4 LISTED SPECIES AND RESOURCES OF CONCERN POTENTIALY IN THE STUDY AREA

The federal Endangered Species Act provides for the listing of "any subspecies of fish or wildlife or plants, and any distinct population segment [DPS] of any species of vertebrate fish or wildlife which interbreeds when mature. For Pacific salmon (genus *Oncorhynchus*), the term "distinct population segment" has become nuanced, if not clarified, by use of the term ESU (Waples 1991). The mixed goals of management and conservation have resulted in applications of Waples' ESU framework that are neither biologically consistent nor legally stable (Ford 2004, Williams 2006). For the purpose of this assessment, the term ESU will be defined simply as a population segment, or part thereof, or a group of such segments, that has been accorded special status under authority of federal or California state endangered species statutes.

The five species dealt with in this section are southern DPS green sturgeon (*Acipenser medirostris*), chinook salmon *(Oncorhynchus tshawytscha)* , steelhead (*O. mykiss*), Delta smelt (*Hypomesus transpacificus*), and longfin smelt (*Spirinchus thaleichthys*). For all species except steelhead, catch data for San Pablo Bay stations (Figure 4-1) are available from the California Department of Fish and Wildlife (CDFW) and the Interagency Ecological Program for the San Francisco Estuary's Bay Study (Orsi 1999). Bay Study otter trawl and midwater trawl data consist of monthly samples for the years 1980 through 2011 and were supplied by Ms Kathy Hieb of CDFW Stockton. All catch data for both nets are reported as raw numbers, or as standardized catch per hectare or (in the case of longfin smelt) as estimated abundance per hectare.

San Pablo Bay is basically a shallow embayment bisected by a deep channel formed by tidal and residual flows to and from the Delta. The Site is on what will be referred to here as the southeast shoal (Figure 4-1), near CDFW Bay Study Station 319.

4.1 Green sturgeon Southern DPS (*Acipenser medirostris*): Status: federal threatened (FT)

Green sturgeon is the most widely distributed member and the most marine-oriented of the sturgeon family, entering rivers only to spawn. Adults (age 15 yrs +) of the southern DPS of green sturgeon enter the Sacramento River in winter and spawn in spring and early summer; juveniles remain in fresh and estuarine waters for one to four years and then begin to migrate out to the sea (Moyle et al 1995, Moyle 2002, Israel et al. 2004). Subadult green sturgeon present in San Francisco Bay in summer are probably a mix of Northern and Southern DPSs (NOAA 2005b), although most of them are of the southern DPS (Israel et al. 2009). The summertime aggregations in San Pablo Bay, and in estuaries in general, are not associated with spawning (Lindley et al. 2008, Israel et al. 2009).

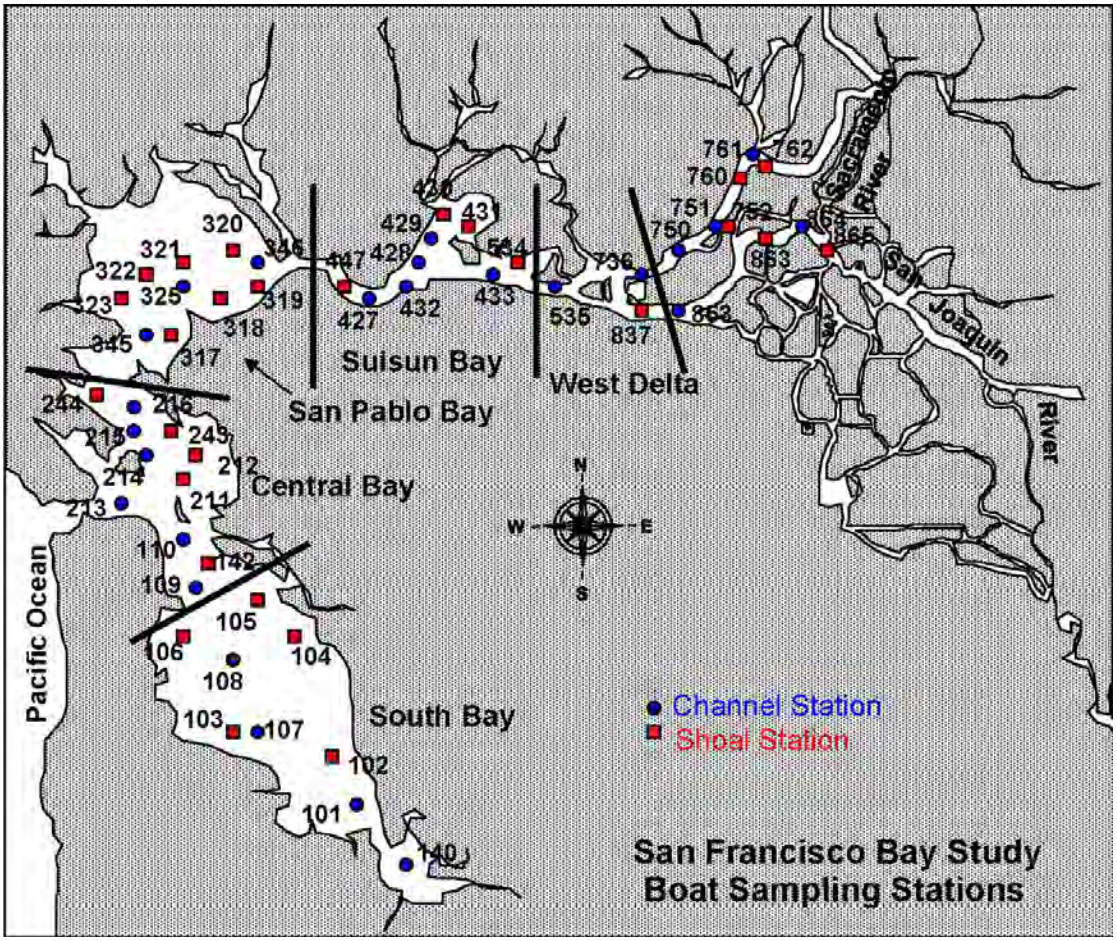

Figure 4-1 CDFW Sampling Stations

Presence during Project activities

The probability of a green sturgeon being in the Project vicinity at any time of year is low and encountering Project activities is very low. Given the uncertain numbers of this species in the Bay and uncertainties as to their movements, this probability cannot be quantified.

Encounter rates at Project site

Bay Study data are sparse for this large-bodied fish: in 32 years, only 63 specimens were captured by the otter trawl throughout the estuary, and just nine of these were taken in San Pablo Bay. None were taken on the southeast shoal in summertime, and none were taken at station 319 in any month. An alternate assessment of the distribution pattern of green sturgeon,

though not of their abundance, can be judged from studies of acoustically tagged individuals, as described below.

Hearn et al. (2010) reported that approximately 400 acoustically tagged green sturgeon were at large in the estuary at the time of their study, and that detections of these tags were common in San Pablo Bay. Some idea of the propensity of green sturgeon to venture very near shore may be had from those authors' observations at marina sites: "No green sturgeon were detected at most of the marina sites (Berkley, Larkspur, San Rafael Canal, Port Sonoma, Emeryville). One fish was detected at Richmond Point for 22 minutes, while five fish were detected at Vallejo Marina…. Most of the fish in the system were detected by the receiver at Martinez Marina (median exposure time = 20 minutes), although it must be taken into account that **this receiver probably detects fish out into the channel**. The median exposure time and number of fish detected were both greatest in the San Pablo Bay Channel (SP Buoys 7-10)" (emphasis added).

With regard to the exposure of green sturgeon to the proposed pipeline removal, it can thus be said that the probability of encounter, though unknown, is probably small, and that the location of the Project in shallow, nearshore water minimizes the chance of an encounter.

4.2 Salmonids (2 species, 4 ESUs)

San Francisco Bay serves as a migratory pathway for two anadromous salmonid species: chinook salmon *(Oncorhynchus tshawytscha)* and steelhead (*O. mykiss*). Williams (2006) stated, "Chinook salmon and steelhead have highly variable life-history patterns, with age at spawning in Chinook varying from one year to seven years, and age at emigration to estuaries or the ocean ranging from a few days to two years. Steelhead have even more variable life histories and may omit ocean rearing altogether…" Both species spawn in gravel-bed, freshwater streams. A biologically profound difference between the two species is that chinook die after spawning once (semelparous), whereas steelhead have the capacity to survive the spawning run, return to sea, and spawn again in future years (iteroparous) (for recent reviews of biological literature see Williams 2006, 2012; for recent data and discussions of out-migration of juveniles through San Francisco Bay see Hearn et al. 2010, Jahn 2011a). The following salmonid ESUs (NOAA Fisheries 2005) have the potential to be near the proposed dredging site.

Chinook Salmon, Sacramento winter-run: *Status: State and Federal Endangered (***SE, FE***).*

Winter chinook, cut off from their native spawning grounds by Shasta Dam, now spawn as a single population in the main stem of the Sacramento River below the dam, where cool water released from the reservoir provides naturalistic habitat (Moyle 2002, Lindley et al. 2007). Spawning occurs in early summer, and juveniles spend 5-10 months in the upper river before

migrating to the Delta, where they spend an "indeterminate time" before migrating to the ocean (Moyle 2002). Summer temperatures in the Delta and Suisun Bay are not salubrious for salmon, and therefore the migration through San Francisco Bay likely occurs in late winter and spring.

Chinook Salmon, Central Valley spring-run: *Status:* **ST, FT**.

Central Valley spring chinook currently exist as three independent naturally spawning populations in the upper Sacramento system plus a hatchery population on the Feather River (Lindley et al. 2007). The Feather River part of this ESU is now believed to be closely related to fall-run fish (Williams 2012). Williams (2012) stated, "Spring Chinook have the most variable juvenile patterns [of the four named Central Valley chinook runs], based on monitoring of wild populations on Mill, Deer, and Butte creeks." The Butte Creek population, at least, appear to be mainly fry migrants to low-gradient streams (Williams 2012), but some spring chinook have an ocean-type life history (Williams 2006), in which fry migrate to the ocean soon after emergence. Until on-going genetic work is complete, the timing of these fish entering San Francisco Bay will remain poorly known, although the migration probably occurs before summer temperatures arrive in the Delta and Suisun Bay.

Steelhead , Central California Coast: *Status:* **FT.**

The Central California Coast steelhead ESU extends from the Russian River in the north to Aptos Creek in the south and includes fish in tributaries to San Francisco and San Pablo Bays (Moyle 2002). These fish migrate to freshwater in winter and spawn in winter and spring, then return to the ocean if they are in good health and not isolated by low water (Moyle 2002). This ESU exists mainly as resident trout populations above dams, flood control projects, etc. (Moyle 2002). However, some steelhead runs do occur in streams tributary to San Francisco Bay. The nearest steelhead runs to the Project area are in the Napa River to the north and Pinole Creek just seaward of the site (Leidy et al. 2005). Koehler and Blank (2012) have documented outmigrations of several thousand juvenile steelhead from Napa River in recent years, with most leaving freshwater by June.

Steelhead , California Central Valley: *Status:* **FT.**

All Central Valley steelhead are considered winter steelhead. Busby et al. (1996) wrote, "Steelhead within this ESU have the longest freshwater migration of any population of winter steelhead. There is essentially a single continuous run of steelhead in the upper Sacramento River. River entry ranges from July through May, with peaks in September and February; spawning begins in late December and can extend into April (McEwan and Jackson 1996)."

Presence of Salmonids during Project Activities

Chinook and steelhead appear to make little use of nearshore habitats in San Francisco Bay (as opposed to the brackish marshes upstream of San Pablo Bay; Williams 2006). This is because the fish (at least in modern times) migrate rapidly through the lower bays on their way to the ocean (MacFarlane and Norton 2002, Hearn et al. 2010, Jahn 2011a). In the CDFW Bay study, trawl captures of juvenile chinook of all sizes/stages (fry/fingerling/smolt) were mainly in the deep channels of San Pablo and Central Bay (Jahn 2011a). Chinook considered by CDFW not to be fall-run fish (i.e., the larger fish believed to represent winter-, spring-, and late fall-run ESUs) were taken in CDFW's Bay study mainly in the months of April through early June (Jahn 2011a), although the size-at-date criteria by which the fish were assigned to runs is not reliable (Williams 2006, Jahn 2011b). . The timing of steelhead outmigration is even less well known, but trawl capture data are consistent with a late-winter and spring migration (Jahn 2011a). The best that can be said is that some fish in the listed salmonid ESUs may be present near the San Francisco waterfront at the proposed time of dredging (May), but are likely to be away form shore, in the tidal channel where the out-migration occurs (see the next section).

Encounter Rates at Project Site

Bay Study captures of steelhead were rare, with only a single specimen taken by otter trawl (in the San Joaquin River) and just seven taken by the midwater trawl in San Pablo Bay, all in winter and spring.

Chinook tend to outmigrate at smaller sizes than steelhead and so were taken in small but cumulatively significant numbers in the Bay Study, especially in the midwater trawl (Table 4-1). The identity of these chinook captures by run is poorly known (Harvey 2011, Jahn 2011b), but the vast majority of fish captured after May are deemed by CDFW to be fall-run fish (Figure 4-2), and thus not members of one of the listed ESUs.

Inasmuch as the population sizes of the four listed salmonid ESUs are poorly known, and their time of passage through the bay is only roughly known, there are no data from which to directly estimate the abundance of listed salmonid ESUs in the immediate vicinity of the Hercules Project. Salmonid smolts tend to migrate through San Pablo and Central Bays in a few days time (Hearn et al. 2010, Jahn 2011a). The fish also tend to remain in deep channel habitat, where the current is swifter, speeding their conveyance to the ocean. Moreover, because of the timing of the migration (red line in Figure 4-2), listed chinook are expected to be rare near Hercules during the time of the proposed Project. Steelhead captures in San Pablo Bay are not common, but here again, the Data of Koehler and Blank (2012) suggest that the outmigration occurs

mainly in winter and spring, such that few if any fish of the central California Coast ESU would be expected at the time of the proposed Project. Because summertime temperatures in the Delta are generally too warm for salmonids, outmigrants of the Central Valley ESU are also expected to have passed by the Project site before the onset of the Project.

Table 4-1. Total CDFW midwater trawl captures of chinook salmon in San Pablo Bay, 1980-2011.

Month\Station	317	318	319	320	321	322	323	325	345	346	Total
Jan	0	0	0	0	1	0	0	0	0	0	1
Feb	0	1	0	3	0	0	0	0	1	0	5
Mar	3	0	5	2	0	0	0	0	0	0	10
Apr	7	3	18	10	2	8	1	17	8	19	93
May	74	35	66	25	27	19	21	49	28	94	438
Jun	29	27	27	17	18	12	19	33	24	34	240
Jul	20	20	8	10	6	0	3	20	8	14	109
Aug	3	2	4	2	3	1	4	3	3	4	29
Sep	2	0	2	1	4	0	1	1	2	5	18
Oct	0	0	0	0	0	0	0	0	0	0	0
Nov	0	0	0	0	0	1	0	1	0	0	2
Dec	0	0	0	0	1	1	0	0	0	0	2
Total	138	88	130	70	62	42	49	124	74	170	947

4.3 Longfin smelt (*Spirinchus thaleichthys*): Status: ST.

The United States Fish and Wildlife Service (USFWS 2012) stated "The U.S. Fish and Wildlife Service has found that the San Francisco Bay-Delta Distinct Population Segment (DPS) of longfin smelt warrants protection under the Endangered Species Act. However, the Service is precluded at this time from proposing to add the species to the Federal List of Threatened and Endangered Species by the need to address other higher priority listing actions."

CDFW (CDFG 2009) summed up San Francisco Bay longfin smelt biology as follows:

> Longfin smelt are pelagic, estuarine fish which range from Monterey Bay northward to Hinchinbrook Island, Prince William Sound Alaska. In California, they have been commonly collected from San Francisco Bay, Eel River, Humboldt Bay and Klamath River. Presently, the only California collections made in the 1990s have been from the Klamath River and San

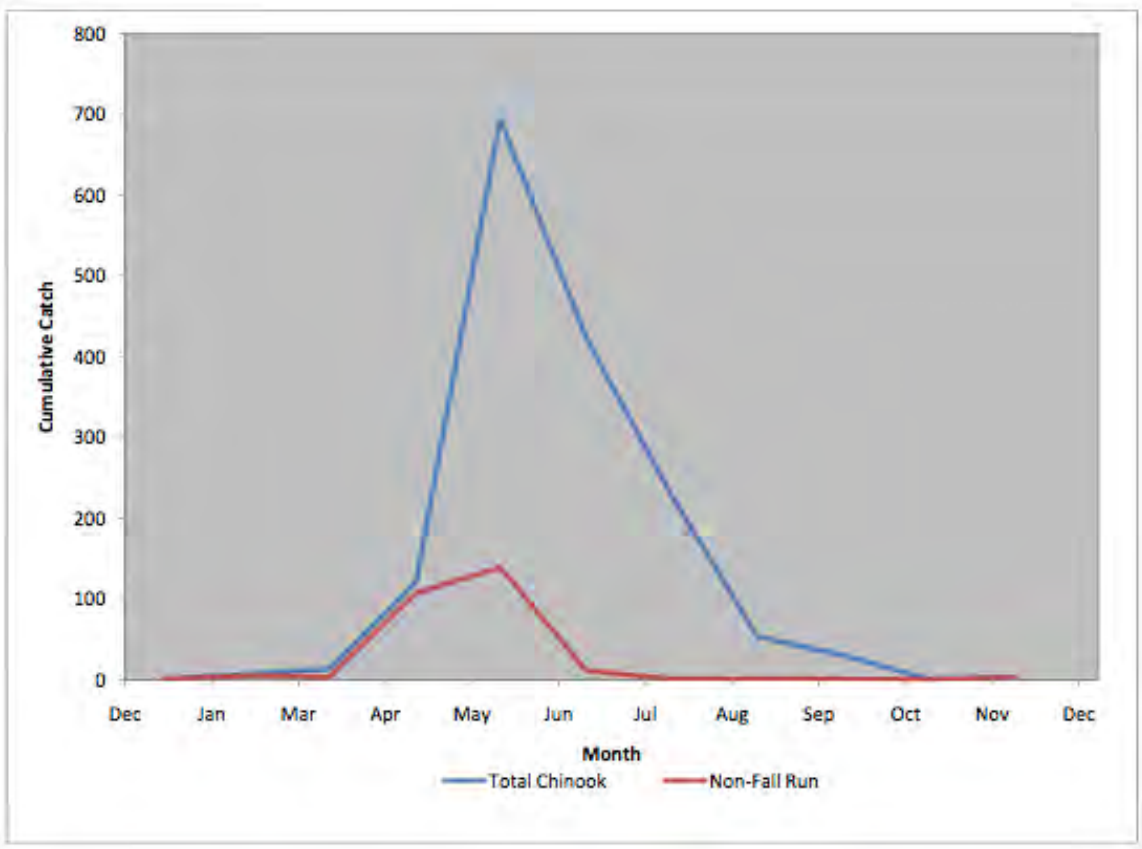

Figure 4-2. Cumultive Bay Study midwater trawl chinook captures by month (from Jahn 2011a)

Francisco Bay. Longfin smelt reach a maximum size of about 150 mm TL. Longfin smelt comprise a small portion of the "whitebait" fishery in San Francisco Bay and have no sport fishery value.

Maturity is reached toward the end of their second year. As they mature in the fall, adults found throughout San Francisco Bay migrate to brackish or freshwater in Suisun Bay, Montezuma Slough, and the lower reaches of the Sacramento and San Joaquin Rivers. Spawning probably takes place in freshwater.

In April and May, juveniles are believed to migrate downstream to San Pablo Bay; juvenile longfin smelt are collected throughout the Bay during the late spring, summer and fall , and occasionally venture into the Gulf of the Farallons. Juveniles tend to inhabit the middle and lower portions of the water column.

Longfin smelt is well-sampled by several programs run by the California Department of Fish and Wildlife (formerly CDFG), in particular the Bay Study, which provided data for the analyses presented below and in Appendix B. Annual abundance of longfin smelt is increased in wet years (as indicated by smaller values of X2; see Jassby et al. 2005), a relationship shown in Figure 4-3. In recent years, X2 (the distance upstream from the Golden gate at which the bottom salinity averages 2 PSU over a tidal cycle) is

managed such that large landward movements of the brackish habitat generally do not occur (Feyrer et al. 2007).

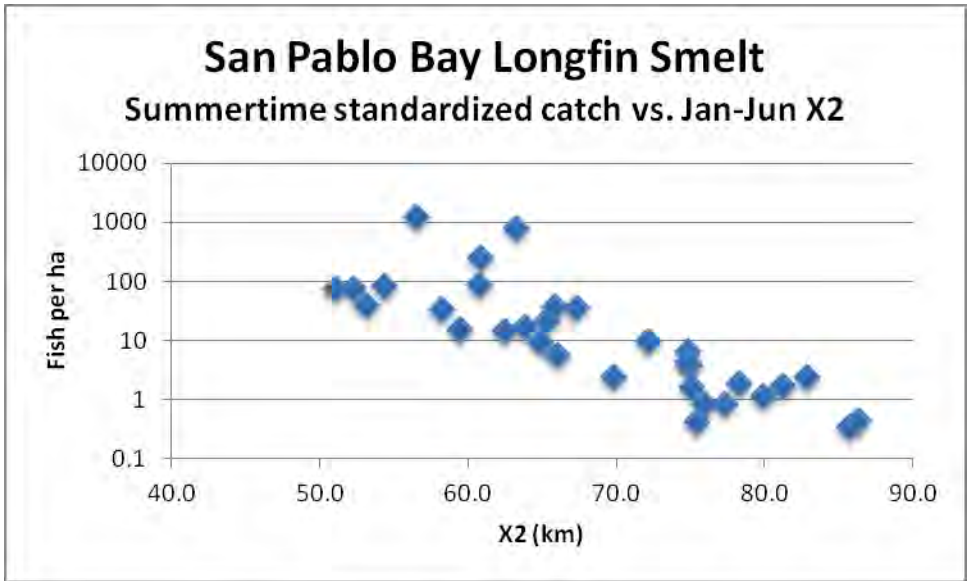

Figure 4-3. Annual average (June through October) CPUE of longfin smelt in San Pablo Bay otter trawl samples vs. January through June X2 (averaged data from http://www.water.ca.gov/dayflow/docs/)

The decline in abundance of longfin smelt in the past decade is well-documented (Jassby et al. 2005, CDFG 2009 and references therein) and is the reason for the State and incipient federal listings of the species. USFWS (2012) stated, "The combined effects of reduced freshwater flows, the invasive overbite clam (reduced levels of phytoplankton and zooplankton that are important to the Bay- Delta food web), and high ammonium concentrations act to significantly reduce habitat suitability for longfin smelt." We note here that none of these major threats apply to San Pablo Bay, although the movement of smelt into San Pablo Bay is certainly augmented by high river flows in some years, affecting local abundance even during the recent period of low abundance (Figure 4-4).

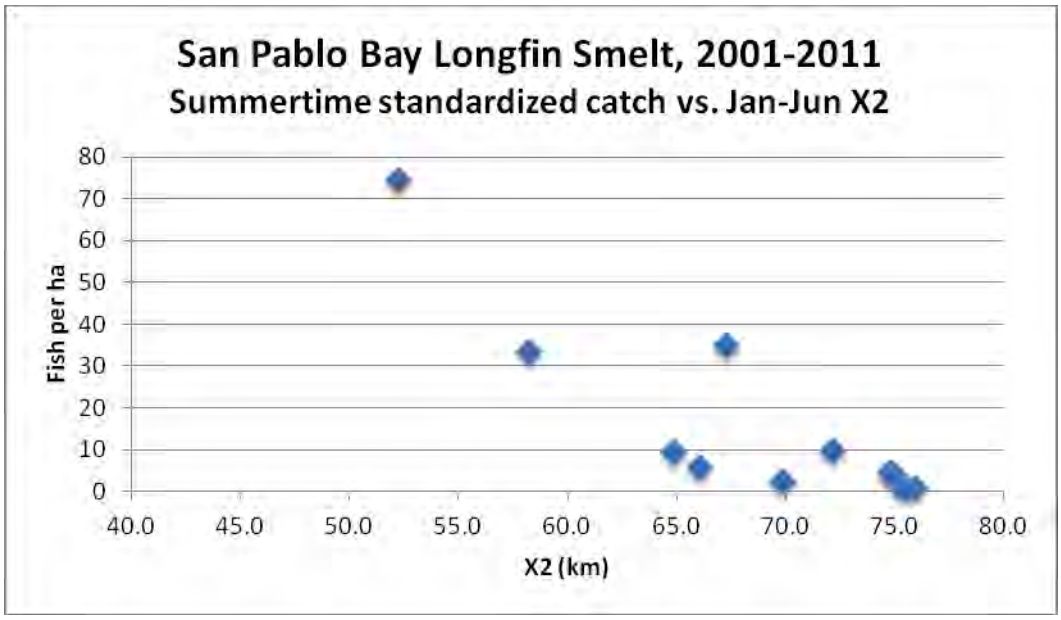

Figure 4-4. Summertime catch rate of longfin smelt during the modern era vs. X2

Presence during Project activities

Unless the Project is performed in a wet year, then the expected San Pablo Bay capture rate of smelt would be expected to be <10 fish per hectare (Figure 4-4; the average summer catch for all the years shown in the figure is 16 fish per Ha). The mean June-October catch rate from 2001-2011 at station 319, near the proposed Project site, was <4 fish/Ha. The catch rate is not abundance *per se*, because small fish can escape through the meshes of the net and older fish may avoid the net. As developed in Appendix A, a conservative estimate is that true longfin smelt abundance is roughly 4 times the standardized catch rate.

Encounter Rates at Project Site

Longfin smelt may be present within the footprint of the proposed construction activities.

4.4 Delta Smelt (*Hypomesus transpacificus*). Status: SE, FT.

Delta smelt is a small, annual osmerid that has declined in recent decades, such that it was listed as threatened under both federal and state Endangered Species Acts in 1993 and elevated to State Endangered status in 2010. This smelt is a low-salinity specialist endemic to the San Francisco estuary.

Bennet (2005) reported that >90% of all delta smelt captured were taken at salinities <6 psu. This salinity restriction included virtually all juveniles taken in the IEP Summer Tow Net samples.

While the historic range of delta smelt extends to western San Pablo Bay and even to Berkeley, Merz et al. (2011) show a more contracted distribution in recent years. They wrote,"Outside the [lower Sacramento River downstream to Suisun Marsh], the cache Slough and Ship Channel was the only region that yielded high catches of delta smelt relative to other regions across multiple life stages for years 1995-2009." The highest annual average frequency of capture for any life stage in eastern San Pablo Bay was 3.6% (for juvenile delta smelt in the Summer Tow Net surveys). However, Merz et al. chose a time period that covers part of two distinct eras in delta smelt abundance: post-drought and POD (pelagic organism decline; Sommer et al. 2007). In the POD period, i.e., since 2001, the CDFW/IEP Bay Study trawl program has captured only a single delta smelt in the midwater trawl and none in the otter trawl.

Presence during Project activities.

Unless 2014 is an exceedingly wet year, delta smelt will not likely occur in San Pablo Bay during the proposed activity.

4.5 EFH Species

The Action Area of San Pablo Bay is included in the listing of essential fish habitat for a variety of pelagic, groundfish, and salmon species covered by the Coastal Pelagic Fish Management Plan (FMP), the Pacific Groundfish FMP, and the Pacific Coast Salmon FMP developed by the Pacific Fishery Management Council under the requirements of the Magnuson-Stevens Act. Table 4-2 lists those fish species covered by these plans identified as utilizing the Action Area, along with the life stage and relative occurrence within the Action Area.

TABLE 4-2 MANAGED FISH SPECIES IN SAN PABLO BAY UNDER THE MAGNUSON-STEVENS ACT

Fisheries Management Plan	Species, Common Name	Species, Scientific Name	Life Stage*	Abundance
Coastal Pelagic	Northern anchovy	*Engraulis mordax*	J, A	Abundant
	Pacific sardine	*Sardinops sagax*	J, A	Present
Pacific Groundfish	English sole	*Parophrys vetulus*	J, A	Abundant
	Sand sole	*Psettichthys melanostictus*	L, J, A	Present
	Starry flounder	*Platichthys stellatus*	J, A	Present
	Lingcod	*Ophiodon elongatus*	J, A	Rare
	Brown rockfish	*Sebastes auriculatus*	J	Present
	Pacific whiting (hake)	*Merluccius productus*	E,L	Absent*
	Leopard shark	*Triakis semifasciata*	J, A	Present
	Spiny dogfish	*Squalus acanthias*	J, A	Present
	Skates	*Raja* ssp.	J, A	Present
	Other rockfish		J	Rare
	Cabezon	*Scorpaenichthys marmoratus*	J	Rare
Pacific Coast Salmon	Chinook salmon	*Oncorhynchus tshawytscha*	J, A	Seasonally Present
	Coho salmon	*Oncorhynchus kisutch*	J, A	Historically Present, Current Occurrence unknown

Table Information Sources: Pacific Fishery Management Council. 2011. Groundfish - http://www.pcouncil.org/groundfish/background/; Salmon- http://www.pcouncil.org/salmon/background/; Coastal Pelagic- http://www.pcouncil.org/coastal-pelagic-species/background-information/. Accessed April 20, 2011. CDFG IEP unpublished midwater trawl data 2005-2009 (Appendix D).

NOTES: A = Adult; J = Juvenile; L = Larvae; E = Egg
* Listing based on a 1961 record. No Bay Study records for this species; listed as Rare in the estuary by USACE&USEPA(2009)

4.6 Habitats of Particular Concern (HAPC)

Eelgrass (Zostera marina) Beds

Although eelgrass has been reported in some years in eastern San Pablo Bay (Boyer and Wyllie-Echeverria 2010), there are no existing or predicted eelgrass beds in the

project area (Merkel and Associates 2005).

Native Olympia oyster (Ostrea conchaphila) Beds

Zabin et al. (2010) suggested that the Project site is unlikely to support native oyster, because, "Sites in San Pablo Bay and northward appear subject to periodic die offs due to seasonal low salinity events."