

**RMP Benthos Study: Mesohaline Benthic Index Development
RMP Data Integration (2008-2009)**

**Summary of Benthos Data Compilation
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The focus of this study is to develop a robust benthic index for the mesohaline benthic assemblage in the San Francisco Estuary (this includes brackish waters with salinities ranging from ~ 5 – 18 psu). Once this assemblage has been characterized through a new ordination and classification analysis, the benthic work group will meet to begin to discuss methods and metrics for use in the development of a mesohaline index of biotic integrity.

Since NOAA, WEMAP, and DWR have sampled the San Francisco Estuary-Delta region extensively since the last effort to characterize benthic assemblages in the region (Thompson et al. 2000), a new ordination and classification analysis will be conducted to characterize the benthic assemblages in the San Francisco Estuary using historic and new data.

Data Compilation Methods:

San Francisco Bay-Delta benthos data were compiled from several studies listed in Table 1 below. Those studies collected grab or core samples of approximately 0.05 m² area (except for the BPTCP97 study) and sieved the samples through 1.0 and/or 0.5 mm sieves and identified all remaining organisms to the lowest practical taxonomic level.

To standardize taxonomic names across studies, a unique list of taxa reported for all studies, and associated frequency of occurrence and average abundance by project-ID, was developed and sent to several taxonomists for review. Most of the taxonomists involved in this standardization exercise are experts on S.F. Bay and Delta taxonomy and were the lead taxonomists on the initial taxonomic identifications for the individual studies. The taxonomists who participated in this exercise include:

<u>Agency</u>	<u>Taxonomist</u>
DWR	Wayne Fields
CCSF OCEANSIDE	Michael Kellogg
	Dorothy Norris
Moss Landing (MLML)	Peter Slattery
SCAMIT	Larry Lovell

Once the unique taxonomic list was standardized, the dataset was updated to these standards.

A subset of studies was selected for the ordination/classification analysis dataset. Selection criteria included studies that sieved the samples through 0.5 mm sieves and sampled a core area of approximately 0.05 m² (except for one BPTCP97 study¹). If more than one sieve size was employed (e.g. 0.5 mm and 1.0 mm nested sieves were used in the initial study), the data were combined and the abundances were summed for all unique taxa in a sample.

The two BPTCP studies that sampled replicate cores that were a less than 0.05 m² core area were standardized as follows:

BPTCP92: Sum of replicates 1, 2, and 3 provided a combined sample with a core area of 0.054 m².

BPTCP97: Sum of replicates 1, 2, and 3 provided a combined sample with a core area of 0.023 m² (see footnote 1).

A total of 403 unique stations were sampled by studies that sieved to 0.5 mm sieve-size, between May-1992 and September-2008 with a total of 2188 samples collected. The station locations among studies represent wetland, river, slough and sub-tidal habitats of the San Francisco Bay-Delta region (see maps in Appendix 1).

In order to further standardize taxonomic names for the ordination/classification analysis that will be performed on the 0.5 mm study dataset, a second working taxon list was developed to further group taxa. Based on professional judgment of the project leads: Sarah Lowe, Bruce Thompson, and Ananda Ranasingha developed the final taxonomic list employing the following general principals:

General Tennant: "find a way to keep species separate if at all possible"

- All names in the analysis dataset should be exclusive. No entry should fit into more than one taxon name row.
- Because species partition the environment, wherever possible we should stay true to species differences and keep individual species names.

Specific decisions for this dataset were:

- When there are two IDs for a genus, one to sp. (or spp) and the other to a specific species name, we will use the ID where the Freq. Of Occ. is dominant across studies. [See Examples: rows 76&77 \(Melinna oculata\), 240&241 \(Chone spp.\)](#)
- When have good IDs to the species level for a genus but also have genus and or family level IDs, we will generally drop the higher taxonomic level IDs. (This

¹ This Study had a maximum core area of 0.023 m² (when the three replicate cores were added together) but was included in this study because the samples were collected from Bay-margin sites that may have been impacted from anthropogenic causes (sites were monitored because they were potential Superfund Sites) and may be especially important in the index development phase of this project.

assumes that the higher taxonomic IDs generally represent immature or damaged organisms.) However, must evaluate this decision using the Feq. Of Occ. and Avg-Abundance data across studies though.

Work files (Sarah Lowe notes):

20090305sl_BenthosMDB_AllStudiesWrk7.mdb

This database contains benthos data from all studies (including those studies that only sieved to 1.0 mm). It also contains the 0.5mm Analysis dataset. The queries in this database are mostly related to this dataset. The Tbl_ANC contains the most up-to-date Fines, TOC, and Sal data fro all studies (incl. 1.0 mm studies). The Tbl_StationLocations has the longitude and latitudes of the stations for all studies.

20090224sl_pt5mmDataset_NewTaxonListV6.xls

This file contains the final taxon list used to update the standardized list to the analysis list (Newpt5mmStudiesTaxonList_Fnl). It also contains a copy of the final taxon list that was used to update the LabOriginal taxon name to the standardized name (TaxonList_updateLabOrigToStanda).

20090305sl_pt5mmDataset_FinalAnalysisTaxonList.xls

This file contains the updated Analysis Dataset taxon list and the updated Frequency of Occurrence and Average Abundance for each ProjectID. It also contains the drop code that will be used to drop the associated data prior to analysis.

References

Thompson, Bruce, S. Lowe, M. Kellogg (2000). Results of the Benthic Pilot Study (1994 – 1997): Part 1–Macrobenthic Assemblages of the San Francisco Bay-Delta, and their Responses to Abiotic Factors. Report # 39. San Francisco Estuary Institute. Oakland. CA

Table 1. Summary of 0.5 mm sieve size studies in the analysis dataset.
N = unique StationCode and SampleDate (does not include replicate samples)

Data Source	ProjectID	N	Project Period (in dataset)		Study Description	Max Of Replicate*	Replicate Comment	Core Size (m ²)	Sieve Size (mm)	Sieve Size Comment	Agency Code	Core Method	Core Device Used
			Start	End									
IanHartwell 11/05/08	NOAA00_01	4	14-Jul-00	01-Aug-00	NOAA sampled 4 RMP stations for possible comparison to RMP Benthic Pilot Study and CISNet Study samples (who also sampled around the same time)	1		0.044	0.5	Only 0.5 mm sieve used in Study	VT	Grab	Young Modified Van Veen
IanHartwell 8/25/08	NOAA00_01	178	11-Jul-00	01-Sep-01	NOAA SFBay subtidal study (2000 – 2001)	1		0.044	0.5	Only 0.5 mm sieve used in Study	VT,MLML,CC SF,WEMAP**	Grab	Young Modified Van Veen
KarenG 20081203	DWR	1730	18-Jan-94	16-Sep-08	Environmental Monitoring Program: San Pablo Bay and east into the Lower Delta (subtidal)	4	Between 3 & 4 reps were sampled at historic DWR stations	0.05	0.595	Only 0.595 mm sieve used in Study	DWR	Grab	Ponar
KarenG 20081203	SQO_07	18	18-Sep-07	20-Sep-07	Sediment Quality Objectives - Phase II Study in Lower Delta. Additional stations not sampled by DWR (freshwater tidal region)	1		0.05	0.595	Only 0.595 mm sieve used in Study	DWR	Grab	Ponar
SFEImdb 20080806 From Share Drive	BADA	54	08-Sep-94	19-Aug-97	Local Effects Monitoring Program: Three stations located near each of three waste water treatment plant outfalls in SFBay (subtidal)	3	1994-9 was the only time replicates were sampled	0.05	0.5,1	Combined both sieve sizes	CCSF OCEANSIDE	Grab	Ponar
SFEImdb 20080806 From Share Drive	BPTCP-92	4	01-May-92	01-May-92	Water Board Study – Bay Protection and Toxic Cleanup Program: stations located in Castro Cove (San Pablo Bay region- subtidal)	1,2,3	Sum of three replicates	0.054	0.5	Only 0.5 mm sieve used in Study	Moss Landing (MLML)	Core	X
SFEImdb 20080806 From Share Drive	BPTCP97	21	01-Apr-97	03-Dec-97	Water Board Study – Bay Protection and Toxic Cleanup Program: stations located near-shore, at potential Superfund Sites around SFBay (Bay margin - subtidal)	1,2,3	Sum of three replicates	0.023	0.5	Only 0.5 mm sieve used in Study	Moss Landing (MLML)	Core	10 cm diameter polycarbonate tube x 12cm sediment depth cores of a Young-modified Van Veen Grab
SFEImdb 20080806 From Share Drive	CISNET	12	19-Jan-00	14-Feb-01	San Pablo Bay and nearby sloughs (tidal sloughs and rivers)	1		0.05	0.5,1	Combined both sieve sizes	CCSF OCEANSIDE	Grab	Ponar
SFEImdb 20080806 From Share Drive	RBPTCP94	3	07-Sep-94	08-Sep-94	SFBay - Subtidal (3 Potential Reference Sites sampled by BPTCP for RMP)	1		0.05	0.5,1	Combined both sieve sizes	CCSF OCEANSIDE	Grab	X
SFEImdb 20080806 From Share Drive	RMP	110	11-Feb-94	25-Aug-03	SFBay - Subtidal Benthid Pilot Study. Stations are a subset of RMP Stations (mostly RMP Benthic Pilot Study plus a few extra samples through 2003)	3	1994 was the only year replicates were sampled	0.05	0.5,1	Combined both sieve sizes	CCSF OCEANSIDE	Grab	Ponar

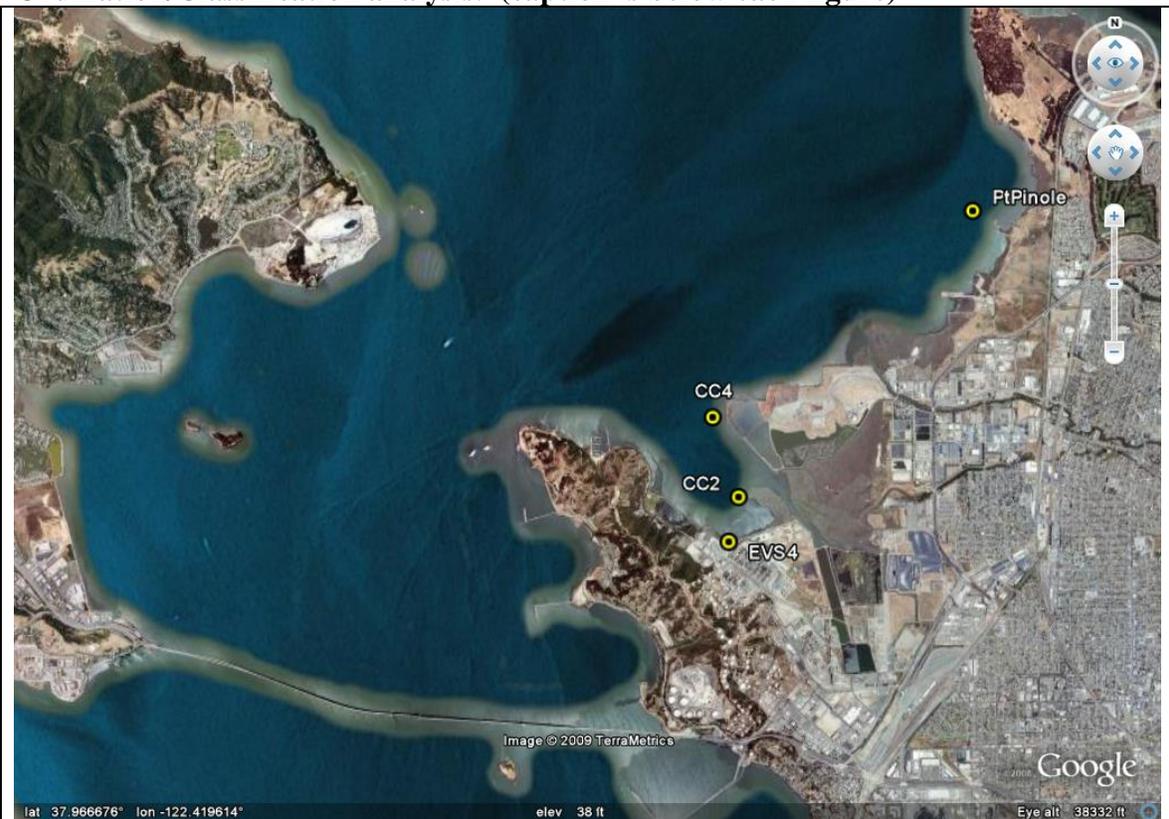
		Project Period (in dataset)											
Data Source	ProjectID	N	Start	End	Study Description	Max Of Replicate*	Replicate Comment	Core Size (m ²)	Sieve Size (mm)	Sieve Size Comment	Agency Code	Core Method	Core Device Used
SFEImdb 20080806 From Share Drive	RMP-W	4	28-Feb-95	01-Mar-95	North Bay China Camp Wetlands - sampled at two sites in the wetland channels	1		0.05	0.5,1	Combined both sieve sizes	CCSF OCEANSIDE	Core	Tube
WEMAPmdb From TomH 20080806	WEMAP00	37	13-Jul-00	17-Aug-00	WEMAP: SFBay subtidal study - 37 samples overlap with the NOAA00_01 Study. Sampling was conducted by the NOAA crew. However the results of the IDs were reworked by WEMAP taxonomists	1		0.044	0.5	Only 0.5 mm sieve used for these samples	VT	Grab	Young Modified Van Veen
WEMAPmdb From TomH 20080806	WEMAP00	13	24-Jul-00	04-Aug-00	WEMAP: SFBay subtidal study - 13 samples did not overlap with NOAA00_01 Study. Sampling was conducted by the WEMAP crew.	1		0.05	0.5,1	Combined both sieve sizes	NOAA	Grab	X
Total SFBay-Delta Samples (not incl. replicates)		2188	01-May-92	16-Sep-08					0.5 mm				

* The first sample is designated Replicate = 1.

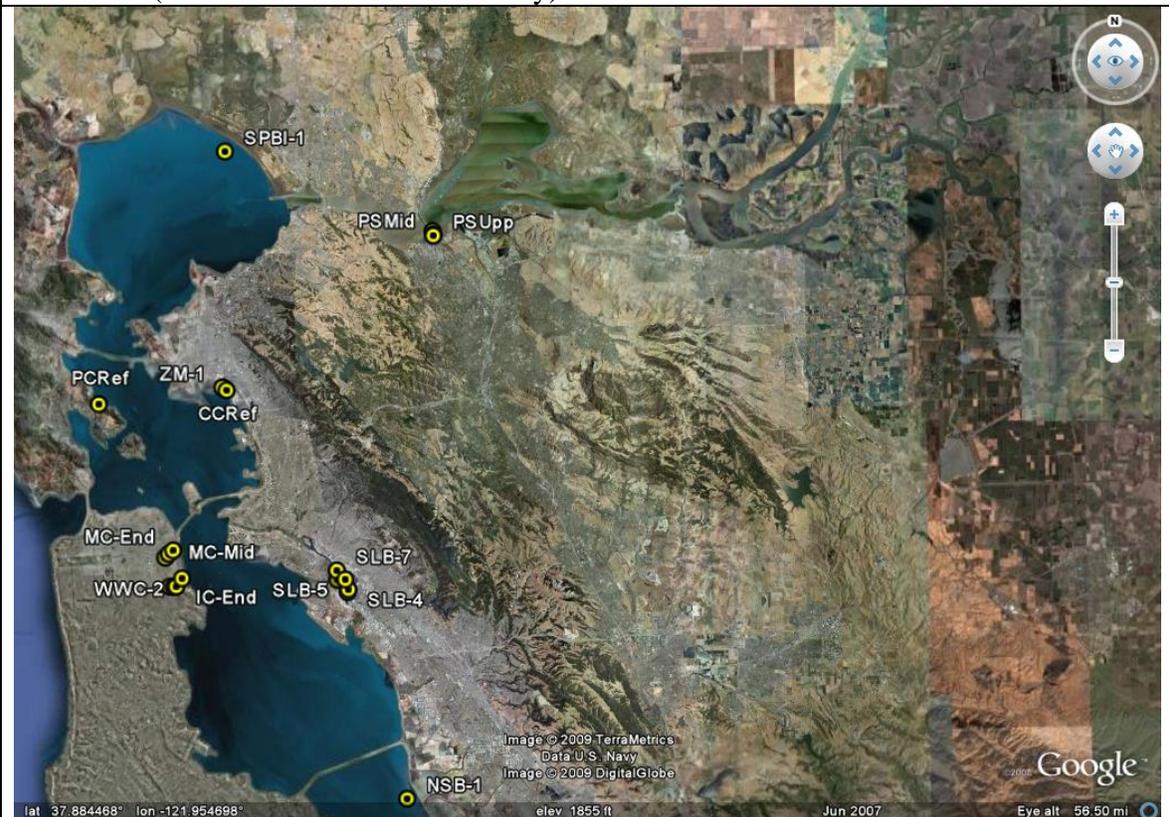
** The NOAA00_01 project data came from Ian Hartwell of NOAA. Vittor taxonomy lab (VT) initially ID's all NOAA 2000 and 2001 samples. However, after the first round of results, it was necessary to get West Coast taxonomists involved in verifying the identifications. A voucher sample verification excersize was conducted on a sub-set of key taxa using experts from San Fransisco Bay Area (CCSF, MLML) and Washington (WEMAP taxonomist). SFEI coordinated the voucher sample verification excersize. Additionally Kathy Welch of WEMAP coordinated an additional sample validation and verification excersize of the 50 WEMAP00 samples employing the WEMAP taxonomists. Ian Hartwell took the results of the two efforts and updated the 178 NOAA samples based on the results of those efforts.

Appendix 1: Maps

Station locations of the 0.5 mm sieve size studies used in the Ordination/Classification analysis. (caption is below each figure)



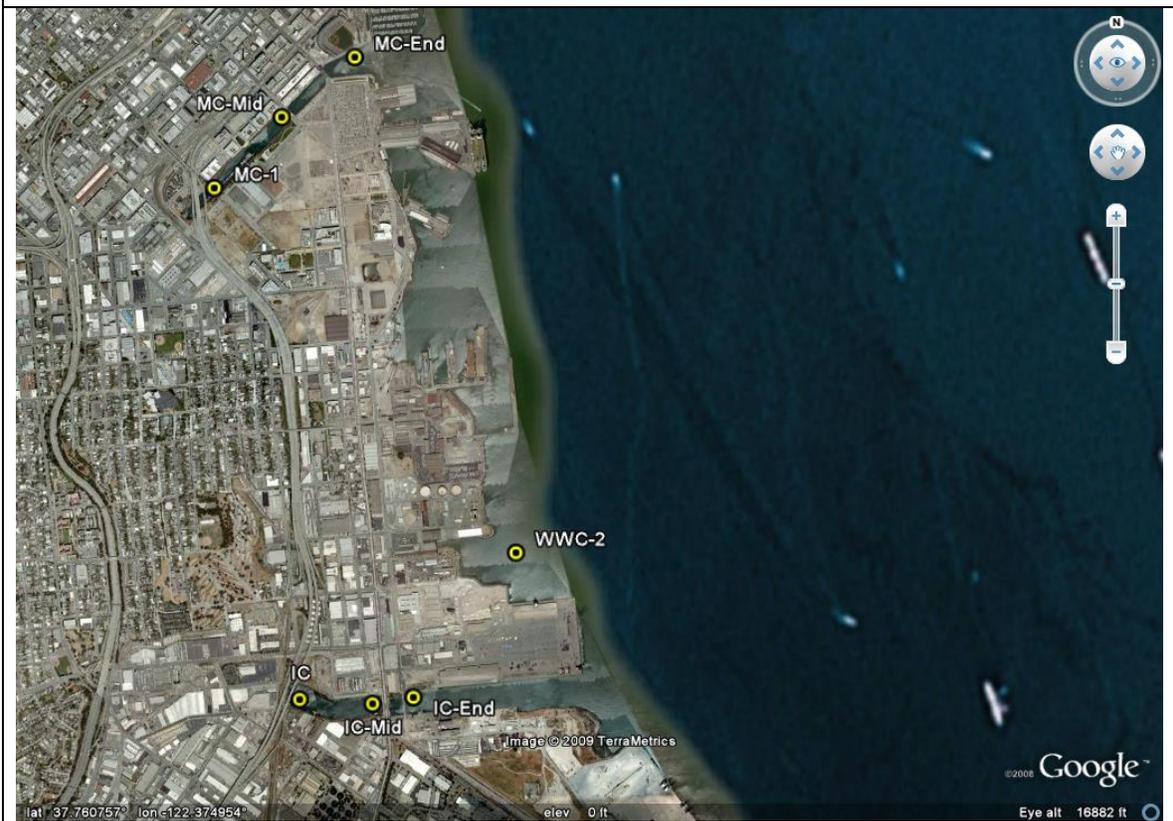
BPTCP92 (Castro Cove in San Pablo Bay)



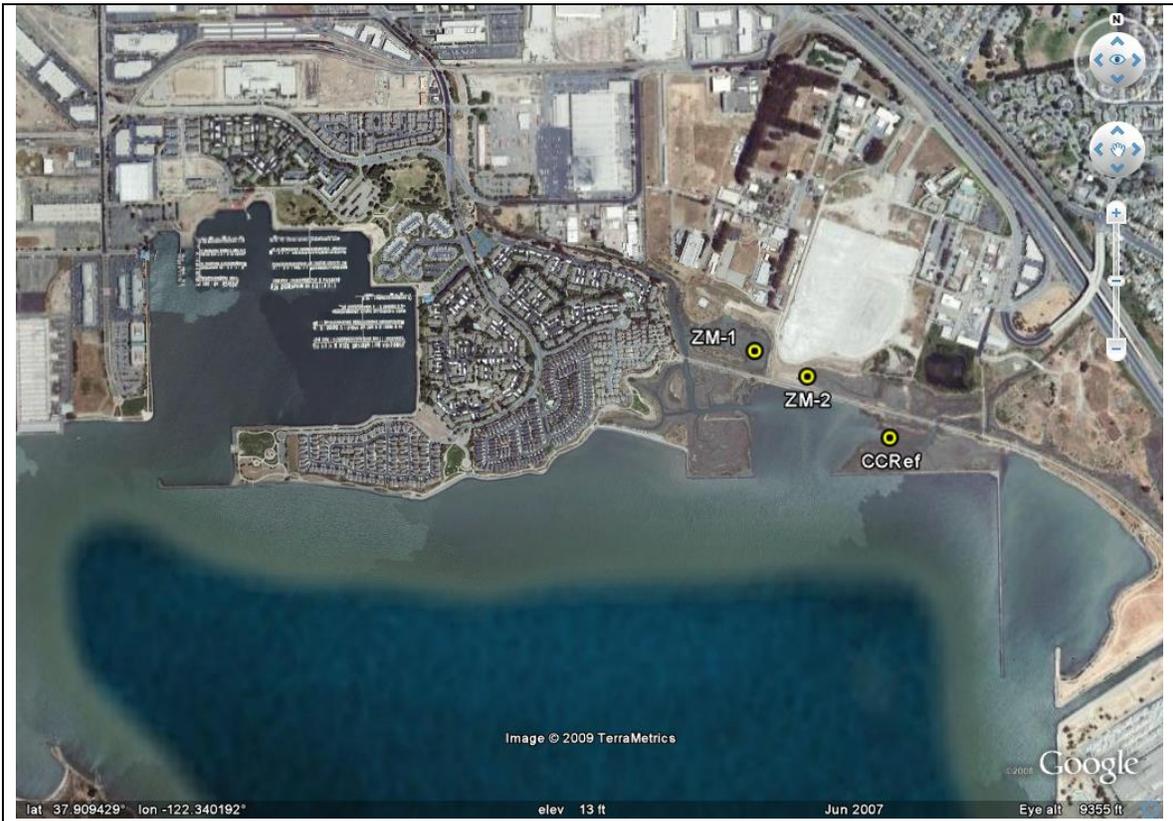
BPTCP97 (All sites)



BPTCP97 (Payton Slough in Suisun Bay)



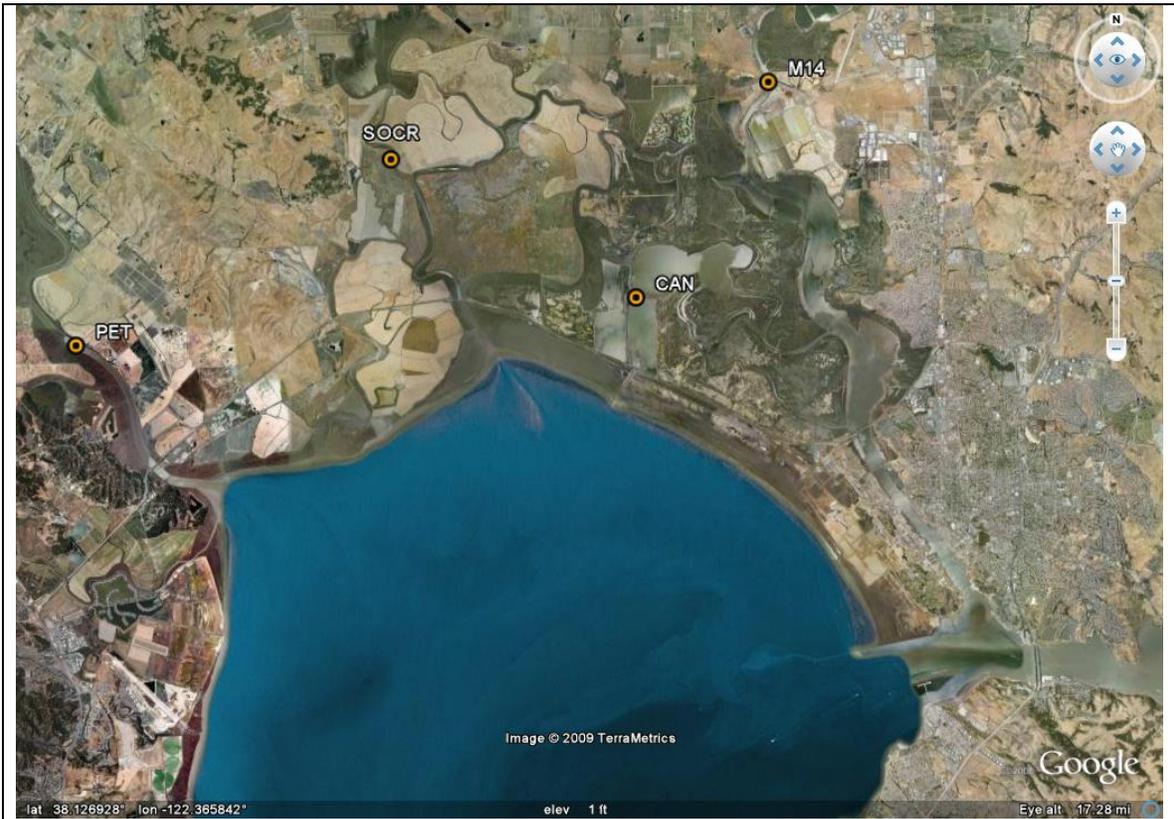
BPTCP97 (Mission Creek, Islas Creek and Warm Water Cove – San Francisco shoreline)



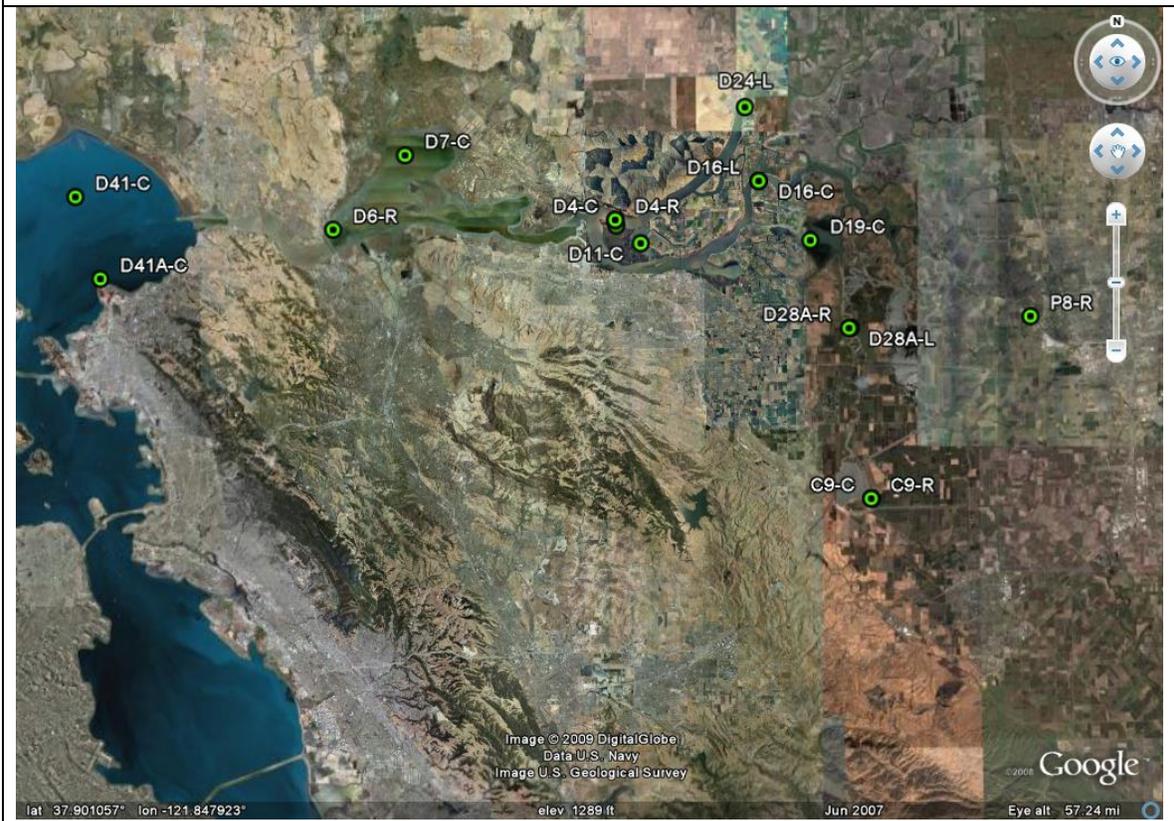
BPTCP97 (Zeneca and Carlson Creek – East Bay shoreline)



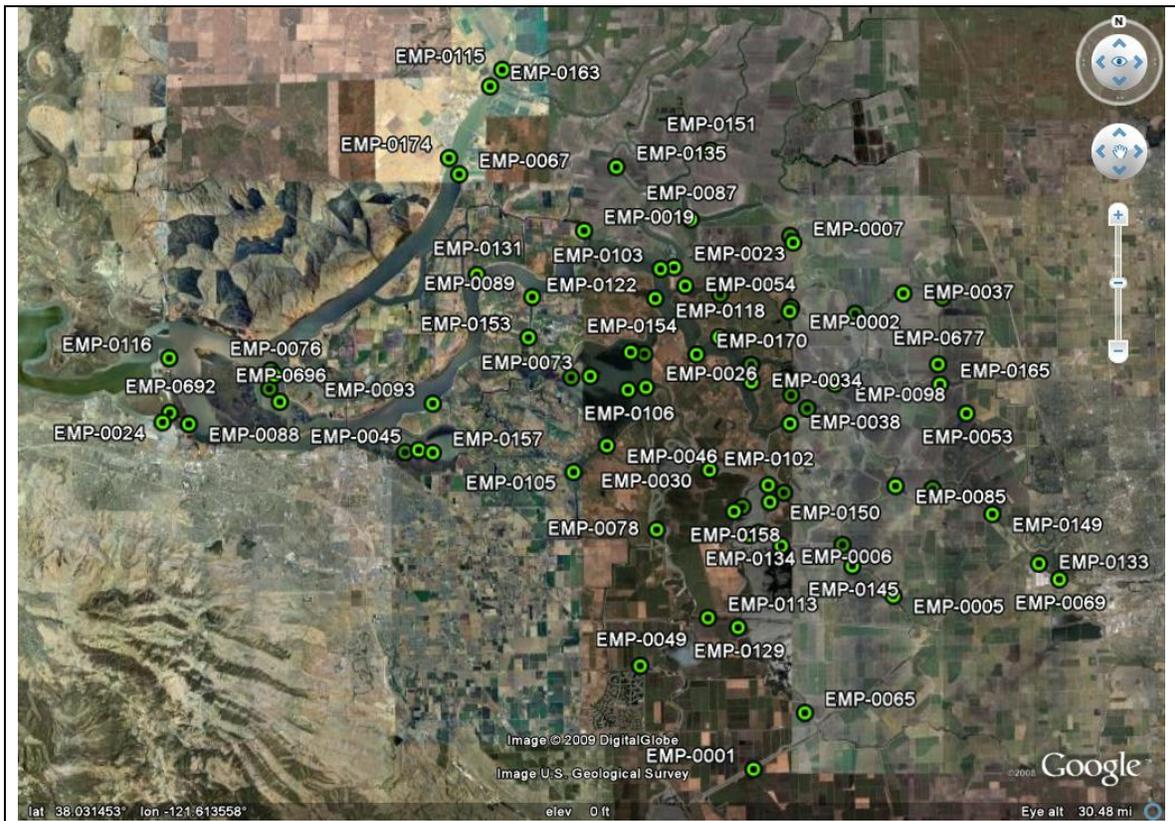
BPTCP97 (San Leandro Bay)



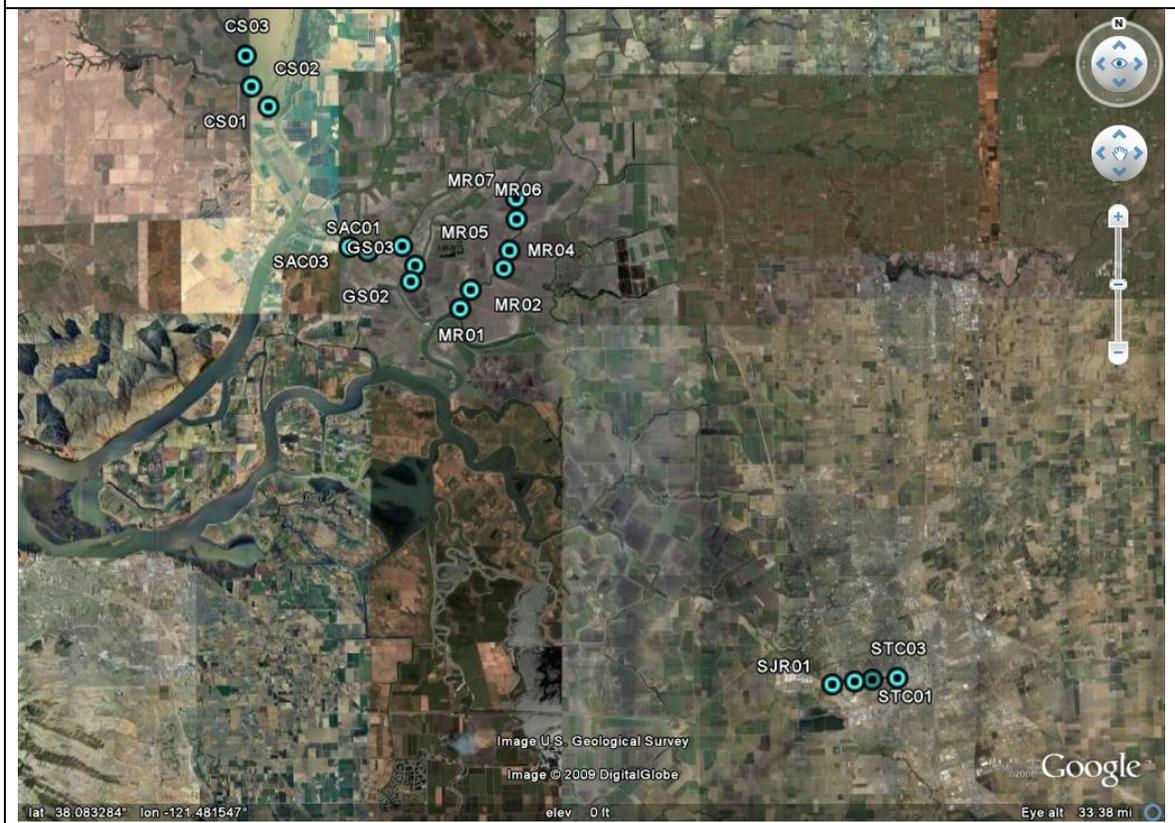
CISNet (San Pablo Bay northern sloughs and rivers)



DWR – Historic sites



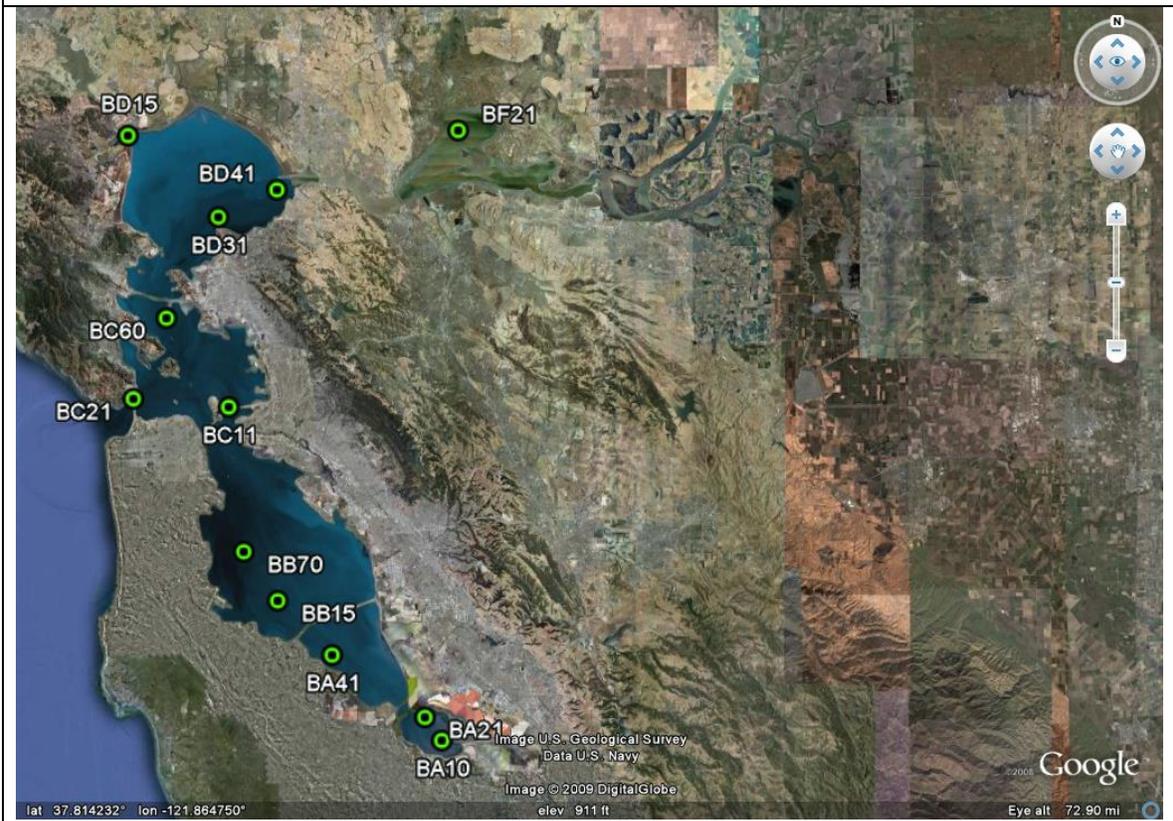
DWR – Random Design sites that overlap with the SQO07 Study



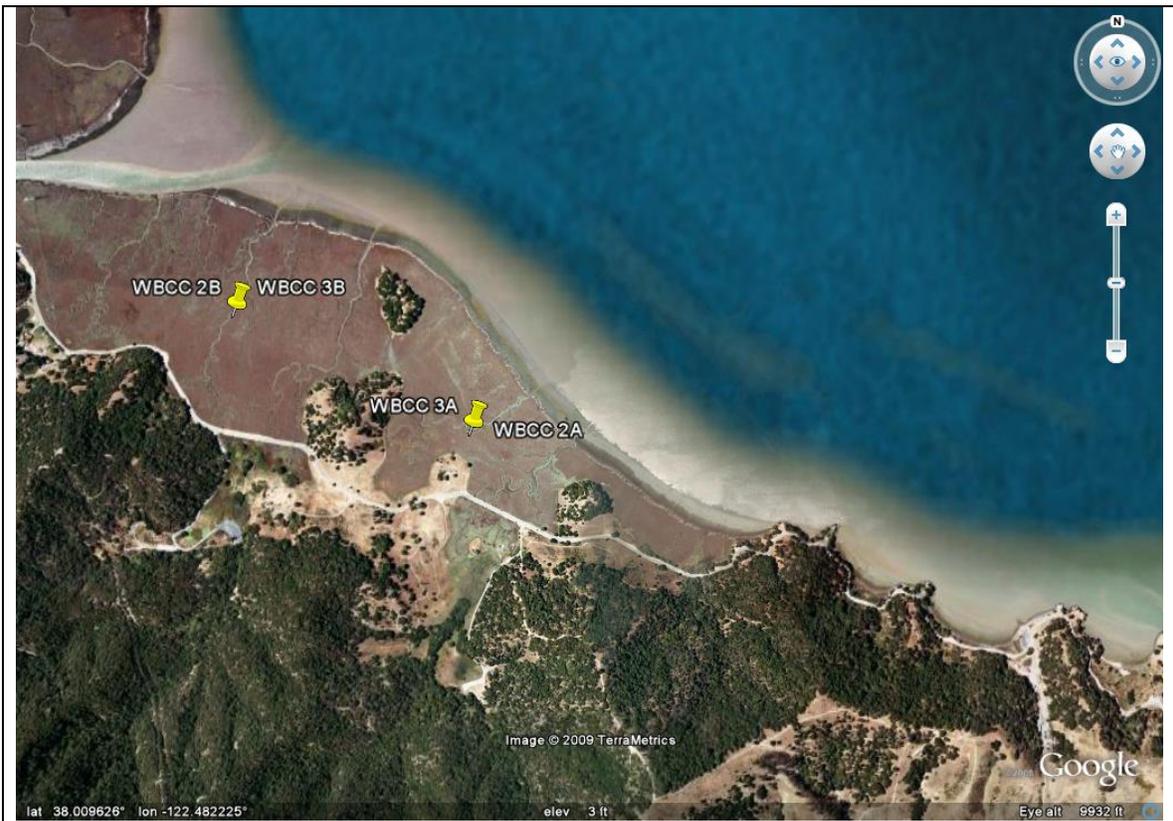
SQO07 – added sites (not part of DWRs 2007 sampling plan)



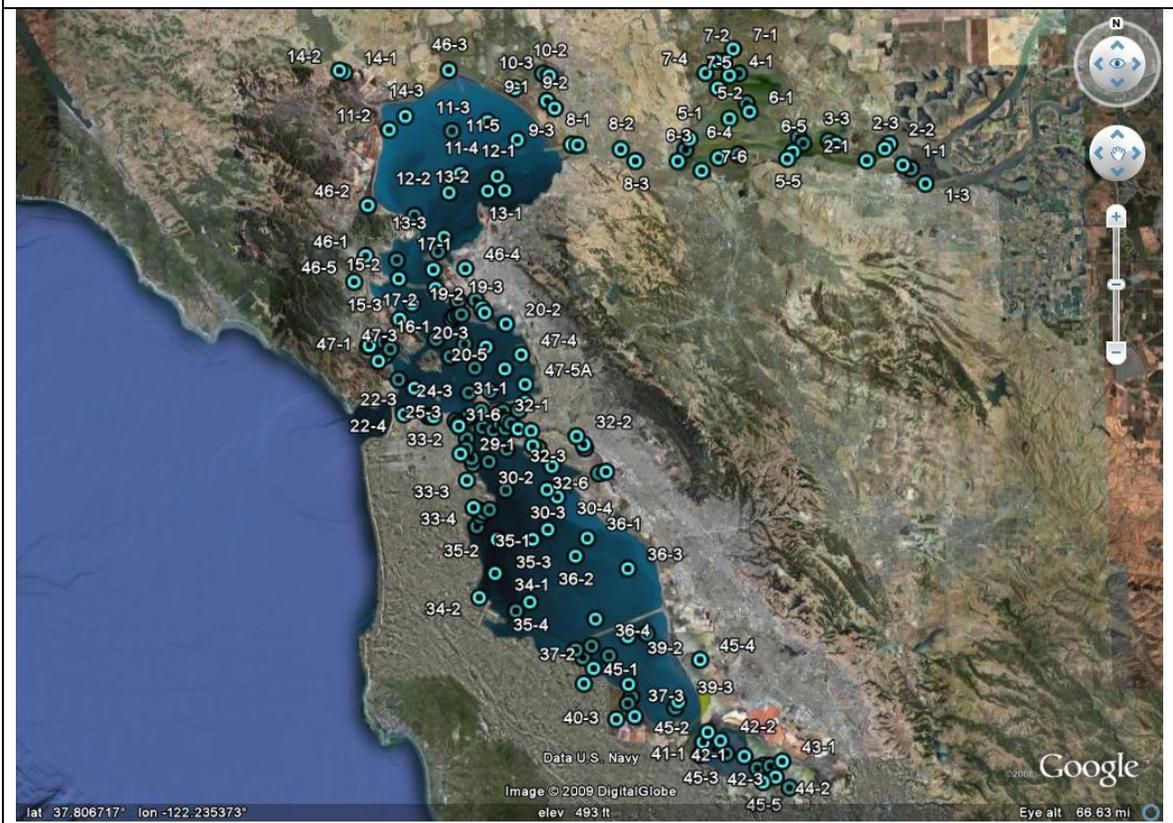
RBPTCP94_Reference Sites



RMP – Benthic Pilot Study (plus a few extra samples taken after the end of the study)



RMP-W (Wetlands Channel Study at China Camp in San Pablo Bay)



NOAA00_01

