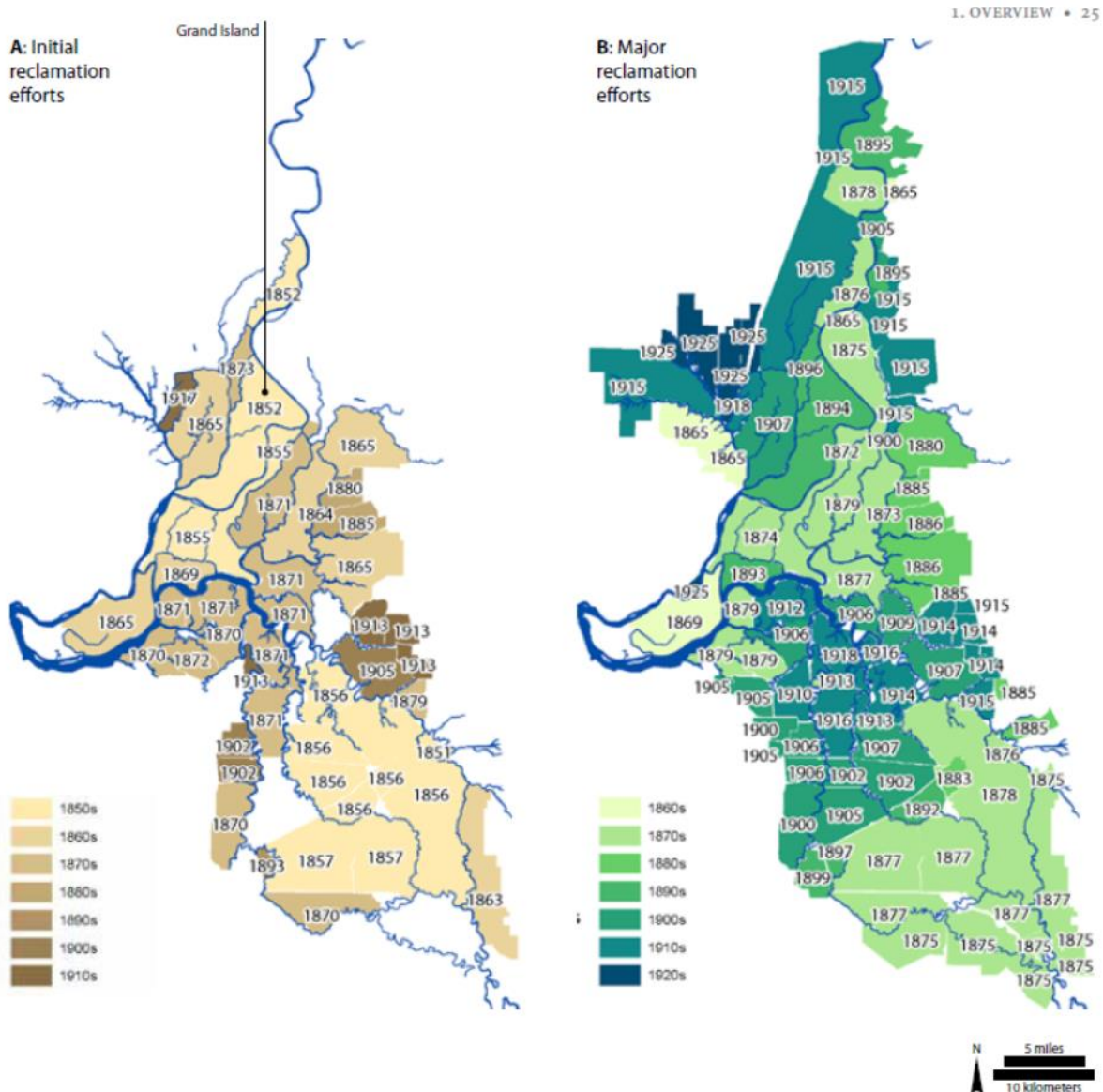
There are no data on the timing and magnitude of biological productivity in the circa 1850 Bay-Delta, nor are we aware of any information on how delta smelt used the estuary at the time.

However, inferences can be made based on general ecosystem function in the northern hemisphere temperate zone and contemporary information. The input of basal food web materials like nutrients and detritus likely co-varied with the timing, duration, and magnitude of freshwater flows (e.g., Delta inflow; Jassby and Cloern 2000), which would likewise have affected the timing, magnitude, and duration of inundation of the system's expansive floodplains (e.g., Whipple *et al.* 2012; Figure 4). The production of planktonic and epibenthic invertebrates from floodplains, tidal wetlands, and open-water habitats that fuel the production of juvenile fishes that feed in open waters may have generally increased during the spring and peaked during the summer in concert with seasonal variation in water temperature (e.g., Heubach 1969; Orsi and Mecum 1986; Merz *et al.* 2016). The summer months are the warmest months in the Bay-Delta region and thus, they support the highest *average* metabolic rates of invertebrates and fish, which rely on water temperature to control their body temperature and metabolic rates. However, there was likely to have been considerable species-specificity to this generalization (e.g., Ambler *et al.* 1985; Gewant and Bollens 2005) because the Bay-Delta's native biotic community includes numerous cold-water adapted species.

The seasonal timing of delta smelt reproduction (February-May; detailed below) would have more broadly coincided with the general timing of peak freshwater flow into the Bay-Delta (Figure 5). The higher outflow and shallower average depth of the system resulted in frequent occurrence of the LSZ in San Pablo Bay during the wet season. Thus, it is likely that delta smelt reared in San Pablo Bay, taking advantage of its greatly expanded low-salinity habitat area (see MacWilliams *et al.* 2015), to much greater extent prior to development of the system than they are able to now. Lower flows in the summer-fall likely caused delta smelt distribution to seasonally retract back into Suisun Bay/marsh and the Delta; ecosystems which were likely much more productive at the time due to the expansive tidal marshes and greater connection between land and water (Whipple *et al.* 2012). Delta smelt's population-level demand for prey annually peaks at some combination of water temperature and growth of the population's biomass. This timing could be estimated from the model developed by Rose *et al.* (2013a), but we are not aware that such a calculation exists.

1920-1967: By 1920, most of the Delta's tidal wetlands had been reclaimed (Whipple *et al.* 2012; Figure 7). The data provided by Gross *et al.* (2018; Figure 4) suggest that Delta outflow may have been a little higher circa 1920 than it had been circa 1850 due to levee construction. However, this may (Hutton and Roy 2019) or may not be consistent with historical observations (Whipple *et al.* 2012). Regardless, Delta outflow and several other net flow metrics from within the Delta did begin to decline between the early 1920s and 1967 (Hutton *et al.* 2017a; 2019). These changes occurred because of four factors: (1) water storage in the Bay-Delta watershed increased from about 4 million acre feet (MAF) to about 40 MAF because of the construction of dams upstream of the Delta, (2) the CVP began exporting water from the Delta in 1951, (3) non-project water diversions within and upstream of the Delta increased, and (4) shipping channels were dredged through the estuary and into the Sacramento and San Joaquin rivers. These changes facilitated a general water management strategy in California to store water during the wet season and re-distribute it during the dry season to provide a more reliable supply than was available naturally. In addition, the CVP and SWP have had to offset a considerable summertime water deficit to protect the quality of their exported water and to protect water quality for senior water rights holders in the Delta. These uses would be highly impaired without water released from CVP and SWP reservoirs during the summer and fall (Hutton *et al.* 2017b).

During the 1930s to 1960s, the navigation channels were dredged deeper (~12 meters) to accommodate shipping traffic from the Pacific Ocean and San Francisco Bay to ports in Sacramento and Stockton and to increase the capacity of the Delta to convey floodwaters. Channel deepening interacted with the simultaneously increasing water storage to change the Bay-Delta ecosystem into one in which Suisun Bay and the Sacramento-San Joaquin River confluence region became the largest and most depth-varying places in the typical range of the LSZ. Even with these changes, the LSZ remained a highly productive fish nursery habitat for many decades (Stevens and Miller 1983; Moyle *et al.* 1992; Jassby *et al.* 1995).

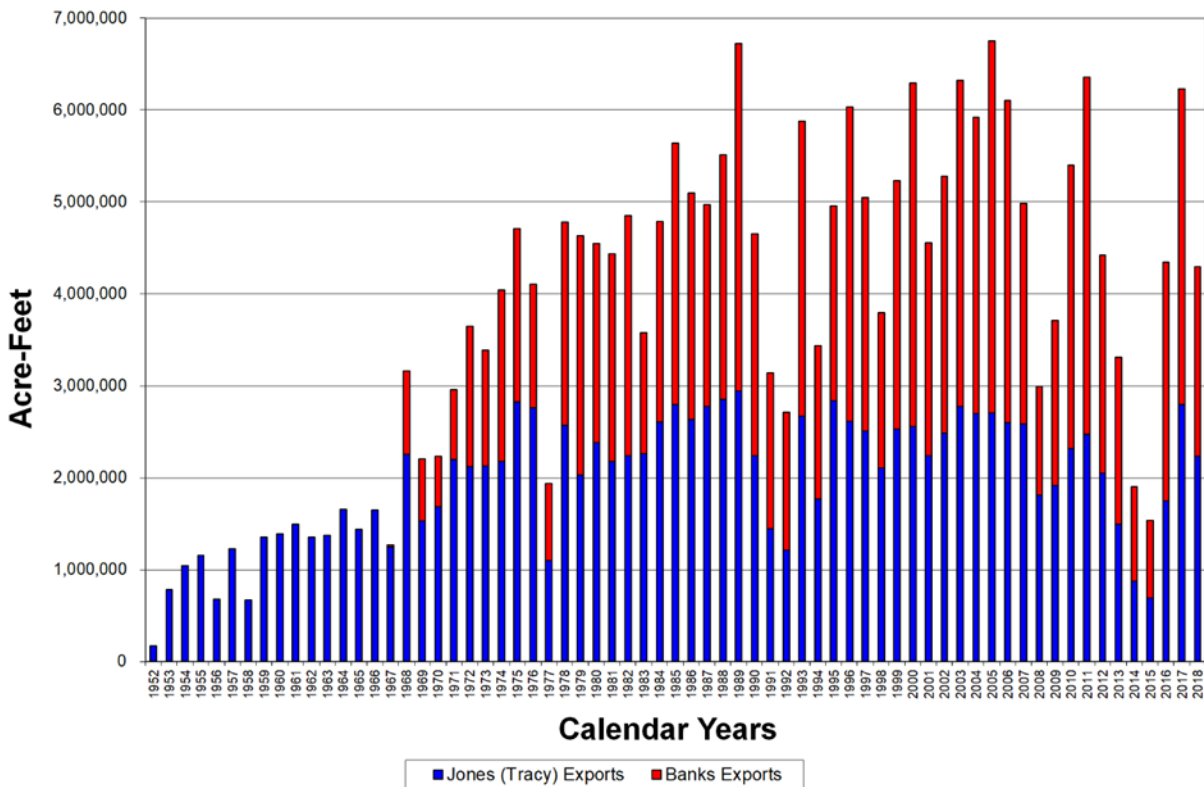


**Figure 7. Maps of the Delta showing years of initial land reclamation attempts on the left and major land reclamation efforts on the right. Note that a large majority of the major reclamation efforts were underway by 1915 and the last efforts in the vicinity of Liberty Island began in 1925. Source: Whipple *et al.* (2012).**

1968-present: The SWP began exporting water from the Delta in 1968 and its exports generally increased until about 1989 (Figure 8). CVP exports reached present-day levels by the end of the 1970s. During the 1980s water storage capacity in the Bay-Delta watershed reached its present-

day level of a little over 50 MAF (Cloern and Jassby 2012; Hutton *et al.* 2017a). Thereafter, combined CVP-SWP exports began to increase in year-to-year variability, which increased the uncertainty about how much water would be supplied south of the Delta annually. This has combined with the increasing human demand for fresh water to result in a conflict between human water demand and environmental water uses, including the maintenance of the hydraulic salinity barrier needed to protect exported water and other in-Delta water users from salinity intrusion (Hutton *et al.* 2017b; Reis *et al.* 2019).

### Annual Historical Delta Export Pumping Volumes



**Figure 8. Time series of Central Valley Project and State Water Project exports from the Delta for 1952 through 2018. State Water Project exports began in water year 1968. Source: DAYFLOW data base.**

The changes discussed above have continued to lower Delta outflow (Hutton *et al.* 2017a,b; Reis *et al.* 2019; Figures 9 and 10), though D-1641 appears to have halted the trend for years in which the eight river index is lower than 20 MAF (middle panel of Figure 9). In Figure 9, exports were modeled as depletions of water from the system, so the more negative the number on the y-axis of the middle panel, the higher the exports. Thus, the graphic shows that in years when the eight river index is more than 20 MAF, exports continue to increase, but in years when the eight river index is lower than 20 MAF, exports have been trending lower. Both of these trends cause the higher year-to-year variability in water exports shown in Figure 8.

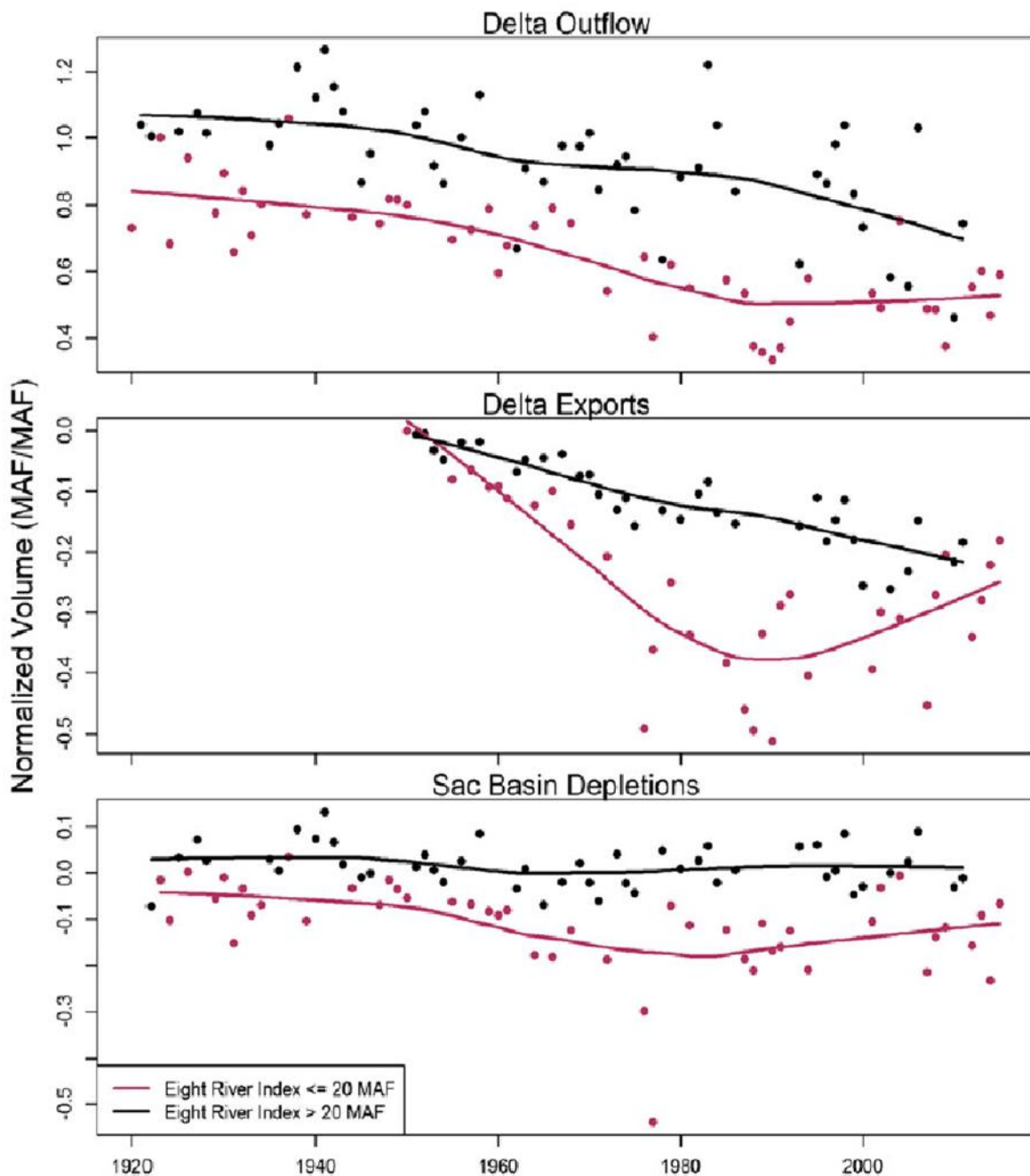
In general, major changes to the flow regime of an aquatic ecosystem are expected to be accompanied by ecological change (Benson 1981; Bunn and Arthington 2002; Poff and Zimmerman 2010; Gillson 2011), and that is what has been observed over time in the Bay and Delta (e.g., Matern *et al.* 2002; Moyle and Bennett 2008; Winder *et al.* 2011; Feyrer *et al.* 2015;

Conrad *et al.* 2016). Delta outflow is a driver of many ecological mechanisms in the Bay-Delta and an indicator of several others (Kimmerer 2002a). Thus, the changes to the estuary's freshwater flow regime have likely interacted with the changes to the estuary's landscape, specifically its deeper channels and greatly reduced land-water connections (Andrews *et al.* 2017), to lower the total biological productivity of the estuary. In addition, changes to the freshwater flow regime detailed above appear to have affected the reproductive success of fishes that use the Delta and Suisun Bay as rearing habitats. The evidence for this is that the native fish assemblage had reproductive seasons timed to winter-spring peak flows, whereas currently dominant non-native species generally spawn later in the spring and into the summer when inflows to the Delta are generally high to support human water use, but outflow from the Delta is generally low (Moyle 2002; Moyle and Bennett 2008). Reis *et al.* (2019) recently described super-critical water years with respect to Delta outflow. Several studies have indicated that low flow years and droughts in particular result in low native fish production in the Bay-Delta (Meng *et al.* 1994; Jassby *et al.* 1995; Kimmerer 2002b; Feyrer *et al.* 2015). Droughts recur and may contribute to cumulative impacts to native fishes like delta smelt. For instance, recent droughts have been particularly problematic for delta smelt (Moyle *et al.* 2018). Thus, the frequency of these super-critical water years, which has been much higher since 1968 than it was from 1920-1967 (Figure 10), is a conservation challenge that the Service and its partners have to contend with.

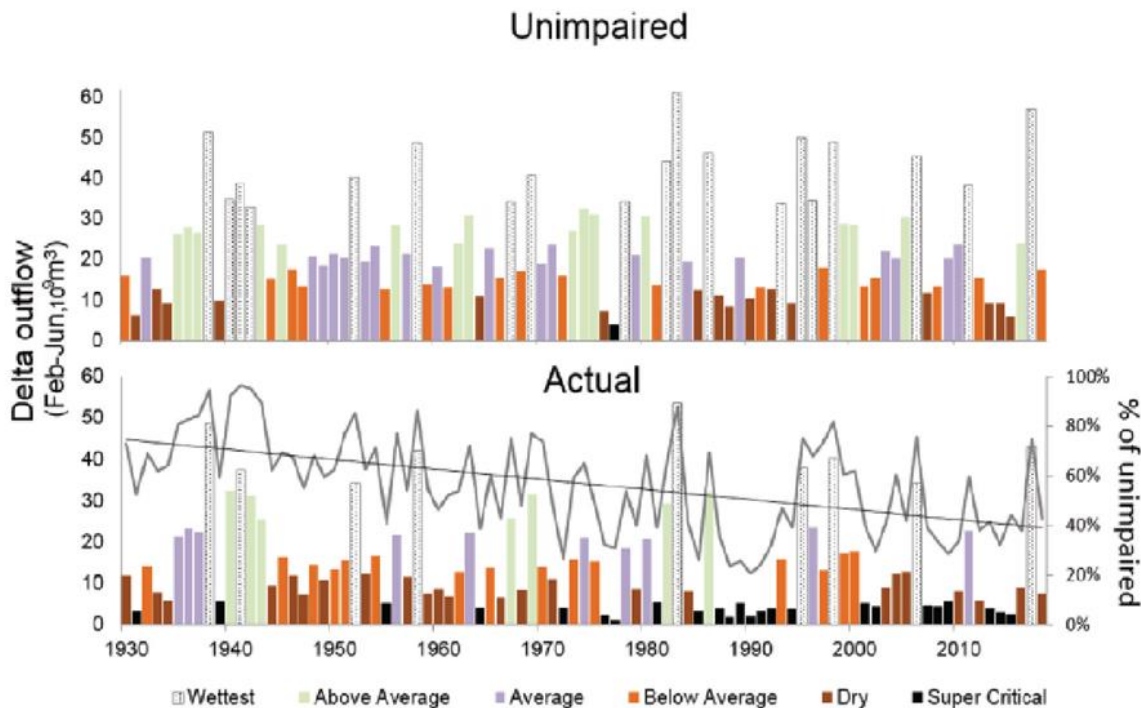
There are several fish species in the Bay-Delta that have historically been shown to have demonstrable positive population responses to freshwater flows into or out of the Delta. These include the well-described relationships for the survival of emigrating Sacramento basin Chinook salmon (*Oncorhynchus tshawytscha*) smolts with Sacramento River inflows (Kjelson and Brandes 1989; Perry *et al.* 2010), the relationship of Sacramento splittail (*Pogonichthys macrolepidotus*) production to Yolo Bypass flow (Moyle *et al.* 2004; Feyrer *et al.* 2006), and the 'fish-X2' relationships for striped bass (*Morone saxatilis*), longfin smelt (*Spirinchus thaleichthys*), and starry flounder (*Platichthys stellatus*) (Turner and Chadwick 1972; Jassby *et al.* 1995; Kimmerer 2002b). The life-history of delta smelt with its affinity for fresh and low-salinity waters seems consistent with that of a fish one could expect to respond similarly to variation in Delta outflow or X2. Researchers searched for some form of analogous relationship for the delta smelt for several decades, but no persistent relationship was found (Stevens and Miller 1983; Moyle *et al.* 1992; Jassby *et al.* 1995; Kimmerer 2002b; Bennett 2005; Mac Nally *et al.* 2010; Thomson *et al.* 2010; Miller *et al.* 2012). Further, Rose *et al.* (2013a,b) did not find salinity variation *per se* to have much impact on predictions of delta smelt population growth rate. The larger predicted impact in their individual-based model related to flow was due to simulated entrainment in exported water (Rose *et al.* 2013b; Kimmerer and Rose 2018). Although entrainment was predicted to lower the population growth rate, in and of itself, it could not convert a strongly positive growing population into a declining one without at least one additional factor impacting survival at the same time.

The IEP (2015) reported a correlation between February-May X2 and ratios of the 20-mm Survey index for delta smelt and either the Spring Kodiak Trawl (SKT) or FMWT indices of the parental stock that produced the 20-mm fish. This relationship emerged in data beginning at the time of the pelagic organism decline (POD) in 2002. This relationship is stronger when considered in terms of salinity at Chipps Island (He and Nobriga 2018), possibly because salinity can be measured more accurately than Delta outflow when net freshwater flow is very low (Monismith 2016). Castillo *et al.* (2018) used a simulation based on SKT data to suggest a link

between Delta outflow and adult delta smelt abundance. In addition, several teams have reported statistical associations of delta smelt spatial distribution and salinity that imply the population spatial distribution co-varies with Delta outflow, X2, or similar indices of freshwater input to the estuary (Feyrer *et al.* 2007; 2011; Nobriga *et al.* 2008; Kimmerer *et al.* 2009; 2013; Bever *et al.* 2016; Polanky *et al.* 2018; Simonis and Merz 2019). The strength of this covariation and its management utility have been contested (e.g., Murphy and Hamilton 2013; Manly *et al.* 2015; Latour 2016; Polanky *et al.* 2018) and supported (Sommer *et al.* 2011; Bever *et al.* 2016; Feyrer *et al.* 2016; Mahardja *et al.* 2017a) in several recently published papers.



**Figure 9.** Time series (1922-2015) of statistical trend outputs of annual Delta outflow (top panel), Delta exports treated as depletions so increasing exports are represented by more negative values (middle panel), and water diversions from the Sacramento River basin in upstream of the Delta (bottom panel). Black symbols and lines are for years in which the eight river index, a measure of water availability in the Bay-Delta watershed, was greater than 20 MAF. Red symbols and lines are for years in which the eight river index was less than or equal to 20 MAF. Source: Hutton *et al.* (2017b).



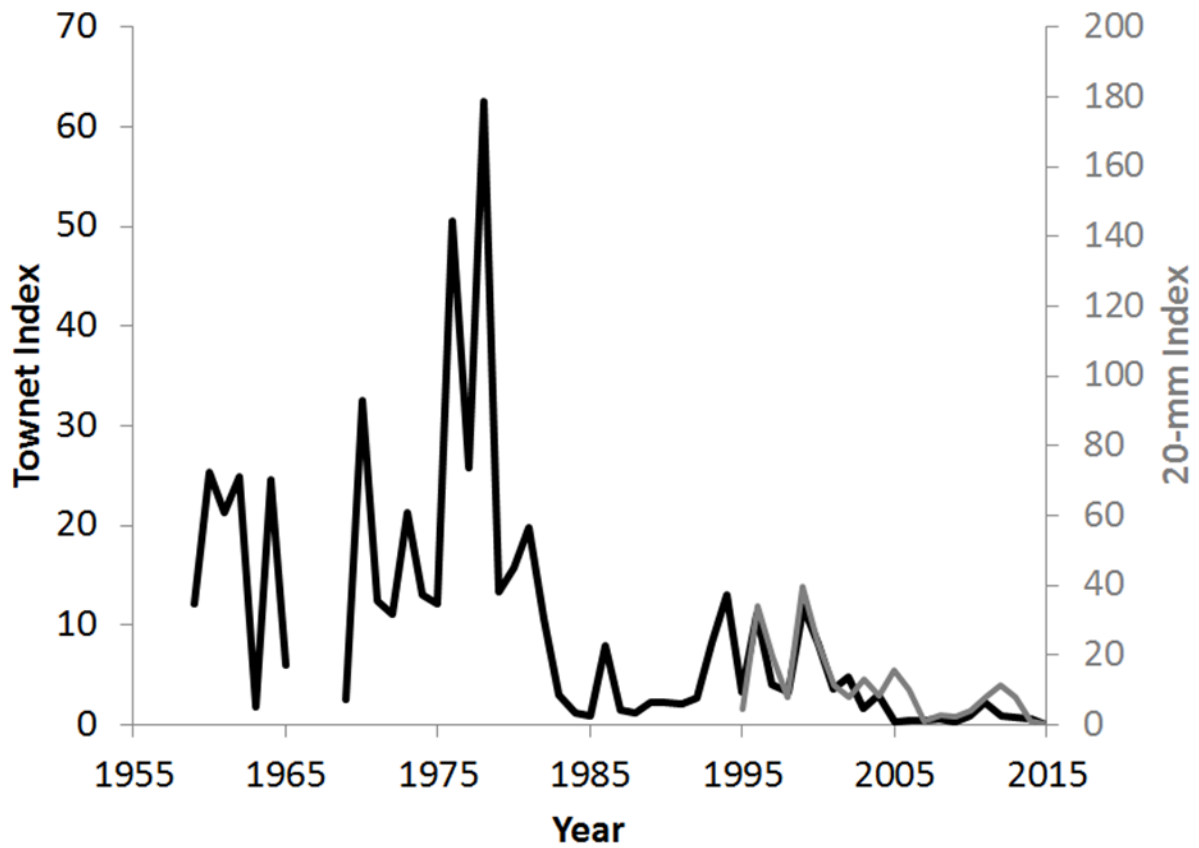
**Figure 10.** Time series of estimates of unimpaired (upper panel) and actual (lower panel) Delta outflow (February-June) color-coded according to six water year types, 1930-2018. The water year types based on basin precipitation are shown in the upper panel. In the lower panel, the water year types were re-assessed based on their fraction of the estimated unimpaired outflow. The long-term trend in this fraction as “% of unimpaired” is shown on the secondary-axis of the bottom panel. Source: Reis *et al.* (2019).

### Delta Smelt Population Trend

The CDFW’s TNS (<http://www.dfg.ca.gov/delta/data/townet/indices.asp?species=3>) and FMWT Survey (<http://www.dfg.ca.gov/delta/data/fmwt/indices.asp>) are the two longest running indicators of the delta smelt’s abundance trend. Indices of delta smelt relative abundance from these surveys date to 1959 and 1967, respectively (Figures 11 and 12). The FMWT index has traditionally been the primary indicator of delta smelt trend because it samples later in the life cycle, providing a better indicator of annual recruitment than the TNS (Service 1996). It has also sampled more consistently and more intensively than the TNS. The FMWT deploys more than 400 net tows per year over its four-month sampling season (September through December). The highest FMWT index for delta smelt (1,673) was recorded in 1970 and a comparably high index (1,654) was reported in 1980 (Figure 12). The last FMWT index exceeding 1,000 was reported in 1993. The last FMWT indices exceeding 100 were reported in 2003 and 2011. In 2018, the FMWT index was zero for the first time. The TNS index for delta smelt has been zero four times since 2015. Thus, the TNS and FMWT have recorded a 40-50 year decline in which delta smelt

went from a minor (but common) species to essentially undetectable by these long-term surveys (Figures 11 and 12).

Following the listing of the delta smelt, the CDFW launched a 20-mm Survey (1995) and a SKT Survey (SKT; 2002) to monitor the distribution and relative abundance of late larval stage and adult delta smelt, respectively. These newer indices have generally corroborated the trends implied by the TNS and the FMWT (Figures 11 and 12). The CDFW methods generate abundance indices from each survey but each index is on a different numeric scale. This means the index number generated by a given survey only has quantitative meaning relative to other indices generated by the same survey. Further, the CDFW indices lack estimates of uncertainty (variability) which limits interpretation of abundance changes from year to year even within each sampling program. The Service recently completed a new delta smelt abundance indexing procedure using data from all four of these surveys (Polansky *et al.* 2019). The Service method improves upon the CDFW method because it generates abundance indices in units of numbers of fish, including attempts to correct for different sampling efficiencies among surveys, and the method includes measures of uncertainty. Service indices of spawner abundance based on combined January and February SKT sampling are listed with their confidence intervals in Table 1. The estimates show the most recent 20 years of the delta smelt's longer-term decline in numbers of fish as best as they can be approximated with currently available information. The 2021 abundance estimate based on the January and February SKT sampling is 0 because no delta smelt were caught during those sampling efforts. However, Service's more recent Enhanced Delta Smelt Monitoring (EDSM) surveys did collect delta smelt during January and February, although in low numbers. For both surveys, data collected from January and February of each year were combined to derive a single abundance estimate. EDSM is designed to complete Delta wide surveys at a weekly time scale while SKT does this at a monthly scale, so the Service calculated EDSM abundance estimates using all weekly survey data within the January-February time interval (Table 2). While not 0 like the SKT based abundance, the EDSM calculated abundance estimate of spawning adults is an extremely low 267 individuals.



**Figure 11. Time series of juvenile and larval delta smelt relative abundance as depicted by the California Department of Fish and Wildlife’s TNS and 20-mm Survey, respectively. The TNS began in 1959 and the 20-mm Survey began in 1995. The second-y-axis was scaled to better align the indices which are calculated on different numeric scales.**

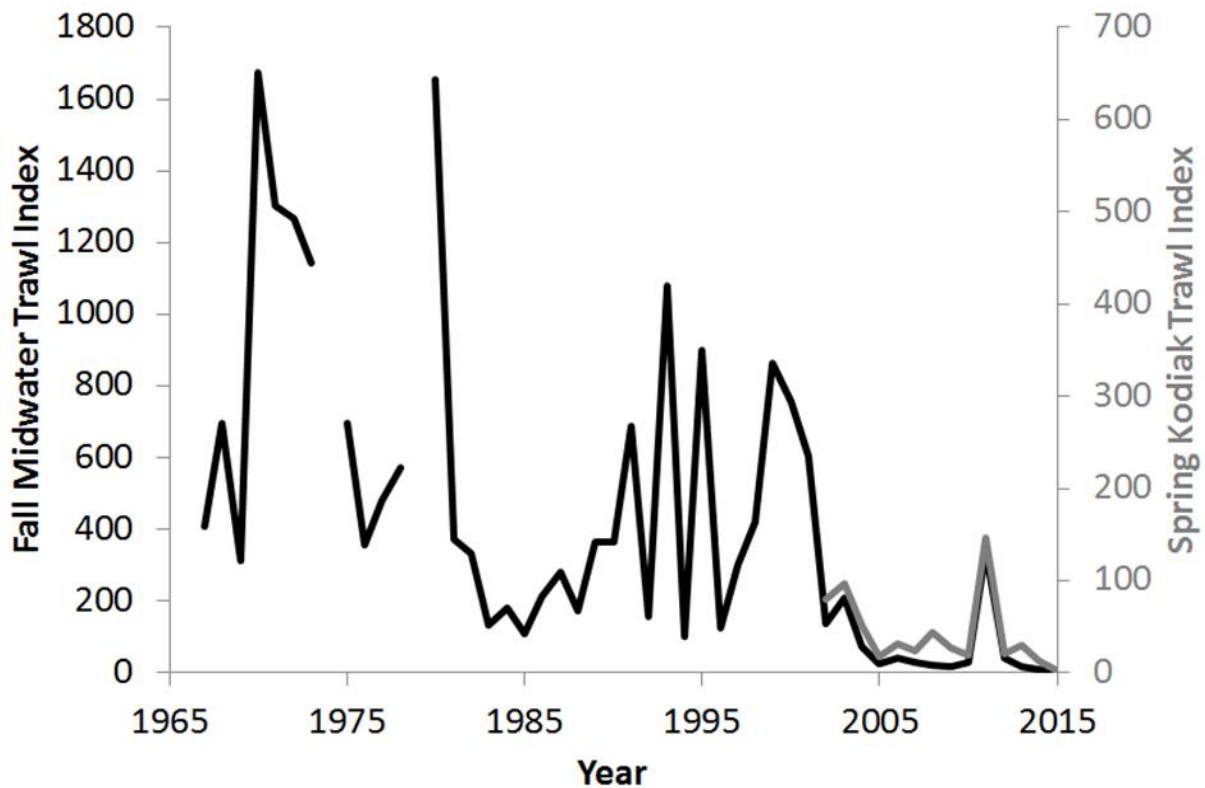


Figure 12. Time series of juvenile and larval delta smelt relative abundance as depicted by the California Department of Fish and Wildlife’s FMWT and SKT Survey, respectively. The FMWT survey began in 1967 and the SKT trawl survey began in 2002. The secondary-axis was scaled to better align the indices which are calculated on different numeric scales.

Table 1. Estimates of adult delta smelt population size during January-February SKT of 2002 through 2021 with 95% confidence intervals.

Year	Abundance Estimate	Standard Error	95% Confidence Interval		Number of Delta Smelt Caught (total tows) in the SKT Survey		Year-to-Year Ratio
			Lower Bound	Upper Bound	January	February	
2002	1,093,244	195,329	760,332	1,523,294	262 (35)	394(39)	NA
2003	996,055	261,205	581,197	1,597,198	NA (0)	232 (39)	0.91
2004	966,981	262,190	553,729	1,573,002	380 (39)	300 (34)	0.97
2005	715,858	147,190	470,572	1,044,828	220 (39)	218 (40)	0.74
2006	272,327	42,400	198,681	364,438	44 (40)	84 (40)	0.38
2007	449,466	128,731	249,216	749,168	109 (40)	107 (39)	1.65
2008	509,428	188,396	236,859	963,839	132 (40)	36 (39)	1.13
2009	1,166,145	523,856	459,083	2,464,804	579 (40)	61 (42)	2.29
2010	251,863	54,580	161,753	374,582	88 (41)	57 (41)	0.22
2011	461,599	202,547	185,712	962,088	177 (42)	128 (40)	1.83
2012	1,177,201	328,682	662,728	1,939,836	320 (42)	287 (42)	2.55

<b>2013</b>	333,682	89,809	191,886	541,064	100 (41)	125 (41)	0.28
<b>2014</b>	308,972	91,474	167,858	522,884	148 (40)	55 (40)	0.93
<b>2015</b>	213,345	76,639	101,434	397,439	21 (39)	68 (39)	0.69
<b>2016</b>	25,445	9,584	11,661	48,622	7 (40)	6 (39)	0.12
<b>2017</b>	73,331	23,342	38,010	128,459	18 (38)	8 (41)	2.88
<b>2018</b>	26,649	21,397	5,215	82,805	10 (40)	4 (41)	0.36
<b>2019</b>	5,610	4,395	1,138	17,135	1 (40)	1 (39)	0.21
<b>2020</b>	5,213	3,644	1,241	14,710	1 (39)	1 (40)	0.93
<b>2021</b>	0	Not defined	Not defined	Not defined	0 (39)	0 (36)	0

**Table 2. Enhanced Delta Smelt Monitoring (EDSM) Survey abundance estimates with columns as in Table 1.**

Year	Abundance Estimate	Standard Error	95% Confidence Interval		Total delta smelt caught (total tows) by the EDSM survey		Year-to-Year Ratio
			Lower Bound	Upper Bound	January	February	
<b>2017</b>	83,878	20,070	28,770	193,146	63 (477)	33 (684)	NA
<b>2018</b>	6,821	2,778	1,664	19,123	10 (772)	3 (610)	0.08
<b>2019</b>	4,482	1,062	1,546	10,288	18 (730)	7 (518)	0.66
<b>2020</b>	1,027	520	209	3,134	3 (691)	2 (606)	0.23
<b>2021</b>	267	189	41	928	2 (327)	0 (466)	0.26

### *Climate Change*

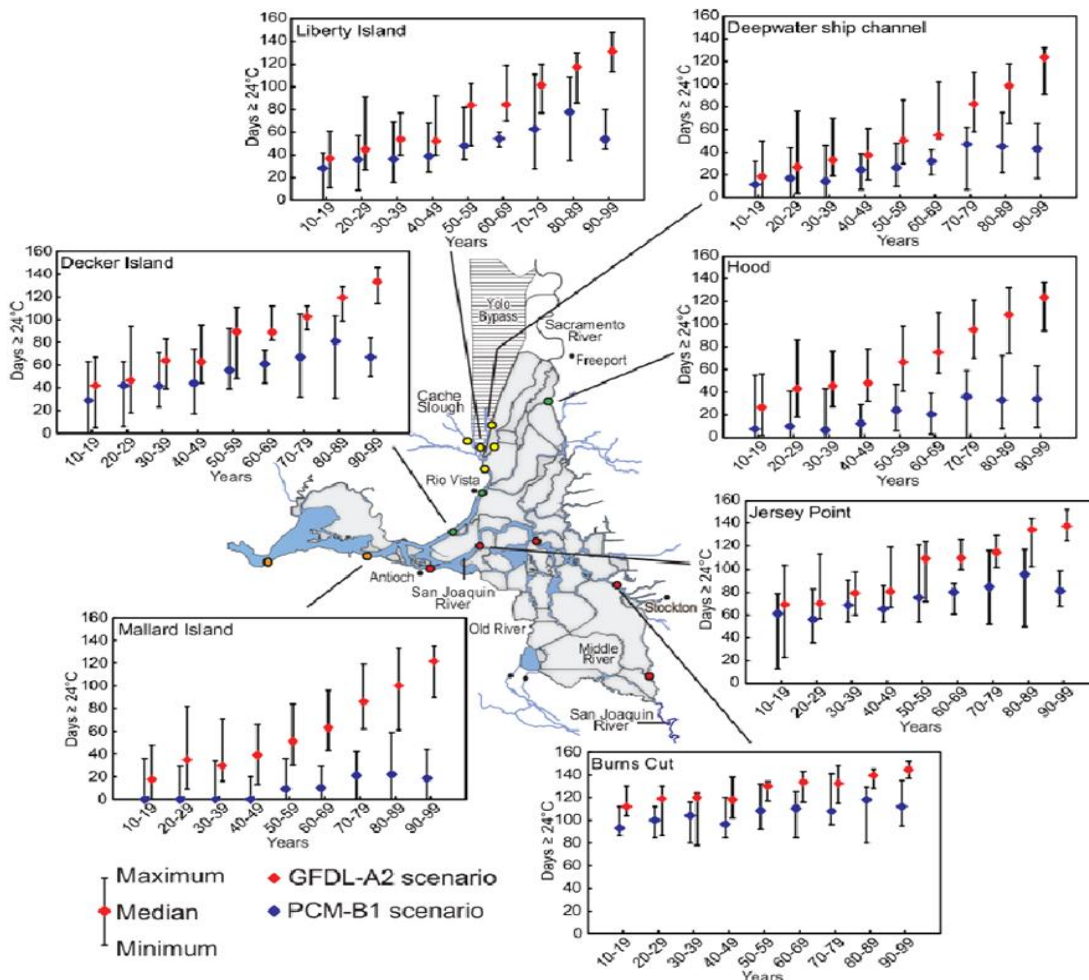
Climate projections for the San Francisco Bay-Delta and its watershed indicate that changes will be substantial by mid-century and considerable by the year 2100. Climate models broadly agree that average annual air temperatures will rise by about 2°C at mid-century and about 4°C by 2100 if current atmospheric carbon emissions accelerate as currently forecasted (Dettinger *et al.* 2016). It remains highly uncertain whether annual precipitation in the Bay-Delta watershed will trend wetter or drier (Dettinger 2005; Dettinger *et al.* 2016). The warmer air temperature projections suggest more precipitation will fall as rain rather than snow and that storms may increase in intensity, but will have more dry weather in between them (Knowles and Cayan 2002; Dettinger 2005; Dettinger *et al.* 2016). The expected consequences are less water stored in spring snowpacks, increased flooding and an associated decrease in runoff for the remainder of the year (Hayhoe *et al.* 2004). Changes in storm tracks may lead to increased frequency of flood and drought cycles during the 21<sup>st</sup> century (Dettinger *et al.* 2015).

As of 2009, sea level rise had not had much effect on X2 (Hutton *et al.* 2017b). However, additional sea level rise is another anticipated consequence of a warming global climate and if it is not mitigated, sea level rise will likely increase saltwater intrusion into the Bay-Delta (Rath *et al.* 2017). During the summer of 2015, variation in sea level interacted with very low Delta inflows to cause frequent recurrence of net negative Delta outflow (Monismith 2016).

Since the early 1980s, climate change is thought to have increased wind speed along the central California coast, resulting in a more frequent and longer lasting upwelling season (Garcia-Reyes and Largier 2010). Coastal upwelling causes colder deep water to rise to the ocean surface, bringing with it nutrients that stimulate the coastal food web. One effect of wind blowing over the estuary is that it resuspends sediment deposited in shallow areas like San Pablo Bay, Grizzly Bay, and Honker Bay (Ruhl *et al.* 2001). Thus, higher wind speeds blowing onto the coast might be expected to result in higher turbidity of the water in parts of the estuary. In contrast to this expectation, Bever *et al.* (2018) reported a recent reduction in wind speed over the Bay-Delta during 1995-2015, which these authors associated with lower turbidity in Suisun Bay. The Service notes these contrasting results for completeness but we cannot reconcile these opposing trends in wind speed at this time. We show below that Secchi disk depths (an indicator of water turbidity) have not increased since the mid-1980s near the (mobile) location of X2 even though suspended sediment concentrations in Suisun Bay have decreased since about 2000 (Schoellhamer 2011; Bever *et al.* 2018).

Central California's warm summers are already a source of energetic stress for delta smelt and warm springs can already severely compress the duration of their spawning season (Rose *et al.* 2013a,b). We expect warmer estuary temperatures to present a significant conservation challenge for delta smelt in the coming decades (Brown *et al.* 2013; 2016a; Figure 13). Feyrer *et al.* (2011) and Brown *et al.* (2013; 2016a) have evaluated the anticipated effects of projected climate change on several delta smelt habitat metrics. Collectively, these studies indicate the future will bring chronically compressed fall habitat, fewer 'good' turbidity days (defined by the authors as a mean turbidity greater than or equal to 18 Nephelometric Turbidity Units (NTU)), a spawning window of similar duration but that is shifted 2 to 3 weeks earlier in the year, and a substantial increase in the number of days delta smelt will need to endure lethal or near lethal summer water temperatures.

The delta smelt lives at the southern limit of the inland distribution of the family Osmeridae along the Pacific coast of North America. The anticipated effects of a warming climate are expected to create increasing temperature related challenges for delta smelt at some future point. The amount of anticipated change to the regional climate expected in the near term is lower than it is for the latter half of the century (Figure 13). Therefore, it is less certain that any measurable change from current conditions will occur in the next approximately 10 years than by 2050 or 2100. For the time being, water temperatures are stressful to delta smelt, but not of themselves lethal in most of the upper estuary (Komoroske *et al.* 2015).



**Figure 13.** Plots of median, maximum, and minimum number of days each year with an estimated average daily water temperature greater than or equal to 24°C (75°F) at selected sites in the Delta by decade for the 21<sup>st</sup> century. The water temperature threshold reflects one chosen by the authors to represent near lethal conditions for delta smelt. Source: Brown *et al.* (2016a).

### *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 Service's December 15, 2008 *Formal Endangered Species Act Consultation on the Proposed Coordinated Operations of the Central Valley Project (CVP) and State Water Project (SWP)* (2008 BO), the Reasonable and Prudent Alternative (RPA) required protection of all life stages from entrainment and augmentation of Delta outflow during the fall of Wet and Above-Normal years as classified by the State of California (Service 2008). The expansion of entrainment protection for delta smelt in the 2008 BO was in response to large increases in juvenile and adult salvage in the early 2000s

(Kimmerer 2008; Brown *et al.* 2009). The fall X2 requirement in the 2008 RPA was in response to increased fall exports that had reduced variability in Delta outflow and lowered habitat suitability during the fall months and the 2008 proposed action was anticipated to reduce it further (Feyrer *et al.* 2011).

The Service's (2010c) recommendation to uplist delta smelt from threatened to endangered included a discussion of threats related to reservoir operations and water diversions upstream of the estuary as additional water operations mechanisms interacting with exports from the Delta to restrict the LSZ and concentrate delta smelt with competing and predatory 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 rivers; and, establish a genetic management plan for captive-reared delta smelt with the goals of minimizing the loss of genetic diversity and limiting risk of extinction caused by unpredictable catastrophic events. The Service (2012) recently added climate change to the list of threats to the delta smelt.

Maintaining 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 the Service has previously indicated are needed to recover the delta smelt.

There have been several recent papers suggesting it is time to consider supplementation of the wild delta smelt population with captive-bred fish as part of a broad-based conservation strategy to avoid extinction in the wild, also known as extirpation (Moyle *et al.* 2016; 2018; Hobbs *et al.* 2017; Lessard *et al.* 2018). In 2019, pilot research conducted by the California Department of Water Resources (DWR) has demonstrated that captive-bred delta smelt held within steel enclosures can survive in the Delta for at least 30 days. This is long enough to show that the fish can feed themselves and did not die from acute water toxicity in either of two locations tested thus far. The fish will be evaluated for chronic toxic exposure, but that work is not finished. These results are promising and similar research is planned this year.

The status of the delta smelt is poor. The current estimated delta smelt population sizes are so low that it seems unlikely the species can be habitat- or food-limited even though both physical and food web-related habitat attributes have degraded over time. It is more likely that delta smelt have been marginalized by non-native fishes and invertebrates that compete with and prey on them. When fish populations reach very low levels, they can fall victim to demographic problems (often termed Allee effects in the scientific literature). These include problems concentrating enough individuals in particular locations for successful spawning, successful feeding, or maintaining large enough egg supplies, or shoals and schools of juvenile and adult fish to provide effective protection from predators (Liermann and Hilborn 2001; Keith and Hutchings 2012).

### *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 Bay-Delta and the species is approaching extinction in the wild (Moyle *et al.* 2016; 2018; Hobbs *et al.* 2017). The extremely low 2018-2020 abundance indices reflect 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 Bay-Delta and its watershed such as warmer water temperatures, greater salinity intrusion, lower snowpack contribution to spring outflow, and the potential for frequent extreme drought, indicate challenges to delta smelt survival will increase.

### Delta Smelt Critical Habitat

#### *Legal Status*

The Service designated critical habitat for the 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) (Service 1994).

#### *Conservation Role of Delta Smelt Critical Habitat*

The Service's primary objective in designating critical habitat was to identify the key components of delta smelt habitat that support successful completion of the life cycle, including spawning, larval and juvenile transport, rearing, and adult migration back to spawning sites. Delta smelt are endemic to the Bay-Delta and the vast majority only live one year. Thus, regardless of annual hydrology, the Bay-Delta estuary must provide suitable habitat all year, every year. The primary constituent elements considered essential to the conservation of the delta smelt as they were characterized in 1994 are physical habitat, water, river flow, and salinity concentrations required to maintain delta smelt habitat for spawning, larval and juvenile transport, rearing, and adult migration (Service 1994). The Service recommended in its designation of critical habitat for the delta smelt that salinity in Suisun Bay should vary according to water year type, which it does. For the months of February through June, this element was codified by the SWRCB "X2 standard" described in D-1641 and the SWRCB's current Water Quality Control Plan.

See the *Detailed Review of the Habitat Use and Distribution of Delta Smelt* above in the Status of the Species section.

#### *Description of the Primary Constituent Elements*

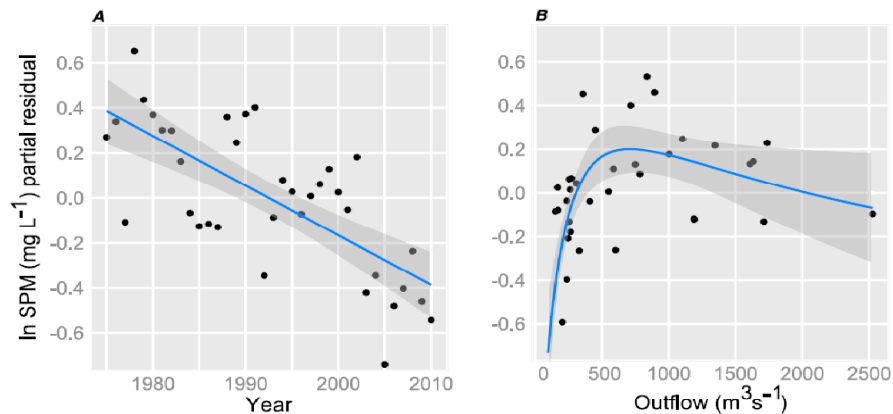
PCE #1: "Physical habitat" is defined as the structural components of habitat (Service 1994). As reviewed above, physical habitat in the Bay-Delta has been substantially changed with many of the changes having occurred many decades ago (Andrews *et al.* 2017; Gross *et al.* 2018). Physical habitat attributes are important in terms of spawning substrate, rearing habitat in terms

of how geographic location and bathymetry affect tidal current velocities (Bever *et al.* 2016), and possibly, foraging opportunities near the edges of emergent marshes (Whitley and Bollens 2014; Hammock *et al.* 2019). Information on spawning habitat is incomplete and it is difficult to protect spawning habitat without knowing what it is.

PCE #2: “Water” is defined as water of suitable quality to support various delta smelt life stages that allow for survival and reproduction (Service 1994). Certain conditions of turbidity, water temperature, and food availability characterize suitable habitat for delta smelt and are discussed in detail below. Contaminant exposure can degrade this primary constituent element even when the basic habitat components of water quality are otherwise suitable (Hammock *et al.* 2015).

*Turbidity:* Turbidity is the measure of relative clarity of a liquid. It is an optical characteristic of water and is a measurement of the amount of light scattered by material in the water when a light is shined through the water sample. The higher the intensity of scattered light, the higher the turbidity. Material that causes water to be turbid can include clay, silt, particulate organic matter, algae, dissolved colored organic compounds, and other microscopic organisms. In the Bay-Delta, turbidity results mainly from sediment suspended in the water column and to a lesser degree phytoplankton (Cloern and Jassby 2012). Turbidity can play an important role in structuring fish communities; one mechanism by which this can occur is the scale dependence in how fish of different sizes can have their prey detection enhanced or impaired (Utne-Palm 2002). Turbidity typically lowers the reactive distance of fishes feeding on zooplankton or each other. However, if the turbidity increases prey contrast (which it often does for fish larvae and planktivorous species), then it can enhance the feeding of these small fishes while still impairing the ability of their predators to see them.

The delivery of suspended sediment to the estuary increased substantially following the era of hydraulic gold mining in the watershed (Schoellhamer 2011). It increased again during rapid regional population growth and development after World War II. Since then, the delivery of new sediment to the estuary has declined (Wright and Schoellhamer 2004; Schoellhamer 2011). In addition, summertime phytoplankton production has been greatly diminished (Cloern and Jassby 2012). These changes have resulted in a general clearing of the estuary’s waters (Figure 14); however, the clearing trend has been strongest in the Delta where expansive beds of SAV further filter fine sediment from the water (Kimmerer 2004; Feyrer *et al.* 2007; Nobriga *et al.* 2008; Hestir *et al.* 2016). Water exports from the south Delta may also have contributed to the trend toward clearer estuary water by removing suspended sediment in exported water (Arthur *et al.* 1996); however, the contribution of exports to the total suspended sediment budget in the estuary is small (Schoellhamer 2012).



**Figure 14. Partial residual plots for a regression model that accounts for variability in annual average concentration of suspended particulate matter at IEP station D8 in Suisun Bay as a result of its long-term trend (left panel) and its relationship to annual average Delta outflow (right panel). The blue lines are loess smoothers and the gray shading is the 95% confidence interval around the line. Source: Cloern and Jassby (2012).**

The available catch data for delta smelt imply the species has an affinity for turbid water throughout most, if not all, of its free-swimming life (e.g., Nobriga *et al.* 2005; 2008; Feyrer *et al.* 2007; 2011; Grimaldo *et al.* 2009; Kimmerer *et al.* 2009; Mahardja *et al.* 2017a; Polansky *et al.* 2018; Simonis and Merz 2019), but there have been some recent suggestions that turbidity in the water affects the ability of fishing gears to catch delta smelt perhaps more than it is an actual habitat attribute (Latour 2016). The aquaculture techniques developed for delta smelt include rearing in black tanks under low light conditions because the fish are sensitive to highly lit circumstances (Lindberg *et al.* 2013; Hasenbein *et al.* 2016a). In addition, the tanks are circular and kept free of in-water structures. These captive rearing techniques are consistent with inhabitation of low visibility environments in the wild such as maintaining a spatial association with turbid water.

Below, we review process-based laboratory research that supports the ‘turbidity as habitat’ hypothesis. Then, we summarize long-term data on Secchi disk depths to demonstrate how water has remained relatively turbid where estuarine physics (Monismith *et al.* 1996; 2002) interacting with shallow water wind wave mixing (Ruhl *et al.* 2001; Bever *et al.* 2016) may contribute to an important refuge for delta smelt even though the biological productivity of this region has been substantially diminished (i.e., that phytoplankton currently contributes less to the turbidity than it once did). This turbid-water refuge occurs in the LSZ and is one of only two remaining in the range of the delta smelt. Turbid water may be a needed present-day habitat attribute because it provides cover for foraging delta smelt (Ferrari *et al.* 2014). By extension, it may be a factor modulating feeding success; one recent study found histopathologic evidence of elevated delta smelt feeding success in the turbid Cache Slough Complex and Suisun Marsh (Hammock *et al.* 2015); a follow-up study found elevated stomach fullness of delta smelt inhabiting the LSZ even though they were spatially disconnected from where zooplankton density was highest (Hammock *et al.* 2017). These findings are also qualitatively consistent with a more macroscopic study of the Delta’s fish assemblages that found most native fishes, including delta smelt, to be more common in lower productivity turbid habitats than higher productivity SAV habitats (Nobriga *et al.* 2005). For these reasons, the Service believes delta smelt’s association with turbid water, which in the present state of the Bay-Delta system is mainly caused by sediment suspended in the water, is a true habitat association.

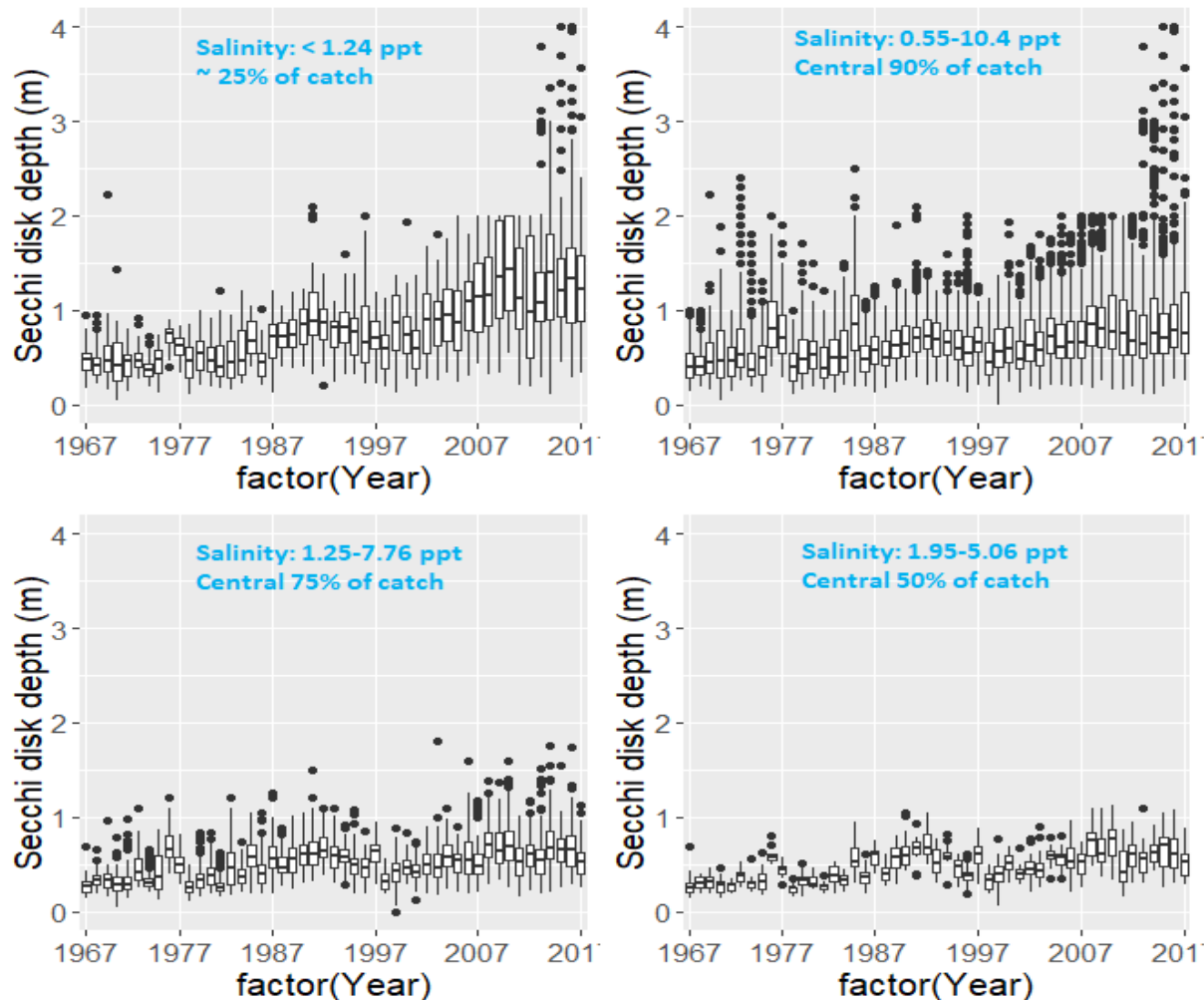
It has been shown experimentally that delta smelt larvae require particles in the water to see their transparent prey (Baskerville-Bridges *et al.* 2004). Thus, without some kind of turbidity in the water, delta smelt larvae will starve to death. Another recent laboratory study using late larval stage delta smelt found that feeding success and survival varied across a gradient of turbidity (Hasenbein *et al.* 2016a). The results implied bell-shaped response curves in which both survival and feeding success were highest at intermediate values, though the results among treatment levels were only significantly different in a few cases. A similar experiment using 120-day-old juvenile delta smelt produced different results (Hasenbein *et al.* 2013). In this experiment, the authors reported that feeding success decreased as turbidity was increased; however, their results indicate that statistically speaking, turbidity had no effect except at the highest treatment level. The highest treatment level was 250 NTU which is exceptionally turbid water. It is worth noting two things about these studies. First, the turbidity in the tanks was created using algae, which is not the dominant source of water turbidity in the estuary. Second, in the studies described by Hasenbein *et al.* (2013; 2016b), the experiments were conducted under low light conditions even when turbidity was low (~ 1 lux). In the wild, a surface-oriented fish might have the benefit of both turbidity and high light conditions similar to those that experimentally optimized successful first feeding (Baskerville-Bridges *et al.* 2004).

In another laboratory experiment, the vulnerability of delta smelt to predation by largemouth bass was lower in a circa 3 NTU treatment (again, using algae) than a clear-water treatment (Ferrari *et al.* 2014). In a DNA-based diet study of field-caught predators, the predation of delta smelt larvae was strongly affected by water turbidity (Schreier *et al.* 2016). Thus, the available evidence suggests that delta smelt require turbid water to succeed in the contemporary Bay-Delta food web.

In fish survey data, the longest-term indicator of water turbidity is Secchi disk depth measurements that for several decades have accompanied most individual net tows. Secchi disk depths are basically inverses of turbidity because the less turbid the water is, the deeper into the water column a Secchi disk remains visible. The FMWT Secchi disk depth data set summarized below dates to 1967 (Figure 15).

The Secchi disk depth information suggests the increasing water clarity trends discussed above are not uniform across the upper estuary (Figure 15). From a regional perspective, they have been most pronounced in the San Joaquin River half of the Delta where SAV proliferation has been most expansive (Feyrer *et al.* 2007; Nobriga *et al.* 2008; Hestir *et al.* 2016). Consistent with this, boxplots depicting the time series of Secchi disk depth measurements from the FMWT show the previously reported increasing trend is most pronounced when and where the Secchi disk depths were taken in fresh water (upper left panel of Figure 15). In this upper left panel for which the Secchi disk depth data were summarized only when and where salinity was lower than 1.25 ppt, the previously reported trend of increasing water transparency is apparent; median Secchi disk depths have increased from about 0.5 meters with extreme values seldom exceeding 1 meter early in the time series to medians typically exceeding 1 meter and extreme values near 4 meters in recent years. When data summaries include these freshwater samples along with samples from the LSZ, the trend and extreme data points remain (upper right panel of Figure 15). This could lead to the erroneous conclusion that Secchi disk depths have been similarly increasing in the LSZ.

However, it is also important to consider the hydrodynamic aspect of water turbidity in the estuary. As mentioned above, X2 is a boundary upstream of which salinity tends to be the same from the surface of the water to the bottom, and downstream of which salinity varies from top to bottom (Jassby *et al.* 1995). That variability in salinity from surface to bottom waters is indicative of a front that helps to aggregate turbidity near X2. This does not mean it all aggregates precisely at X2; tidal dispersion results in a spatially complex distribution of sinking particles widely distributed in the LSZ (Kimmerer *et al.* 2014a). Thus, when the FMWT Secchi disk depth data set are constrained to brackish water samples, the long-term trend looks very different (lower panels of Figure 15). There is still an increasing trend over time, but it is much more modest. In particular, at a salinity near 2 to 5 ppt, Secchi disk depths have not consistently increased since the mid-1980s and observations exceeding 1 meter are still rare. Thus, there is a turbid water refuge for delta smelt that persists in the LSZ similar to the one that persists in the Cache Slough Complex.



**Figure 15. Boxplot time series of Secchi disk depth measurements taken during the California Department of Fish and Wildlife Fall Midwater Trawl Survey, 1967-2017. The boxes depict the central 50% of observations; the line through each box is the median. The black circles are observations outside the central 95% of observations. The data have been grouped into four salinity bins based on statistical summaries of delta smelt data (Kimmerer *et al.* 2013). The salinity range graphed is reported on each panel as is the predicted fraction of FMWT delta smelt catch. Source: Service unpublished data analysis using a specific conductance to**

**salinity conversion described by Schemel (2001) and generalized additive model results provided by W. Kimmerer.**

*Water temperature:* Water temperature is the primary driver of the timing and duration of the delta smelt spawning season (Bennett 2005). Water temperature also affects delta smelt's metabolic and growth rates which in turn can affect their susceptibility to contaminants (Fong *et al.* 2016), food limitation (Rose *et al.* 2013a), and readiness to spawn (Hobbs *et al.* 2007b). Water temperature is not strongly affected by variation in Delta inflows or outflows except at the margins of the Delta where these inflows enter (Kimmerer 2004). The primary driver of water temperature variation in the delta smelt critical habitat is air temperature (Wagner *et al.* 2011). Very high flows can transiently cool the upper estuary (*e.g.*, flows in the upper 10<sup>th</sup> percentile, Kimmerer 2004), but the system rapidly re-equilibrates once air temperatures begin to warm. Thus, like duration of the spawning season, other water temperature-driven mechanisms affecting recruitment and survival are not freshwater flow mechanisms.

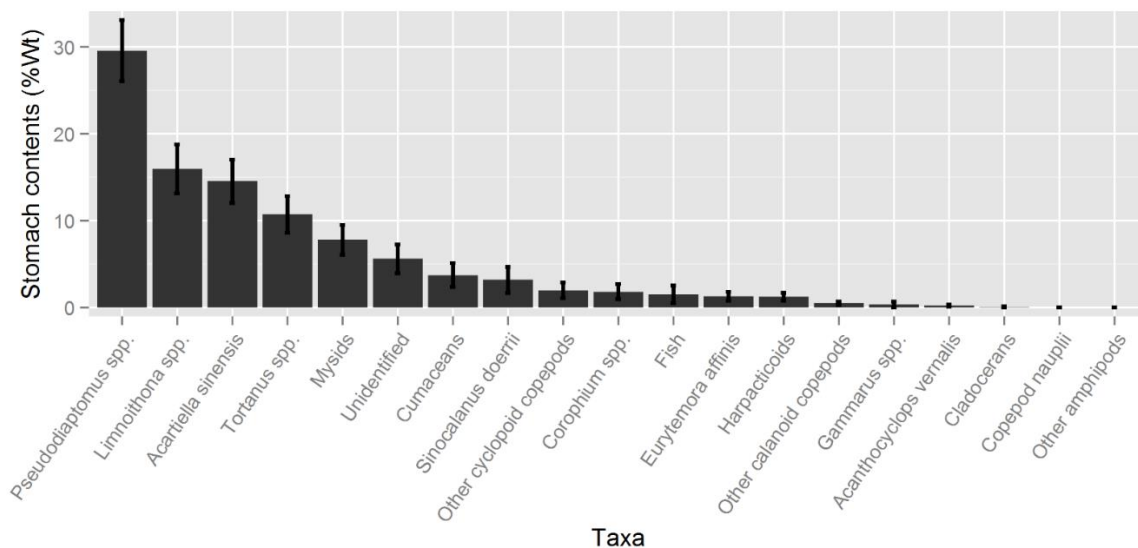
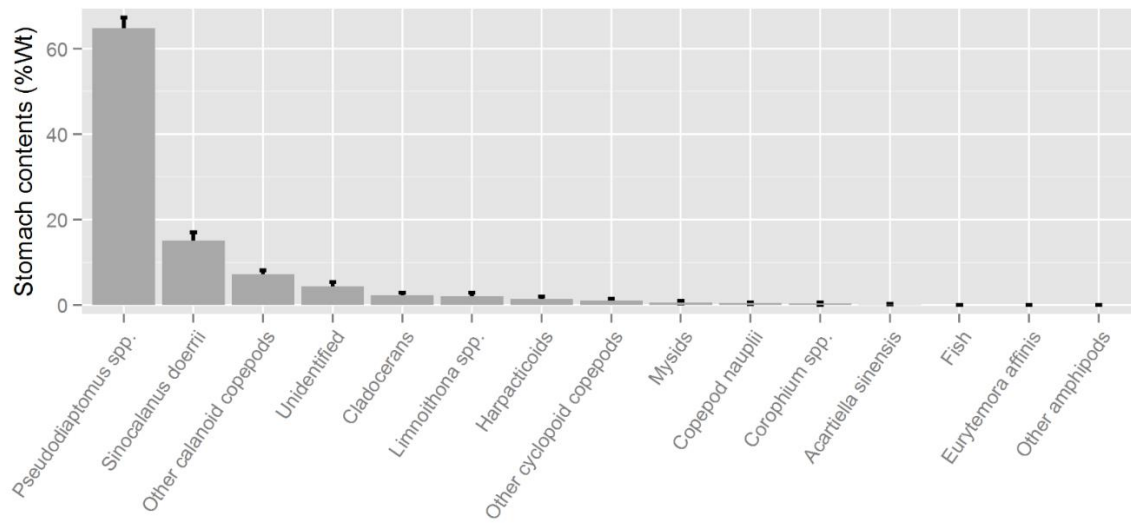
Research initially suggested an upper water temperature limit for delta smelt of about 25°C, or 77°F (Swanson *et al.* 2000). Newer research suggests delta smelt temperature tolerance decreases as the fish get older, but is a little higher than previously reported, ranging from nearly 30°C or 86°F in the larval life stage down to about 25°C in post-spawn adults (Komoroske *et al.* 2014). These are upper *acute* water temperature limits meaning these temperatures will kill, on average, one of every two fish. Subsequent research into delta smelt's thermal tolerances indicated that molecular stress response begins to occur at temperatures at least 4°C cooler than the acute thermal maxima (Komoroske *et al.* 2015).

In the laboratory and the wild, delta smelt appear to have a physiological optimum at temperatures of about 16-20°C or 61-68°F (Nobriga *et al.* 2008; Rose *et al.* 2013a; Eder *et al.* 2014; Jeffries *et al.* 2016). Most of the upper estuary exceeds this water temperature from May or June through September (Komoroske *et al.* 2015). Thus, during summer, many parts of the estuary are energetically costly and physiologically stressful to delta smelt (Komoroske *et al.* 2014). Generally speaking, spring and summer water temperatures are cooler to the west and warmer to the east due to the differences in overlying air temperatures between the Bay Area and the warmer Central Valley (Kimmerer 2004). In addition, there is a strong water temperature gradient across the Delta with cooler water in the north and warmer water in the south. The much higher summer inflows from the Sacramento River probably explain this north-south gradient. Note that water temperatures in the north Delta near Liberty Island and the lower Yolo Bypass where summer inflows are low to non-existent, are also typically warmer than they are along the Sacramento River. This may have consequences for the survival of freshwater-resident delta smelt during comparatively warm summers (Bush 2017).

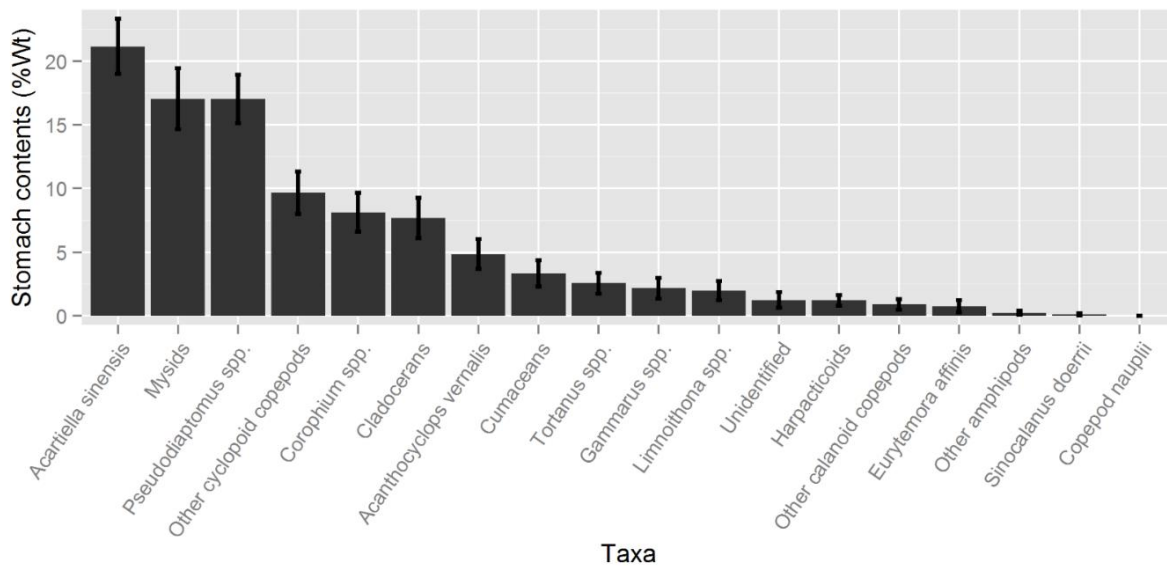
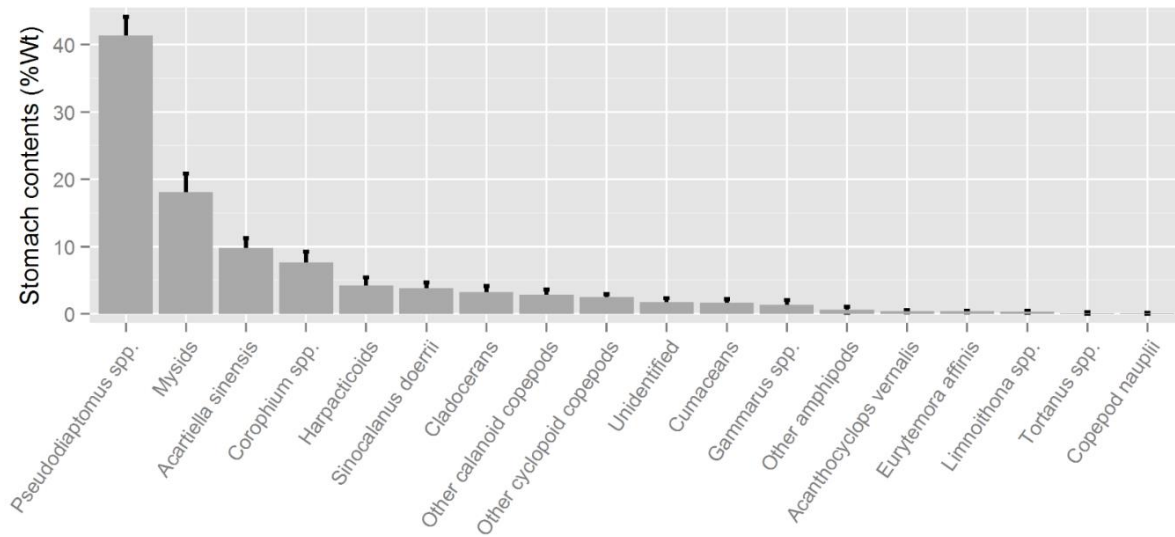
*Food:* Food and water temperature are strongly interacting components of the "Water" element of delta smelt critical habitat because the warmer the water, the more food delta smelt require (Rose *et al.* 2013a). If the water gets too warm, then no amount of food is sufficient. The more food delta smelt eat (or must try to eat) the more they will be exposed to predators and contaminants.

The open-water habitat use of delta smelt is reflected in their diet composition, which is largely made up of planktonic and epibenthic crustaceans (Moyle *et al.* 1992; Nobriga 2002; Hobbs *et al.* 2006; Slater and Baxter 2014). Some of the epibenthic crustaceans discussed below (*e.g.*,

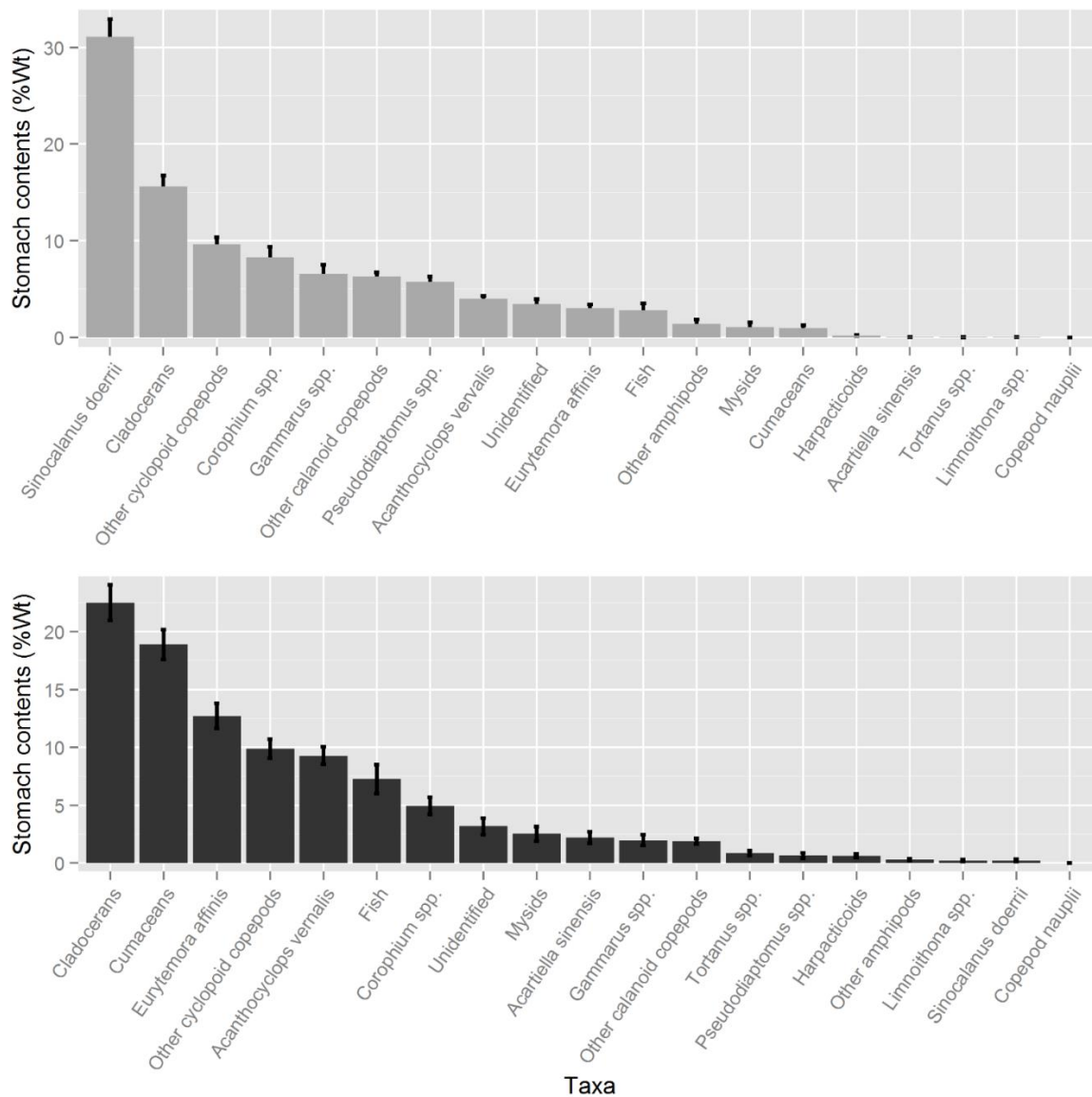
amphipods and mysids) ascend into the water column at times (Kimmerer *et al.* 2002) and are therefore available to predators foraging in the open water. A large majority of the identifiable prey of delta smelt larvae is copepods, particularly the early life stages of copepods (Nobriga 2002; Hobbs *et al.* 2006; Slater and Baxter 2014). Juvenile delta smelt feeding in the summer months also have copepod-dominated diets, but these larger individuals tend to eat adult copepods and also begin to include prey taxa in their diets that grow larger than copepods (Slater and Baxter 2014; Figure 16). The older juveniles and adults continue to prey on copepods, but have less reliance on them and greater diet diversity (Moyle *et al.* 1992; Slater and Baxter 2014; Whitley and Bollens 2014; Figures 17 and 18). All of the delta smelt’s major prey taxa (e.g., copepods, amphipods) are ubiquitously distributed, but which prey species are present at particular times and locations changes from early morning to mid-day, season to season, and has changed dramatically over time (Kimmerer *et al.* 2002; Winder and Jassby 2011; Kratina *et al.* 2014). The latter two have likely affected delta smelt feeding success (Kimmerer and Rose 2018).



**Figure 16.** Diet compositions of delta smelt collected by the TNS upper panel for stations with a salinity lower than 0.55 ppt and lower panel for stations with a salinity greater than or equal to 0.55 ppt. Of the prey taxa listed on the x-axis, the ones that are *not* copepods are Cladocerans, Mysids, Corophium spp., Fish, Other Amphipods, Cumaceans, and Gammarus spp. Source: supplemental material for Hammock *et al.* (2017).



**Figure 17.** Diet compositions of delta smelt collected by the FMWT upper panel for stations with a salinity lower than 0.55 ppt and lower panel for stations with a salinity greater than or equal to 0.55 ppt. Of the prey taxa listed on the x-axis, the ones that are *not* copepods are Cladocerans, Mysids, Corophium spp., Other Amphipods, Cumaceans, and Gammarus spp. Source: supplemental material for Hammock *et al.* (2017).



**Figure 18.** Diet compositions of delta smelt collected by the SKT upper panel for stations with a salinity lower than 0.55 ppt and lower panel for stations with a salinity greater than or equal to 0.55 ppt. Of the prey taxa listed on the x-axis, the ones that are *not* copepods are Cladocerans, Mysids, Corophium spp., Fish, Other Amphipods, Cumaceans, and Gammarus spp. Source: supplemental material for Hammock *et al.* (2017).

An influence of copepod production on the production of delta smelt has been a common finding in quantitative modeling research on delta smelt’s population dynamics (Mac Nally *et al.* 2010; Maunder and Deriso 2011; Miller *et al.* 2012; Rose *et al.* 2013a; Hamilton and Murphy 2018; Kimmerer and Rose 2018).

The earliest published paper on a freshwater flow influence on fish production in the Bay-Delta posited that the mechanisms producing striped bass worked primarily through the LSZ food web (Turner and Chadwick 1972). Specifically, these authors suggested that higher Delta inflow stimulated the food web that supported striped bass and increased turbidity which hid them from their predators. Because IEP monitoring was originally set up to better understand striped bass

recruitment, the IEP has monitored the pelagic food web extensively since the 1970s (Brown *et al.* 2016b).

The varied sources of primary productivity that fuel estuarine fish production are an area of active research in the Bay-Delta (Sobczak *et al.* 2002; 2005; Grimaldo *et al.* 2009; Howe and Simenstad 2011; Schroeter *et al.* 2015). As is the general case in open-water food webs of estuaries and coastal marine systems, diatoms are the dominant source of primary productivity supporting open-water fish production (Sobczak *et al.* 2002; 2005; Grimaldo *et al.* 2009). Phytoplankton-based and submerged aquatic vegetation-based food webs can be separated on the basis of stable isotopes of carbon and nitrogen, but phytoplankton-based food web paths cannot be clearly separated from pathways based on terrestrial vegetation using these isotopes (Grimaldo *et al.* 2009; Schroeter *et al.* 2015). Sulfur isotopes may provide greater ability to discern among sources within and near tidal marsh environments, but to date, have not been extensively evaluated in the Bay-Delta (Howe and Simenstad 2011). The production of littoral and bottom-feeding fishes is supported by a greater fraction of non-planktonic primary producer sources (Grimaldo *et al.* 2009; Schroeter *et al.* 2015). These non-planktonic food web pathways likely have some importance to delta smelt (Whitley and Bollens 2014; Hammock *et al.* 2019).

There may be tremendous potential for benthic and epiphytic processes to periodically subsidize delta smelt's food supply, and these subsidies may occur at critical times of need, yet such pathways remain underemphasized and understudied. It is common for estuarine amphipods to rise into the water column to relocate to newly formed depositional areas, where they feed on deposited detritus and other organic materials; their successive landward movements via repeated use of selective tidal stream transport (STST, or "tidal surfing") diminish in terms of distance of upstream travel, but ultimately place them within depositional habitats (Hough and Naylor 1992; Forward and Tankersley 2001; Naylor 2006). This behavior results in the amphipods spending a great deal of time in the water column, especially when the water is dimly lit. Being in the water column may make the amphipods more available as prey for delta smelt, but the amphipods are nevertheless energetically tied to benthic basal resources, despite their spending a great deal of time in the water column (i.e., they are still energetically tied to primary production that is bottom-associated: vascular plant detritus, phytodetritus, or benthic microalgae, as opposed to phytoplankton). Mysids, on the other hand, are harder to generalize, as some species are herbivorous, some are predatory, and some are omnivorous. They also use STST, which likely increases their availability to (adult) delta smelt (Wooldridge and Erasmus 1980; Orsi 1986). Thus, depending on mysid species, they may or may not link delta smelt to benthically driven energy pathways.

Jassby *et al.* (1993) estimated benthic microalgae to be responsible for nearly 30% of the primary production in upper San Francisco Bay, inclusive of delta smelt habitat. Light penetration has since improved as turbidity has decreased (Parker *et al.* 2012a), and so this ~30% contribution may have increased dramatically. Jassby *et al.* (1993) provided no estimate for epiphytic microalgae associated with SAV and the zones of emergent grass stems (in marshes) that are near the surface and within the photic zone. Even if the photic zone is just a few centimeters deep, these substrates, when added together, can provide very large surface areas for epiphytic production.

There are two clam species that affect phyto- and zooplankton biomass within the distribution of the delta smelt population. The freshwater *Corbicula fluminea*, which has been in the Delta and

its tributary rivers since the 1940s, and the estuarine overbite clam *Potamocorbula amurensis*, which started invading the estuary in 1986 and was well-established within a year (Alpine and Cloern 1992). The freshwater clam can suppress diatom production in shallow freshwater habitats (Lucas *et al.* 2002; Lopez *et al.* 2006). However, the overbite clam appears to have a larger impact on the food web than the freshwater clam (Alpine and Cloern 1992; Jassby *et al.* 2002; Kimmerer and Thompson 2014), so the focus of this review will be on the overbite clam.

In the 1970s and early 1980s, scientists had learned that year-to-year variation in Delta inflow (or salinity at Chipps Island) - especially during the spring and summer - drove the year-to-year variation in the productivity of the low-salinity zone food web (Cloern *et al.* 1983; Knutson and Orsi 1983). In wet years, the flow brought a lot of nutrients and organic carbon into the low-salinity zone (Jassby and Cloern 2000) where it fueled food web production as Delta outflow seasonally decreased into an optimal range estimated by Cloern *et al.* (1983) to be about 100 to 350 cubic meters per second (about 3,500 to 12,400 cubic feet per second (cfs)). In dry years, elevated salinity allowed a marine clam (*Mya arenaria*) to colonize Suisun Bay and graze the diatoms down to low levels. This in turn lowered the production of the mysid shrimp (*Neomysis mercedis*), which was a key food source for several fish species, particularly striped bass (Knutson and Orsi 1983; Orsi and Mecum 1996; Feyrer *et al.* 2003). This stimulation of mysid shrimp production was one of the food web mechanisms that Turner and Chadwick (1972) had hypothesized led to higher striped bass production in higher flow years. Similar 'fish-flow' relationships were later established for longfin smelt (*Spirinchus thaleichthys*) and starry flounder (*Platyichthys stellatus*); both of these fish are also mysid shrimp predators and were shown to have step-declines in their abundance indices associated with the overbite clam invasion (Kimmerer 2002b).

The overbite clam, once established (~ 1987), resulted in a permanent source of loss to diatoms and copepods in the LSZ that resulted in rapid step-declines in the abundance of the most important historical food web components: diatoms, mysid shrimp, and *Eurytemora affinis*; the latter is a copepod that was a major prey for both the opossum shrimp (Knutson and Orsi 1983) and delta smelt (Moyle *et al.* 1992). Unlike striped bass, longfin smelt, and starry flounder, no change in delta smelt abundance occurred coincident with the establishment of the overbite clam (Stevens and Miller 1983; Jassby *et al.* 1995; Kimmerer 2002b; Mac Nally *et al.* 2010; Thomson *et al.* 2010). However, the average size of delta smelt declined somewhat (Sweetnam 1999; Bennett 2005).

Some scientists have hypothesized that the diatom decline was caused by wastewater treatment plant inputs of ammonium or changes in the ratios of dissolved forms of nitrogen that support aquatic plant growth more than by overbite clams (Glibert *et al.* 2011; Dugdale *et al.* 2012; Parker *et al.* 2012b; Wilkerson *et al.* 2015). One piece of evidence used to support this hypothesis is an observation that ammonium was frequently crossing a critical 4 micro-molar threshold concentration for diatom growth at about the same time the overbite clam became established. These researchers have established that uptake of dissolved ammonium inhibits the growth rate of diatoms in the Bay-Delta. However, diatoms can still grow on ammonium, and actually take it into their cells preferentially over nitrate; they just grow more slowly using ammonium as their cellular nitrogen source (Glibert *et al.* 2015). This means that 'but for' the overbite clam, the diatom population in the LSZ would eventually build up enough biomass each year to metabolize ambient ammonium concentrations to levels below the 4 micro-molar threshold and then increase their growth rate using the nitrate that is also in the water. Thus,

although nitrogen chemistry could be a problem, a more fundamental one is that as Delta outflow declines during the spring into early summer to levels that could enable diatom blooms, the water temperature is rising and that supports reproduction of the overbite clam. With help from a few other abundant grazers (Kimmerer and Thompson 2014), the growing overbite clam population depletes diatoms faster than they can metabolize the ammonium in the water. Thus, clam grazing is the fundamental reason that summer-fall diatom blooms no longer occur (Cloern and Jassby 2012; Kimmerer and Thompson 2014; Cloern 2019). During spring when Delta outflow is higher, outflow can interact with other factors to limit diatom accumulation as well (Dugdale *et al.* 2012; 2016). Note that Dugdale *et al.* (2016) suggested that available estimates of the overbite clam grazing rate were over-estimates, but this assertion has been contested (Kimmerer and Thompson 2014; Cloern 2019).

The largest source of dissolved ammonium is the Sacramento Regional Wastewater Treatment Plant. Upgrades to the facility are expected to occur in 2021-2023, which will result in reductions in dissolved ammonium concentrations in the Delta. It is scheduled to significantly reduce its nitrogen effluent concentrations beginning in 2023. Once that happens, it should become apparent within a few years how important ammonium ratios are in limiting diatom production in the Bay-Delta.

Because the overbite clam repressed the production of historically dominant diatoms and zooplankton, there were numerous successful invertebrate species invasions and changes in plant communities that followed for a decade or so thereafter (Kimmerer and Orsi 1996; Bouley and Kimmerer 2006; Winder and Jassby 2011). Changing nutrient ratios (including the forms of nitrogen and the ratios of nitrogen and phosphorus) necessary for plant growth may also have contributed to changing phytoplankton and plant communities (Glibert *et al.* 2015; Dahm *et al.* 2016). In addition, extreme drought and propagule pressure are also thought to have directly contributed to the zooplankton species changes (Winder *et al.* 2011). The most important changes for delta smelt have been changes to the copepod community. The copepod invasions of the late 1980s and early 1990s actually helped stem (but not recover the system from) what had been a major decline in copepod abundance (Winder and Jassby 2011). Prior to the overbite clam, delta smelt had diets dominated by *E. affinis* from the time the larvae started feeding in the spring until at least the following fall (Moyle *et al.* 1992). The overbite clam suppressed the production of *E. affinis* (Kimmerer *et al.* 1994; Kimmerer and Orsi 1996) and that seems to have opened the door for several non-native copepods including *Pseudodiaptomus forbesi*, which became the new main prey of delta smelt from late spring into the fall (Moyle *et al.* 1992; Nobriga 2002; Hobbs *et al.* 2006; Slater and Baxter 2014; Hammock *et al.* 2017; Figures 16 and 17).

There is general agreement among quantitative delta smelt models that the production of copepods including *P. forbesi* are important to recruitment and survival (Kimmerer 2008; Maunder and Deriso 2011; Miller *et al.* 2012; Hamilton and Murphy 2018; Kimmerer and Rose 2018; Simonis and Merz 2019). Recognition of *P. forbesi*'s importance to delta smelt led to substantial research into this non-native copepod's population dynamics (Kimmerer and Gould 2010; Sullivan *et al.* 2013; Kimmerer *et al.* 2014b; Kayfetz and Kimmerer 2017; Kimmerer *et al.* 2018a,b). The delta smelt's primary historical prey (*E. affinis*) bloomed from within the LSZ and had peak abundance near X2 (Orsi and Mecum 1986). This copepod still blooms each spring, but disappears by summer due to overbite clam grazing (Kimmerer *et al.* 1994). The same thing happens to *P. forbesi* in the LSZ (Kayfetz and Kimmerer 2017). However, the *P. forbesi*

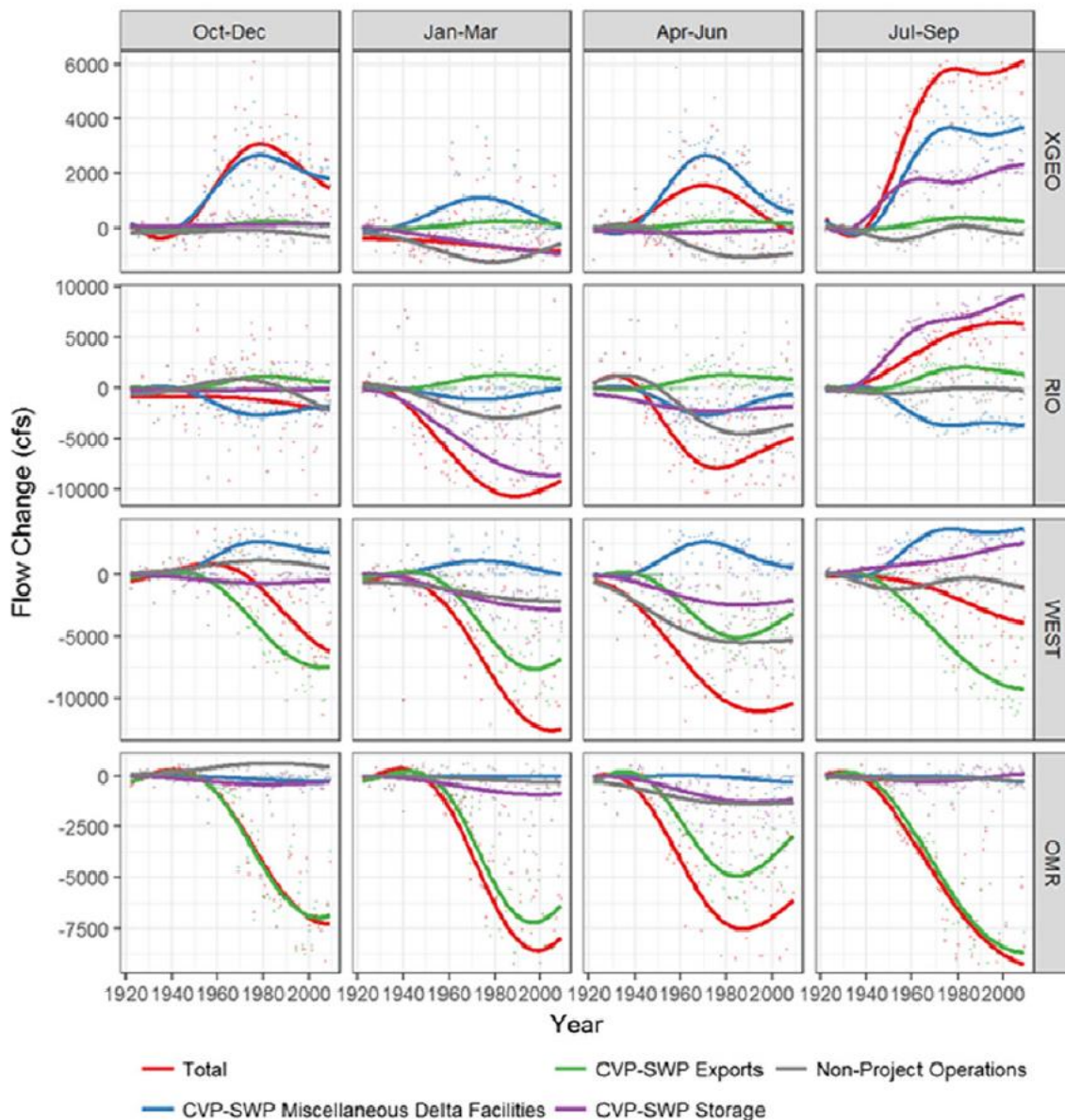
population survives the summer because its center of reproduction is in freshwater habitats landward of the LSZ. It would disappear from the LSZ altogether were it not for a constant replenishment (or subsidy) from upstream where the overbite clam and a predatory non-native copepod are less abundant. It is the combination of tidal mixing and Delta outflow that seems to provide this subsidy (Kimmerer *et al.* 2018a,b). Thus, this subsidy of *P. forbesi* to delta smelt inhabiting the turbid water refuge of the LSZ appears to be of substantial importance – particularly during the summer and fall.

The most obvious test of whether the overbite clam affected delta smelt is a before-after comparison. As mentioned above, this has been tested several times and no obvious effect like the ones reported for striped bass, longfin smelt, and starry flounder has been established. Rather, the first big decline in delta smelt abundance occurred prior to the overbite clam invasion and the second one about 15 years afterward. Thus, if copepod production limits delta smelt production, it is either a part-time limit (e.g., Hamilton and Murphy 2018), or (a) it was a limiting factor prior to the overbite clam, and (b) it did not become a further limit until sometime thereafter. These are not mutually exclusive hypotheses.

*Contaminants:* Research conducted over the past 10 years suggests that delta smelt are fairly susceptible to contaminants (e.g., Connon *et al.* 2009; 2011a,b; Hasenbein *et al.* 2014; Jeffries *et al.* 2015; Jin *et al.* 2018). The effects of ambient Sacramento River water, pyrethroid pesticides, several herbicides, copper, and ammonium have all been examined and all of these compounds have shown at least sub-lethal effects represented by changes in gene expression. In some cases, delta smelt were exposed to higher than observed concentrations of some compounds in order to estimate their LC<sub>50</sub>, the estimated concentration that kills half of the test fish over the study duration. Exposure durations have varied widely among studies (4 hour to 1 week), which limits the ability to quantitatively compare toxicity among studies. The loading of some contaminants into the habitats occupied by delta smelt can be functions of freshwater flow inputs (e.g., Kuivila and Moon 2004; Weston *et al.* 2014; 2015) so in some instances, the impacts of contaminants can be freshwater flow mechanisms. However, the impacts of others may be related to where individuals are located (Hammock *et al.* 2015), what delta smelt eat, or water temperature-based demand for prey, all of which could affect the quantities of biomagnifying substances that get ingested over the life span of the fish.

PCE #3: “River flow” was originally believed to be critical as transport flow to facilitate an extended spawning migration by adult fish and the transport of offspring to LSZ rearing habitats (Service 1994). However, it has since been shown that although some individual fish may embark on what could be considered a short spawning migration, there is no population-scale spawning migration *per se*, and that most transport and retention mechanisms for delta smelt (and their prey) involve the selective use of tidal currents rather than net flows (Kimmerer *et al.* 1998; 2002; Bennett *et al.* 2002; Kimmerer *et al.* 2014a; Bennett and Bureau 2015). River flow includes both inflow to and outflow from the Delta, both of which influence the net movements of water through the Delta and further into the estuary (Kimmerer and Nobriga 2008). As mentioned above, these variations in freshwater flow affect the spatial distribution of salinity including X2, which in turn exert some influence on the distribution of delta smelt (Sweetnam 1999; Dege and Brown 2004; Feyrer *et al.* 2007; Nobriga *et al.* 2008; Sommer *et al.* 2011; Manly *et al.* 2015; Polansky *et al.* 2018; Simonis and Merz 2019).

Net water movements in the Delta have recently been reconstructed and analyzed for long-term trend attribution (Hutton *et al.* 2019; Figure 19). This analysis demonstrated several net flow variables have experienced strong time trends since water exports from the Delta began. In particular, cross-Delta flows have increased during the summer and fall, Rio Vista flows have decreased in the winter and spring and increased in the summer, Jersey Point flow and Old and Middle river flow (OMR) have decreased year-around. The change attribution indicated that CVP and SWP operations were predominantly the source of these net flow changes except for Jersey Point flow in the spring, which is also strongly influenced by in-Delta irrigation demand. The net flow changes ultimately influence Delta outflow, which as discussed above, has been trending downward for more than 100 years.

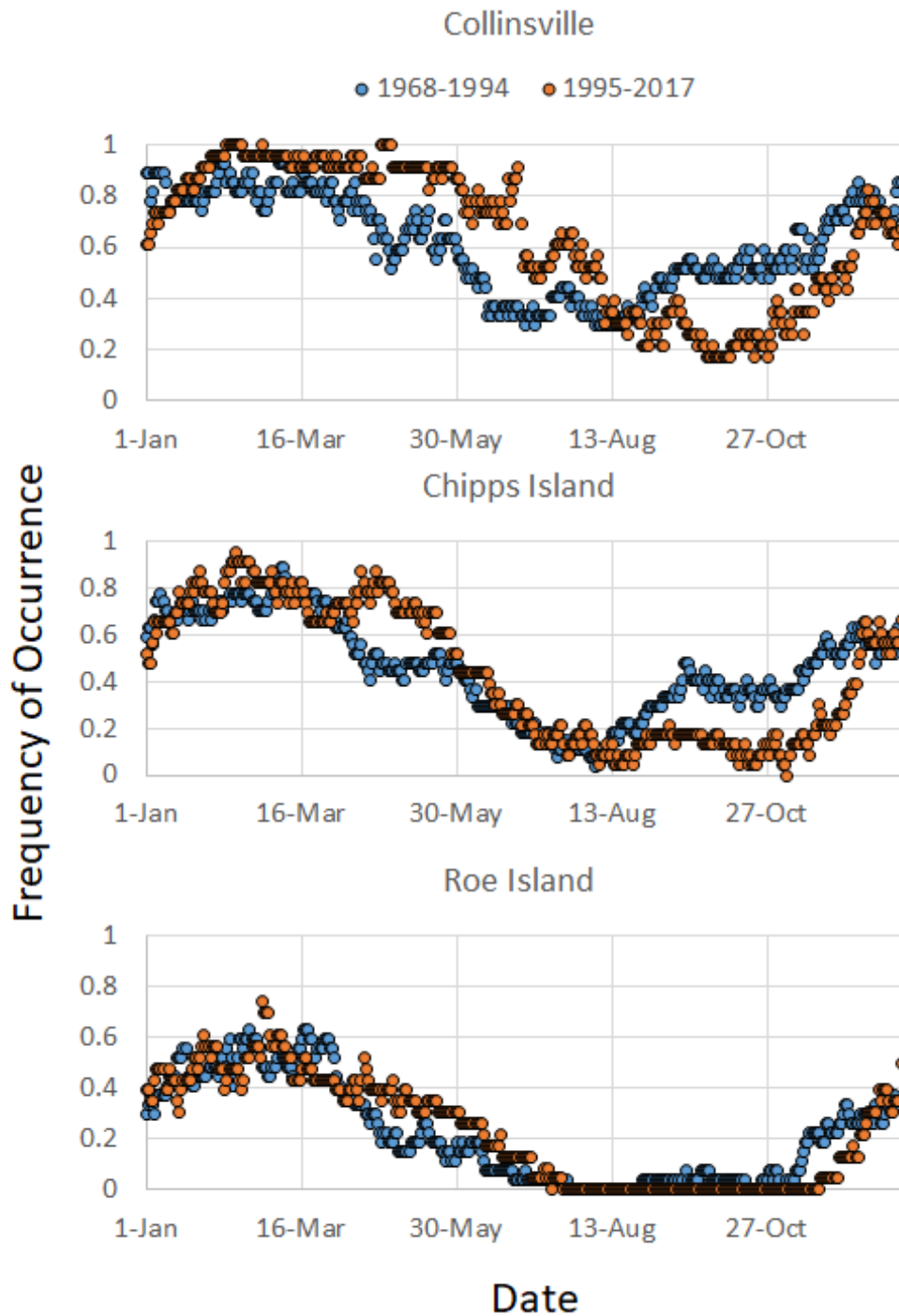


**Figure 19. Time series (1922-2009) of statistical trend outputs of annual cross Delta flows (XGEO), net flow at Rio Vista (RIO), net flow at Jersey Point on the San Joaquin River (WEST), and net flow in Old and Middle rivers (OMR). For XGEO net north to south flows have positive values. For RIO and WEST, net seaward (downstream) flows have positive values. For OMR, which seldom has positive values, net north to south**

**flows are depicted as negative values. The colored lines reflect the statistical trend in the time series with the different colors reflecting the relative contributions of the sources listed in the legend. Source Hutton *et al.* (2019).**

A concise summary of the contemporary Delta outflow hydrograph is shown in Figure 20. A value on the y-axis of 0.5 suggests that an outflow on a given day has had an equal chance of being at least as high as one or in some cases all three of the chosen thresholds. Delta outflow at least as high as the Roe Island standard freshens the estuary enough for delta smelt to spawn in typically brackish regions like the Napa River and western Suisun Marsh, and tends to reduce the likelihood of entrainment. Delta outflows at least as high as the Chipps Island standard tend to generate LSZ coverage throughout much or all of Suisun Bay. Outflows near the Collinsville standard are associated with a typical X2 slightly upstream of the confluence of the Sacramento and San Joaquin rivers with low-salinity conditions extending into, but not throughout Suisun Bay and marsh. The water management response to D-1641 has been to increase the intra-annual variability in outflows. The greater intra-annual variability is related to the more frequent meeting of these flow thresholds in the winter and spring as required by D-1641, with lower frequency in the fall. This pattern is especially pronounced for outflows greater than or equal to 7,100 cfs (“Collinsville”) and 11,400 cfs (Chipps Island; Figure 20). The same pattern is visible for 27,200 cfs (“Roe Island”; Figure 20), but with less change (mainly days 100-150 and 325-350, which correspond to April and the November-December transition). This does more closely mimic the timing and duration of the natural Delta outflow hydrograph than occurred during the 1968-1994 period, though the magnitude is considerably lower as discussed above (Figures 5, 9, and 10). Note that the DAYFLOW calculations used to make Figure 20 can be highly uncertain at values lower than about 10,000 cfs (Monismith 2016).

The tidal and net flow of water toward the south Delta pumping plants is frequently indexed using OMR (Grimaldo *et al.* 2009; Andrews *et al.* 2017; Figure 19). The tidal and net flows in Old and Middle rivers influence the vulnerability of delta smelt larvae, juveniles, and adults to entrainment at the Banks and Jones facilities (Kimmerer 2008; 2011; Grimaldo *et al.* 2009). Currently available information indicates that OMR is a very good indicator of larval delta smelt entrainment risk (Kimmerer 2008; 2011). When the fish reach the juvenile stage, they can leave the south Delta to avoid adverse water temperatures (Kimmerer 2008). When maturing adults disperse the following winter, their advection into the south Delta can be affected by OMR flow, but turbidity is also an important mediator of their entrainment risk (Grimaldo *et al.* 2009). The Service’s experience, particularly since 2008, is that the risk of seeing entrained fish in CVP or SWP fish salvage is low if south Delta turbidity remains less than 12 NTU.



**Figure 20. Daily frequency that the Net Delta Outflow Index (NDOI) was at least as high as the steady-state thresholds for the D-1641 ‘X2 standard’ for January 1 to December 31, 1968-1994 (pre-Bay Delta Accord; blue symbols) and 1995-2017 (post Bay Delta Accord; orange symbols). The X2 standards outlined in the Bay Delta Accord were adopted into D-1641. The steady-state NDOI thresholds used to calculate the frequencies were Roe Island  $\geq 27,200$  cfs, Chipps Island  $\geq 11,400$  cfs, and Collinsville  $\geq 7,100$  cfs. For reference, a frequency of 0.5 means an NDOI at least as high as the threshold occurred half of the time on a given day. Note that this plot is intended to provide a concise view of the seasonality of Delta outflow. It is not intended to reflect anything about compliance or non-compliance with D-1641, which can be based on Delta outflow, salinity, or X2. Source: Service unpublished analysis of the DAYFLOW database.**

PCE # 4: “Salinity”. Fish assemblages are able to lessen competition among species and life stages by partitioning habitats. For instance, some fish species and life stages are more shoreline oriented whereas others are more offshore oriented. Some species are better adapted to midwater or surface waters, while others are more adapted to stay close to the substrate. Some fish are tolerant of turbidity, while others are not. In estuaries, salinity is often a dominant factor separating different groups of fishes (e.g., Bulger *et al.* 1993; Edgar *et al.* 1999). Similarly, in the Bay-Delta, dominant fishes replace one another at several places along the salinity gradient (Feyrer *et al.* 2015).

Delta smelt is part of the fish assemblage that uses the low-salinity waters of the estuary (Kimmerer *et al.* 2009; 2013). Thus, the Primary Constituent Element “Salinity” helps define its nursery habitat (Service 1994). Freshwater flow into the estuary, and Delta outflow in particular, is the most significant mechanism affecting the salinity distribution of the estuary (Jassby *et al.* 1995; MacWilliams *et al.* 2015). Thus any recruitment or survival mechanisms that change in intensity as functions of salinity, or where particular ranges of salinity are distributed, are ultimately freshwater flow mechanisms (see Kimmerer 2002a). As discussed above, these may include the spatial extent of spawning habitat (Hobbs *et al.* 2007a), the availability of low velocity water refuges that remain turbid (Bever *et al.* 2016), and population-scale entrainment in water diversions (Kimmerer and Nobriga 2008; Kimmerer 2008). Some contaminant exposure and dilution mechanisms are also related to changes in freshwater flow inputs. For instance, the toxicity of water in creeks flowing into Suisun Marsh and the Delta can increase when storms increase flows that mobilize contaminated sediment (Weston *et al.* 2014; 2015). At a larger spatial-temporal scale, water toxicity varies regionally and seasonally, and may on average, be higher in years with low winter-spring inflows (Werner *et al.* 2010).

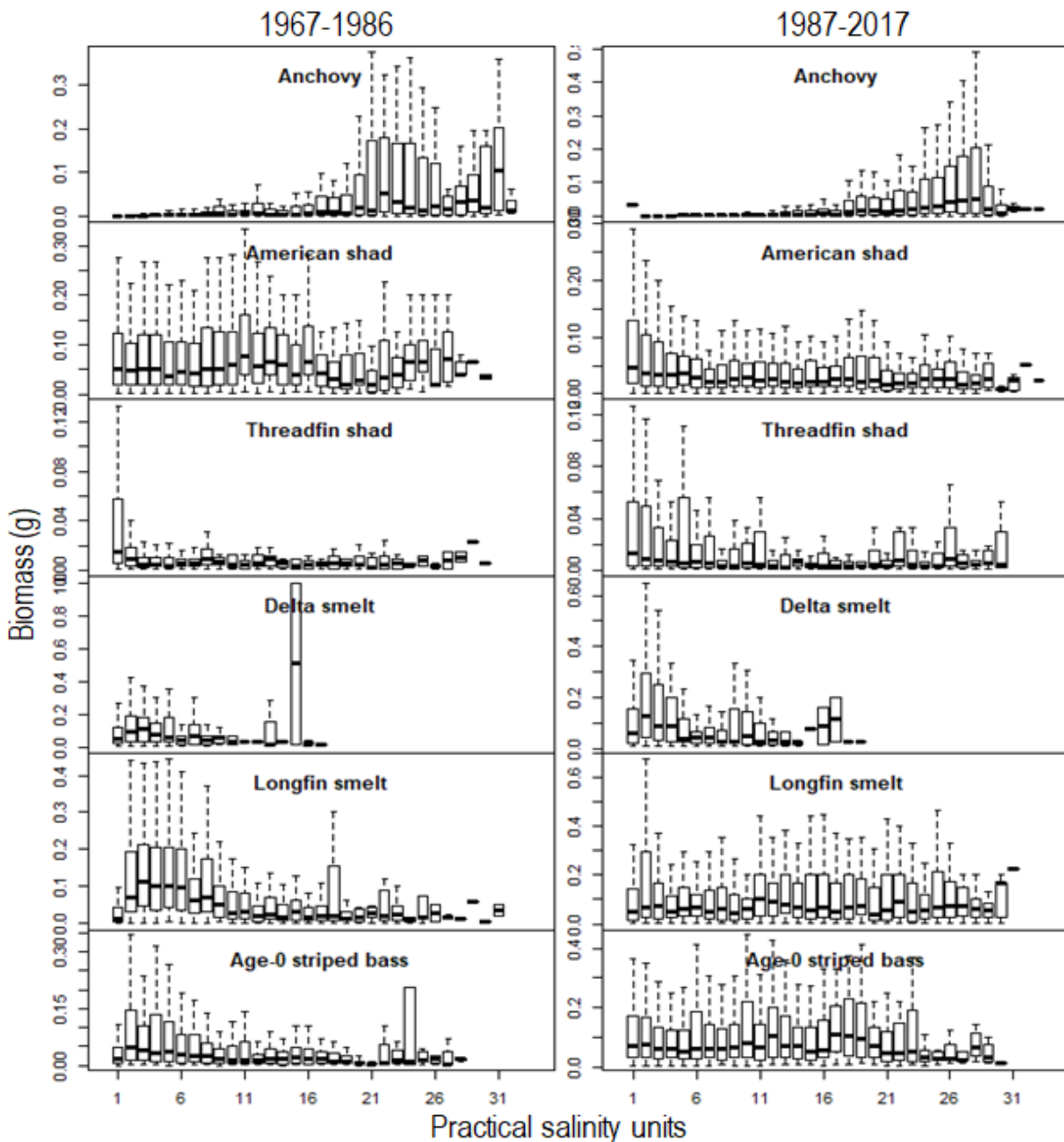
Initial research indicated that delta smelt have an upper acute salinity tolerance of about 20 ppt (Swanson *et al.* 2000) which is about 60% of seawater’s salt concentration of 32-34 ppt. Newer research suggests that some individual delta smelt can acclimate to seawater, but that about one in three juveniles and one in four adults die within a few days if they are rapidly transitioned from low-salinity water to marine salinity water (Komoroske *et al.* 2014). The survivors can live for at least several weeks in seawater, but lose weight (Komoroske *et al.* 2014; 2016). This clear evidence of physiological stress for delta smelt exposed to seawater has not been observed at lower salinity challenges – including salinities as high as 18-19 ppt. Different molecular responses have been observed, particularly at salinities higher than 6 ppt (Komoroske *et al.* 2016). These different molecular responses may reflect physiological stress, but this is not certain. There are currently several published studies that have examined aspects of delta smelt physiology at salinities in the 12-19 ppt range; none have found obvious evidence of an inability of the delta smelt to adjust its physiology to handle salinity in this range (Komoroske *et al.* 2014; 2016; Kammerer *et al.* 2016; Davis *et al.* 2019).

These findings are interesting because peak catches of early life stage wild delta smelt have occurred in fresh- or very low-salinity water and peak catches of juvenile and sub-adult fish have occurred at salinities that typify the LSZ. This contrast between where most wild delta smelt have been collected and what laboratory research indicates they can tolerate suggests one of three things. One possibility is there is a persistent laboratory artifact, though we are not aware of what such an artifact would be. A second possibility is that the analyses that have been done to date may not have accounted for change through time that has covaried with declining catches.

For instance, in a recent analysis of the SKT Survey, Castillo *et al.* (2018) found that when salinity was higher during sampling (i.e., during periods of low outflow) delta smelt and other fishes were collected from a higher mean salinity. The third possibility is that a discrepancy between field salinity distribution and laboratory results may be evidence that delta smelt's distribution along the estuary salinity gradient is due to a factor or factors other than salinity *per se*. Historically, delta smelt's prey were most abundant in the LSZ, but that has not been the case for more than 30 years. One explanation that may better align with recent laboratory research is that turbidity is the more important physical habitat attribute. Relatively turbid waters occur as a mobile front within the LSZ (Figure 15), occur regularly in Grizzly and Honker bays (Bever *et al.* 2016), and the Cache Slough complex (Sommer and Mejia 2013), all of which are places delta smelt have frequently been collected. This could mean that hiding from predators or minimizing competition are the more relevant drivers of delta smelt distribution. The Service has permitted the use of cultured fish enclosures placed along the estuary salinity gradient to explore this possibility.

The Service used the FMWT data to re-evaluate delta smelt salinity distribution and included equivalent data for five other open-water species to provide context. We analyzed the data separately for pre- and post-overbite clam eras given the large changes in food web function and fish distribution that occurred following its invasion (e.g., Kimmerer 2002b; Kimmerer 2006). To generate Figure 21, we converted the specific conductance data recorded during FMWT sampling to salinity using the equation provided by Schemel (2001) and created salinity bins spanning 1 ppt. We normalized the catch of each species each year relative to salinity so that years of high abundance would not contribute to the results more than years of low abundance. We did this by setting each year's maximum catch of each species to one, and converting smaller catches to fractions of these annual maxima. We then summarized the results with boxplots that show the interannual variability in normalized catch relative to the salinity gradient. Note that catch data were converted to biomass estimates before normalizing.

Of the species summarized in Figure 21, the delta smelt showed the smallest change in distribution relative to salinity after the overbite clam invasion. This is partly because delta smelt is the only one that has never been recorded at a salinity higher than about 20 ppt, which is consistent with previous field data summaries and the laboratory results reviewed above. There are small modes in delta smelt biomass in the LSZ and a general tapering off (with occasional exceptions in particular 1 ppt bins) out to 20 ppt. The northern anchovy data show the skew toward more marine waters that was described by Kimmerer (2006). Longfin smelt and age-0 striped bass had a more even distribution relative to salinity after the overbite clam than they did before. In contrast, American shad had a relatively even distribution across the salinity gradient before the overbite clam, but its distribution has been skewed into somewhat fresher water since. Threadfin shad appear to have greater relative use of the LSZ since the overbite clam, and perhaps higher salinity water more generally. Collectively, these data suggest some re-distribution of the upper estuary fish assemblage has occurred since the 1980s. We note that because mean salinity of the FMWT sampling grid has increased as well (Feyrer *et al.* 2007; 2011) some of these changes may also reflect that trend (e.g., northern anchovy, longfin smelt, striped bass, and threadfin shad). In contrast, the shift toward fresher water by American shad and the lack of major change by delta smelt suggest these species' spatial distribution has changed – if it had not, they would be distributed in more saline water like the other four species. For delta smelt, this distribution shift to the east is consistent with what has been reported previously (Feyrer *et al.* 2007; 2011; Sommer *et al.* 2011; Sommer and Mejia 2013).



**Figure 21. Salinity distributions of Fall Midwater Trawl catch for six pelagic San Francisco Estuary fishes, summarized by pre-overbite clam invasion years (1967-1986) and post-invasion years (1987-2017). Each Fall Midwater Trawl sample was associated with a specific conductance measurement, which was converted to practical salinity units. Annual frequencies of positive catches for each species, binned into one salinity unit increments, were divided by the total positive catch for each year-species combination, to yield proportional positive catch by salinity. Proportions represented annual distributions along the salinity gradient. Within each salinity bin and across years, the distributions of proportional catches were summarized with boxplots.**

*Summary of Status of Delta Smelt Critical Habitat*

The Service’s primary objective in designating critical habitat was to identify the key components of delta smelt habitat that support successful completion of the life cycle.

The delta smelt's critical habitat is currently not adequately serving its intended conservation role and function because there are very few locations that consistently provide all the needed habitat attributes for larval and juvenile rearing at the same times and in the same places (Table 3). The Service's review indicates it is rearing habitat that remains most impacted by ecological changes in the estuary, both before and since the delta smelt's listing under the Act. As described above, those changes have stemmed from chronic low outflow, changes in the seasonal timing of Delta inflow, and lower flow variability, species invasions and associated changes in how the upper estuary food web functions, declining prey availability, high water temperatures, declining water turbidity, and localized contaminant exposure and accumulation by delta smelt.

**Table 3. Summary of habitat attribute conditions for delta smelt in six regions of the estuary that are permanently or seasonally occupied in most years.**

	<b>Landscape</b>	<b>Turbidity</b>	<b>Salinity</b>	<b>Temperature</b>	<b>Food</b>
<b>Montezuma Slough</b>	Appropriate	Appropriate	Appropriate <i>when outflow is sufficient, or when the Suisun Marsh Salinity Control Gates are operated to lower salinity</i>	Usually appropriate	Appropriate
<b>Suisun Bay</b> (including Honker and Grizzly bays)	Appropriate except in shipping channel	Usually appropriate	Appropriate <i>when outflow is sufficient</i>	Usually appropriate	Depleted
<b>West Delta</b>	Limited area 4 to 15 feet deep	Marginal, declining	Appropriate	Can be too high during summer	Depleted
<b>North Delta (Cache Slough region)</b>	Appropriate	Appropriate	Appropriate	Can be too high during summer	Appropriate, but associated with elevated contaminant impacts
<b>Sacramento River above Cache Slough confluence</b>	Limited area 4 to 15 feet deep; swift currents	Marginal except during high flows, declining	Appropriate, but possibly lower than optimal	Usually appropriate	Likely low due to swift currents and wastewater inputs
<b>South Delta</b>	Appropriate except too much coverage by submerged plants	Too low	Appropriate	Too high in the summer	Appropriate

## **Environmental Baseline**

*Environmental baseline* refers to the condition of the listed species or its designated critical habitat in the Action Area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the Action Area, the anticipated impacts of all proposed Federal projects in the Action Area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the *Environmental Baseline*.

The proposed project is located on the southeastern tip of Bethel Island south of Franks Tract. The Delta Coves development included excavation of a man-made lagoon, which is connected to Sand Mound Slough and the Sacramento-San Joaquin Delta. Prior to construction of the Delta Coves project, the site was agricultural land.

The Delta Coves project area is lined by a reinforced levee that abuts Bethel Island. The interior of the lagoon is approximately 4-5 meters deep. The levee of the lagoon is largely devoid of vegetation. Subtidal waters less than 2 meters deep are largely colonized by dense beds of *Egeria densa*, that requires annual treatment by the California Division of Boating and Waterways.

Previous research in the area shows that the area is largely dominated by non-native fish, including predatory largemouth bass and striped bass (Grimaldo *et al.* 2004; Grimaldo *et al.* 2012). In addition to *Egeria densa*, the aquatic habitat in the area also supports large mats of water hyacinth, a floating aquatic weed that supports large numbers of non-native invertebrates and fishes (Toft *et al.* 2003). Seasonally, the area will support relatively small numbers of native fish, especially during the winter and spring when they are known to emigrate through the area. However, by summer, when water temperatures increase, most native fish move out of the area (Nobriga *et al.* 2008; Grimaldo *et al.* 2012).

### Delta Smelt

The Action Area is located in the central Delta on the San Joaquin River side of the delta smelt's range and delta smelt occur seasonally near the Action Area during the winter/spring spawning season. The lagoon is infested with non-native invasive aquatic weeds which provide habitat from non-native predators and create less turbid habitat conditions for the delta smelt. Delta smelt are not expected to be present in the summer or fall months as water temperatures increase along with aquatic weed growth. Based on current conditions, delta smelt may not utilize the lagoon at all. Currently, California is experiencing extremely dry conditions. Drought response actions and water quality further reduce the likelihood delta smelt will be in the Action Area during in-water construction. As discussed in the *Status of the Species* section delta smelt abundance is historically low and continues to trend downward.

### Delta Smelt Critical Habitat

The proposed project is within the delta smelt's designated critical habitat and contains some of the Primary Constituent Elements described in the critical habitat designation but quality and amount vary depending on conditions as discussed in the *Status of the Critical Habitat* section.

### **Effects of the Proposed Action**

*Effects of the action* are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. *Effects of the action* may occur later in time and may include consequences occurring outside the immediate area involved in the action.

### Delta Smelt

#### *Creation of the Lagoon*

The construction of the lagoon resulted in the loss of shoreline habitat for the delta smelt and created conditions for invasive non-native aquatic weeds to colonize the area and creating habitat for non-native predators like largemouth bass. As such, the applicant has proposed to purchase 1.25 acres worth of delta smelt credits at the North Delta Fish Conservation Bank, when credits are available, to comply with the original consultation and minimize the effect from the loss and degradation of habitat.

When credits are purchased at a Service-approved conservation bank, this component of the action will have the effect of protecting and managing habitat for the species' conservation in perpetuity. A Service-approved conservation bank provides suitable habitat for spawning, feeding, or sheltering commensurate with or better than habitat lost as a result of the proposed project. Purchasing credits at a Service-approved conservation bank may contribute to other recovery efforts for the species. However, even with the proposed conservation measures the lagoon will continue to function as habitat for non-native fish and aquatic nuisance species.

#### *Dock Construction and Maintenance*

As described in the *Environmental Baseline*, delta smelt may not utilize the lagoon due to its poor habitat quality. Additionally, in-water construction is proposed to occur from July through October when delta smelt are not anticipated to occur in the Action Area and will therefore not be affected.

#### Floating Debris and Water Hyacinth Removal

As described in the *Environmental Baseline*, the creation of the lagoon created habitat for non-native invasive aquatic weeds and predatory fish. It is unlikely that delta smelt utilize the lagoon at all and would not be present during debris and mechanical removal of water hyacinth.

### Delta Smelt Critical Habitat

Physical shoreline habitat (PCE 1) was lost from the construction of the lagoon and as described above the lagoon created water quality issues (PCE 2) and is not functional delta smelt habitat.

Purchasing delta smelt credits at a Service-approved conservation bank will minimize the permanent loss of habitat by protecting in perpetuity habitat commensurate with or better than habitat lost as a result of the Delta Coves project. It is unknown if other PCEs were affected by the creation of the lagoon as hydraulic and water quality analyses were not provided. The effects to PCE 1 and 2 are small relative to the entire designated critical habitat, and with the implementation of compensatory mitigation, are not expected to appreciably diminish the value of the critical habitat or prevent it from sustaining its role in the conservation of the delta smelt. However, even with the implementation of proposed conservation measures, PCE 2 will continue to be affected from invasive non-native aquatic weeds.

### **Cumulative Effects**

Cumulative effects include the effects of future State, Tribal, local, or private actions that are reasonably certain to occur in the area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action or future actions that implement planning efforts that may have adverse effects are not considered in this section. These projects would have a Federal nexus and would require separate consultation pursuant to section 7 of the Act to delta smelt and delta smelt critical habitat as appropriate.

Adverse effects to delta smelt and delta smelt critical habitat may result from point and non-point source chemical contaminant discharges within the Action Area. These contaminants include but are not limited to ammonia and free ammonium ion, numerous pesticides and herbicides from agricultural activities, and oil and gasoline product discharges. Oil and gasoline product discharges may be introduced into Delta waterways from shipping and boating activities and from urban activities and runoff. Implicated as potential stressors, these contaminants may adversely affect fish reproductive success and survival rates.

### **Conclusion**

After reviewing the current *Status of the Species* status for the delta smelt and its critical habitat, 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 Delta Coves Project, as proposed, is not likely to jeopardize the continued existence of the delta smelt and is not likely to destroy or adversely modify delta smelt critical habitat. The Service reached this conclusion because the project-related effects to the species, when added to the *Environmental Baseline* and analyzed in consideration of all potential *Cumulative Effects*, will not rise to the level of reducing the likelihood of survival or recovery of these species and will not rise to the level of precluding the function of the delta smelt's critical habitat to serve its intended conservation role for the species based on the following: (1) the purchase of conservation bank credits will minimize the effect of permanent habitat and critical habitat loss; and (2) in-water work will avoid the time when delta smelt may be present in the Action Area.

## **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 to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harass is defined by Service regulations at 50 CFR 17.3 as an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Harm is defined by the same regulations as an act which actually kills or injures wildlife. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavior 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 that is 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 nondiscretionary and must be implemented by the Corps so that they become binding conditions of this action, in order 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 require the applicant to adhere to the terms and conditions of the incidental take statement and/or (2) fails to retain oversight to ensure compliance with these terms and conditions, 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 anticipates incidental take of delta smelt will be difficult to detect and quantify because of the species' small size and cryptic nature and therefore it is not possible to provide precise numbers of delta smelt that could be harmed, injured, or killed from the proposed project. There are numerical limitations with respect to detecting individual delta smelt in the wild, and for that reason, it is not practical to express the amount or extent of anticipated take of this species or monitor take-related impacts in terms of individual delta smelt. Due to the difficulty in quantifying the number of delta smelt that will be taken as a result of the proposed project, the Service is using habitat as a surrogate to quantify incidental take of the species. Therefore, to quantify the level of incidental take associated with the proposed project, the Service anticipates that all delta smelt within the estimated 140 acres of the lagoon will be subject to incidental take in the form of harm from habitat modification and degradation. Upon implementation of the *Reasonable and Prudent Measures*, incidental take associated with the project will become exempt from the prohibitions described under section 9 of the Act.

### **Effect of the Take**

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

### **Reasonable and Prudent Measure**

The following reasonable and prudent measure is necessary and appropriate to minimize the effects of the proposed project to the delta smelt:

1. The Corps shall minimize the potential for take of the delta smelt.

### **Term and Condition**

In order to be exempt from the prohibitions of section 9 of the Act, the Corps shall ensure compliance with the following term and condition, which implement the reasonable and prudent measure described above. This term and condition is nondiscretionary.

1. The following Terms and Conditions implement Reasonable and Prudent Measure Number One (1):
  - a. The Corps shall minimize the potential for harm or harassment of delta smelt resulting from project related activities by implementation of the *Conservation Measures* as described in the *Description of the Proposed Action* in this biological opinion.
  - b. The Corps shall educate and inform staff and contractors involved in the project as to the *Conservation Measures* and *Term and Condition* in this biological opinion.

### **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 reporting 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 24 hours of the finding of any injured or dead listed species or any unanticipated damage to its habitat associated with the proposed project. Injured listed species shall be cared for by a licensed veterinarian or other qualified person. Notification will be made to the contact below in *Reporting Requirements*, 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 shall follow the steps outlined in the *Disposition of Individuals Taken* section below.
2. Sightings of any listed or sensitive animal species shall be reported to the Service and California Natural Diversity Database (<https://www.wildlife.ca.gov/Data/CNDDDB/Submitting-Data>).
3. The applicant shall provide documentation of conservation bank credits purchase to the Service within one year of the signature date of this reinitiated biological opinion.

### *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, the name of the person who found it, and the bag containing the specimen 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 person is Jana Affonso, Assistant Field Supervisor of the Endangered Species Division at (916) 930-2664.

## **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. The Service recommends the Corps maintain current knowledge of Delta species biology, ecology, and status to inform project design and species-specific *Conservation Measures*.
2. Encourage or require the use of appropriate California native species in restoration and revegetation efforts.
3. Assist the Service with implementing other recovery actions identified within the most current recovery plans for these species.
4. Encourage the participation of the Applicant in programs being developed by the Federal and State resource agencies to limit and reverse the spread of non-native species, such as *Phragmites*, *Lepidium*, *Egeria densa*, clams, and other invasive species.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

## **REINITIATION - CLOSING STATEMENT**

This concludes the consultation for the Delta Coves Project. As provided in 50 CFR §402.16,

(a) Reinitiation of consultation is required and shall be requested by the Federal agency or by the Service, where discretionary Federal involvement or control over the action has been retained or is authorized by law and:

- (1) If the amount or extent of taking specified in the incidental take statement is exceeded;

(2) If 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;

(3) If 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 the biological opinion or written concurrence; or

(4) If a new species is listed or critical habitat designated that may be affected by the identified action.

(b) An agency shall not be required to reinitiate consultation after the approval of a land management plan prepared pursuant to 43 U.S.C. 1712 or 16 U.S.C. 1604 upon listing of a new species or designation of new critical habitat if the land management plan has been adopted by the agency as of the date of listing or designation, provided that any authorized actions that may affect the newly listed species or designated critical habitat will be addressed through a separate action-specific consultation. This exception to reinitiation of consultation shall not apply to those land management plans prepared pursuant to 16 U.S.C. 1604 if:

(1) Fifteen years have passed since the date the agency adopted the land management plan prepared pursuant to 16 U.S.C. 1604; and

(2) Five years have passed since the enactment of Public Law 115-141 [March 23, 2018] or the date of the listing of a species or the designation of critical habitat, whichever is later.

Please address any questions or concerns regarding this response to Kim Squires, Section 7 Division Manager, at [Kim\\_Squires@fws.gov](mailto:Kim_Squires@fws.gov). Please refer to Service file numbers 08FBDT00-2022-F-0002, in any future correspondence.

Sincerely,

Donald Ratcliff  
Field Supervisor

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Refer to NMFS ECO#: WCRO-2022-00414

May 04, 2022

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*Electronic transmittal only*

Re: Endangered Species Act Section 7(a)(2) Concurrence Letter for the Delta Coves Project.

Dear Ms. Campbell:

On February 15, 2022, NOAA's National Marine Fisheries Service (NMFS) received your request for a written concurrence that the U.S. Army Corp of Engineers (USACE) issuance of a Department of Army permit for DMB Associate's (Applicant) SDC Delta Cove's Project (Project, SPK-1994-00393), is not likely to adversely affect (NLAA) species listed as threatened or endangered or critical habitats designated under the Endangered Species Act (ESA). This response to your request was prepared by NMFS pursuant to section 7(a)(2) of the ESA and implementing regulations at 50 CFR 402.

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 document will be available within two weeks at the Environmental Consultation Organizer (<https://www.fisheries.noaa.gov/resource/tool-app/environmental-consultation-organizer-eco>). A complete record of this consultation is on file at NMFS California Central Valley Office in Sacramento, California.

## **Consultation History and Background**

### *History*

- On August 8, 2018, NMFS received a consultation initiation request letter and a Biological Technical Report (revised in February 2018) from USACE for the proposed action.
- On September 28, 2018, NMFS sent a close out letter, informing USACE their withdrawal from the consultation due to insufficient information on the proposed action; after NMFS requested for further information and did not receive it.



- On December 15, 2020, USACE prepared a consultation initiation request letter and a Biological Assessment (BA) (dated May 2020) for the proposed action to be sent to NMFS; NMFS has no record of receiving the letter or BA.
- On February 15, 2022, NMFS received an email from USACE inquiring about the 2020 consultation initiation request.
- On February 16, 2022, NMFS met with USACE, and NMFS received the 2020 consultation initiation request letter and BA for the proposed action.
- On February 18, 2022, NMFS sent an insufficiency response to the USACE, via email, requesting specific clarifications and updates on the proposed action.
- On March 16, 2022, NMFS received the requested information on the Project from USACE. NMFS determined that the information received was enough to initiate section 7 consultation on this date.

### *Background*

Delta Coves is a residential community and lagoon that was constructed from 2006 to 2008, with 494 lots that each came equipped with an easily accessible dock slip attached to the owner's private property (ICF 2020). This community is also equipped with a Home Owner's Association (HOA) (Waterston 2022) and a club house called the Island Camp which is equipped with a marina (Figure 1, Delta Coves Website 2022). All lighting provided at the docks are to be motion censored and directed away from the water's surface in order to decrease the attraction of fish to the residential area. The HOA also requires a submittal of a Design Review Application for review and approval by the HOA prior to any resident alteration to their dock, which includes lifts, lighting, boat covers, and any additional construction (Waterston 2022).

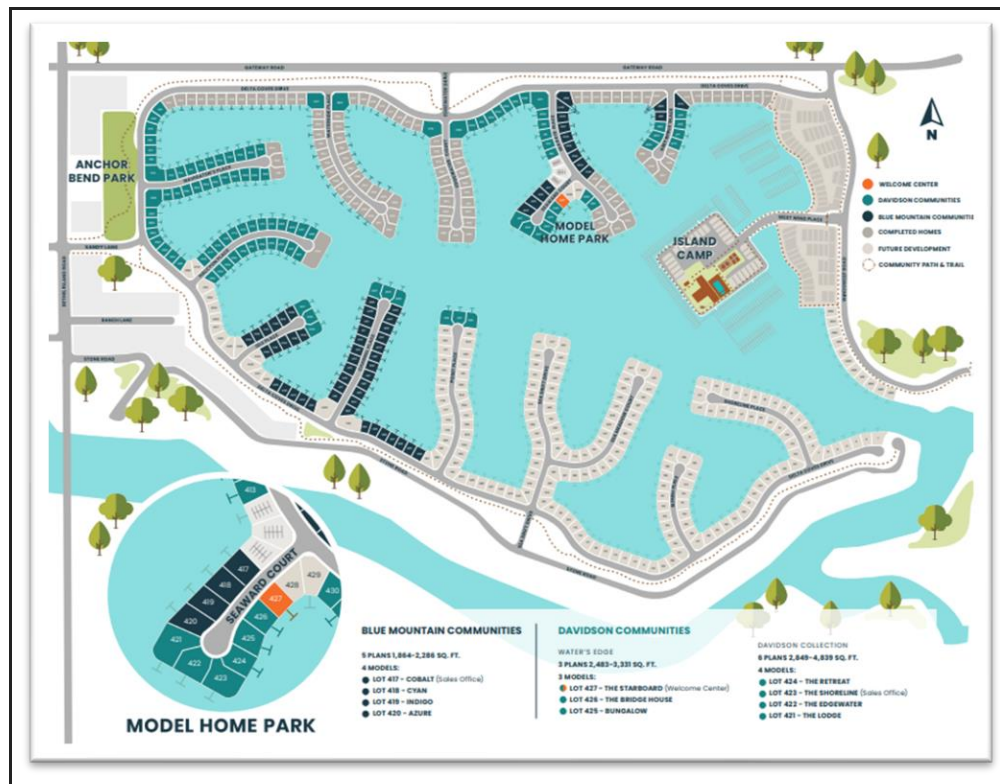


Figure 1: Community Map (Delta Coves, 2021)

In order to meet USACE requirements, the Delta Coves HOA will be responsible for the implementation of long-term maintenance of docks, lifts, boat covers, and recreational boats for residents of the community, during and after the life of the permit. Docks will be used as the lots are sold and maintenance to individual docks, shade canopies, and boat lifts will not be expected for the first few years after the completion of the Project. If needed, maintenance activities may include walk-way cleaning, railing and wood support replacement, hardware tightening and/or replacement, canopy fabric cleaning/replacement, replacement of pulleys and/or lift cables, and lubrication of moving parts. Such maintenance will follow implemented procedures in order to meet conservation measures in preventing the introduction of contaminants into the lagoon (Waterston 2022).

In order to meet state requirements, further long-term maintenance of the lagoon in which Delta Coves resides in, is also under the community's HOA's responsibility during and after the life of the permit. This maintenance includes the removal of floating debris, such as trash that has accumulated in the lagoon, and the regular removal of the invasive aquatic weed water hyacinth (*Eichhornia crassipes*). The frequency of debris removal would depend on the rate of accumulation, to be determined by regular visual monitoring of the site. The HOA would schedule and implement a regular debris removal program, removing debris from the project site as frequently as needed to comply with the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins' direction that "water shall not contain floating material in amounts that cause nuisance or adversely affect beneficial uses." Water hyacinth would also be regularly removed from the lagoon area through the development and implementation of a water hyacinth control program to ensure that the cover of water hyacinth in the project area does not increase beyond existing conditions. The frequency of water hyacinth removal would depend on the rate of vegetation growth, being most abundant from March to December, and when accumulation reaches 20% in the most affected areas of the lagoon (ICF 2020).

The Applicant's HOA will provide educational handouts and power-point presentations to new home buyers outlining their responsibilities for caring for the lagoon. This includes details on properly removing invasive algae (water hyacinth) from their property (docks and shoreline), as well as any watercraft prior to leaving the lagoon (Waterston 2022), along with required best management practices for cleaning and maintaining their property, including the docks and its accessories.

## **Proposed Action and Action Area**

### *Proposed Action*

As of June 2021, 78 of the 494 lots have been developed with a residential home (Google Earth) and 416 of the 494 originally-proposed private docks are accessible in the lagoon (ICF 2020). Since 2008, some of the original docks have deteriorated and floated out into the lagoon, where they damage other docks until they are retrieved by boat. The Applicant will examine all 416 existing private docks and determine which docks could be cleaned and repaired in place, over the life of the 5-year permit. Those in extremely poor condition will be removed and replaced (ICF 2020). In addition, there will be a total of 175 new multi-slip docks and dry boat storage lifts installed (Waterston 2022) and up to two shade canopies added to each dock.

The existing dock configurations are t-shaped and the new docks will have fingers that extend perpendicularly from the dock in order to create multiple slips within each dock. The Project will be carried out using both land-based equipment and equipment mounted on a barge within the lagoon, where necessary. The construction of the Project will require the use of the following pieces of equipment: a backhoe, a barge-mounted crane, a crawler crane, vibratory pile driver, pile driving rig, a generator, a tandem roller, haul trucks, a concrete pump truck, and a loader, as well as at least one of either a clamshell excavator, a long-arm excavator, or a dragline excavator. The new docks will be set into the water with a crane and bolted together. The maximum distance that the docks will extend into the lagoon is 48 feet. To secure the 30-40-foot-long docks, 10-inch hollow core fiberglass or steel pilings will be driven into the substrate with a vibratory hammer, onto which the docks will be bolted (ICF 2020). The small pile driving vessel will use a multi-layer cushion block in order to minimize vibrations and hydroacoustic impacts and will utilize a graduated blow method to mitigate localized soil disturbance in and around the point of penetration. The maximum number of piles to be driven per day is 10 (Waterston 2022). The total number of piles for all multi-slip docks is 245: two for each 2-slip dock, three for each 3-slip dock, and four for each 4-slip dock. The addition of the multi-slip docks will add 6.35 acres of surface area coverage over the lagoon.

All spoils will be removed from water to land and transported to an approved dumpsite; materials that can be reused or repurposed, such as metal gangways, will be stored on land. Existing gangways for t-shaped docks will stay in the same location for the new multi-slip docks. No existing piles are expected to be removed from the lagoon (ICF 2020), however, if the Applicant determines that a pile needs to be removed for any reason, it will be taken completely out of the water and moved onto dry land for storage or disposal (Waterston 2022).

The number of access routes, size of staging areas, storage, parking areas, and the total area of the activity will be located on rural or developed lands and limited to the minimum necessary to achieve the Project's goal, e.g., locating maintenance areas away from sensitive natural communities (e.g., water zones). These sensitive areas will be labeled with markers to indicate the boundary, 1 week prior to the start of construction, and work will be limited to outside the marked areas. The Applicant will inspect and clean all equipment being used for brush clearing to minimize the spread of invasive plant species into suitable upland refugia and tidal marsh habitat. Prior to storm events, all construction activities will cease and appropriate erosion control measures will be implemented. Erosion-control materials will be weed-free or contain less than 1% weed seed, and tightly woven fiber netting or similar material will be used for erosion control. No plastic mono-filament matting will be used for erosion control, as this material may ensnare wildlife. Surface disturbance will be minimized to the greatest extent feasible to complete the work.

Approximately 300 of the existing docks will have their anchors replaced with a newer four cable anchor system developed by Sea Flex. This new system will use the existing lagoon floor anchorage and replace the cable system between the anchorage and the dock, and is guaranteed to last for 20 years or more. The remaining docks will either be constructed within elbow areas of the lagoon or at the point lots at the end of the cul-de-sacs. All existing and new docks will be equipped with lighting (ICF 2020). This lighting will be directed away from the water surface and will be motion censored in order to decrease the attraction of fish to the area (Waterston

2022). The canopies will be removable and may extend up to 15 feet over the water, beyond the dock. All attachment parts for the canopy will be located on the dock (ICF 2020). The lifts come in two different designs, side-mount and center-mount. Side-mount lifts attach to the side of the dock and center-mount lifts attach between two slips. A maximum of two center-mount boat lifts per dock will be attached to internal sides of the slips (Waterston 2022). Neither the shade canopies nor the boat lifts will result in permanent surface area coverage as they will be above water, or in the case of the boat lifts, only be lowered into the water while the vessel is going into or coming out of the water (ICF 2020).

All in-water work will be conducted between 9:00 a.m. to 5:00 p.m., up to 7 days per week, between August 1 to October 31. Work on dry land will be conducted between 9:00 a.m. to 5:00 p.m. year-round, depending on weather (Waterston 2022). No night time work will be conducted, and no security lighting will be near the water's edge. Upon the completion of the Project, the contractor will return staging areas to their original, or better, condition. Eradication methods for removing terrestrial invasive species to prevent dispersal may include the use of herbicides approved for use near waterways by a trained ground crew who will spot-spray during dry conditions when no wind is present. Best Management Practices (BMPs) will be in place prior, during, and post construction. Areas disturbed by construction will be revegetated, as required by the Project's stormwater pollution prevention plan (SWPPP).

#### *Action Area*

The Project is located in a residential community called SDC Delta Coves, on Bethel Island in Contra Costa County, California and is located at latitude 38.015739 and longitude -121.630263 (Figure 2). Delta Coves is a man-made lagoon off of Sand Mound Slough, in the central Sacramento-San Joaquin River Delta (Delta), which is tidally connected to the Pacific Ocean. The action area is considered the lagoon in which Delta Coves resides in. Although the lagoon is not designated as critical habitat for listed anadromous fish, it is connected to Sand Mound Slough which is designated critical habitat, and connects with the rest of the Delta. Although the action area is considered only the lagoon, possible stressors outside of the action area are considered. These stressors may be a result of the likely increase in recreational boaters within Delta Coves that have direct access to the Delta and its designated critical habitats.

The lagoon is approximately 12-16 feet deep, is lined by a reinforced levee that abuts Bethel Island (Glen Lukos Associates 2018), the High Mean Water Line (HMWL) is 3.04 feet of elevation (Waterston 2022), and the lagoon floor's substrate has never been altered from the original clay. Currently water hyacinth (*Eichhornia crassipes*), a floating aquatic weed, is a nuisance in the lagoon and supports large numbers of non-native invertebrates and fish (ICF 2020). The only water entrance of the lagoon is located in the south east corner of the community onto Sand Mound Slough, which is the only tidally influenced inlet for the action area. Currents within the actual lagoon are minimal and are dependent on tidal fluctuation and wind speed/direction. As natural water movement is minimal within the lagoon, an intake and pump station is located on the eastern edge of the lagoon, which allows circulation within the lagoon at multiple outlets (Waterston 2022).

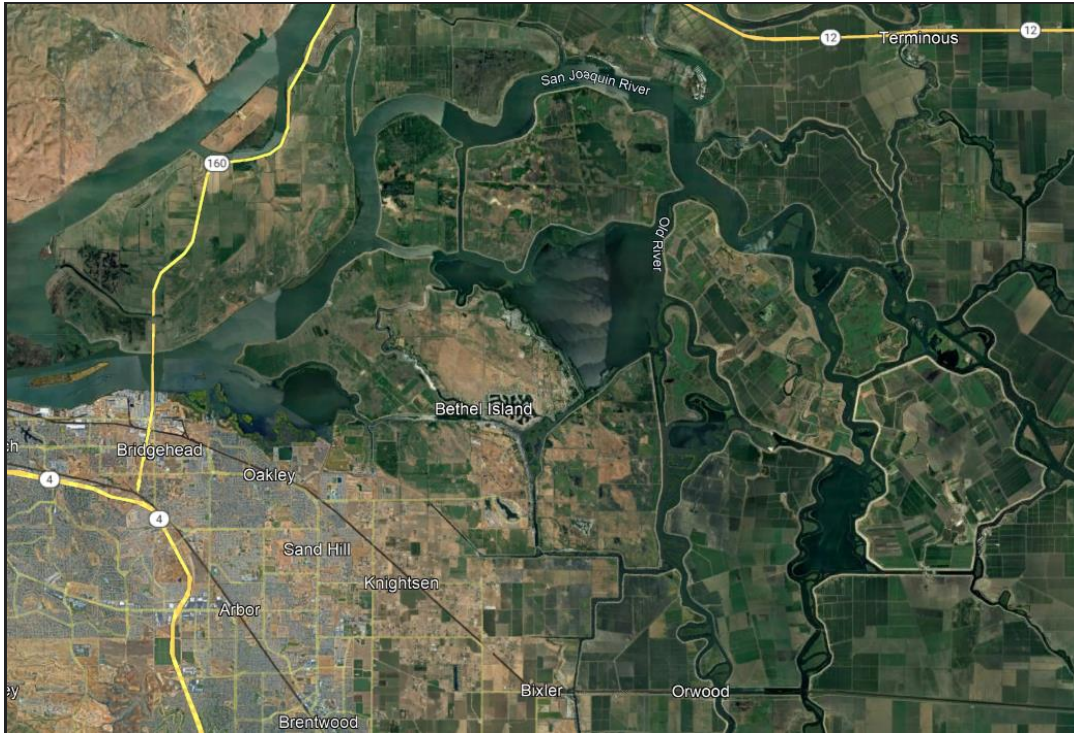


Figure 2 : Regional Map (Google Earth)

### *Minimization and Avoidance Measures*

The Applicant has committed to implementing the following conservation measures to avoid and minimize potential effects on listed species and designated critical habitats; the following are described in the BA (ICF 2020), unless noted otherwise.

#### BMPs:

- A qualified biologist will conduct a mandatory awareness and impact avoidance measures for biological resources training for all personnel prior to construction. The biologist will be onsite during all construction activities within the lagoon and will be notified in advance of all work activities and locations.
- Prior to any construction activities, a job briefing will be held to discuss the activities that will be performed that day and all foods and food-related trash items will be enclosed in sealed trash containers and removed from the site at the end of each workday.
- Environmentally sensitive areas will be flagged or fenced prior to construction. All crews will know of all environmental areas via provided plans. The plans will define acceptable materials and prohibited construction-related activities, vehicle operation, equipment storage, and other surface disturbing activities within sensitive areas.
- The number of access routes, size of staging areas, storage, parking areas, and the total area of the activity will be located on rural or developed lands and limited to the minimum necessary to achieve the Project's goal; e.g., locating maintenance areas outside of any drainages or creeks. Sensitive natural communities (e.g., water zones) will be installed to mark the boundary 1 week prior to the start of construction, and work will be limited to outside the marked areas.

- Vehicle travel adjacent to water zone areas will be limited to existing roads and designated access paths and are not allowed to go more than 15 miles per hour.
- Hazardous materials, such as fuels and oils, will be stored in sealed containers in a designated location that is at least 200 feet from any aquatic habitat, storm or drainage courses, and agricultural areas. All equipment will be maintained to limit leaks of machine fluids such as gasoline, diesel, or oils.
- Prior to storm events, all construction activities will cease and appropriate erosion control measures will be implemented.
- Erosion-control materials will be weed-free or contain less than 1% weed seed, and tightly woven fiber netting or similar material will be used for erosion control. No plastic mono-filament matting will be used for erosion control, as this material may ensnare wildlife. Surface disturbance will be minimized to the greatest extent feasible to complete the work.
- Supervisors will be trained about the importance of controlling and preventing the spread of invasive plant infestations. Terrestrial invasive plant species will be removed manually. If herbicide is to be used, trained ground crew will spot-spray during dry conditions when no wind is present.
- The Applicant, or its contractor, will inspect and clean all equipment being used for brush clearing to minimize the spread of invasive plant species into suitable upland refugia and tidal marsh habitat.
- Upon completion of the Project, all temporarily disturbed natural areas, including banks, shall be returned to original contours to the extent feasible. Affected wetlands, banks or stream channels will be stabilized prior to the rainy season and/or prior to reestablishing flow. Native wetland vegetation will be reestablished as appropriate.
- To prevent introduction and/or transport of aquatic invasive species into the action area, any equipment that comes into contact with the channel will be inspected and cleaned before and after contact, according to the most current Inspection Standards and Cleaning and Decontamination Procedures.
- Water hyacinth will be regularly removed from lagoon areas through the development and implementation of a water hyacinth control program to ensure that the cover of water hyacinth in the lagoon does not increase beyond existing conditions at the time that the work is completed.
- Vibratory pile driving will be set with a soft set and graduated blow method to mitigate localized soil disturbance in and around the point of penetration. The piles set are hollow, which will not displace as much sediment as a closed pile. Piles will be driven via a small driving vessel that will utilize a multi-layer cushion block to minimize acoustic vibrations. The pile driver will be set to “soften” as the installed pile receives resistance in order to minimize vibrations and hydroacoustic impacts (Waterston 2022).
- The construction contractor will ensure that all equipment is fitted with sound-control devices no less effective than those provided as original equipment to ensure that construction noise levels, as applicable, do not exceed 80 dBA (weighted decibels) (one-hour Leq) and no equipment will be operated with an unmuffled exhaust.
- In-water work will be conducted between 9:00 am and 5:00 pm between August 1 through October 31 (Waterston 2022).

**SWPPP:**

- A description of site characteristics will be provided to the construction team, including the following; runoff, drainage, soil erosion hazard, proposed construction procedures, and construction-site housekeeping practices (prohibitions on discharging or washing potentially harmful materials into streets, shoulder areas, inlets, catch basins, gutters, or agricultural fields, associated drainage, or irrigation features).
- A description of measures that will be implemented for erosion and sediment control, including the following:
  - Conduct major construction activities involving excavation and spoils haulage during the dry season.
  - Conduct all construction work in accordance with site-specific construction plans that minimize the potential for increased sediment inputs to storm drains and surface waters.
  - Grade and stabilize spoils sites to minimize erosion and sediment input to surface waters.
  - Implement erosion control measures as appropriate to prevent sediment from entering surface waters, agricultural water features, and storm drains, including the use of silt fencing or fiber rolls to trap sediments and erosion control blankets on exposed slopes.
- A Spill Prevention and Response Plan (SPRP) that identifies any hazardous materials to be used during construction; describes measures to prevent, control, and minimize the spillage of hazardous substances, describes transport, storage and disposal procedures for these substances, and outlines procedures to be followed in case of a hazardous material spill. It will also stipulate procedures, such as the use of spill containment pans, to minimize hazards during onsite fueling and servicing of construction equipment. The SPRP will require that the Applicant be notified immediately of any substantial spill or release.
- Construction will be monitored by the Applicant to ensure that contractors are adhering to all provisions relevant to state and federal stormwater discharge requirements, and that the Applicant will shut down the construction site in the event of noncompliance.
- All in-water work will be done by equipment operating from dry areas outside the lagoon or by a barge-mounted crane. Silt fences, fiber rolls, silt/turbidity curtains, and other appropriate sediment control measures will be used to minimize sediment input to the water.

**Species Background and Action Agency's Effects Determination**

The USACE has determined that the proposed action may affect, but is NLAA the following listed species and critical habitats:

**Sacramento winter-run Chinook salmon** (*Oncorhynchus tshawytscha*)  
Endangered (June 28, 2005, 70 FR 37160)

**Central Valley (CV) spring-run Chinook salmon** (*O. tshawytscha*)  
Threatened (June 28, 2005, 70 FR 37160)

**California Central Valley (CCV) steelhead (*O. mykiss*)**

Threatened (January 1, 2006, 71 FR 834)

Critical habitat (September 2, 2005, 70 FR 52488)

**Southern distinct population segment (sDPS) of North American green sturgeon***(Acipenser medirostris)*

Threatened (April 7, 2006, 71 FR 17757)

Critical habitat (October 9, 2009, 74 FR 52300)

*Sacramento winter-run Chinook salmon & CV spring-run Chinook salmon*

The Sacramento–San Joaquin River Delta (Delta) serves as a migration corridor for both Sacramento winter-run and CV spring-run Chinook salmon. Although these listed species utilize the Delta, they are not commonly found in/or around Sand Mound Slough and no critical habitat is designated for these listed species within the slough or the lagoon Delta Coves resides in.

*CCV steelhead*

CCV steelhead adults generally leave the ocean and migrate into the Delta from June through November, with most migration occurring between August and October. Migration into the San Joaquin River occurs July through March, with most moving September through February. Emigrating CCV steelhead use the lower reaches of the Sacramento River and the Delta for rearing and as a migration corridor to the ocean. Out migrating juvenile steelhead are captured in the San Joaquin River at Mossdale trawl from February to June, with the most fish captured March to May. Some steelhead may utilize tidal marsh areas, non-tidal freshwater marshes, and other shallow water areas in the Delta as rearing areas for short periods prior to their final emigration to the sea. Although CCV steelhead juveniles and adults are not commonly found in the lagoon that Delta Coves resides in, they may migrate past the entrance to Delta Coves. However, the slough has suitable rearing marshes in the area that may deter CCV steelhead away from the lagoon's entrance, resulting with none being expected in the action area.

The lagoon where Delta Coves resides in is not designated critical habitat for CCV steelhead. However, designated critical habitat is in Sand Mount Slough and the waterways surrounding Bethel Island. Critical habitat for steelhead is defined as specific areas that contain the Primary Constituent Elements (PCEs) and physical habitat elements essential to the conservation of the species. Migratory corridors comprise rearing habitat for juveniles, which feed and grow before and during their out-migration. Rearing habitat condition is strongly affected by habitat complexity, food supply, and the presence of predators of juvenile salmonids. Ideal freshwater migration corridors are free of migratory obstructions, with water quantity and quality conditions that enhance migratory movements. They contain natural cover such as riparian canopy structure, submerged and overhanging large woody objects, aquatic vegetation, large rocks, and boulders, side channels, and undercut banks which augment juvenile and adult mobility, survival, and food supply. Sand Mound Slough contains migratory corridor and potential rearing habitat PCEs for CCV steelhead.

*sDPS of North American green sturgeon*

Southern DPS of North American green sturgeon (green sturgeon) adults, juveniles greater than 5 months old, sub-adults, and non-spawning sub-adults are present in the Sacramento-San Joaquin-San Francisco estuary during all months of the year. Juvenile green sturgeon have been salvaged at the Skinner Delta Fish Protective Facility and the Tracy Fish Collection Facility in the south Delta, and captured in trawling studies by California Department of Fish and Wildlife (CDFW) during all months of the year. The majority of these fish were between 200 millimeters (mm) and 500 mm, indicating they were from 2 to 3 years of age. The lack of a significant proportion of juveniles smaller than approximately 200 mm in Delta captures indicates that juveniles likely hold in the mainstem Sacramento River. However, the lagoon that Delta Coves resides in has minimal current influences, a constant depth of 12 feet, and poor water quality for green sturgeon, resulting with none to be expected in the action area.

The lagoon where Delta Coves resides is not designated critical habitat for green sturgeon. However, designated critical habitat for green sturgeon is in Sand Mount Slough and the waterways surrounding Bethel Island. The PCEs for green sturgeon within the designated critical habitat in Sand Mound Slough include abundant prey resources, adequate water flow, temperature, oxygen and other chemical characteristics, a diversity of depths necessary for shelter, foraging, and migration of juvenile, subadult, and adult life stages, and sediment quality necessary for normal behavior, growth, and viability of all life stages.

**Effects of the Action**

Under the ESA, “effects of the action” are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (50 CFR 402.02). In our analysis, which describes the effects of the proposed action, we considered 50 CFR 402.17(a) and (b). When evaluating whether the proposed action is not likely to adversely affect listed species or critical habitat, NMFS considers whether the effects are expected to be completely beneficial, insignificant, or discountable. Completely beneficial effects are contemporaneous positive effects without any adverse effects to the species or critical habitat. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Effects are considered discountable if they are extremely unlikely to occur.

The effects of the proposed action include the following:

*Construction-Related Disturbance*

During construction activities, including the possible movement and placement of construction materials near the water’s edge, any listed fish that may be present in the action area may be disturbed. The BMPs in place should minimize or prevent construction-related disturbances, considering the majority of the construction and related material is not near Sand Mound Slough.

All construction will only be conducted during daylight hours and dry conditions, with erosion preventions in place. Turbidity curtains and other sediment control measures will be used to minimize sediment input to the water. All construction vehicles are to be equipped with mufflers and pile driving will be equipped with a multi-layer cushion block to minimize acoustic vibrations. Therefore, impacts to Sacramento winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, and green sturgeon due to construction-related disturbance are insignificant, as they will not reach the scale where take occurs.

The action area is not within designated critical habitat for the listed species, therefore, the Project is not expected to affect designated critical habitats.

### *Contaminants*

During construction, the potential exists for spills or leakage of toxic substances that could enter the lagoon. Refueling, operations, and storage of construction equipment and materials could result in accidental spills of pollutants. Adverse effects to ESA-listed fishes may result from point and non-point source chemical contaminant discharges within the action area and oil and gasoline product discharges may be introduced into Delta waterways from barge use during pile driving. However, Sacramento winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, and green sturgeon are not expected to be in the action area during construction. Therefore, effects to the listed species from contaminants are insignificant, as they will not reach the scale where take occurs. Due to the minimal current and tidal influences that the lagoon Delta Coves is in, and that the action area is not within designated critical habitats for the listed species, the Project is not expected to affect designated critical habitat, since any contaminants that may be discharged into the lagoon will be mostly confined to the action area.

Long term inspection and maintenance activities will be occurring for the docks, shade canopies and center mount boat lifts. Shade canopies and center-mount boat lift maintenance activities may include canopy fabric cleaning/replacement, tightening and/or replacement of hardware, replacement of pulleys and/or lift cables, and lubrication of moving parts. Dock inspection and maintenance will include walk-way cleaning, railing and wood support replacement, and hardware tightening and/or replacement. Maintenance activities could result in contaminants such as soap, oil, or grease entering the waterway. Oil and gasoline product discharges may be introduced into Delta waterways from increased boating activities and from urban activities and runoff. The release of contaminants such as oil or gas from the boats could injure fish or cause long-term complications. Although designated critical habitats are not within the action area, recreational boats that leave the lagoon/action area could discharge oil and/or gasoline into designated critical habits, including Sand Mound Slough. However, NMFS expects any discharge would be small amounts that would not negatively affect any PCEs of designated critical habitats.

The Applicant will implement BMPs, which include construction site housekeeping measures, an SPRP to avoid, and if necessary, clean up accidental releases of hazardous materials, and an SWPPP in place for the replacement and installation of the multi-slip docks. Hazardous materials, such as fuels and oils, will be stored in sealed containers in a designated location that is at least 200 feet from any aquatic habitat, storm or drainage courses, and agricultural areas. All equipment will be maintained to limit leaks of machine fluids such as gasoline, diesel, or oils.

The Applicant will be responsible for ensuring compliance with all conditions during maintenance, where potential effects on water quality will be addressed by the listed conservation measures, including construction site housekeeping measures as well as measures to clean up accidental releases of hazardous materials, such that the likelihood of a spill would be discountable.

### *Turbidity and Suspended Sediment*

The Project activities that could increase turbidity and sedimentation are those that disturb in-water sediments (e.g., removing existing docks, installing piles and new docks) or soils on the adjacent bank or levee where they can be carried by surface runoff to the river (e.g., heavy equipment placement). During the installation of the piles for the new docks, sediments from the bottom of the lagoon are expected to be disturbed by the construction activities and resuspended into the overlying water column. This will create localized turbidity plumes.

Elevated concentrations of fine sediment and turbidity in the aquatic environment can have both direct and indirect impacts on fish. The severity of these impacts depends on the concentration and duration of exposure and the sensitivity of the species and life stage. Temporary water quality effects may cause injury to fish by clogging gills, disrupting normal behaviors, and potentially increasing the susceptibility of some individuals to predation. Increases in turbidity and suspended sediment associated with in-water and ground-disturbing activities are likely to extend beyond the immediate construction area and could result in short- to long-term effects on fish and aquatic resources depending on the effectiveness of the proposed erosion control and in-water turbidity control measures.

The Applicant has multiple BMPs in place to minimize such events, and will only work during the dry season, and in dry conditions. Listed species may be near, but are not expected in, the action area, and therefore, construction effects would not be experienced by listed species. Due to the minimal current and tidal influences that the lagoon experiences and is not designated critical habitat, it is NLAA the critical habitat outside of the action area since any contaminants that may be discharged into the lagoon will be mostly confined to the action area. Potential effects on water quality during project construction would be addressed by the conservation measures, which include construction site housekeeping measures incorporated in the Project SWPPP and provisions to control erosion and sedimentation, including the use a turbidity curtain. If listed anadromous fish were to enter the action area during construction, the effects of turbidity would be insignificant with conservation measures in use, like the turbidity curtain. The Applicant will be responsible for ensuring compliance with all conditions of these commitments.

### *Sound Pollution*

Construction activities would result in temporary noise disturbance that may cause injury or death of fish by disrupting normal behaviors and potentially increasing the susceptibility of some individuals to predation. Noise and other disturbances from general construction activities (i.e., placing piles for docks) would be limited to the immediate construction area, affecting only small numbers of individuals. Installation of piles would occur with a vibratory driver and is not expected to affect fish species in the action area. Vibratory pile driving is not known to affect fish and there are no sound level thresholds associated with

injuries from vibratory pile driving. New 10-inch hollow pilings will be driven into the lagoon with a vibratory hammer, onto which the docks will be bolted. Potential impacts from noise during project construction will be insignificant due to the timing of construction activities and the use of a vibratory driver to insert the dock piles. Barges or trucks will be used to convey building materials to the project site during construction activities, depending on the location of the staging area or the size or amount of the material being brought to the site. Any noise disturbance or increases in turbidity from barge disturbance of substrates would be temporary and have limited effects on salmonids or green sturgeon, which are not expected to be in the action area. There will also be an increase of boat traffic inside and outside of the lagoon area which could disturb designated critical habitat, outside of the action area, due to noise. However, NMFS expects any noise associated with an increase in boat traffic would not negatively affect any PCEs of designated critical habitats.

The construction contractor will ensure that all equipment is fitted with sound-control devices no less effective than those provided as original equipment. All equipment will be operated and maintained to meet the applicable standards for construction noise generation. No equipment will be operated with an unmuffled exhaust. Piles will be driven via a small driving vessel that will utilize a multi-layer cushion block to minimize acoustic vibrations. The pile driver will be set to “soften” as the installed pile receives resistance in order to minimize vibrations and hydroacoustic impacts. Due to the poor-quality habitat in the lagoon, listed anadromous fish species are not expected to be in the action area, and any potential effects are discountable.

#### *Lighting & Predation*

The action area is largely dominated by non-native fish, including predatory largemouth bass and striped bass. The increase in shade from the new docks and shade canopies could increase predatory fish habitat. Shading from the barges that will be used for pile driving activities would temporarily affect habitat by providing cover for predatory fish species. However, the shading would be temporary until the materials are offloaded or a pile is driven, and listed species are not expected to be in the action area, therefore, increase predation on salmonids or green sturgeon are discountable.

Given the numerous residences and private docks, there presumably is some degree of additional illumination above that which would otherwise exist if there was no development in the area. Artificial lighting may alter the behavior of juvenile fish. The increase in illumination could slightly increase the potential for predation on listed anadromous fish species in the vicinity of the docks within the action area. Lighting at the docks will be directed away from the water surface and will be motion censored in order to decrease the attraction of fish to the area. No night time work will be conducted, so no additional lighting for construction will be present in the lagoon. Due to the poor habitat quality in the lagoon, predation effects on listed fish species is expected to be discountable since listed species are not commonly found in the action area.

Due to the minimal current and tidal influences in the lagoon that Delta Coves resides in, and that the action area is not within designated critical habitats for the listed species, the Project is not expected to affect designated critical habitat, since any contaminants that may be discharged into the lagoon will be mostly confined to the action area.

## **Conclusion**

Based on this analysis, NMFS concurs with USACE's determination that the proposed action is not likely to adversely affect the subject listed species and designated critical habitats.

## **Reinitiation of Consultation**

Reinitiation of consultation is required and shall be requested by USACE or by NMFS, where discretionary Federal involvement or control over the action has been retained or is authorized by law and (1) the proposed action causes take; (2) 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; (3) 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 the written concurrence; or (4) a new species is listed or critical habitat designated that may be affected by the identified action (50 CFR 402.16). This concludes the ESA consultation.

## **Conservation Recommendations**

“Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of threatened and endangered species. The USACE also has the same responsibilities, and informal consultation offers action agencies an opportunity to address their conservation responsibilities under section 7(a)(1).”

The following conservation recommendations are for the USACE to consider in their permit requirements to the Applicant, as they apply to the proposed action:

1. The Applicant should develop further education and outreach programs to their residents and visitors of Delta Cove to encourage river stewardship in the area, as suggested in DEL 2.27 of NMFS Recovery Plans (NMFS 2014, 2018), since Delta Coves is within the important Delta ecological area for listed species.
2. The Applicant should offer and present regularly scheduled refreshers for residents on how to maintain boats, lifts, and docks in an ecologically safe manner as suggested in DEL 2.20 of NMFS Recovery Plans (NMFS 2014, 2018), since there will be an increase in boating storage and activities in the lagoon.
3. The Applicant should offer and present regularly scheduled refreshers and posted signs for residents on how to remove invasive aquatic vegetation before leaving the lagoon in an ecologically safe manner as suggested in DEL 2.19 of NMFS Recovery Plans (NMFS 2014, 2018), since there will be an increase in boater activity between the infested lagoon and the waterways of the Delta among residents and visitors.

Please direct questions regarding this letter to Katrina Poremba in our California Central Valley Office by email at [katrina.poremba@noaa.gov](mailto:katrina.poremba@noaa.gov) or by telephone at (916) 201-0382.

Sincerely,



Garwin Yip  
Branch Supervisor  
Water Operations and Delta Consultations

Cc: Electronic copy only: 151422-WCR2022-SA00008  
Ms. Mary Pakenham-Walsh, Chief, USACE, Mary.R.Pakenham-Walsh@usace.army.mil

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## Central Valley Regional Water Quality Control Board

15 December 2020

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7600 E Doubletree Ranch Rd, Ste 300  
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### **CLEAN WATER ACT SECTION 401 TECHNICALLY CONDITIONED WATER QUALITY CERTIFICATION; DMB ASSOCIATES, DELTA COVES DOCKS RECONFIGURATION PROJECT (WDID#5B07CR00227), CONTRA COSTA COUNTY**

This Order responds to the 28 August 2020 application submitted by DMB Associates (Applicant) for the Water Quality Certification of the Delta Coves Docks Reconfiguration Project (Project), permanently impacting 0.003 acre of waters of the United States.

This Order serves as certification of the United States Army Corps of Engineers' Individual Permit (SPK-1994-00393) under Section 401 of the Clean Water Act, and a Waste Discharge Requirement under the Porter-Cologne Water Quality Control Act and State Water Resources Control Board Order 2003-0017-DWQ.

#### **WATER QUALITY CERTIFICATION STANDARD CONDITIONS:**

- 1. This Water Quality Certification (Certification) is not valid until coverage under Section 404 of the Clean Water Act is obtained. If the Project, including the area of impact (as described) is modified through this process, this Certification will not be valid until amended by the Central Valley Regional Water Quality Control Board (Central Valley Water Board).**
2. This Certification action is not intended and shall not be construed to apply to any discharge from any activity involving a hydroelectric facility requiring a Federal Energy Regulatory Commission (FERC) license or an amendment to a FERC license unless the pertinent Certification application was filed pursuant to Section 3855(b) of the California Code of Regulations, and the application specifically identified that a FERC license or amendment to a FERC license for a hydroelectric facility was being sought.
3. The validity of any non-denial Certification action shall be conditioned upon total payment of the full fee required under Section 3860(c) of the California Code of Regulations.

4. This Certification is no longer valid if the Project (as described) is modified, or coverage under Section 404 of the Clean Water Act has expired.
5. All reports, notices, or other documents required by this Certification or requested by the Central Valley Water Board shall be signed by a person described below or by a duly authorized representative of that person.
  - (a) For a corporation: by a responsible corporate officer such as: 1) a president, secretary, treasurer, or vice president of the corporation in charge of a principal business function; 2) any other person who performs similar policy or decision-making functions for the corporation; or 3) the manager of one or more manufacturing, production, or operating facilities if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.
  - (b) For a partnership or sole proprietorship: by a general partner or the proprietor.
  - (c) For a municipality, state, federal, or other public agency: by either a principal executive officer or ranking elected official.
6. Any person signing a document under Standard Condition number 5 shall make the following certification:

“I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.”

#### **TECHNICAL CERTIFICATION CONDITIONS:**

In addition to the above standard conditions, the Applicant shall satisfy the following:

1. The Applicant shall notify the Central Valley Water Board in writing seven (7) days in advance of the start of any work within waters of the United States.
2. Except for activities permitted by the United States Army Corps of Engineers under Section 404 of the Clean Water Act, soil, silt, or other organic materials shall not be placed where such materials could pass into surface water or surface water drainage courses.
3. The Applicant shall maintain a copy of this Certification and supporting documentation (Project Information Sheet) at the Project site during construction for

review by site personnel and agencies. All personnel (employees, contractors, and subcontractors) performing work on the proposed Project shall be adequately informed and trained regarding the conditions of this Certification.

4. The Applicant shall perform surface water sampling:
  - a) when performing any in-water work;
  - b) in the event that Project activities result in any materials reaching surface waters; or
  - c) when any activities result in the creation of a visible plume in surface waters.

The sampling requirements in Table 1 shall be conducted upstream out of the influence of the Project, and 300 feet downstream of the work area. The sampling frequency may be modified for certain projects with written approval from Central Valley Water Board staff.

**Table 1: Sample Type and Frequency Requirements**

Parameter	Unit	Type of Sample	Minimum Sampling Frequency	Required Analytical Test Method
Turbidity	NTU	Grab <sup>1</sup>	Every 4 hours during in-water work	2, 3
Visible construction related pollutants <sup>4</sup>	Observations	Visual Inspections	Continuous throughout the construction period	NA

Surface water sampling shall occur at mid-depth. A surface water monitoring report shall be submitted within two weeks of initiation of in-water construction, and every two weeks thereafter. In reporting the sampling data, the Applicant shall arrange the data in tabular form so that the sampling locations, date, constituents, and concentrations are readily discernible. The data shall be summarized in such a

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<sup>1</sup> Grab samples shall not be collected at the same time each day to get a complete representation of variations in the receiving water.

<sup>2</sup> Pollutants shall be analyzed using the analytical methods described in 40 Code of Federal Regulations Part 136, where no methods are specified for a given pollutant, the method shall be approved by Central Valley Water Board staff.

<sup>3</sup> A hand-held field meter may be used, provided the meter utilizes a USEPA-approved algorithm/method and is calibrated and maintained in accordance with the manufacturer's instructions. A calibration and maintenance log for each meter used for monitoring shall be maintained onsite.

<sup>4</sup> Visible construction-related pollutants include oil, grease, foam, fuel, petroleum products, and construction-related, excavated, organic or earthen materials.

manner to illustrate clearly whether the Project complies with Certification requirements. The report shall include surface water sampling results, visual observations, and identification of the turbidity increase in the receiving water applicable to the natural turbidity conditions specified in the turbidity criteria below. If no sampling is required, the Applicant shall submit a written statement stating, "No sampling was required" within two weeks of initiation of in-water construction, and every two weeks thereafter.

5. The Central Valley Water Board adopted a *Water Quality Control Plan for the Sacramento River and San Joaquin River Basins*, Fifth Edition, revised May 2018 (Basin Plan) that designates beneficial uses, establishes water quality objectives, and contains implementation programs and policies to achieve those objectives for all waters addressed through the plan. Turbidity limits are based on water quality objectives contained in the Basin Plan and are part of this Certification as follows:
  - a) Waters shall not contain oils, greases, waxes, or other materials in concentrations that cause nuisance, result in a visible film or coating on the surface of the water or on objects in the water, or otherwise adversely affect beneficial uses.
  - b) Activities shall not cause turbidity increases in surface water to exceed:
    - i. where natural turbidity is less than 1 Nephelometric Turbidity Units (NTUs), controllable factors shall not cause downstream turbidity to exceed 2 NTUs;
    - ii. where natural turbidity is between 1 and 5 NTUs, increases shall not exceed 1 NTU;
    - iii. where natural turbidity is between 5 and 50 NTUs, increases shall not exceed 20 percent;
    - iv. where natural turbidity is between 50 and 100 NTUs, increases shall not exceed 10 NTUs; and
    - v. where natural turbidity is greater than 100 NTUs, increases shall not exceed 10 percent.

In determining compliance with the above limits, appropriate averaging periods may be applied provided that beneficial uses will be fully protected. Averaging periods may only be used with prior permission of the Central Valley Water Board Executive Officer.

For Delta waters, the general objectives for turbidity apply subject to the following: except for periods of storm runoff, the turbidity of Delta waters shall not exceed 50 NTUs in the waters of the Central Delta and 150 NTUs in other Delta waters.

6. The Applicant shall notify the Central Valley Water Board immediately if the above criteria for turbidity or other water quality objectives are exceeded.
7. The Applicant shall perform surface water sampling in accordance with Technical Certification Condition No. 4, if any of the following conditions occur: 1) in-water work is conducted during an unanticipated flow event; 2) Project activities result in any materials reaching surface waters; or 3) Project activities result in the creation of a visible plume in surface waters.
8. Activities shall not cause visible oil, grease, or foam in the receiving water.
9. Refueling of equipment within the floodplain or within 300 feet of the waterway is prohibited. If critical equipment must be refueled within 300 feet of the waterway, spill prevention and countermeasures must be implemented to avoid spills. Refueling areas shall be provided with secondary containment including drip pans and/or placement of absorbent material. No hazardous materials, pesticides, fuels, lubricants, oils, hydraulic fluids, or other construction-related potentially hazardous substances should be stored within a floodplain or within 300 feet of a waterway. The Applicant must perform frequent inspections of construction equipment prior to utilizing it near surface waters to ensure leaks from the equipment are not occurring and are not a threat to water quality.
10. The Applicant shall develop and maintain onsite a project-specific Spill Prevention, Containment and Cleanup Plan outlining the practices to prevent, minimize, and/or clean up potential spills during construction of the Project. The Plan must detail the Project elements, construction equipment types and location, access and staging and construction sequence.
11. Raw cement, concrete (or washing thereof), asphalt, drilling fluids, lubricants, paints, coating material, oil, petroleum products, or any other substances which could be hazardous to fish and wildlife resulting from or disturbed by project-related activities, shall be prevented from contaminating the soil and/or entering waters of the United States.
12. The discharge of petroleum products, any construction materials, hazardous materials, pesticides, fuels, lubricants, oils, hydraulic fluids, raw cement, concrete, asphalt, paint, coating material, drilling fluids, or other construction-related potentially hazardous substances to surface water and/or soil is prohibited. In the event of a prohibited discharge, the Applicant shall notify the Central Valley Water Board Contact within 24-hours of the discharge.
13. A method of containment must be used below the boardwalk(s), or any temporary crossing(s) to prevent debris from falling into the water body through the entire duration of the Project.
14. Silt fencing, straw wattles, or other effective management practices must be used along the construction zone to minimize soil or sediment along the embankments

from migrating into the waters of the United States through the entire duration of the Project.

15. The use of netting material (e.g., monofilament-based erosion blankets) that could trap aquatic dependent wildlife is prohibited within the Project area.
16. All areas disturbed by Project activities shall be protected from washout and erosion.
17. All temporarily affected areas shall be restored to pre-construction contours and conditions upon completion of construction activities.
18. Hydroseeding shall be performed with California native seed mix.
19. All materials resulting from the Project shall be removed from the site and disposed of properly.
20. If temporary surface water diversions and/or dewatering are anticipated, the Applicant shall develop and maintain on-site a Surface Water Diversion and/or Dewatering Plan(s). The Plan(s) must be developed prior to initiation of any water diversions. The Plan(s) shall include the proposed method and duration of diversion activities. The Plan(s) must be consistent with this Certification and must be made available to the Central Valley Water Board staff upon request.
21. When work in a flowing stream is unavoidable and any temporary dam or other artificial obstruction is being constructed, maintained, or placed in operation, sufficient water shall at all times be allowed to pass downstream, to maintain beneficial uses of waters of the state below the dam. Construction, dewatering, and removal of temporary cofferdams shall not violate Technical Certification Condition 5 of this Certification.
22. If any temporary dam or other artificial obstruction is constructed, the temporary dam or other artificial obstruction shall only be built from clean materials such as sandbags, gravel bags, water dams, or clean/washed gravel which will cause little or no siltation. Stream flow shall be temporarily diverted using gravity flow through temporary culverts/pipes or pumped around the work site with the use of hoses.
23. The Applicant shall apply for a name change or amendment to this Certification should any of the following occur: a) a change in the ownership of all or any portion of the Project; b) any change in the Project description; c) any change involving discharge amounts, temporary impacts, or permanent impacts; or d) amendments, modifications, revisions, extensions, or changes to the United States Army Corps of Engineers' Individual Permit, the United States Fish and Wildlife Service decision document(s), or the California Department of Fish and Wildlife Streambed Alteration Agreement.
24. The Applicant shall submit a copy of the final, signed and dated Lake or Streambed Alteration Agreement to the Central Valley Water Board Contact within 14 days of

issuance by the California Department of Fish and Wildlife. The Applicant shall comply with all California Department of Fish and Wildlife requirements, including those requirements described in the Lake or Streambed Alteration Agreement.

25. If the Project will involve land disturbance activities of one or more acres, or where the Project disturbs less than one acre but is part of a larger common plan of development that in total disturbs one or more acres, the Applicant shall obtain coverage under the National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities Order No. 2009-0009-DWQ for discharges to surface waters comprised of storm water associated with construction activity.
26. The Conditions in this Certification are based on the information in the attached "Project Information Sheet" and the application package. If the actual project, as described in the attached Project Information Sheet and application package, is modified or changed, this Certification is no longer valid until amended by the Central Valley Water Board.
27. The Applicant shall implement each of the mitigation measures specified in the certified Environmental Impact Report for the Project, as they pertain to biology, hydrology and water quality impacts as required by Section 21081.6 of the Public Resource Code and Section 15097 of the California Code of Regulations.
28. In the event of any violation or threatened violation of the conditions of this Certification, the violation or threatened violation shall be subject to any remedies, penalties, process, or sanctions as provided for under state and federal law. The applicability of any state law authorizing remedies, penalties, process, or sanctions for the violation or threatened violation constitutes a limitation necessary to ensure compliance with this Certification.
  - (a) If the Applicant or a duly authorized representative of the Project fails or refuses to furnish technical or monitoring reports, as required under this Certification, or falsifies any information provided in the monitoring reports, the applicant is subject to civil liability, for each day of violation, and/or criminal liability.
  - (b) In response to a suspected violation of any condition of this Certification, the Central Valley Water Board may require the Applicant to furnish, under penalty of perjury, any technical or monitoring reports the Central Valley Water Board deems appropriate, provided that the burden, including cost of the reports, shall be in reasonable relationship to the need for the reports and the benefits to be obtained from the reports.
  - (c) The Applicant shall allow the staff of the Central Valley Water Board, or an authorized representative(s), upon the presentation of credentials and other documents, as may be required by law, to enter the Project premises for inspection, including taking photographs and securing copies of project-related

records, for the purpose of assuring compliance with this Certification and determining the ecological success of the Project.

**NOTIFICATIONS AND REPORTS:**

29. The Applicant shall provide a Notice of Completion (NOC) no later than 30 days after the Project completion. The NOC shall demonstrate that the Project has been carried out in accordance with the Project description in the Certification and in any approved amendments. The NOC shall include a map of the Project location(s), including final boundaries of any on-site restoration area(s), if appropriate, and representative pre and post construction photographs. Each photograph shall include a descriptive title, date taken, photographic site, and photographic orientation.
30. The Applicant shall submit all notifications, submissions, materials, data, correspondence, and reports in a searchable Portable Document Format (PDF). Documents less than 50 MB must be emailed to: [centralvalleysacramento@waterboards.ca.gov](mailto:centralvalleysacramento@waterboards.ca.gov). In the subject line of the email, include the Central Valley Water Board Contact, Project name, and WDID number as shown in the subject line above. Documents that are 50 MB or larger must be transferred to a disk and mailed to the Central Valley Water Board Contact.

**CENTRAL VALLEY WATER BOARD CONTACT:**

Angela Nguyen-Tan  
Central Valley Regional Water Quality Control Board  
11020 Sun Center Drive, Suite 200  
Rancho Cordova, CA 95670-8114  
[Angela.Nguyen-Tan@waterboards.ca.gov](mailto:Angela.Nguyen-Tan@waterboards.ca.gov)  
(916) 464-0335

**CALIFORNIA ENVIRONMENTAL QUALITY ACT:**

The Central Valley Water Board has determined that this project meets the Categorical Exemption, under Sections 13501 of the California Code of Regulations, which exempts repair or minor alteration of existing structures, and Section 15302 which exempts replacement or reconstruction of existing structures.

**WATER QUALITY CERTIFICATION:**

I hereby issue an Order certifying that any discharge from the DMB Associates, Delta Coves Docks Reconfiguration Project (WDID#5B07CR00227) will comply with the applicable provisions of Section 301 ("Effluent Limitations"), Section 302 ("Water Quality Related Effluent Limitations"), Section 303 ("Water Quality Standards and Implementation Plans"), Section 306 ("National Standards of Performance"), and Section 307 ("Toxic and Pretreatment Effluent Standards") of the Clean Water Act. Through this Order, this discharge is also regulated under State Water Resources Control Board Water Quality Order No. 2003-0017 DWQ "Statewide General Waste Discharge Requirements For Dredged Or Fill Discharges That Have Received State Water Quality Certification (General WDRs)."

Except insofar as may be modified by any preceding conditions, all Certification actions are contingent on: a) the discharge being limited and all proposed mitigation being completed in compliance with the conditions of this Certification, DMB Associates' application package, and the attached Project Information Sheet; and b) compliance with all applicable requirements of the *Water Quality Control Plan for the Sacramento River and San Joaquin River Basins*, Fifth Edition, revised May 2018.

Any person aggrieved by this action may petition the State Water Resources Control Board to review the action in accordance with California Water Code Section 13320 and California Code of Regulations, Title 23, Section 2050 and following. The State Water Resources Control Board must receive the petition by 5:00 p.m., 30 days after the date of this action, except that if the thirtieth day following the date of this action falls on a Saturday, Sunday, or state holiday, the petition must be received by the State Water Resources Control Board by 5:00 p.m. on the next business day. Copies of the law and regulations applicable to filing petitions may be found on the State Water Resources Control Board's [Water Quality Petitions webpage](http://www.waterboards.ca.gov/public_notices/petitions/water_quality) ([http://www.waterboards.ca.gov/public\\_notices/petitions/water\\_quality](http://www.waterboards.ca.gov/public_notices/petitions/water_quality)) or will be provided upon request.

Patrick Pulupa  
Executive Officer

Enclosure: Project Information Sheet

Attachments: Figure 1 – Project Location Map  
Figure 2—Site Impact Map

cc: Distribution List, page 14

## PROJECT INFORMATION SHEET

**Application Date:** 28 August 2020

**Applicant:** Nick Taratsas  
DMB Associates  
7600 E Doubletree Ranch Road, Suite 300  
Scottsdale, AZ 85258

**Applicant Representative:** Chris Waterston  
Glenn Lukos Associates  
1940 E. Deere Ave, Suite 250  
Santa Ana, CA 92705

**Project Name:** Delta Coves Docks Reconfiguration Project

**Application Number:** WDID#5B07CR00227

**Date on Public Notice:** 11 September 2020

**Date Application Deemed Complete:** 2 October 2020

**Date All Information Received:** 18 November 2020

**Type of Project:** Non-Bioengineered Channel Construction, Maintenance

**Approved Months of Project Implementation:** The Project will be constructed 1 September through 31 August, or as otherwise required by the United States Fish and Wildlife Service, National Marine Fisheries, or Department of Fish and Wildlife.

**Project Location:** Latitude: 38.015739° N and Longitude: 121.630263°W

**County:** Contra Costa County

**Receiving Water(s) (hydrologic unit):** Sand Mound Slough, San Joaquin Hydrologic Basin, San Joaquin Delta Hydrologic Unit #544.00.

**Water Body Type:** Stream Channel

**Designated Beneficial Uses:** The *Water Quality Control Plan for the Sacramento River and San Joaquin River Basins*, Fifth Edition, revised May 2018 (Basin Plan) has designated beneficial uses for surface and ground waters within the region. Beneficial uses that could be impacted by the project include, but are not limited to: Municipal and Domestic Water Supply (MUN); Agricultural Supply (AGR); Industrial Supply (IND); Hydropower Generation (POW); Groundwater Recharge (GWR); Water Contact Recreation (REC-1); Non-Contact Water Recreation (REC-2); Warm Freshwater Habitat (WARM); Cold Freshwater Habitat (COLD); Preservation of Biological Habitats of Special Significance (BIOL); Rare, Threatened, or Endangered Species (RARE);

Migration of Aquatic Organisms (MIGR); Spawning, Reproduction, and/or Early Development (SPWN); and Wildlife Habitat (WILD). A comprehensive and specific list of the beneficial uses applicable for the project area can be found on the Central Valley Water Board's [Basin Planning webpage](http://www.waterboards.ca.gov/centralvalley/water_issues/basin_plans/index.shtml) ([http://www.waterboards.ca.gov/centralvalley/water\\_issues/basin\\_plans/index.shtml](http://www.waterboards.ca.gov/centralvalley/water_issues/basin_plans/index.shtml)).

**303(d) List of Water Quality Limited Segments:** The Sand Mound Slough is the receiving water for the Delta Coves Docks Reconfiguration Project. The Sand Mound Slough is within the Delta Waterways (western portion), which is on the 303(d) list for chlorpyrifos, DDT (dichlorodiphenyltrichloroethane), diazinon, electrical conductivity, Group A pesticides, invasive species, mercury, and unknown toxicity. This project, as conditioned with mitigation measures to prevent transport of sediment due to project activities, will minimize impacts to Sand Mound Slough. The most recent list of approved water quality limited segments is found on the State Water Resources Control Board's [Impaired Water Bodies webpage](http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml) ([http://www.waterboards.ca.gov/water\\_issues/programs/tmdl/integrated2010.shtml](http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml)).

The most recent list of approved water quality limited segments is found on the State Water Resources Control Board's [Impaired Water Bodies webpage](http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml) ([http://www.waterboards.ca.gov/water\\_issues/programs/tmdl/integrated2010.shtml](http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml)).

**Project Description:** The Delta Coves Docks Reconfiguration Project (Project) is located at the Delta Coves Development on Bethel Island. The Project consists of repairing or demolishing existing docks that are deteriorating and placing new 10-inch hollow epoxy-coated steel piles for new multi-slip docks. New support piles will be placed by vibratory hammer into 0.003 acre of stream channel within the Delta Coves lagoon using a crane on shore or a barge, depending on access to the individual dock.

No dewatering will occur within the Project area. No wet concrete will be placed into the stream channel. The Project will permanently impact 0.003 acre of waters of the United States.

**Preliminary Water Quality Concerns:** Construction activities may impact surface waters with increased turbidity.

**Proposed Mitigation to Address Concerns:** The Applicant will implement Best Management Practices to control sedimentation and erosion. This Certification requires all work to be conducted during periods of no flow. In the event that project activities result in any materials reaching surface waters or unanticipated in-water work occurs, the Applicant will conduct turbidity testing. During this testing, the Applicant will stop work if Basin Plan criteria are exceeded or observations indicate an exceedance of a water quality objective.

The Applicant will conduct turbidity testing during in-water work, stopping work if Basin Plan criteria are exceeded or observations indicate an exceedance of a water quality objective.

All temporary affected areas will be restored to pre-construction contours and conditions upon completion of construction activities to provide 1:1 mitigation for temporary impacts.

**Excavation/Fill Area:** Approximately 245 steel piles will be placed into 0.003 acre of waters of the United States.

**Dredge Volume:** None

**California Integrated Water Quality System Impact Data:** The Project will permanently impact 0.003 acre of stream channel habitat from fill activities.

**Table 2: Total Project Fill/Excavation Permanent Physical Loss of Area Impact Quantity**

Aquatic Resource Type	Acres	Cubic Yards	Linear Feet
Stream Channel	0.003		

**United States Army Corps of Engineers File Number:** SPK-1994-00393

**United States Army Corps of Engineers Permit Type:** Individual Permit

**California Department of Fish and Wildlife Lake or Streambed Alteration**

**Agreement:** The Applicant applied for a Lake or Streambed Alteration Agreement on 20 August 2020.

**Possible Listed Species:** Delta smelt, Central Valley Spring-run Chinook salmon, Central Valley steelhead, Sacramento Winter-run Chinook salmon, and North American Green Sturgeon.

**Status of CEQA Compliance:** The Central Valley Water Board has determined that this project meets the Categorical Exemption, under Sections 15301 which exempts repair or minor alteration of existing structures, and Section 15302 which exempts replacement or reconstruction of existing structures.

**Compensatory Mitigation:** The Central Valley Water Board is not requesting compensatory mitigation for the permanent impact to 0.003 acre of waters of the United States because individual impacts are minimal and will not have a negative impact effect on existing water quality.

**Application Fee Provided:** \$1,949.00 was received on 28 August 2020. The fee amount was determined as required by California Code of Regulations, title 23, sections 3833(b)(3) and 2200(a)(3) and was calculated as category A - Fill & Excavation Discharges (fee code 84) with the dredge and fill fee calculator.

**DISTRIBUTION LIST**

Peck Ha (SPK-1994-00393)  
United States Army Corps of Engineers  
Sacramento District Headquarters  
Regulatory Division  
SPKRegulatoryMailbox@usace.army.mil

Department of Fish and Wildlife, Region 2 (Electronic Copy Only)  
R2LSA@wildlife.ca.gov

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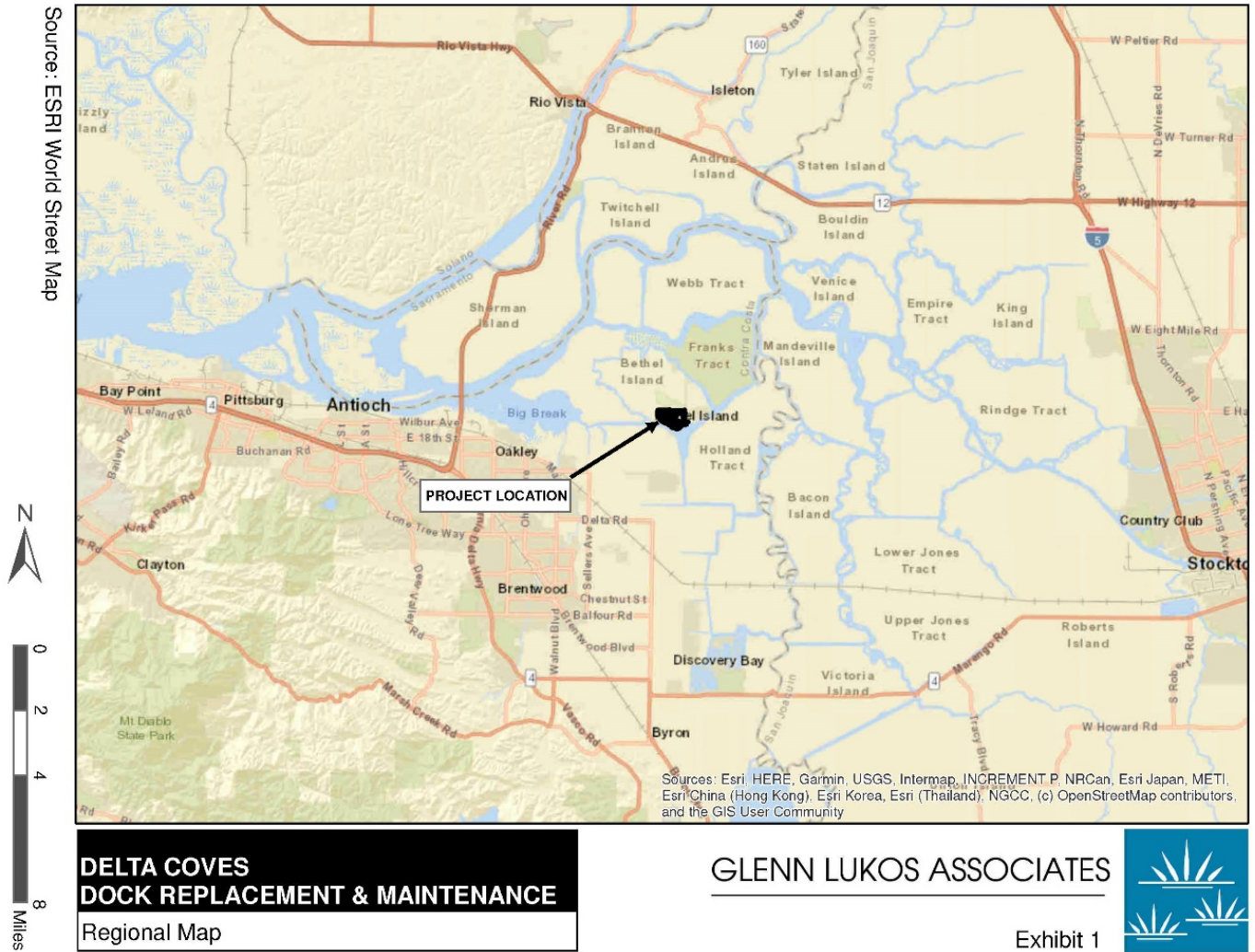
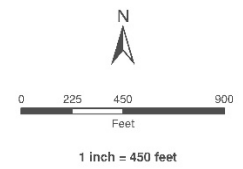


Figure 1 – Project Location Map



**DELTA COVES  
DOCK REPLACEMENT & MAINTENANCE**  
Original Project Site

GLENN LUKOS ASSOCIATES 

Exhibit 3

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Figure 2—Site Impacts Map