Name of study: North Bay Aqueduct Survey

Program element: 096

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Purpose/Objective: This survey has two major foci: 1) Estimate and evaluate larval delta smelt loss at the State Water Project's North Bay Aqueduct (NBA) due to entrainment and 2) Monitor abundance and distribution of larval delta smelt in the Cache Slough Complex and near Prospect Island. Prospect Island is a CALFED habitat restoration site and this sampling is used to evaluate whether delta smelt would use this site for spawning habitat. Future restoration of Prospect Island will warrant additional monitoring stations. The presence of delta smelt larvae in Barker Slough (Part of the Cache slough complex leading to the NBA) is a criterion for restrictions on NBA pumping. The 1995 Delta Smelt Biological Opinion mandates monitoring at the three Barker Slough stations in Barker Slough and the surrounding areas on a "recent-time" (within 72 hours) basis, posting delta smelt information on the world wide web so that interested parties may use this information for water management decisions.

Data collected: Water temperature, surface electro-conductivity, water transparency, water volume sampled, tidal stage, sample time, tow depth, bottom depth, and fish catch.

Geographic range of field work: Northern Sacramento-San Joaquin Delta.

Number of sites: Eight stations.

Period of record (start year): 1995.

Size for complete data base for program element in KB (MB): 10+ megabytes.

Number of individual files: One file or database contains all data.

Sample frequency per time unit (second, week, month): The sampling season is from mid-February to mid-July with high priority stations (Barker and Lindsey Sloughs) sampled every two days and the remaining stations (Cache and Miner Sloughs, and Sacramento Deep Water Channel) sampled every four days.

Field sampling: The North Bay Aqueduct Survey net uses a cone shaped net 3.35 meters in length with a mouth area of 0.37 m^2. The net itself is composed of 505 µm Nitex^R and is mounted on a fixed metal tube frame with skids. The net is connected to the frame by a canvas mouth. A Flowmeter is mounted across the net's mouth to estimate the water volume filtered.

Laboratory analysis: Sample jars are taken to the laboratory at the California Department of Fish and Game's Bay Delta Branch, Stockton where the contents are sorted and any larval fish present are identified and counted. All fish are identified to species or lowest possible taxon and all Osmerids, including delta smelt, are measured. All lab data is recorded on data sheets corresponding to field measurements and entered into a relational database where it is subsequently uploaded to the world wide web.

Relative density analysis: The mean number of fish per volume water sampled (standardized to 1,000 m^3) is calculated using the following equations:

$$V = A * K * D$$

Where: V = volume of water (m^3) filtered through the net

A = mouth opening of the net (m^2)

K = calibration factor for the flow meter

D = difference in flow meter counts from start to finish of tow

$$N = F / V * 1{,}000\ m^3$$

Where: N = number of fish per 1,000 m^3 per station

F = fish sampled

V = volume of water filtered through the net (m^3)

Entrainment Estimates: NBA pumping is regulated by the "presence" of delta smelt, which is defined as a weighted mean of the actual catch at the three Barker Slough stations $\geq$ 1.0. The "weight" assigned to each station is dependent on its proximity to the NBA intake. Station 721 has a 50% weighting, 727 has a 30% weighting and station 720 has a 20% weighting. As stated in the 1995 USFWS Delta Smelt Biological Opinion, the diversions at NBA will be restricted to a 5 day running average of 65 cfs for 5 days when delta smelt are present. In mathematical terms, the NBA restrictions are in place when the following equation is true:

0.5*(Catch at 721) + 0.3*(Catch at 727) + 0.2*(Catch at 720) >= 1.0

An entrainment estimate is then calculated as the weighted mean density of delta smelt multiplied by the total water exported for the sampling day and the day after.

Changes over time: Historically, the North Bay Aqueduct Survey (NBA) was part of a much larger Egg and Larval Survey (1968-1995) that sampled the entire Delta and upper Estuary, targeting larval Striped Bass. The Barker and Lindsey slough portion of the Egg and Larval Survey was added in 1986, however, the Egg and Larval Survey was substantially reduced in 1995 and eliminated in 1996. Coinciding with these events was the beginning of the North Bay Aqueduct Survey. Only a remnant of the original egg and larval survey remains in Barker and Lindsey sloughs, which is thought to be a delta smelt spawning area. Station 721a was renamed 727 in 1995.

The North Bay Aqueduct program was terminated after the field season in 2004. In its place, an expanded larval fish sampling effort (Delta Smelt Larval Survey) was implemented in 2005.

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