appendix C

QUALITY ASSURANCE/ QUALITY CONTROL

QUALITY ASSURANCE/QUALITY CONTROL

This appendix details quality assurance/quality control information for the water quality analyses, sediment geochemistry analyses, tissue chemistry analyses, invertebrate taxonomy, and otter trawl sample collection conducted for the Orange County Sanitation District's (OCSD) 2012-13 ocean monitoring program.

INTRODUCTION

The Core monitoring program was designed to measure compliance with permit conditions and for temporal and spatial trend analysis. The program includes measurements of:

- Water quality;
- Sediment quality;
- Benthic infaunal community health;
- Fish and macroinvertebrate community health;
- Fish tissue contaminant concentrations (chemical body burden); and
- Fish health (including external parasites and diseases).

The Core monitoring program complies with the Orange County Sanitation District (OCSD) Quality Assurance/Quality Control (QA/QC) Program requirements and applicable federal, state, local, and contract requirements. The objectives of the quality assurance program are as follows:

- Scientific data generated will be of sufficient quality to stand up to scientific and legal scrutiny.

- Data will be gathered or developed in accordance with procedures appropriate for the intended use of the data.

- Data will be of known and acceptable precision, accuracy, representativeness, completeness, and comparability as required by the program.

The various aspects of the program are conducted on a schedule that varies weekly, monthly, quarterly, semi-annually, and annually. Table C-1, C-2, and C-3 shows that sampling goals were achieved for 100 percent of the required samples. Sampling and data analysis is characterized by quarters 1 through 4, which are representative of summer (July–September), fall (October–December), winter (January–March), and spring (April–June) seasons, respectively.

WATER QUALITY NARRATIVE

AMMONIA

Introduction

OCSD's Environmental Laboratory and Ocean Monitoring (ELOM) staff collected 568, 549, 619, and 647 discrete ammonia samples, respectively, during the four quarters beginning July 1, 2012 and ending June 30, 2013. All samples were iced upon collection, preserved with 1:1 sulfuric acid upon receipt by the ELOM laboratory staff, and stored at 4 ± 2 °C until analysis according to laboratory Standard Operating Procedures (SOPs), which are found in the Laboratory Operating Procedures Manual (LOPM).

Analytical Method

The samples were analyzed for ammonia on a segmented flow analyzer using Standard Methods 4500-NH_3 G. In the analysis, sodium phenolate and sodium hypochlorite react with ammonia to form indophenol blue in a concentration proportional to the ammonia concentration in the sample. The blue color is intensified with sodium nitroprusside and is measured at 660 nm. Method detection limits (MDLs) for ammonia are presented in Table C-4.

QA/QC

A typical sample batch include a blank at a maximum of every 20 samples, an external reference standard monthly, and a spike in seawater collected from a control site at a maximum of every 20 of samples . One spike and spike replicate is added to the batch every ten samples. The method detection limit (MDL) for low-level ammonia samples using the segmented flow instrument is 0.02 mg/L. QA/QC summary data are presented in Table C-5. All samples were analyzed within the required holding time. 211 out of the 211 analyses met the QA/QC criteria for blanks. 209 out of 211 analyses met the QA/QC criteria for blank spikes. Those results out of control can be attributed to instrument drift.

All analyses met the QA/QC criteria for the external reference sample. Zero of 141 matrix spike recoveries, zero of 141 matrix spike replicate recoveries, and one of 141 precision measurements for the matrix spike and matrix spike replicate samples were out of control for first quarter samples. Zero of 125 matrix spike recoveries, Zero of 125 matrix spike replicate recoveries and one of 125 precision measurements for the matrix spike and matrix spike replicates were out of control for second quarter samples. Zero of 64 matrix spike replicate samples, two of 64 matrix spike replicate recoveries and zero of 64 precision measurements for matrix spike and matrix spike replicates were out of control for third quarter samples. Zero of 67 matrix spike recoveries, zero of 67 matrix spike replicate recoveries and zero of 67 precision measurements for matrix spike and matrix spike replicates were out of control for fourth quarter samples. In all cases, it was determined that recovery and precision criteria were exceeded due to matrix effect or instrumentation malfunction. Additionally, the set of results following those in question were within the control limits and therefore all results are considered valid.

BACTERIA

Introduction

OCSD's Environmental Laboratory and Ocean Monitoring (ELOM) staff collected 294, 280, 260, and 244 discrete offshore water quality bacteria samples, respectively, during the four quarters beginning July 1, 2012 and ending June 30, 2013.

Along the surfzone, the staff collected 294, 307, 286, and 287 discrete bacteria samples from core stations and an additional 329, 348, 357, and 339 discrete bacteria samples from regional stations during the same timeframe as mentioned above.

All samples were iced upon collection, and stored at 4 ± 2 °C until analysis according to laboratory Standard Operating Procedures (SOPs), which are found in the Laboratory Operating Procedures Manual (LOPM).

Analytical Method

The samples collected offshore for water quality were analyzed for bacteria by Enterolert™ for enterococci and Colilert-18™ for total and fecal coliforms for offshore water quality stations. This method utilizes enzyme substrates that when hydrolyzed, will produce a fluorescent signal when viewed under long-wavelength (365-nm) ultraviolet light.

For samples collected along the surfzone for both core and regional stations, samples were analyzed by culture-based methods for direct count of bacteria. EPA Method 1600 was applied to enumerate enterococci bacteria. For enumeration of total and fecal coliforms, Standards Methods 9222B and 9222D were used, respectively. Method detection limits (MDLs) for bacteria are presented in Table C-4.

QA/QC

All samples were analyzed within the required holding time. For recreational samples, samples were processed and incubated within 8 hours of sample collection. Duplicate analyses were performed on a minimum of 10% of samples with at least one sample per sample batch.

All equipment, reagents, and dilution waters used for sample analyses were sterilized before use. Each lot of medium was tested for sterility and performance with known positive negative controls prior to use. For surfzone samples, a positive and negative control was run simultaneously with each batch of sample for each type of media used to ensure performance. Each Quanti-Tray sealer was checked by addition of dye to 100mL of water, and the tray was sealed and subsequently checked for leaking. Each lot of dilution blanks commercially purchased was checked for appropriate volume.

Table C-1. Ocean monitoring program sample collection requirements and percent completion for water quality, July 2012–June 2013.

Orange County Sanitation District, California.

Quarter	Program Type	Parameter	Nominal # of Samples	# of Samples Collected	# of QA Duplicates* (≥10%)	# of Duplicates Collected	# of Additional Samples Collected	%Samples Collected
1	Water Quality	CTD Drops	146	146	15	14	26	100
		Ammonium	450	472	61	74	73	100
		Bacteria	175	175	35	37	126	100
2	Water Quality	CTD Drops	146	146	15	15	13	100
		Ammonium	450	467	61	81	0	100
		Bacteria	175	175	35	35	105	100
3	Water Quality	CTD Drops	146	146	15	16	15	100
		Ammonium	450	468	61	81	70	100
		Bacteria	175	175	35	32	84	100
4	Water Quality	CTD Drops	146	146	15	17	17	100
		Ammonium	450	468	61	81	98	100
		Bacteria	175	175	35	32	70	100

* Number of QA duplicates indicates the number of field duplicates or lab sample splits only. It does not include spikes or other QA samples.

Table C-2. Ocean monitoring program sample collection requirements and percent completion for sediments, July 2012–June 2013.

Orange County Sanitation District, California.

Quarter	Program Type	Parameter	Nominal # of Samples	# of Samples Collected	# of QA Duplicates* (≥10%)	# of Duplicates Collected	# of Additional Samples Collected	%Samples Collected
1	Sediment Chemistry	Grain size	68	68	7	NA	0	100
		TOC	68	68	4	NA	0	100
		Dissolved Sulfides	68	68	7	NA	0	100
		Metals	68	68	7	NA	0	100
		DDT/Pesticides	68	0	0	NA	0	**
		PCB	68	0	0	NA	0	**
		PAH	68	68	6	NA	0	100
		LAB	68	68	6	NA	0	100
	Benthic Infauna	Infauna	68	68	7	NA	0	100
3	Sediment Chemistry	Grain size	29	29	3	NA	0	100
		TOC	29	29	2	NA	0	100
		Dissolved Sulfides	29	29	3	NA	0	100
		Total Nitrogen	29	29	0	NA	0	100
		Total Phosphorus	29	29	0	NA	0	100
		Metals	29	29	3	NA	0	100
		DDT/Pesticides	29	29	4	NA	0	100
		PCB	29	29	4	NA	0	100
		PAH	29	29	4	NA	0	100
	Benthic Infauna	Infauna	29	29	3	NA	0	100

NA = not applicable

* Number of QA duplicates indicates the number of field duplicates or lab sample splits only. It does not include spikes or other QA samples.

** Sample effort for sediment geochemistry and benthic infauna in Summer 2012 traded to increase sampling effort in for sediment mapping SPS.

Table C-3. Ocean monitoring program sample collection requirements and percent completion for trawl caught fish and sport fish, July 2012–June 2013.

Orange County Sanitation District, California.

Quarter	Program Type	Parameter	Nominal # of Samples	# of Samples Collected	# of QA Duplicates* (≥10%)	# of Duplicates Collected	# of Additional Samples Collected	%Samples Collected
1	Fish Community	Trawls *	15	15	NA	NA	NA	100
	Fish Tissue	Hornyhead turbot	NS	NS	NS	NS	NA	NA
		English sole	NS	NS	NS	NS	NA	NA
	Sport Fish Tissue Zone 1	Rockfish	10 ***	10	1	NA	NA	100
		Kelp Bass	10 ***	0	0	NA	NA	0
		Sand Bass	10 ***	0	0	NA	NA	0
	Sport Fish Tissue Zone 2	Rockfish	10 ***	0	0	NA	NA	0
		Kelp Bass	10 ***	0	0	NA	NA	0
		Sand Bass	10 ***	0	0	NA	NA	0
3	Fish Community	Trawls	6	6	NA	NA	NA	100
	Fish Tissue	Hornyhead turbot	20 X 2 = 40 **	20 X 2 **	5	4 X 2	NA	100
		English sole	20 X 2 = 40 **	20 X 2 **	3	4 X 2	NA	100
	Sport Fish Tissue Zone 1	Kelp Bass	NS	NS	NS	NS	NA	NA
		Sand Bass	NS	NS	NS	NS	NA	NA
		Kelp Bass	NS	NS	NS	NS	NA	NA
	Sport Fish Tissue Zone 2	Kelp Bass	NS	NS	NS	NS	NA	NA
		Sand Bass	NS	NS	NS	NS	NA	NA
		Kelp Bass	NS	NS	NS	NS	NA	NA

NA = not applicable.
NS = Not Sampled
* Number of QA duplicates indicates the number of field duplicates or lab sample splits only. It does not include spikes or other QA samples.
** English sole and hornyhead turbot samples were analyzed for both muscle and liver tissue.
*** Sport Fish are taken from two zones, analyzed only for muscle tissue

Table C-4. Method detection levels for ammonium and bacteria in receiving water, July 2012–June 2013.

Orange County Sanitation District, California.

Parameter	Method Detection Limit (ng/g wet weight)
Ammonium	0.02
Total coliform	10
E. coli	10
Enterococci	10

Table C-5. Water Quality Ammonium QA/QC Summary, July 2012–June 201.

Orange County Sanitation District, California.

Quarter	Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
Summer	NH3WQ120725-1	Ammonium	Blank	3	3	<2X MDL	N/A
			Matrix Spike	5	5	80-120	
			Matrix Spike Dup	5	5	80-120	
			Matrix Spike Precision	5	5		< 11%
			ERA Check Standard	3	3	87 - 114	
Summer	NH3WQ120726-1	Ammonium	Blank	5	5	<2X MDL	N/A
			Matrix Spike	9	9	80-120	
			Matrix Spike Dup	9	9	80-120	
			Matrix Spike Precision	9	9		< 11%
			ERA Check Standard	5	3*	87 - 114	
Summer	NH3WQ120807-1	Ammonium	Blank	5	5	<2X MDL	N/A
			Matrix Spike	9	9	80-120	
			Matrix Spike Dup	9	9	80-120	
			Matrix Spike Precision	9	9		< 11%
			Blank Spike	5	5	90-110	
Summer	NH3WQ120809-1	Ammonium	Blank	5	5	<2X MDL	N/A
			Matrix Spike	10	10	80-120	
			Matrix Spike Dup	10	10	80-120	
			Matrix Spike Precision	10	10		< 11%
			Blank Spike	5	5	90-110	
Summer	NH3WQ120821-1	Ammonium	Blank	7	7	<2X MDL	N/A
			Matrix Spike	13	13	80-120	
			Matrix Spike Dup	13	13	80-120	
			Matrix Spike Precision	13	12**		< 11%
			Blank Spike	7	7	90-110	
Summer	NH3WQ120911-1	Ammonium	Blank	6	6	<2X MDL	N/A
			Matrix Spike	11	11	80-120	
			Matrix Spike Dup	11	11	80-120	
			Matrix Spike Precision	11	11		< 11%
			Blank Spike	6	6	90-110	

Table C-5 Continues.

Table C-5 Continued.

Quarter	Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
Summer	NH3WQ120912-1	Ammonium	Blank	6	6	<2X MDL	N/A
			Blank Spike	12	12	90-110	
			Matrix Spike	12	12	80-120	
			Matrix Spike Dup	12	12	80-120	
			Matrix Spike Precision	6	6		< 11%
			ERA Check Standard	7	7	87 - 114	
Summer	NH3WQ120913-1	Ammonium	Blank	12	12	<2X MDL	N/A
			Matrix Spike	12	12	80-120	
			Matrix Spike Dup	12	12	80-120	
			Matrix Spike Precision	7	7		< 11%
			Blank Spike	3	3	90 - 110	
Summer	NH3WQ120913-2	Ammonium	Blank	6	6	<2X MDL	N/A
			Matrix Spike	6	6	80-120	
			Matrix Spike Dup	6	6	80-120	
			Matrix Spike Precision	3	3		< 11%
			Blank Spike	3	3	90 - 110	
Summer	NH3WQ120918-1	Ammonium	Blank	6	6	<2X MDL	N/A
			Matrix Spike	6	6	80-120	
			Matrix Spike Dup	6	6	80-120	
			Matrix Spike Precision	3	3		< 11%
			Blank Spike	6	6	90-110	
Summer	NH3WQ120919-1	Ammonium	Blank	12	12	<2X MDL	N/A
			Matrix Spike	12	12	80-120	
			Matrix Spike Dup	12	12	80-120	
			Matrix Spike Precision	6	6		< 11%
			Blank Spike	7	7	90-110	
Summer	NH3WQ120920-1	Ammonium	Blank	13	13	<2X MDL	N/A
			Matrix Spike	14	14	80-120	
			Matrix Spike Dup	14	14	80-120	
			Matrix Spike Precision	7	7		< 11%
			Blank Spike	6	6	90-110	

Table C-5 Continues.

Table C-5 Continued.

Quarter	Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
Summer	NH3WQ120925-1	Ammonium	Blank	4	4	<2X MDL	N/A
			Matrix Spike	7	7	80-120	
			Matrix Spike Dup	7	7	80-120	
			Matrix Spike Precision	7	7		< 11%
			Blank Spike	4	4	90-110	
Summer	NH3WQ120926-1	Ammonium	Blank	6	6	<2X MDL	N/A
			Matrix Spike	12	12	80-120	
			Matrix Spike Dup	12	12	80-120	
			Matrix Spike Precision	12	12		< 11%
			Blank Spike	6	6	90-110	
Summer	NH3WQ120928-1	Ammonium	Blank	2	2	<2X MDL	N/A
			Matrix Spike	3	3	80-120	
			Matrix Spike Dup	3	3	80-120	
			Matrix Spike Precision	3	3		< 11%
			Blank Spike	2	2	90-110	
Fall	NH3WQ121002-1	Ammonium	Blank	9	9	<2X MDL	N/A
			Matrix Spike	18	18	80-120	
			Matrix Spike Dup	18	18	80-120	
			Matrix Spike Precision	18	17**		< 11%
			Blank Spike	9	9	90-110	
Fall	NH3WQ121002-2	Ammonium	Blank	10	10	<2X MDL	N/A
			Matrix Spike	19	19	80-120	
			Matrix Spike Dup	19	19	80-120	
			Matrix Spike Precision	19	19		< 11%
			Blank Spike	10	10	90-110	
fall	NH3WQ121004-1	Ammonium	Blank	9	9	<2X MDL	N/A
			Matrix Spike	17	17	80-120	
			Matrix Spike Dup	17	17	80-120	
			Matrix Spike Precision	17	17		< 11%
			Blank Spike	9	9	90-110	

Table C-5 Continues.

Table C-5 Continued.

Quarter	Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
Fall	NH3WQ121010-1	Ammonium	Blank	7	7	<2X MDL	N/A
			Matrix Spike	15	15	80-120	
			Matrix Spike Dup	15	15	80-120	
			Matrix Spike Precision	15	15		< 11%
			Blank Spike	7	7	90-110	
Fall	NH3WQ121105-1	Ammonium	Blank	7	7	<2X MDL	N/A
			Blank Spike	14	14	90-110	
			Matrix Spike	14	14	80-120	
			Matrix Spike Dup	14	14	80-120	
			Matrix Spike Precision	7	7		< 11%
Fall	NH3WQ121107-1	Ammonium	Blank	7	7	<2X MDL	N/A
			Matrix Spike	14	14	80-120	
			Matrix Spike Dup	14	14	80-120	
			Matrix Spike Precision	14	14		< 11%
			Blank Spike	7	7	90-110	
Fall	NH3WQ121109-1	Ammonium	Blank	3	3	<2X MDL	N/A
			Blank Spike	5	5	90-110	
			Matrix Spike	5	5	80-120	
			Matrix Spike Dup	5	5	80-120	
			Matrix Spike Precision	3	3		< 11%
Fall	NH3WQ121120-1	Ammonium	Blank	5	5	<2X MDL	N/A
			Matrix Spike	9	9	80-120	
			Matrix Spike Dup	9	9	80-120	
			Matrix Spike Precision	9	9		< 11%
			Blank Spike	5	5	90-110	
Fall	NH3WQ121205-1	Ammonium	Blank	7	7	<2X MDL	N/A
			Matrix Spike	14	14	80-120	
			Matrix Spike Dup	14	14	80-120	
			Matrix Spike Precision	14	14		< 11%
			Blank Spike	7	7	90-110	

Table C-5 Continues.

Table C-5 Continued.

Quarter	Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
Winter	NH3WQ130204-1	Ammonium	Blank	3	3	<2X MDL	N/A
			Matrix Spike	5	5	80-120	
			Matrix Spike Dup	5	5	80-120	
			Matrix Spike Precision	5	5		< 11%
			Blank Spike	3	3	90-110	
Winter	NH3WQ130205-1	Ammonium	Blank	4	4	<2X MDL	N/A
			Matrix Spike	9	9	80-120	
			Matrix Spike Dup	9	9	80-120	
			Matrix Spike Precision	9	9		< 11%
			Blank Spike	5	5	90-110	
Winter	NH3WQ130206-1	Ammonium	Blank	1	1	<2X MDL	N/A
			Matrix Spike	2	2	80-120	
			Matrix Spike Dup	2	2	80-120	
			Matrix Spike Precision	2	2		< 11%
			Blank Spike	1	1	90-110	
Winter	NH3WQ130219-1	Ammonium	Blank	4	4	<2X MDL	N/A
			Matrix Spike	7	7	80-120	
			Matrix Spike Dup	7	7	80-120	
			Matrix Spike Precision	7	7		< 11%
			Blank Spike	4	4	90-110	
Winter	NH3WQ130227-1	Ammonium	Blank	5	5	<2X MDL	N/A
			Matrix Spike	10	10	80-120	
			Matrix Spike Dup	10	10	80-120	
			Matrix Spike Precision	10	10		< 11%
			Blank Spike	5	5	90-110	
Winter	NH3WQ130228-2	Ammonium	Blank	2	2	<2X MDL	N/A
			Blank Spike	3	3	90-110	
			Matrix Spike	3	3	80-120	
			Matrix Spike Dup	3	3	80-120	
			Matrix Spike Precision	2	2		< 11%

Table C-5 Continues.

Table C-5 Continued.

Quarter	Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
Winter	NH3WQ130305-3	Ammonium	Blank	6	6	<2X MDL	N/A
			Matrix Spike	12	12	80-120	
			Matrix Spike Dup	12	12	80-120	
			Matrix Spike Precision	12	12		< 11%
			Blank Spike	6	6	90-110	
Winter	NH3WQ130320-1	Ammonium	Blank	5	5	<2X MDL	N/A
			Matrix Spike	10	10	80-120	
			Matrix Spike Dup	10	10	80-120	
			Matrix Spike Precision	10	10		< 11%
			Blank Spike	5	5	90-110	
Winter	NH3WQ130321-1	Ammonium	Blank	3	3	<2X MDL	N/A
			Matrix Spike	6	6	80-120	
			Matrix Spike Dup	6	6	80-120	
			Matrix Spike Precision	6	6		< 11%
			Blank Spike	3	3	90-110	
Spring	NH3WQ130502-1	Ammonium	Blank	6	6	<2X MDL	N/A
			Matrix Spike	10	10	80-120	
			Matrix Spike Dup	10	10	80-120	
			Matrix Spike Precision	10	10		< 11%
			Blank Spike	6	6	90-110	
Spring	NH3WQ130503-1	Ammonium	Blank	4	4	<2X MDL	N/A
			Matrix Spike	7	7	80-120	
			Matrix Spike Dup	7	7	80-120	
			Matrix Spike Precision	7	7		< 11%
			Blank Spike	4	4	90-110	
Spring	NH3WQ130508-1	Ammonium	Blank	6	6	<2X MDL	N/A
			Blank Spike	10	10	90-110	
			Matrix Spike	10	10	80-120	
			Matrix Spike Dup	10	10	80-120	
			Matrix Spike Precision	6	5		< 11%

Table C-5 Continues.

Table C-5 Continued.

Quarter	Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
Spring	NH3WQ130528-1	Ammonium	Blank	4	4	<2X MDL	N/A
			Matrix Spike	7	7	80-120	
			Matrix Spike Dup	7	7	80-120	
			Matrix Spike Precision	7	7		< 11%
			Blank Spike	4	4	90-110	
Spring	NH3WQ130529-1	Ammonium	Blank	5	5	<2X MDL	N/A
			Matrix Spike	9	9	80-120	
			Matrix Spike Dup	9	9	80-120	
			Matrix Spike Precision	9	9		< 11%
			Blank Spike	5	5	90-110	
spring	NH3WQ130531-1	Ammonium	Blank	4	4	<2X MDL	N/A
			Matrix Spike	7	7	80-120	
			Matrix Spike Dup	7	7	80-120	
			Matrix Spike Precision	7	7		< 11%
			Blank Spike	4	4	90-110	
Spring	NH3WQ130604-1	Ammonium	Blank	1	1	<2X MDL	N/A
			Matrix Spike	1	1	80-120	
			Matrix Spike Dup	1	1	80-120	
			Matrix Spike Precision	1	1		< 11%
			Blank Spike	1	1	90-110	
Spring	NH3WQ130620-1	Ammonium	Blank	5	5	<2X MDL	N/A
			Matrix Spike	9	9	80-120	
			Matrix Spike Dup	9	9	80-120	
			Matrix Spike Precision	9	9		< 11%
			Blank Spike	5	5	90-110	
Spring	NH3WQ130624-1	Ammonium	Blank	4	4	<2X MDL	N/A
			Blank Spike	7	7	90-110	
			Matrix Spike	7	7	80-120	
			Matrix Spike Dup	7	7	80-120	
			Matrix Spike Precision	4	4		< 11%

*Blank Spike out of control due to instrumentation drift. All associated samples are non-detectable, therefore results valid.

** Precision out of control due to matrix interference.

SEDIMENT CHEMISTRY NARRATIVE

FIRST QUARTER (JULY 2012)

Introduction

OCSD's Environmental Laboratory and Ocean Monitoring (ELOM) laboratory received 68 sediment samples from ELOM's ocean monitoring staff during July 2012. All samples were stored according to ELOM LOPM. All samples were analyzed for organochlorine pesticides, polychlorinated biphenyl congeners (PCBs), polycyclic aromatic hydrocarbons (PAHs), linear alkyl benzenes (LABs), trace metals, mercury, dissolved sulfides (DS), total organic carbon (TOC), and grain size. Additional sediment samples were received from ELOM for a special sediment mapping project, but were not part of the OCSD core program.

Analytical Methods - PAHs and LABs

The analytical methods used to detect PAHs and LABs in the samples are described in the OCSD ELOM LOPM. All sediment samples were extracted using an accelerated solvent extractor (ASE) during the month of November 2012. Approximately ten grams (dry weight) of sample were used for each analysis. A separatory funnel extraction was performed using 100 milliliters of sample when field and rinse blanks were included in the batch.

A typical sample batch included 9 field samples with required quality control (QC) samples. Sample batches that were analyzed for PAHs included the following QC samples: one sand blank, one PAH reporting level spike, two standard reference materials (SRM), one PAH matrix spike set, and two sample extraction duplicates. There was one batch extracted and analyzed for PAHs. In addition, this batch contained one rinse sample and one field blank. Method detection limits (MDLs) for PAHs are presented in Table C-6. Acceptance criteria for PAH SRMs are presented in Table C-7.

QC samples for LAB analyses included one sand blank, one LAB reporting level spike, two SRM, one LAB matrix spike set, and two sample extraction duplicates. In addition, one batch contained a field blank and one rinse sample. There was one batch extracted and analyzed for LABs. MDLs for LABs are presented in Table C-6.

Sediment PAH and LAB QA/QC summary data are presented in Table C-8. All analyses were performed within holding times and with appropriate quality control measures, as stated in the program's Quality Assurance Project Plan (QAPP). Any variances are noted in the Comments/Notes section of each batch summary.

Analytical Methods - Organochlorine Pesticides and PCB Congeners

The analytical methods used to process the organochlorine pesticides and PCB congeners samples are described in the ELOM LOPM. An ASE was used to extract the sediment samples during the month of February 2013. All sediment extracts were analyzed by GC/MS. Approximately ten grams (dry weight) of sample were used for each analysis. If a field blank and rinse were included in the batch, a separatory funnel extraction was performed using 100 milliliters of sample.

A typical sample batch consisted of 9 field samples with required QC samples, which included one sand blank, two SRM, one PCB/pesticide reporting level spike, one PCB/pesticide matrix spike set, and two duplicate sample extractions. There was one batch extracted. In addition, this batch contained a rinse sample and a field blank. MDLs for PCBs/pesticides are presented in Table C-9 and C-10. Acceptance Criteria for PCB/pesticide SRMs are presented in Table C-11.

Sediment PCB/pesticide QA/QC summary data are presented in Table C-12. All analyses were performed within QAPP stated holding times and with appropriate quality control measures. When constituent concentrations exceeded the calibration range of the instrument, dilutions were performed and the samples reanalyzed. Any variances are noted in the Comments/Notes section of each batch summary.

Analytical Methods - Trace Metals

Dried sediment samples were analyzed for trace metals in accordance with methods in the ELOM LOPM. A typical sample batch for silver, cadmium, chromium, copper, nickel, lead, zinc, selenium, arsenic, and beryllium analyses included three blanks, a blank spike, and one SRM. Additionally, duplicate samples, spiked samples and duplicate spiked samples were analyzed a minimum of once every 10 sediment samples. QC for a typical sample batch for aluminum and iron analyses included three blanks, an SRM, sediment samples with duplicates, spiked samples and duplicate spiked samples analyzed a minimum of once every 10 sediment samples. The analysis of the blank spike and SRM provided a measure of the accuracy of the analysis. The analysis of the sample, its duplicate, and the two spiked samples were evaluated for precision. The samples that were spiked with aluminum and iron were not evaluated for spike recoveries because the spike levels were extremely low compared to the concentrations of aluminum and iron in the native samples. The samples were spiked at 20 mg/kg dry weight whereas the native concentrations ranged between 5,000 and 35,000 mg/kg dry weight.

All samples were analyzed within their 6- month holding times. If any analyte exceeded the appropriate calibration curve, and Linear Dynamic Range, the sample was diluted and reanalyzed. MDLs for metals are presented in Table C-13. Acceptance criteria for trace metal SRMs are presented in Table C-14.

The digested samples were analyzed for silver, cadmium, chromium, copper, nickel, lead, zinc, selenium, arsenic, and beryllium by inductively coupled mass spectroscopy (ICPMS). Aluminum and iron were analyzed using inductively coupled emission spectroscopy (ICPES). Sediment trace metal QA/QC summary data are presented in Tables C-15.

Analytical Methods - Mercury

Dried sediment samples were analyzed for mercury in accordance with methods described in the ELOM LOPM. QC for a typical batch included a blank, blank spike, and SRM. Sediment samples with duplicates, spiked samples and duplicate spiked samples were run approximately once every ten sediment samples. All samples were analyzed within their 6-month holding time. When sample mercury concentration exceeded the appropriate calibration curve, the sample was diluted with the reagent blank and reanalyzed. The samples were analyzed for mercury on a Perkin Elmer FIMS 400 system.

The MDL for sediment mercury is presented in Table C-13. Acceptance criteria for mercury SRM is presented in Table C-14. All QA/QC summary data are presented in Table C-15.

All samples, with some noted exceptions, met the QA/QC criteria guidelines for accuracy and precision. One Pb and two Hg duplicate analysis RPDs were out of range due to low results and non-homogeneous sample matrices.

Analytical Methods - Dissolved Sulfides

Dissolved sulfides samples were analyzed in accordance with methods described in the ELOM LOPM. The MDL for dissolved sulfides is presented in Table C-16. Sediment dissolved sulfides QA/QC summary data are presented in Table C-17. All samples were analyzed within their required holding times. All analyses met the QA/QC criteria for blanks, blank spikes, matrix spike dups, and matrix spike precisions. One of seven sets of matrix spike and matrix spike dup recoveries was out of control due to matrix interferences.

Analytical Methods - Total Organic Carbon

Total Organic Carbon (TOC) samples were analyzed by a contract laboratory: ALS Environmental Services, Kelso, WA. The MDL for TOC is presented in Table C-16. Sediment TOC QA/QC summary data are presented in Table C-18. The samples were analyzed within their required holding times. Four samples were analyzed in duplicate and matrix spike. The samples and their duplicate analyses had a RPD of less than 10%. The recoveries for matrix spike were within 80-120% range.

Analytical Methods - Grain Size

Grain size samples were analyzed by a contract laboratory, EMSL Analytical, Cinnaminson, NJ. The MDL for sediment grain size is presented in Table C-16. Sediment grain size QA/QC summary data are presented in Table C-19. Twelve samples and their duplicate analyses had a RPD ≤10%.

SECOND QUARTER (OCTOBER 2012)

OCSD's ELOM laboratory received 9 sediment samples from the ELOM's ocean monitoring staff during the month of November 2012. All samples were stored according to methods described in the ELOM LOPM. All samples were analyzed for organochlorine pesticides, PCB congeners, PAHs, trace metals, mercury, dissolved sulfides, grain size, and TOC.

All sediment samples that were analyzed for organochlorine pesticides and PCB congeners were extracted during the month of February 2013. All sediment samples that were analyzed for PAHs were extracted during the month of March 2013. Any variances are noted in the Comments/Notes section of each batch summary. All sediment samples were extracted using an ASE. All sediment extracts were analyzed by GC/MS.

All samples were analyzed for metals within their holding times. Sediment metals QA/QC summary data are presented in Table C-15.

Sediment mercury QA/QC summary data are presented in Table C-15. All samples met the QA criteria guidelines.

The analyses for dissolved sulfides and TOC met criteria guidelines as specified in the project QAPP. MDL, SRM, and QA/QC summary data are presented in Tables C-16through C-19.

THIRD QUARTER (MARCH 2013)
SEMI ANNUAL COLLECTION (per new permit)

OCSD's Environmental Laboratory and Ocean Monitoring (ELOM) laboratory received 29 sediment samples from the ELOM's ocean monitoring staff during the month of March 2013. All samples were stored according to methods described in the ELOM LOPM. All samples were analyzed for organochlorine pesticides, PCB congeners, PAHs, trace metals, mercury, dissolved sulfides, grain size, TOC, total nitrogen, and total phosphorus.

All sediment samples that were analyzed for organochlorine pesticides and PCB congeners were extracted during the months of June and July 2013. All sediment samples that were analyzed for PAHs were extracted during the months of May and July 2013. Any variances are noted in the Comments/Notes section of each batch summary. All sediment samples were extracted using an ASE. All sediment extracts were analyzed by GC/MS.

All samples were analyzed for metals within their holding times. Sediment metals QA/QC summary data are presented in Table C-15. Sediment mercury QA/QC summary data are presented in Table C-15. All samples met the QA criteria guidelines.

Analytical Methods – Total Nitrogen
Total Nitrogen samples were analyzed in accordance with methods described in the ELOM LOPM. The MDL for total nitrogen is presented in Table C-16. Sediment total nitrogen QA/QC summary data are presented in Table C-20.

Analytical Methods – Total Phosphorus
Total phosphorus samples were analyzed in accordance with methods described in the ELOM LOPM. The MDL for total phosphorus is presented in Table C-16. Sediment total phosphorus QA/QC summary data are presented in Table C-20.

The analyses for TOC, dissolved sulfide, grain size, total nitrogen and total phosphorus met the QA criteria guidelines specified in the QAPP. MDL, SRM, and QA/QC summary data are presented in Tables C-16 through C-19. Thirty grain size standard reference material (SRM) samples were analyzed and all analyses were within three standard deviations of SRM for the statistical parameters (median phi, dispersion, and skewness), percent gravel, percent sand, percent clay, and percent silt.

Table C-6. Method detection levels for PAH and LAB compounds in sediments, July 2012–June 2013.

Orange County Sanitation District, California.

Parameter	Accelerated Solvent Extraction SIM Detection Limit, (ng/g dry weight)	Parameter	Accelerated Solvent Extraction SIM Detection Limit, (ng/g dry weight)
PAH Compounds			
1,6,7-Trimethylnaphthalene	0.10	Benzo[g,h,I]perylene	0.10
1-Methylnaphthalene	0.10	Benzo[k]fluoranthene	0.10
1-Methylphenanthrene	0.10	Biphenyl	0.10
2,3,6-Trimethylnaphthalene	1.0*	Chrysene	0.10
2,6-Dimethylnaphthalene	0.10	Dibenz[a,h]anthracene	0.10
2-Methylnaphthalene	0.50	Dibenzothiophene	0.10
Acenaphthene	0.40	Fluoranthene	0.10
Acenaphthylene	0.40	Fluorene	0.20
Anthracene	0.10	Indeno[1,2,3-c,d]pyrene	0.10
Benz[a]anthracene	0.200.10	Naphthalene	0.80
Benzo[a]pyrene	0.10	Perylene	0.10
Benzo[b]fluoranthene	0.10	Phenanthrene	0.10
Benzo[e]pyrene	0.10	Pyrene	0.10
PAH Alkylated Homologues			
C1-Chrysenes	2	C1-Fluoranthenes/Pyrenes	2
C2-Chrysenes	2	C1-Naphthalenes	2
C3-Chrysenes	2	C2-Naphthalenes	2
C4-Chrysenes	2	C3-Naphthalenes	2
C1-Dibenzothiophenes	2	C4-Naphthalenes	2
C2-Dibenzothiophenes	2	C1-Phenanthrenes/Anthracenes	2
C3-Dibenzothiophenes	2	C2-Phenanthrenes/Anthracenes	2
C1-Fluorenes	2	C3-Phenanthrenes/Anthracenes	2
C2-Fluorenes	2	C4-Phenanthrenes/Anthracenes	2
C3-Fluorenes	2		
LAB Compounds			
2-Phenyldecane	0.10	6-Phenyltetradecane	0.20
3-Phenyldecane	0.10	7-Phenyltetradecane	0.20
4-Phenyldecane	0.10	2-Phenylundecane	0.20
5-Phenyldecane	0.10	3-Phenylundecane	0.10
2-Phenyltridecane	0.70	4-Phenylundecane	0.10
3-Phenyltridecane	0.40	5-Phenylundecane	0.15
4-Phenyltridecane	0.50	6-Phenylundecane	0.10
5-Phenyltridecane	0.60	2-Phenyldodecane	0.20
6-Phenyltridecane+7-Phenyltridecane	1.0	3-Phenyldodecane	0.30
2-Phenyltetradecane	0.10	4-Phenyldodecane	0.30
3-Phenyltetradecane	0.10	5-Phenyldodecane	0.30
4-Phenyltetradecane	0.10	6-Phenyldodecane	0.40
5-Phenyltetradecane	0.20		

*Reporting Limit

Table C-7. Acceptance criteria for standard reference materials of PAHs in sediments, July 2012–June 2013.

Orange County Sanitation District, California.

Compound Name	True Value µg/g	Certified Acceptance Criteria µg/g	
		Min.	Max.
SRM 1944A - Organics in Marine Sediment National Institute of Standards and Technology.			
Anthracene	1.77	0.44	2.21
Benz[a]anthracene	4.72	1.18	5.90
Benzo[a]pyrene	4.30	1.08	5.38
Benzo[b]fluoranthene	3.87	0.97	4.84
Benzo[e]pyrene	3.28	0.82	4.10
Benzo[g,h,i]perylene	2.84	0.71	3.55
Benzo[k]fluoranthene	2.30	0.58	2.88
Chrysene	4.86	1.22	6.08
Dibenz[a,h]anthracene	0.42	0.11	0.53
Fluoranthene	8.92	2.23	11.15
Indeno(1,2,3-c,d)pyrene	2.78	0.70	3.48
Naphthalene	1.65	0.41	2.06
Perylene	1.17	0.29	1.46
Phenanthrene	5.27	1.32	6.59
Pyrene	9.70	2.43	12.13
SRM 1941B - Organics in Marine Sediment National Institute of Standards and Technology			
Anthracene	184	110	258
Benz[a]anthracene	335	201	469
Benzo[a]pyrene	358	215	501
Benzo[b]fluoranthene	453	272	634
Benzo[e]pyrene	325	195	455
Benzo[g,h,i]perylene	307	184	430
Benzo[k]fluoranthene	225	135	315
Chrysene	291	175	407
Dibenz[a,h]anthracene	53	32	74
Fluoranthene	651	391	911
Indeno(1,2,3-c,d)pyrene	341	205	477
Naphthalene	848	509	1,187
Perylene	397	238	556
Phenanthrene	406	244	568
Pyrene	581	349	813

Table C-8. Sediment PAH/LAB QA/QC summary, July 2012–June 2013.

Orange County Sanitation District, California.

Quarter	Sample Set	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD	Comments
1	Sedcore_Jul12_EJ	PAH SRM 1944	15	13	25% of the certified or published acceptance limits[1]	NA	93% Pass
		PAH SRM 1941b	15	13			93% Pass
		PAH Reporting Level Spike	26	25	60 -120		96% Pass
		LAB Reporting Level Spike	25	25			100% Pass
		PAH Matrix Spike					
		Based on Mean of MS and MSD	26	25	40 - 120	NA	96% Pass
		LAB Matrix Spike					
		Based on Mean of MS and MSD	25	25	40 - 120	NA	100% Pass
		PAH Duplicate Analysis - #1	14	3	NA	< 20% @ 3 x MDL of Sample Mean	21% Pass
		PAH Duplicate Analysis - #2	13	0			0% Fail
		LAB Duplicate Analysis - #1	14	12			86% Pass
		PAH Duplicate Analysis - #2	13	11			85% Pass
1	Sedcore_Jul12_EK	PAH SRM 1944	15	13	25% of the certified or published acceptance limits[1]	NA	93% Pass
		PAH SRM 1941b	15	13			93% Pass
		PAH Reporting Level Spike	26	26	60 -120		100% Pass
		LAB Reporting Level Spike	25	24			96% Pass
		PAH Matrix Spike					
		Based on Mean of MS and MSD	26	24	40 - 120	NA	92% Pass
		LAB Matrix Spike					
		Based on Mean of MS and MSD	25	25	40 – 120	NA	100% Pass
		PAH Duplicate Analysis - #1	13	8	NA	< 20% @ 3 x MDL of Sample Mean	62% Fail
		PAH Duplicate Analysis - #2	13	0			0% Fail
		LAB Duplicate Analysis - #1	8	5			63% Fail
		PAH Duplicate Analysis - #2	18	16			89% Pass

Table C-8 Continues.

Table C-8 Continued.

Quarter	Sample Set	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD	Comments
1	Sedcore_Jul12_EL	PAH SRM 1944	15	13	25% of the certified or published acceptance limits[1]	NA	93% Pass
		PAH SRM 1941b	15	13			93% Pass
		PAH Reporting Level Spike	26	26	60 -120		100% Pass
		LAB Reporting Level Spike	25	25			100% Pass
		PAH Matrix Spike					
		Based on Mean of MS and MSD	26	26	40 - 120	NA	100% Pass
		LAB Matrix Spike					
		Based on Mean of MS and MSD	25	25	40 - 120	NA	100% Pass
		PAH Duplicate Analysis - #1	8	3	NA	< 20% @ 3 x MDL of Sample Mean	38% Fail
		PAH Duplicate Analysis - #2	18	13			72% Fail
		LAB Duplicate Analysis - #1	8	6			75% Fail
		LAB Duplicate Analysis - #2	9	7			78% Fail
1	Sedcore_Jul12_EM	PAH SRM 1944	15	12	25% of the certified or published acceptance limits[1]	NA	80% Pass
		PAH SRM 1941b	15	13			93% Pass
		PAH Reporting Level Spike	26	26	60 -120		100% Pass
		LAB Reporting Level Spike	25	24			96% Pass
		PAH Matrix Spike					
		Based on Mean of MS and MSD	26	26	40 - 120	NA	100% Pass
		LAB Matrix Spike					
		Based on Mean of MS and MSD	25	25	40 - 120	NA	100% Pass
		PAH Duplicate Analysis - #1	4	4	NA	< 20% @ 3 x MDL of Sample Mean	100% Pass
		PAH Duplicate Analysis - #2	5	4			80% Pass
		LAB Duplicate Analysis - #1	14	11			79% Fail
		LAB Duplicate Analysis - #2	11	11			100% Pass

Table C-8 Continues.

Table C-8 Continued.

Quarter	Sample Set	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD	Comments
2	Sedcore_Nov12_EN	PAH SRM 1944	15	13	25% of the certified or published acceptance limits[1]	NA	93% Pass
		PAH SRM 1941b	15	13			93% Pass
		PAH Reporting Level Spike	26	26	60 -120		100% Pass
		LAB Reporting Level Spike	25	23			92% Pass
		PAH Matrix Spike					
		Based on Mean of MS and MSD	26	26	40 - 120	NA	100% Pass
		LAB Matrix Spike					
		Based on Mean of MS and MSD	25	24			96% Pass
		PAH Duplicate Analysis - #1	8	2	NA	< 20% @ 3 x MDL of Sample Mean	25% Fail
		PAH Duplicate Analysis - #2	1	0			0% Fail
		LAB Duplicate Analysis - #1	0	0	NA	< 20% @ 3 x MDL of Sample Mean	NA
		LAB Duplicate Analysis - #2	0	0			NA
3	Sedcore_Mar13_EP	PAH SRM 1944	15	12	25% of the certified or published acceptance limits[1]	NA	80% Pass
		PAH SRM 1941b	15	13			93% Pass
		PAH Reporting Level Spike	26	22	60 -120		85% Pass
		PAH Matrix Spike					
		Based on Mean of MS and MSD	26	26	40 - 120	NA	100% Pass
		PAH Duplicate Analysis - #1	24	0	NA	< 20% @ 3 x MDL of Sample Mean	0% Fail
		PAH Duplicate Analysis - #2	23	1			4% Fail

Table C-8 Continues.

Table C-8 Continued.

Quarter	Sample Set	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD	Comments
3	Sedcore_Mar13_EN	PAH SRM 1944	15	13	25% of the certified or published acceptance limits[1]	NA	93% Pass
		PAH SRM 1941b	15	13			93% Pass
		PAH Reporting Level Spike	26	22	60 -120		85% Pass
		PAH Matrix Spike					
		Based on Mean of MS and MSD	26	25	40 - 120	NA	100% Pass
		PAH Duplicate Analysis - #1	11	1	NA	< 20% @ 3 x MDL of Sample Mean	9% Fail
		PAH Duplicate Analysis - #2	12	0			0% Fail

Notes: [1] SRM certified values are based on the addition of selected compounds prior to extraction for use as internal standards for quantification purposes.

(NIST, Certificate of Analysis, SRM 1941b, SRM 1944a, Organics in Marine Sediment).

OCSD laboratory results are not corrected for surrogate recoveries, causing some analytes with lower molecular weights and boiling points to fail the established criteria for SRM certified values

Higher RSD values occurred for the individual analytes that were associated with concentrations near the method detection limits. Corrective action for low % precision involved a review of sample preparation before extraction.

Matrix interferences from duplicate analyses and or matrix spike samples have caused some analytes to fail the established criteria for precision factors and % recoveries respectively. Visual inspection of the replicate samples and the spike samples did not reveal any obvious interference. A system check was performed prior to sample analysis and all the analytes of concern from calibration standards were within specifications. Data set integrity was verified and accepted.

N/A=not applicable

Table C-9. Method detection levels for PCB congeners and pesticides in sediments, GC/MS Scion SQ, July 2012–June 2013

Orange County Sanitation District, California.

Parameter	ASE & GC/MS Method Detection Limit (ng/g dry weight)	Parameter	ASE & GC/MS Method Detection Limit (ng/g dry weight)
Aldrin	0.3	PCB 87	0.1
cis-Chlordane	0.1	PCB 99	0.1
Dieldrin	0.2	PCB 101	0.1
Endrin	0.5*	PCB 105	0.1
gamma-BHC	0.5*	PCB 110	0.1
trans-Chlordane	0.1	PCB 114	0.1
Heptachlor	0.5*	PCB 118	0.1
Heptachlor epoxide	1*	PCB 119	0.1
Hexachlorobenzene	0.3	PCB 123	0.1
Mirex	0.1	PCB 126	0.1
trans-Nonachlor	5*	PCB 128	0.1
Endosulfan-*alpha*	2*	PCB 138	0.1
Endosulfan-*beta*	5*	PCB 149	0.1
Endosulfan sulfate	0.5*	PCB 151	0.1
2,4'-DDD (o,p'-DDD)	0.1	PCB 153	NA
2,4'-DDE (o,p'-DDE)	0.1	PCB 153/168	0.2
2,4'-DDT (o,p'-DDT)	0.2	PCB 156	0.1
4,4'-DDD (p,p'-DDD)	0.5*	PCB 157	0.1
4,4'-DDE (p,p'-DDE)	0.3	PCB 158	0.1
4,4'-DDT (p,p'-DDT)	0.5*	PCB 167	0.1
4,4'-DDMU	0.1	PCB 168	NA
PCB 8	0.1	PCB 169	0.1
PCB 18	0.1	PCB 170	0.1
PCB 28	0.1	PCB 177	0.1
PCB 37	0.1	PCB 180	0.1
PCB 44	0.1	PCB 183	0.1
PCB 49	0.1	PCB 187	0.1
PCB 52	0.1	PCB 189	0.1
PCB 66	0.1	PCB 194	0.1
PCB 70	0.1	PCB 195	0.1
PCB 74	0.1	PCB 201	0.1
PCB 77	0.1	PCB 206	0.1
PCB 81	0.1	PCB 209	0.1

* Value is the reporting limit (RL).

NA = Not analyzed.

Table C-10. Method detection levels for PCB congeners and pesticides in sediments, DSQII, July 2012–June 2013

Orange County Sanitation District, California.

Parameter	ASE & GC/MS/MS Method Detection Limit (ng/g dry weight)	Parameter	ASE & GC/MS Method Detection Limit (ng/g dry weight)
Aldrin	0.06	PCB 87	0.06
cis-Chlordane	0.13	PCB 99	0.17
Dieldrin	0.16	PCB 101	0.13
Endrin	0.15	PCB 105	0.14
gamma-BHC	0.06	PCB 110	0.07
trans-Chlordane	0.05	PCB 114	0.13
Heptachlor	0.06	PCB 118	0.07
Heptachlor epoxide	0.08	PCB 119	0.11
Hexachlorobenzene	0.04	PCB 123	0.11
Mirex	0.14	PCB 126	0.08
trans-Nonachlor	0.09	PCB 128	0.14
Endosulfan-alpha	1.0*	PCB 138	0.13
Endosulfan-beta	1.0*	PCB 149	0.11
Endosulfan sulfate	1.0*	PCB 151	0.10
2,4'-DDD (o,p'-DDD)	0.14	PCB 153	NA
2,4'-DDE (o,p'-DDE)	0.11	PCB 153/168	0.25
2,4'-DDT (o,p'-DDT)	0.14	PCB 156	0.07
4,4'-DDD (p,p'-DDD)	0.10	PCB 157	0.09
4,4'-DDE (p,p'-DDE)	0.08	PCB 158	0.12
4,4'-DDT (p,p'-DDT)	0.13	PCB 167	0.11
4,4'-DDMU	0.08	PCB 168	NA
PCB 8	0.06	PCB 169	0.13
PCB 18	0.04	PCB 170	0.08
PCB 28	0.05	PCB 177	0.10
PCB 37	0.15	PCB 180	0.11
PCB 44	0.09	PCB 183	0.13
PCB 49	0.07	PCB 187	0.11
PCB 52	0.05	PCB 189	0.10
PCB 66	0.09	PCB 194	0.17
PCB 70	0.11	PCB 195	0.13
PCB 74	0.11	PCB 201	0.17
PCB 77	0.07	PCB 206	0.16
PCB 81	0.07	PCB 209	0.29

* Value is the reporting limit (RL).

NA = Not analyzed.

Table C-11. Acceptance criteria for standard reference materials of pesticides/PCBs in sediments, July 2012–June 2013

Orange County Sanitation District, California.

Parameter	True Value (ng/g)	Acceptance Range (ng/g)		Parameter	True Value (ng/g)	Acceptance Range (ng/g)	
		min.	max.			min.	max.
SRM 1944a - Organics in Marine Sediment, National Institute of Standards and Technology, New York/New Jersey Waterway Sediment							
cis-Chlordane	16.51	15.7	17.3	PCB 99	37.5	35.1	39.9
trans-Chlordane *	8.00	6.00	10.0	PCB 101	73.4	70.9	75.9
Hexachlorobenzene	6.0	5.68	6.38	PCB 105	24.5	23.4	25.6
trans-Nonachlor	8.20	7.69	8.71	PCB 110	63.5	58.8	68.2
2,4'-DDD *	38.0	30.0	46.0	PCB 118	58.0	53.7	62.3
2,4'-DDE *	19.0	16.0	22.0	PCB 128	8.47	8.19	8.75
4,4'-DDD *	108	92.0	124	PCB 138	62.1	59.1	65.1
4,4'-DDE *	86.0	74.0	98.0	PCB 149	49.7	48.5	50.9
4,4'-DDT	119	108	130	PCB 151	16.93	16.57	17.3
2,4'-DDD *	38.0	30.0	46.0	PCB 153	74.0	71.1	76.9
PCB 8	22.3	20.0	24.6	PCB 156	6.52	5.86	7.18
PCB 18	51.0	48.4	53.6	PCB 170	22.6	21.2	24.0
PCB 28	80.8	78.1	83.5	PCB 180	44.3	43.1	45.5
PCB 44	60.2	58.2	62.2	PCB 183	12.19	11.6	12.8
PCB 49	53.0	51.3	54.7	PCB 187	25.1	24.1	26.1
PCB 52	79.4	77.4	81.4	PCB 194	11.2	9.80	12.6
PCB 66	71.9	67.6	76.2	PCB 195	3.75	3.36	4.14
PCB 87	29.9	25.6	34.2	PCB 206	9.21	8.70	9.72
SRM 1941B - Organics in Marine Sediment, National Institute of Standards and Technology, New York/New Jersey Waterway Sediment							
cis-Chlordane	0.850	0.740	0.960	PCB 99	2.90	2.54	3.26
trans-Chlordane	0.566	0.473	0.659	PCB 101	5.11	4.77	5.45
Hexachlorobenzene	5.83	5.45	6.21	PCB 105	1.43	1.33	1.53
trans-Nonachlor	0.438	0.365	0.511	PCB 110	4.62	4.26	4.98
2.4'-DDE *	0.380	0.260	0.500	PCB 118	4.23	4.04	4.42
4,4'-DDE	3.22	2.94	3.50	PCB 128	0.696	0.652	0.740
4,4'-DDD	4.66	4.20	5.12	PCB 138	3.60	3.32	3.88
4,4'-DDT *	1.12	0.700	1.54	PCB 149	4.35	4.09	4.61
PCB 8	1.65	1.46	1.84	PCB 153/168	5.47	5.15	5.79
PCB 18	2.39	2.10	2.68	PCB 156	0.507	0.417	0.597
PCB 28	4.52	3.95	5.09	PCB 158 *	0.650	0.500	0.800
PCB 44	3.85	3.65	4.05	PCB 170	1.35	1.26	1.44
PCB 49	4.34	4.06	4.62	PCB 180	3.24	2.73	3.75
PCB 52	5.24	4.96	5.52	PCB 183	0.979	0.892	1.07
PCB 66	4.96	4.43	5.49	PCB 187	2.17	1.95	2.39
PCB 70 *	4.99	4.70	5.28	PCB 194	1.04	0.980	1.10
PCB 74 *	2.04	1.89	2.19	PCB 195	0.645	0.585	0.705
PCB 77 *	0.310	0.280	0.340	PCB 201	0.770	0.736	0.804
PCB 87	1.14	0.980	1.30	PCB 206	2.42	2.23	2.61
PCB 8	1.65	1.46	1.84	PCB 209	4.86	4.41	5.31
PCB 18	2.39	2.10	2.68				

* non-certified

Table C-12. Sediment PCB/pesticide QA/QC summary, July 2012–June 2013.

Orange County Sanitation District, California.

Quarter	Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
1	FB	PCB	SRM 1944a	27	16	25% of the certified ranges or published acceptance limits	NA
		PCB	SRM 1941b	27	26		
		PCB	Reporting Level Spike	44	44	60 -120	NA
		PCB	Matrix Spike	44	41	40 - 120	NA
		PCB	Matrix Spike Dup	44	44	40 - 120	NA
		PCB	Matrix Spike Precision	44	41	NA	< 20%
		Pesticide	SRM 1944a	4	3	25% of the certified ranges or published acceptance limits	NA
		Pesticide	SRM 1941b	6	6		
		Pesticide	Reporting Level Spike	21	20	60 -120	NA
		Pesticide	Matrix Spike	21	20	40 - 120	NA
		Pesticide	Matrix Spike Dup	21	20	40 - 120	NA
		Pesticide	Matrix Spike Precision	21	19	NA	< 20%
		PCB	Duplicate 1	0	0	NA	< 20% @ 3 x MDL of Sample Mean.
		Pesticides	Duplicate 1	1	1	NA	
		PCBs and Pesticides	Duplicate 1 Sum	1	1	NA	NA
		PCB	Duplicate 2	0	1	NA	< 20% @ 3 x MDL of Sample Mean.
		Pesticides	Duplicate 2	0	0	NA	
		PCBs and Pesticides	Duplicate 2 Sum	1	1	NA	NA
1	FC	PCB	SRM 1944a	27	NA*	25% of the certified ranges or published acceptance limits	NA
		PCB	SRM 1941b	27	NA*		
		PCB	Reporting Level Spike	44	44	60 -120	NA
		PCB	Matrix Spike	44	44	40 - 120	NA
		PCB	Matrix Spike Dup	44	44	40 - 120	NA
		PCB	Matrix Spike Precision	44	44	NA	< 20%
		Pesticide	SRM 1944a	4	NA*	25% of the certified ranges or published acceptance limits	NA
		Pesticide	SRM 1941b	6	NA*		
		Pesticide	Reporting Level Spike	21	21	60 -120	NA
		Pesticide	Matrix Spike	21	21	40 - 120	NA
		Pesticide	Matrix Spike Dup	21	21	40 - 120	NA
		Pesticide	Matrix Spike Precision	21	21	NA	< 20%
		PCB	Duplicate 1	0	1	NA	< 20% @ 3 x MDL of Sample Mean.
		Pesticide	Duplicate 1	1	1	NA	
		PCBs and Pesticides	Duplicate 1 Sum	1	1	NA	NA
		PCB	Duplicate 2	NA	NA	NA	< 20% @ 3 x MDL of Sample Mean.
		Pesticide	Duplicate 2	NA	NA	NA	
		PCBs and Pesticides	Duplicate 2 Sum	NA	NA	NA	NA

Table C-12 continues.

Table C-12 Continued

Quarter	Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
3	FE	PCB	SRM 1944a	27	20	25% of the certified ranges or published acceptance limits	NA
		PCB	SRM 1941b	27	22		
		PCB	Reporting Level Spike	44	44	60 -120	NA
		PCB	Matrix Spike	44	44	40 - 120	NA
		PCB	Matrix Spike Dup	44	44	40 - 120	NA
		PCB	Matrix Spike Precision	44	44	NA	< 20%
		Pesticide	SRM 1944a	4	2	25% of the certified ranges or published acceptance limits	NA
		Pesticide	SRM 1941b	6	2		
		Pesticide	Reporting Level Spike	21	20	60 -120	NA
		Pesticide	Matrix Spike	21	20	40 - 120	NA
		Pesticide	Matrix Spike Dup	21	20	40 - 120	NA
		Pesticide	Matrix Spike Precision	21	21	NA	< 20%
		PCB	Duplicate 1	16	12	NA	< 20% @ 3 x MDL of Sample Mean.
		Pesticides	Duplicate 1	7	6	NA	
		PCBs and Pesticides	Duplicate 1 Sum	1	1	NA	NA
		PCB	Duplicate 2	23	1	NA	< 20% @ 3 x MDL of Sample Mean.
		Pesticides	Duplicate 2	5	2	NA	
		PCBs and Pesticides	Duplicate 2 Sum	1	0	NA	NA
3	FF	PCB	SRM 1944a	27	25	25% of the certified ranges or published acceptance limits	NA
		PCB	SRM 1941b	27	21		
		PCB	Reporting Level Spike	44	40	60 -120	NA
		PCB	Matrix Spike	44	44	40 - 120	NA
		PCB	Matrix Spike Dup	44	44	40 - 120	NA
		PCB	Matrix Spike Precision	44	44	NA	< 20%
		Pesticide	SRM 1944a	4	2	25% of the certified ranges or published acceptance limits	NA
		Pesticide	SRM 1941b	6	2		
		Pesticide	Reporting Level Spike	21	17	60 -120	NA
		Pesticide	Matrix Spike	21	15	40 - 120	NA
		Pesticide	Matrix Spike Dup	21	19	40 - 120	NA
		Pesticide	Matrix Spike Precision	21	20	NA	< 20%
		PCB	Duplicate 1	19	7	NA	< 20% @ 3 x MDL of Sample Mean.
		Pesticide	Duplicate 1	3	0	NA	
		PCBs and Pesticides	Duplicate 1 Sum	0	1	NA	NA
		PCB	Duplicate 2	3	2	NA	< 20% @ 3 x MDL of Sample Mean.
		Pesticide	Duplicate 2	3	3	NA	
		PCBs and Pesticides	Duplicate 2 Sum	1	1	NA	NA

Comments:

Review of calibration check standards injected after sample injections, extraction notes, and instrument conditions did not indicate any atypical circumstances.

NA = Not Applicable

Table C-13. Method detection limits for trace metals in sediments, July 2012–June 2013.

Orange County Sanitation District, California.

Parameter	Detection Limits (mg/kg dry weight)
Aluminum	50
Arsenic	0.15
Beryllium	0.01
Cadmium	0.01
Chromium	0.15
Copper	0.10
Iron	50
Lead	0.10
Nickel	0.10
Mercury	0.00011
Selenium	0.15
Silver	0.02
Zinc	0.15

Table C-14. Acceptance criteria for standard reference materials of metals in sediments, July 2012–June 2013

Orange County Sanitation District, California.

Environmental Resource Associates D069-540 Priority PollutnT™/CLP Inorganic Soils – Microwave Digestion Environmental Resource Associates			
Parameter	True Value (mg/kg)	Certified Acceptance Criteria (mg/kg)	
		Min.	Max.
Aluminum	9780	4340	15200
Arsenic	109	76.2	143
Beryllium	92.1	68.6	116
Cadmium	110	80.6	139
Chromium	93.4	64.7	122
Copper	74.7	55.0	94.5
Iron	13100	4250	21900
Lead	152	112	192
Nickel	109	78.8	138
Mercury	16.3	8.37	24.2
Selenium	207	142	272
Silver	51.9	34.5	69.2
Zinc	299	214	383

Table C-15. Sediment metals QA/QC summary, July 2012–June 2013.

Orange County Sanitation District, California.

Quarter	Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
Summer	HMSED120905-1	Arsenic, Beryllium, Cadmium, Chromium, Copper, Lead, Nickel, Selenium, Silver, Zinc	Blank	36	36	<3X MDL	N/A
			Blank Spike	12	12	90-110	N/A
			Matrix Spike	24	22	70-130	
			Matrix Spike Dup	24	22	70-130	
			Matrix Spike Precision	24	24		< 25%
			Duplicate Analysis	24	24	NA	@ ≥ 10 X MDL < 30%
			CRM Analysis	12	12	80-120% or certified value, whichever is greater.	
Summer	HMSED121024-1	Arsenic, Beryllium, Cadmium, Chromium, Copper, Lead, Nickel, Selenium, Silver, Zinc	Blank	48	48	<3X MDL	N/A
			Blank Spike	24	21***	90-110	N/A
			Matrix Spike	24	22**	70-130	
			Matrix Spike Dup	24	22**	70-130	
			Matrix Spike Precision	24	24		< 25%
			Duplicate Analysis	24	21**	NA	@ ≥ 10 X MDL < 30%
Summer	HMSED121031-1	Arsenic, Beryllium, Cadmium, Chromium, Copper, Lead, Nickel, Selenium, Silver, Zinc	Blank	36	36	<3X MDL	N/A
			Blank Spike	24	22***	90-110	N/A
			Matrix Spike	36	33**	70-130	
			Matrix Spike Dup	36	33**	70-130	
			Matrix Spike Precision	36	36		< 25%
			Duplicate Analysis	36	35**	NA	@ ≥ 10 X MDL < 30%
Summer	HMSED121128-1	Arsenic, Beryllium, Cadmium, Chromium, Copper, Lead, Nickel, Selenium, Silver, Zinc	Blank	36	36	<3X MDL	N/A
			Blank Spike	24	21***	90-110	N/A
			Matrix Spike	36	32**	70-130	
			Matrix Spike Dup	36	32**	70-130	
			Matrix Spike Precision	36	36		< 25%
			Duplicate Analysis	36	34**	NA	@ ≥ 10 X MDL < 30%
Summer	ALFESED120907-1	Aluminum, Iron	Blank	6	6	<3X MDL	N/A
			Duplicate Analysis	4	4	NA	
			CRM Analysis	2	2	80-120% or certified value, whichever is greater.	

Table C-15 Continues.

Table C-15 Continued.

Quarter	Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
Summer	ALFESED121025-1	Aluminum, Iron	Blank	8	8	<3X MDL	N/A
			Duplicate Analysis	4	4	NA	@ ≥ 10 X MDL < 30%
Summer	ALFESED121108-1	Aluminum, Iron	Blank	6	6	<3X MDL	N/A
			Duplicate Analysis	6	6	NA	@ ≥ 10 X MDL < 30%
Summer	ALFESED121128-1	Aluminum, Iron	Blank	6	6	<3X MDL	N/A
			Duplicate Analysis	6	6	NA	@ ≥ 10 X MDL < 30%
Summer	HGSED120813-1	Mercury	Blank	4	4	<2X MDL	N/A
			Blank Spike	3	3	90-110	N/A
			Matrix Spike	6	4	70-130	
			Matrix Spike Dup	6	4	70-130	
			Matrix Spike Precision	6	4		< 25%
			Duplicate Analysis	6	4	NA	@ ≥ 10 X MDL < 30%
			CRM Analysis	1	1	80-120% or certified value, whichever is greater.	
Summer	HGSED120824-1	Mercury	Blank	3	3	<2X MDL	N/A
			Blank Spike	2	2	90-110	N/A
			Matrix Spike	4	4	70-130	
			Matrix Spike Dup	4	4	70-130	
			Matrix Spike Precision	4	4		< 25%
			Duplicate Analysis	4	3**	NA	@ ≥ 10 X MDL < 30%
Summer	HGSED120905-1	Mercury	Blank	2	2	<2X MDL	N/A
			Blank Spike	2	1*	90-110	N/A
			Matrix Spike	4	4	70-130	
			Matrix Spike Dup	4	4	70-130	
			Matrix Spike Precision	4	4		< 25%
			Duplicate Analysis	4	2**	NA	@ ≥ 10 X MDL < 30%
Winter	HMSED130722-1	Aluminum, Iron	Blank	8	8	<3X MDL	N/A
			Duplicate Analysis	6	6	NA	@ ≥ 10 X MDL < 30%

Table C-15 Continues.

Table C-15 Continued.

Quarter	Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
Winter	HGSED130619-1	Mercury	Blank	2	2	<2X MDL	N/A
			Blank Spike	2	2	90-110	N/A
			Matrix Spike	3	2	70-130	
			Matrix Spike Dup	3	2**	70-130	
			Matrix Spike Precision	3	2**		< 25%
			Duplicate Analysis	3	3	NA	@ ≥ 10 X MDL < 30%
			CRM Analysis	1	1	80-120% or certified value, whichever is greater.	
Winter	HMSED130904-1	Arsenic, Beryllium, Cadmium, Chromium, Copper, Lead, Nickel, Selenium, Silver, Zinc	Blank	48	47****	<3X MDL	N/A
			Blank Spike	24	24	90-110	N/A
			Matrix Spike	36	33**	70-130	
			Matrix Spike Dup	36	32**	70-130	
			Matrix Spike Precision	36	36		< 20%
			Duplicate Analysis	36	36**	NA	@ ≥ 10 X MDL < 30%
			CRM Analysis	12	9	80-120% or certified value, whichever is greater.	

NA = Not applicable.

* Hg Blank spike 89.21%, Matrix Spk and SR acceptable for accociated data.

** Out of range due to non-homogeneous sample matrices.

*** Cr, Se, and Zn recoveries out of control blank spikes (86%-110.5%) all other metal recoveries acceptable.

**** Zn Blank out of range, result acceptable when averaged with accociated blanks.

Table C-16. Method Detection Limits for Dissolved Sulfides, Total Organic Carbon, and Grain Size in Sediments, July 2012–June 2013.

Orange County Sanitation District, California.

Parameter	Detection Limits
Dissolved Sulfides (OCSD)	1.03 mg/kg dry weight
Total Organic Carbon (Columbia Analytical Services)	0.05 %
Total Nitrogen	7.4 mg/kg dry weight
Total Phosphorus	3.7 mg/kg dry weight
Grain Size (Weston Solutions, Inc.)	0.001 %

Table C-17. Sediment Dissolved Sulfides QA/QC Summary, July 2012–June 2013.

Orange County Sanitation District, California.

Quarter	Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
Summer	SULFIDE120921-1 SULFIDE120924-1 SULFIDE120925-1 SULFIDE121002-1 SULFIDE121008-1 SULFIDE121010-1 SULFIDE121016-1	Dissolved Sulfides	Method Blank	7	7	<2X MDL	N/A
			Blank Spike	7	7	80 -120	N/A
			Matrix Spike	7	6*	70 - 130	
			Matrix Spike Dup	7	6*	70 - 130	
			Matrix Spike Precision	7	7		<30%
Fall	SULFIDE121210-1	Dissolved Sulfides	Method Blank	1	1	<2X MDL	N/A
			Blank Spike	1	1	80 -120	N/A
			Matrix Spike	1	1	70 - 130	
			Matrix Spike Dup	1	1	70 - 130	
			Matrix Spike Precision	1	1		<30%
Winter	SULFIDE130311-1 SULFIDE130313-1 SULFIDE130313-2	Dissolved Sulfides	Method Blank	3	3	<2X MDL	N/A
			Blank Spike	3	3	80 -120	N/A
			Matrix Spike	3	3	70 - 130	
			Matrix Spike Dup	3	3	70 - 130	
			Matrix Spike Precision	3	3		<30%

* Matrix spike and matrix spike duplicate recoveries (44% and 52%, respectively) was out of control due to matrix interferences.

Table C-18. Sediment Total Organic Carbon QA/QC Summary, July 2012–June 2013.

Orange County Sanitation District, California.

Quarter	Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
Summer	TOC-120820-1	Total Organic Carbon	Duplicate and Matrix Spike	4	4	80-120[1]	10%[1]
Fall	TOC-130213-1	Total Organic Carbon	Duplicate and Matrix Spike	1	1	80-120[1]	10%[1]
Winter	TOC-130418-1	Total Organic Carbon	Duplicate and Matrix Spike	2	2	80-120[1]	10%[1]

[1] TOC Target Precision/Accuracy of QC Criteria is not described in the Core Monitoring Quality Assurance Project Plan.

Table C-19. Sediment Grain Size QA/QC Summary, July 2012–June 2013.

Orange County Sanitation District, California.

Quarter	Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
Summer	PSIZE121105-1	Grain Size	Reference Standard	0	0	NA	Mean ± 3 σ of the reference standard for median phi, skewness, dispersion, % gravel, % sand, % clay, and % silt
			Duplicate	12	12		≤10%
Fall	PSIZE130214-1	Grain Size	Reference Standard	0	0	NA	Mean ± 3 σ of the reference standard for median phi, skewness, dispersion, % gravel, % sand, % clay, and % silt
			Duplicate	1	1		≤10%
Winter	PSIZE130409-1	Grain Size	Reference Standard	30	30	NA	Mean ± 3 σ of the reference standard for median phi, skewness, dispersion, % gravel, % sand, % clay, and % silt
			Duplicate	3	3		≤10%

Table C-20. Sediment Total Nitrogen and Total Phosphorus QA/QC Summary, January–June 2013.

Orange County Sanitation District, California.

Quarter	Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
Winter	TN130408-1	Total Nitrogen	Method Blank	2	2	-	N/A
			Blank Spike	2	2	80 -120	N/A
			Matrix Spike	2	2	70 - 130	
			Matrix Spike Dup	2	2	70 - 130	
			Matrix Spike Precision	2	2		<30%
Winter	TP130408-1	Total Phosphorus	Method Blank	2	2	-	N/A
			Blank Spike	2	2	80 -120	N/A
			Matrix Spike	2	2	70 - 130	
			Matrix Spike Dup	2	2	70 - 130	
			Matrix Spike Precision	2	2		<30%

FISH TISSUE CHEMISTRY NARRATIVE

FIRST QUARTER (JULY 2012)

Introduction

OCSD's Environmental Laboratory and Ocean Monitoring (ELOM) laboratory received 10 individual rig fish samples from ELOM's ocean monitoring staff during the month of July 2012. The individual samples were stored, dissected, and homogenized according to methods described in the OCSD ELOM LOPM. A 1:1 muscle to water ratio was used. After the individual samples were homogenized, equal aliquots of muscle from each sample were frozen and distributed to the metals and organic chemistry sections of the analytical chemistry laboratory for analyses.

The organic chemistry section extracted 10 fish muscle samples, and analyzed them for PCB congeners and organochlorine pesticides. Percent lipid content was also determined for each sample.

A typical organic tissue sample batch included 15 field samples with required QC samples. The QC samples included one hydromatrix blank, two duplicate sample extractions, one matrix spike, one matrix duplicate spike, two SRMs, and one reporting level spike (matrix of choice was tilapia).

For mercury analysis, one sample batch consisted of 15–20 fish tissue samples and the required QC samples, which included a blank, blank spike, SRM, sample duplicates, matrix spikes, and matrix spike duplicates.

Analytical Methods - Organochlorine Pesticides and PCB Congeners

The analytical methods used for organochlorine pesticides and PCB congeners were according to methods described in the ELOM LOPM. All fish tissue was extracted using an ASE 200 and analyzed by GC/MS.

The MDLs for pesticides and PCBs in fish tissue are presented in Table C-21. Acceptance criteria for PCB and pesticides SRMs in fish tissue are presented in Tables C-22 and C-23. Fish tissue pesticide and PCB QA/QC summary data are presented in Table C-24. All analyses were performed within the required holding times and with appropriate quality control measures. In cases where constituent concentrations exceeded the calibration range of the instrument, the samples were diluted and reanalyzed. Any variances that occurred during sample preparation or analyses are noted in the Comments/Notes section of each batch summary.

Analytical Methods – Lipid Content

Percent lipid content was determined for each sample of fish using methods described in the ELOM LOPM. Lipids were extracted by dichloromethane from approximately 1 to 2 g of sample and concentrated to 2 mL. A 100 µL aliquot of the extract was placed in a tarred aluminum weighing boat and the solvent allowed to evaporate to dryness. The remaining residue was weighed, and the percent lipid content calculated. Lipid content QA/QC summary data are presented in Table C-25. All analyses were performed within the required holding times and with appropriate quality control measures. Any variances that

occurred during sample preparation or analyses are noted in the Comments/Notes section of the Fish Tissue Percent QA/QC Summary.

Analytical Methods - Mercury

Fish tissue samples were analyzed for mercury in accordance with ELOM SOP 245.1A. Typical QC analyses for a tissue sample batch included a blank, a blank spike, and SRMs (liver and muscle). In the same batch, additional QC samples included duplicate analyses of the sample, spiked samples and duplicate spiked samples, which were run approximately once every 10 samples.

The MDL for fish mercury is presented in Table C-26. Acceptance criteria for the mercury SRMs are presented in Table C-27. Fish tissue mercury QA/QC summary data are presented in Table C-28. All samples were analyzed within their 6-month holding times and met the QA criteria guidelines.

Pretreated (resected and 1:1 Muscle: water homogenized) fish samples were analyzed for mercury in accordance with methods described in the ELOM LOPM. QC for a typical batch included a blank, a blank spike, and an SRM (whole fish). Fish samples with duplicates, spiked samples and duplicate spiked samples were run approximately once every ten fish samples. When sample mercury concentration exceeded the appropriate calibration curve, the sample was diluted with the reagent blank and reanalyzed. The samples were analyzed for mercury on a Perkin Elmer FIMS 400 system.

All samples met the QA criteria guidelines for accuracy and precision.

THIRD QUARTER (March 2013)

OCSD's Environmental Laboratory and Ocean Monitoring (ELOM) laboratory received 40 individual fish samples from ELOM's ocean monitoring staff during the month of March 2013. The individual samples were stored, dissected, and homogenized according to methods described in the OCSD ELOM LOPM. A 1:1 muscle to water ratio was used. No water was used during liver homogenization. After the individual samples were homogenized, equal aliquots of muscle and liver from each sample were frozen and distributed to the metals and organic chemistry sections of the analytical chemistry laboratory for analyses.

The organic chemistry section extracted 40 fish muscle samples and 40 liver samples, and analyzed them for PCB congeners and organochlorine pesticides. Percent lipid content was also determined for each sample.

Table C-21. Method detection levels for pesticides and PCB congeners in fish tissue, DSQII July 2012– June 2013

Orange County Sanitation District, California.

Parameters	Method Detection Limit ng/g wet weight	Parameters	Method Detection Limit ng/g wet weight
Pesticides			
o,p'-DDD	0.33	*cis*-Nonachlor	0.19
o,p'-DDE	0.23	Dieldrin	0.31
o,p'-DDT	0.33	*trans*-Chlordane	0.25
p,p'-DDD	0.16	Heptachlor	0.23
p,p'-DDE	0.31	Heptachlor epoxide	0.37
p,p'-DDT	0.24	*trans*-Nonachlor	0.21
p,p'-DDMU	0.43	Oxychlordane*	1.00
cis-Chlordane	0.33		
PCB Congeners			
PCB 8	0.24	PCB 128	0.08
PCB 18	0.24	PCB 138	0.16
PCB 28	0.21	PCB 149	0.33
PCB 37	0.27	PCB 151	0.22
PCB 44	0.36	PCB 156	0.10
PCB 49	0.17	PCB 157	0.10
PCB 52	0.17	PCB 158	0.18
PCB 66	0.26	PCB 167	0.09
PCB 70	0.23	PCB 168/153	0.23
PCB 74	0.24	PCB 169	0.15
PCB 77	0.21	PCB 170	0.18
PCB 81	0.19	PCB 177	0.09
PCB 87	0.17	PCB 180	0.18
PCB 99	0.44	PCB 183	0.13
PCB 101	0.14	PCB 187	0.06
PCB 105	0.13	PCB 189	0.12
PCB 110	0.19	PCB 194	0.17
PCB 114	0.10	PCB 195	0.13
PCB 118	0.22	PCB 200	0.08
PCB 119	0.14	PCB 201	0.20
PCB 123	0.21	PCB 206	0.11
PCB 126	0.11	PCB 209	0.29

* Reporting Level used for oxychlordane

Table C-22. Acceptance criteria for standard reference materials of PCB congeners in fish tissue, CARP-2, July 2012–June 2013.

Orange County Sanitation District, California.

Parameter	True Value (ng/g)	Acceptance Range (ng/g)	
		Minimum	Maximum
PCB 18	27.3	23.3	31.3
PCB 28	34.0	26.8	41.2
PCB 52	138	95.0	181
PCB 44	86.6	60.7	112
PCB 118	148	115	181
PCB 153	105	83.0	127
PCB 128	20.4	16.0	24.8
PCB 180	53.3	40.3	66.3
PCB 194	10.9	7.80	14.0
PCB 206	4.40	3.30	5.50

CARP-2, Ground Whole Carp Reference Material for Organochlorine Compounds, National Research Council Canada.

Table C-23. Acceptance criteria for standard reference materials of pesticides and PCB congeners in fish tissue, SRM-1946, July 2012–June 2013

Orange County Sanitation District, California.

Parameter	True Value (ng/g)	Acceptance Range (ng/g)		Parameter	True Value (ng/g)	Acceptance Range (ng/g)	
		Minimum	Maximum			Minimum	Maximum
Dieldrin	32.5	29.0	36.0	PCB 101	34.6	32.0	37.2
Heptachlor epoxide	5.50	5.27	5.73	PCB 105	19.9	19.0	20.8
cis-Chlordane	32.5	30.7	34.3	PCB 110	22.8	20.8	24.8
trans-Chlordane	8.36	7.45	9.27	PCB 118	52.1	51.1	53.1
cis-Nonachlor	59.1	55.5	62.7	PCB 126	0.380	0.363	0.397
trans-Nonachlor	99.6	92.0	107	PCB 128	22.8	20.9	24.7
oxychlordane	18.90	17.4	20.4	PCB 138	115	102	128
o,p'-DDD	2.20	1.95	2.45	PCB 149	26.3	25.0	27.6
p,p'-DDD	17.7	14.9	20.5	PCB 153/168	170	161	179
p,p'-DDE	373	325	421	PCB 156	9.52	9.01	10.0
p,p'-DDT	37.2	33.7	40.7	PCB 169	0.106	0.092	0.120
PCB 44	4.66	3.80	5.52	PCB 170	25.2	23.0	27.4
PCB 49	3.80	3.41	4.19	PCB 180	74.4	70.4	78.4
PCB 52	8.1	7.10	9.10	PCB 183	21.9	19.4	24.4
PCB 66	10.8	8.90	12.7	PCB 187	55.2	53.1	57.3
PCB 70	14.9	14.3	15.5	PCB 194	13.0	11.7	14.3
PCB 74	4.83	4.32	5.34	PCB 195	5.30	4.85	5.75
PCB 77	0.327	0.302	0.352	PCB 206	5.40	4.97	5.83
PCB 87	9.4	8.00	10.8	PCB 209	1.30	1.09	1.51
PCB 99	25.6	23.3	27.9				

SRM 1946, Organics in Lake Superior Fish Tissue, National Institute of Standards and Technology.

Table C-24. Fish tissue PCB/pesticide QA/QC summary, July 2012–June 2013.

Orange County Sanitation District, California.

Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
Sample Set – MH (Rig Fish Muscle)				
NRCC CARP-2	10	8	according to published acceptance criteria	NA
SRM 1946	38	27		
PCB Reporting Level Spike	44	43	75 -125	NA
PCB Matrix Spike:	44	44	70 - 130	NA
PCB Matrix Spike Dup	44	44		
Precision	44	44	NA	< 25%
Pesticide Reporting Level Spike	15	15	75 -125	NA
Pesticide Matrix Spike	15	15	70-130	NA
Pesticide Matrix Spike Dup	15	15		
Precision	15	15	NA	< 25%
PCB/Pesticide Duplicate Analysis				
Duplicate 1 PCB	0	0	NA	< 25% @ 3 x MDL of Sample Mean.
Duplicate 1 Pesticides	1	1		
Duplicate 1 Sum of Pesticides and PCBs	1	1		
Duplicate 2 PCB	0	0		
Duplicate 2 Pesticides	1	1		
Duplicate 2 Sum of Pesticides and PCBs	1	1		
Sample Set – MI (Trawl Fish Muscle)				
NRCC CARP-2	10	4	according to published acceptance criteria	NA
SRM 1946	38	35		
PCB Reporting Level Spike	44	39	75 -125	NA
PCB Matrix Spike:	44	43	70 - 130	NA
PCB Matrix Spike Dup	44	44		
Precision	44	44	NA	< 25%
Pesticide Reporting Level Spike	15	11	75 -125	NA
Pesticide Matrix Spike	15	14	70-130	NA
Pesticide Matrix Spike Dup	15	13		
Precision	15	15	NA	< 25%
PCB/Pesticide Duplicate Analysis				
Duplicate 1 PCB	0	0	NA	< 25% @ 3 x MDL of Sample Mean.
Duplicate 1 Pesticides	1	1		
Duplicate 1 Sum of Pesticides and PCBs	1	1		
Duplicate 2 PCB	1	1		
Duplicate 2 Pesticides	0	0		
Duplicate 2 Sum of Pesticides and PCBs	1	1		

Table C-24 Continues.

Table C-24 Continued.

Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
Sample Set – MJ (Trawl Fish Muscle)				
NRCC CARP-2	10	7	according to published acceptance criteria	NA
SRM 1946	38	32		
PCB Reporting Level Spike	44	37	75 -125	NA
PCB Matrix Spike:	44	28	70 - 130	NA
PCB Matrix Spike Dup	44	29		
Precision	44	44	NA	< 25%
Pesticide Reporting Level Spike	15	11	75 -125	NA
Pesticide Matrix Spike	15	8	70-130	NA
Pesticide Matrix Spike Dup	15	7		
Precision	15	15	NA	< 25%
PCB/Pesticide Duplicate Analysis				
Duplicate 1 PCB	1	1	NA	< 25% @ 3 x MDL of Sample Mean.
Duplicate 1 Pesticides	1	1		
Duplicate 1 Sum of Pesticides and PCBs	1	1		
Duplicate 2 PCB	0	0		
Duplicate 2 Pesticides	1	0		
Duplicate 2 Sum of Pesticides and PCBs	1	0		
Sample Set – MK (Trawl Fish Muscle)				
NRCC CARP-2	10	7	according to published acceptance criteria	NA
SRM 1946	38	34		
PCB Reporting Level Spike	44	34	75 -125	NA
PCB Matrix Spike:	44	42	70 - 130	NA
PCB Matrix Spike Dup	44	41		
Precision	44	44	NA	< 25%
Pesticide Reporting Level Spike	15	9	75 -125	NA
Pesticide Matrix Spike	15	11	70-130	NA
Pesticide Matrix Spike Dup	15	14		
Precision	15	15	NA	< 25%
PCB/Pesticide Duplicate Analysis				
Duplicate 1 PCB	0	0	NA	< 25% @ 3 x MDL of Sample Mean.
Duplicate 1 Pesticides	0	1		
Duplicate 1 Sum of Pesticides and PCBs	0	1		
Duplicate 2 PCBs	0	0		
Duplicate 2 Pesticides	2	1		
Duplicate 2 Sum of Pesticides and PCBs	1	1		

Table C-24 Continues.

Table C-24 Continued.

Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
Sample Set – LI (Trawl Fish Liver)				
NRCC CARP-2	10	7	according to published acceptance criteria	NA
SRM 1946	38	34		
PCB Reporting Level Spike	44	29	75 -125	NA
PCB Matrix Spike:	44	43	70 - 130	NA
PCB Matrix Spike Dup	44	31		
Precision	44	34	NA	< 25%
Pesticide Reporting Level Spike	15	12	75 -125	NA
Pesticide Matrix Spike	15	14	70-130	NA
Pesticide Matrix Spike Dup	15	12		
Precision	15	12	NA	< 25%
PCB/Pesticide Duplicate Analysis				
Duplicate 1 PCB	2	0	NA	< 25% @ 3 x MDL of Sample Mean.
Duplicate 1 Pesticides	2	2		
Duplicate 1 Sum of Pesticides and PCBs	1	1		
Duplicate 2 PCB	3	1		
Duplicate 2 Pesticides	1	1		
Duplicate 2 Sum of Pesticides and PCBs	1	1		
Sample Set – LJ (Trawl Fish Liver)				
NRCC CARP-2	10	9	according to published acceptance criteria	NA
SRM 1946	38	30		
PCB Reporting Level Spike	44	43	75 -125	NA
PCB Matrix Spike:	44	43	70 - 130	NA
PCB Matrix Spike Dup	44	42		
Precision	44	40	NA	< 25%
Pesticide Reporting Level Spike	15	15	75 -125	NA
Pesticide Matrix Spike	15	14	70-130	NA
Pesticide Matrix Spike Dup	15	12		
Precision	15	14	NA	< 25%
PCB/Pesticide Duplicate Analysis				
Duplicate 1 PCB	4	0	NA	< 25% @ 3 x MDL of Sample Mean.
Duplicate 1 Pesticides	2	1		
Duplicate 1 Sum of Pesticides and PCBs	1	1		
Duplicate 2 PCBs	5	0		
Duplicate 2 Pesticides	1	1		
Duplicate 2 Sum of Pesticides and PCBs	1	1		

Table C-24 Continues.

Table C-24 Continued.

Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
Sample Set – LK (Trawl Fish Liver)				
NRCC CARP-2	10	7	according to published acceptance criteria	NA
SRM 1946	38	32		
PCB Reporting Level Spike	44	38	75 -125	NA
PCB Matrix Spike:	44	42	70 - 130	NA
PCB Matrix Spike Dup	44	39		
Precision	44	40	NA	< 25%
Pesticide Reporting Level Spike	15	14	75 -125	NA
Pesticide Matrix Spike	15	14	70-130	NA
Pesticide Matrix Spike Dup	15	11		
Precision	15	10	NA	< 25%
PCB/Pesticide Duplicate Analysis				
Duplicate 1 PCB	7	0	NA	< 25% @ 3 x MDL of Sample Mean.
Duplicate 1 Pesticides	2	1		
Duplicate 1 Sum of Pesticides and PCBs	1	0		
Duplicate 2 PCB	7	0		
Duplicate 2 Pesticides	2	1		
Duplicate 2 Sum of Pesticides and PCBs	1	0		

Notes:
CARP-2: National Research Council Canada
SRM 1946: NIST Lake Superior Fish Tissue
N/A=not applicable

Table C-25. Fish tissue percent lipid QA/QC summary, July 2012–June 2013.

Orange County Sanitation District, California.

Sample Set	Tissue Type	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Precision % RPD
MH	Muscle	Percent Lipid	Duplicate Samples	2	2	<25%
MI	Muscle	Percent Lipid	Duplicate Samples	2	2	<25%
MJ	Muscle	Percent Lipid	Duplicate Samples	2	2	<25%
MK	Muscle	Percent Lipid	Duplicate Samples	2	2	<25%
LI	Liver	Percent Lipid	Duplicate Samples	2	2	<25%
LJ	Liver	Percent Lipid	Duplicate Samples	2	2	<25%
LK	Liver	Percent Lipid	Duplicate Samples	2	2	<25%

Table C-26. Method detection levels for mercury in fish tissue, July 2012–June 2013.

Orange County Sanitation District, California.

Parameter	Method Detection Limit (ng/g wet weight)
Mercury	0.002

Table C-27. Acceptance criteria for standard reference materials of mercury in fish tissue, July 2012–June 2013.

Orange County Sanitation District, California.

Mercury	True Value (ng/g)	Acceptance Range (ng/g)	
		Minimum	Maximum
DORM-3	0.382	0.322	0.442

Dogfish Muscle and Liver Reference Material for Mercury, National Research Council Canada.

Table C-28. Fish tissue mercury QA/QC summary, July 2012–June 2013.

Orange County Sanitation District, California.

Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
HGFISH120912-1	Mercury	Blank	1	1	<2X MDL	NA
		Blank Spike	1	1	85-115	NA
		Matrix Spike	1	1	70-130	
		Matrix Spike Dup	1	1	70-130	
		Matrix Spike Precision	1	1		< 25%
		Duplicate Analysis	1	1	NA	@ ≥ 10 X MDL < 30%
		CRM Analysis	1	1	80-120% or certified value, whichever is greater.	
HGFISH130711-1	Mercury	Blank	2	2	<2X MDL	NA
		Blank Spike	2	2	85-115	NA
		Matrix Spike	2	2	70-130	
		Matrix Spike Dup	2	2	70-130	
		Matrix Spike Precision	2	2		< 25%
		Duplicate Analysis	2		NA	@ ≥ 10 X MDL < 30%
HGFISH130717-1	Mercury	Blank	2	2	<2X MDL	NA
		Blank Spike	2	2	85-115	NA
		Matrix Spike	2	2	70-130	
		Matrix Spike Dup	2	2	70-130	
		Matrix Spike Precision	2	2		< 25%
		Duplicate Analysis	2	1*	NA	@ ≥ 10 X MDL < 30%
HGFISH130725-1	Mercury	Blank	2	2	<2X MDL	NA
		Blank Spike	2	2	85-115	NA
		Matrix Spike	2	2	70-130	
		Matrix Spike Dup	2	2	70-130	
		Matrix Spike Precision	2	2		< 25%
		Duplicate Analysis	2	2	NA	@ ≥ 10 X MDL < 30%
HGFISH130725-2	Mercury	Blank	2	2	<2X MDL	NA
		Blank Spike	2	2	85-115	NA
		Matrix Spike	2	2	70-130	
		Matrix Spike Dup	2	2	70-130	
		Matrix Spike Precision	2	2		< 25%
		Duplicate Analysis	2	2	NA	@ ≥ 10 X MDL < 30%

* RPD out of control due to non-homogenous sample

BENTHIC INFAUNA NARRATIVE

SORTING AND TAXONOMY QA/QC

The sorting and taxonomy QA/QC follows the 2012-13 QAPP. Sorting QA/QC procedures were conducted for both the summer (July 2012, Cruise # OC-2012-029) and winter (January 2013, Cruise # OC-2013-008) surveys. Taxonomic re-identifications were conducted for the summer survey.

Sorting QA/QC Procedures

The infauna community was monitored by collecting marine sediments from 29 semi-annual stations at depths from 52–65 m in July 2012 (summer) and March 2013 (winter) and from 39 annual stations at depths from 40–303 m in July 2012 that were located on the San Pedro Shelf (Table A-1, Figure 5-1) for a total of 97 samples for the year. Single replicates were collected at all stations for infauna. The sorting procedure involved removal by the contractor (Marine Taxonomic Services, Inc. (MTS)) personnel of all biological organisms and fragments from each benthic sample. Organisms were the sorted by major taxa, transferred to separate vials and total counts per station were made. When all samples from a cruise passed MTS's in-house sorting efficiency criteria, they were returned with any remaining particulates (RPs), to OCSD for identification and enumeration. Three randomly selected semi-annual stations from both the summer and winter surveys along with an additional four samples (one from each of the four major depth contour intervals) from the summer annual survey (a total of 10 samples) were re-sorted by OCSD. A tally was made of any countable organisms missed by MTS. A sample passes QA if the total number of countable animals (heads) found in the re-sort is ≤ 5% of the total number of individuals reported for that sample.

2012-13 Sorting QA/QC Results

Sorting results for all 2012-13 QA samples were well below the 5% QC limit (95 % accuracy). The average was 1 % with results ranging from 0 – 3% (n= 10).

Taxonomic Identification QA/QC Procedures

Benthic infauna samples underwent comparative taxonomic analysis by two independent groups of taxonomists. Samples were randomly chosen for re-identification from each taxonomist's allotment of assigned samples. These were swapped between taxonomists with the same expertise in the major taxa. The resulting data sets were compared and a discrepancy report generated. The participating taxonomists reconciled the discrepancies. Necessary corrections to taxon names or abundances were made to the database. The results were scored and errors tallied by station. Percent errors were calculated using the equations below:

Equation 1. $$\%Error_{\#\,Taxa} = [(\#\,Taxa_{Resolved} - \#\,Taxa_{Original}) \div \#\,Taxa_{Resolved}] * 100$$

Equation 2. $$\%Error_{\#\,Individuals} = (\#\,Individuals_{Resolved} - \#\,Individuals_{Original}) \div \#\,Individuals_{Resolved}] * 100$$

Equation 3. $$\%Error_{\#\,ID\,Taxa} = (\#\,Taxa_{MissID} \div \#\,Taxa_{Resolved}) * 100$$

Equation 4. $$\%Error_{\#\,ID\,Individuals} = (\#\,Individuals_{MissID} \div \#\,Individuals_{Resolved}) * 100$$

Please refer to the 2012-13 QAPP for detailed explanation of the variables.

When applied to a station as a whole, these equations are a measure of taxonomic accuracy (i.e., QA) for the survey. The first three equations are considered gauges of errors in accounting (e.g., recording on wrong line, miscounting, etc.), which, by their random nature, are difficult to predict. Sample accuracy (i.e., QC) is calculated by station using the fourth equation reported herein. Equation 4 (Eq. 4) is the preferred measure of identification accuracy. It is weighted by abundance and has a more rigorous set of consequences (corrective actions) when errors are greater than 10%. Corrective actions include a reanalysis of additional samples for the effected taxa and additional, targeted, training. Equation 3, while included herein, is, technically, an assessment of identification accuracy (i.e., QC). However, it is too sensitive a measure for sample fractions with low diversities.

2012-13 Taxonomic QA/QC Results

Tables C-29 & C-30 contains the QA/QC results of the re-identifications. All stations met their QC objectives for percent error of number of identified individuals (Eq. 4) with a mean of 2.5%. All samples were also under the actionable threshold for all QA measures.

In addition to the re-identifications, a synoptic data review was conducted upon completion of all data entry and QA. This consisted of a review OCSD's taxonomists of the infauna data for the survey year aggregated by taxonomist (including both in-house and contractor). From this, we can identify anomalous species reports, e.g., species reported outside known depth range, nomenclatural differences of name application, possible data entry errors, etc. The resulting changes are listed in Table C-31.

Table C-29. Re-identification results for January 2013 QA samples.

Orange County Sanitation District, California.

Station	Rep	Description	Original Count	Mis-identified	Final Count
0	1	No. of Individuals	441	8	441
		No. of Taxa	90	5	90
36	1	No. of Individuals	408	8	407
		No. of Taxa	112	6	115
74	1	No. of Individuals	354	13	359
		No. of Taxa	95	8	102

Table C-30. Percent error rates calculated for January 2013 QA samples.

Orange County Sanitation District, California.

Error Type	Station (rep)			
	0(1)	36(1)	74(1)	Mean
1. %Error $_{\text{\# Taxa}}$	0	2.6	6.9	3.2
2. %Error $_{\text{\# Individuals}}$	0	0.2	1.4	0.4
3. %Error $_{\text{\# ID Taxa}}$	5.6	5.2	7.8	6.2
4. %Error $_{\text{\# ID Individuals}}$	1.8	2.0	3.6	2.5

Table C-31. Infaunal name changes resulting from synoptic data review.

Orange County Sanitation District, California.

Original ID	Final ID	Reason for change
Aphelochaeta sp HYP6	*Aphelochaeta* sp LA1	Discrepancy in name application between contractor and OCSD Taxonomists
Polycirrus californicus	*Polycirrus* sp OC1	Discrepancy in name application between contractor and OCSD Taxonomists

OTTER TRAWL NARRATIVE

The OCSD trawl sampling protocols are based upon regionally developed sampling methods (Mearns and Stubs 1974; Mearns and Allen 1978) and US Environmental Protection Agency 301(h) guidance documents (Tetra Tech 1986). These include a maximum distance from the nominal trawl station co-ordinates, sampling depth, vessel speed, and distance (trawl track) covered. Table C-32 lists the trawl quality assurance objectives (QAO).

Established regional survey methods for southern California requires that a portion of the trawl track must pass within a 100-m circle that originates from the nominal sample station position and be within 10% of the station's nominal depth. The speed of the trawl should range from 0.77 to 1.0 m/s or 1.5 to 2.0 kts. Since 1985, the District has trawled a set distance of 450 meters (the distance that the net is actually on the bottom collecting fish and invertebrates); regional surveys trawls are based on time on the bottom, not distance.

Summer 2012

For summer 2012, trawl distances ranged from 452 to 487 m with the average trawl length being 457.6 m and the average trawl speed being 1.0 kts for all trawls combined (Table C-33). All of the trawls passed through the designated 100-meter circle (Figure C-1). Trawl depths and time on the bottom were determined using an attached pressure sensor that showed excellent trawl repeatability in both depth (Table C-34) and distance traveled (Figure C-2).

Winter 2013

For winter 2013, all trawl lengths ranged from 325 to 516 m with the average trawl length being 456.7 m and the average trawl speed being 1.0 kts for all trawls combined (Table C-35). All the trawls passed through the designated 100-meter circle (Figure C-3). Trawl depths and time on the bottom were determined using an attached pressure sensor that showed excellent trawl repeatability in both depth (Table C-36) and distance traveled (Figure C-4).

Table C-32. Districts quality assurance objectives for trawl sampling, July 2012–June 2013.

Orange County Sanitation District, California.

Measure	Quality Assurance Objective (QAO)
Trawl Track Depth	±10% of nominal station depth (at any point during the trawl)
Trawl Track Length	450 m
Distance from nominal	100 m
Vessel Speed	1.5–2.0 knots

Table C-33. Trawl sample dates, track distances, percent difference from target track distance, elapsed time, and vessel speed, July/August 2012.

Orange County Sanitation District, California.

Date	Station	Haul	Distance Trawled (meters)	Percent Difference from Target Distance *	Elapsed Time (seconds)	Trawl speed (knots)**
August 1, 2012	T0	1	454.4	1.0	453	1.0
July 31, 2012	T1	1	455.4	1.2	431	1.1
July 30, 2012	T2	1	460.1	2.2	439	1.0
July 30, 2012	T6	1	457.4	1.6	452	1.0
August 1, 2012	T10	1	451.9	0.4	442	1.0
July 31, 2012	T11	1	451.6	0.4	436	1.0
July 30, 2012	T12	1	453.3	0.7	512	0.9
August 1, 2012	T14	1	453.5	0.8	524	0.9
July 30, 2012	T17	1	456.1	1.4	489	0.9
July 30, 2012	T18	1	455.0	1.1	482	0.9
July 31, 2012	T19	1	459.7	2.1	478	1.0
July 31, 2012	T22	1	455.2	1.2	475	1.0
July 31, 2012	T23	1	455.4	1.2	536	0.8
August 1, 2012	T24	1	486.6	8.1	527	0.9
August 1, 2012	T25	1	458.8	2.0	457	1.0
Mean value			457.6	1.7	475.4	1.0

* Target Distance – 450 meters

** Target Speed – 1.5 – 2.0 knot

Hauls with speeds less than 1.5 knots or greater than 2 knots are denoted in bold.

Table C-34. Ten percent trawl depth QA, July/August 2012.

Orange County Sanitation District, California.

Date	Station	Haul	Nominal Depth (m)	QA Range (m)	Data Source	Average Bottom Depth (m)	10% Y/N
August 1, 2012	T0	1	18	16.2–19.8	SBE DATA	No data	- - -
					SOD DATA	17.5	Y
July 31, 2012	T1	2	55	49.5 - 60.5	SBE DATA	No data	- - -
					SOD DATA	54.5	Y
July 30, 2012	T2	1	35	31.5 - 38.5	SBE DATA	35.9	Y
					SOD DATA	34.5	Y
July 30, 2012	T6	1	36	32.4 - 39.6	SBE DATA	37.9	Y
					SOD DATA	36.5	Y
August 1, 2012	T10	1	137	123.3 - 150.7	SBE DATA	No data	- - -
					SOD DATA	136.0	Y
July 31, 2012	T11	2	60	54.0 - 66.0	SBE DATA	No data	- - -
					SOD DATA	61.5	Y
July 30, 2012	T12	1	57	51.3 - 62.7	SBE DATA	58.2	Y
					SOD DATA	55.5	Y
August 1, 2012	T14	1	137	123.3 - 150.7	SBE DATA	No data	- - -
					SOD DATA	139.5	Y
July 30, 2012	T17	1	60	54.0 - 66.0	SBE DATA	62.4	Y
					SOD DATA	58.5	Y
July 30, 2012	T18	1	36	32.4 - 39.6	SBE DATA	39.5	Y
					SOD DATA	38.0	Y
July 31, 2012	T19	1	137	123.3 - 150.7	SBE DATA	No data	- - -
					SOD DATA	142.0	Y
July 31, 2012	T22	1	60	54.0 - 66.0	SBE DATA	No data	- - -
					SOD DATA	60.5	Y
July 31, 2012	T23	1	58	52.2 - 63.8	SBE DATA	No data	- - -
					SOD DATA	58.5	Y
August 1, 2012	T24	1	36	32.4 - 39.6	SBE DATA	No data	- - -
					SOD DATA	35.5	Y
August 1, 2012	T25	1	137	123.3 - 150.7	SBE DATA	No data	- - -
					SOD DATA	130.0	Y

Notes:

Data is missing for some stations due to instrument malfunction.

SBE = Seabird Electronics

SOD = Station occupation data

Y = Yes (Pass)

N = No (Fail)

N/A = Not analyzed

Table C-35. Trawl sample dates, track distances, percent difference from target track distance, elapsed time, and vessel speed, March/April 2013.

Orange County Sanitation District, California.

Date	Station	Haul	Distance Trawled (meters)	Percent Difference from Target Distance *	Elapsed Time (seconds)	Trawl speed (knots)**
March 13, 2013	T1	1	457.4	1.6	474	1.0
March 13, 2013	T1	2	**324.6**	**-27.9**	**351**	0.9
March 13, 2013	T11	1	453.4	0.8	489	0.9
March 14, 2013	T12	1	486.4	8.1	472	1.0
March 13, 2013	T17	1	**515.5**	**14.5**	**599**	0.9
April 10, 2013	T17	1	461.9	2.6	377	1.2
April 10, 2013	T17	2	462.8	2.8	405	1.1
April 10, 2013	T17	3	457.2	1.6	485	0.9
April 10, 2013	T17	4	453.7	0.8	425	1.1
March 14, 2013	T22	1	479.1	6.5	470	1.0
March 14, 2013	T23	1	471.4	4.8	478	1.0
Mean value			456.7	1.5	456.8	1.0

* Target Distance – 450 meters

** Target Speed – 1.5 – 2.0 knots

Hauls with distances greater than or less than 10% of 450 meters are denoted in bold.

Table C-36. Ten percent trawl depth QA, March/April 2013.

Orange County Sanitation District, California.

Date	Station	Haul	Nominal Depth (m)	QA Range (m)	Data Source	Average Bottom Depth (m)	10% Y/N
March 13, 2013	T1	1	55	49.5–60.5	SBE DATA	55.9	Y
					SOD DATA	54.0	Y
March 13, 2013	T11	2	60	54.0–66.0	SBE DATA	61.9	Y
					SOD DATA	58.0	Y
March 14, 2013	T12	1	57	51.3–62.7	SBE DATA	57.7	Y
					SOD DATA	57.0	Y
April 10, 2013	T17	1	60	54.0–66.0	SBE DATA	61.8	Y
					SOD DATA	56.0	Y
March 14, 2013	T22	1	60	54.0–66.0	SBE DATA	62.3	Y
					SOD DATA	55.5	Y
March 14, 2013	T23	1	58	52.2–63.8	SBE DATA	59.6	Y
					SOD DATA	60.0	Y

Notes:
SBE = Seabird Electronics
SOD = Station occupation data
Y = Yes (Pass)
N = No (Fail)
N/A = Not analyzed

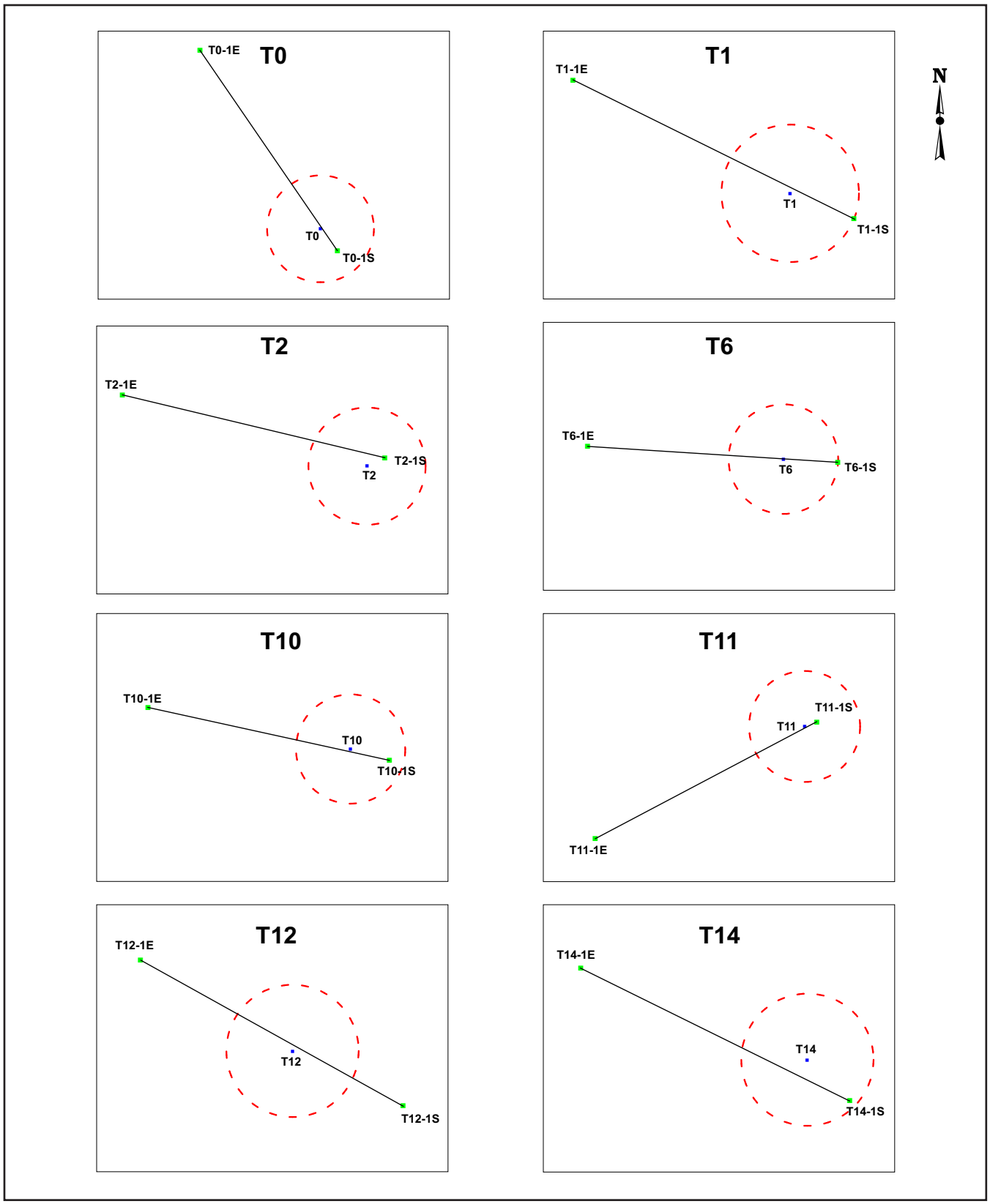

Figure C-1. Quality assurance plots of distance to station for otter trawl hauls, July and August 2012.

Red circle represents 100 meter distance from nominal trawl station center point.
Blue lines represent trawl path while net is on the bottom.
Trawl endpoints are labeled by station name, haul number, start (S) and end (E).

Orange County Sanitation District, California.

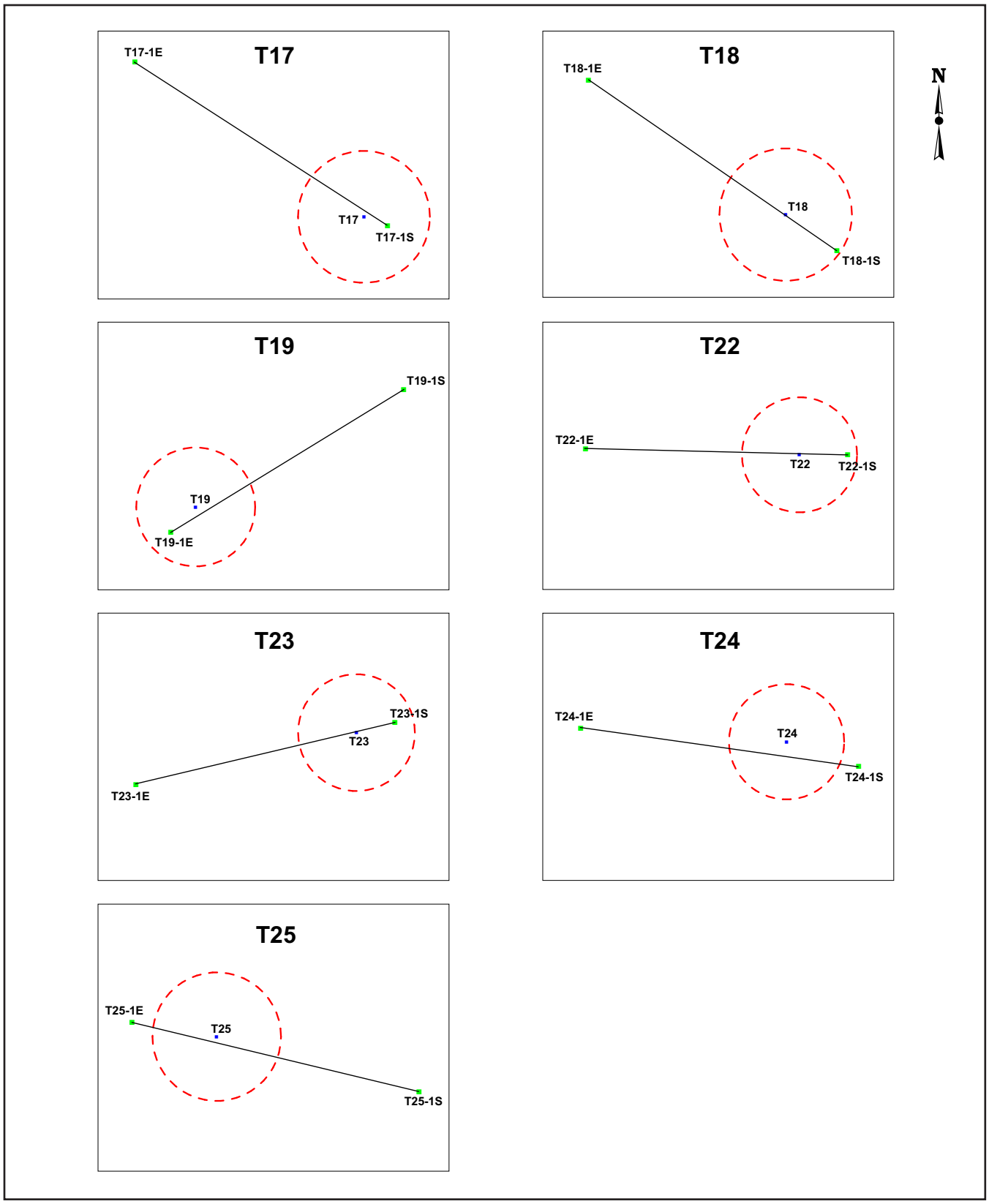

Figure C-1 continued.

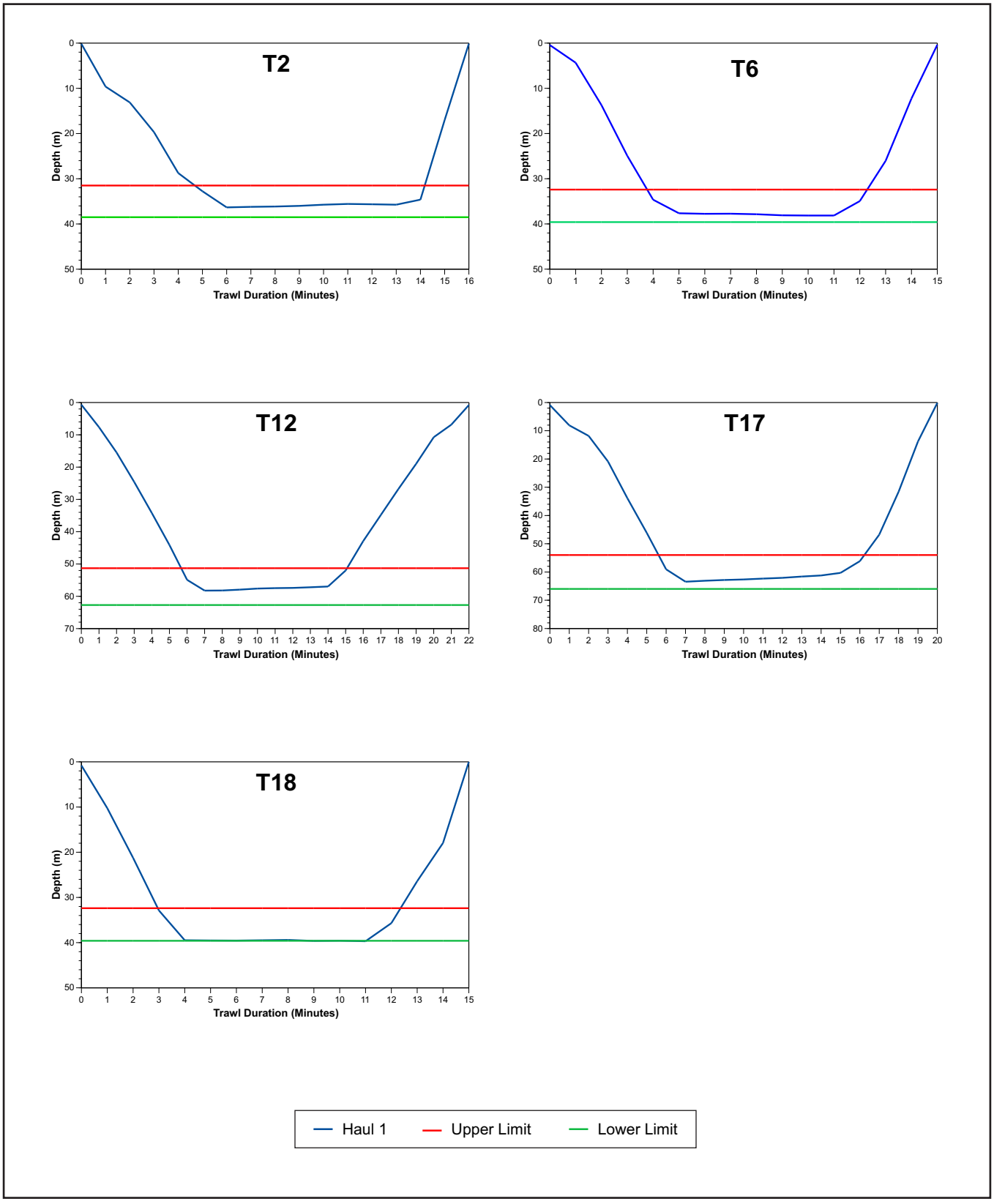

Figure C-2. **Quality assurance plots of trawl depth and trawl duration per haul for otter trawl stations, July 2012.**
Upper and lower limit lines are ± 10% of nominal trawl depth.
Data for a number of stations was unavailable due to instrument malfunction.

Orange County Sanitation District, California.

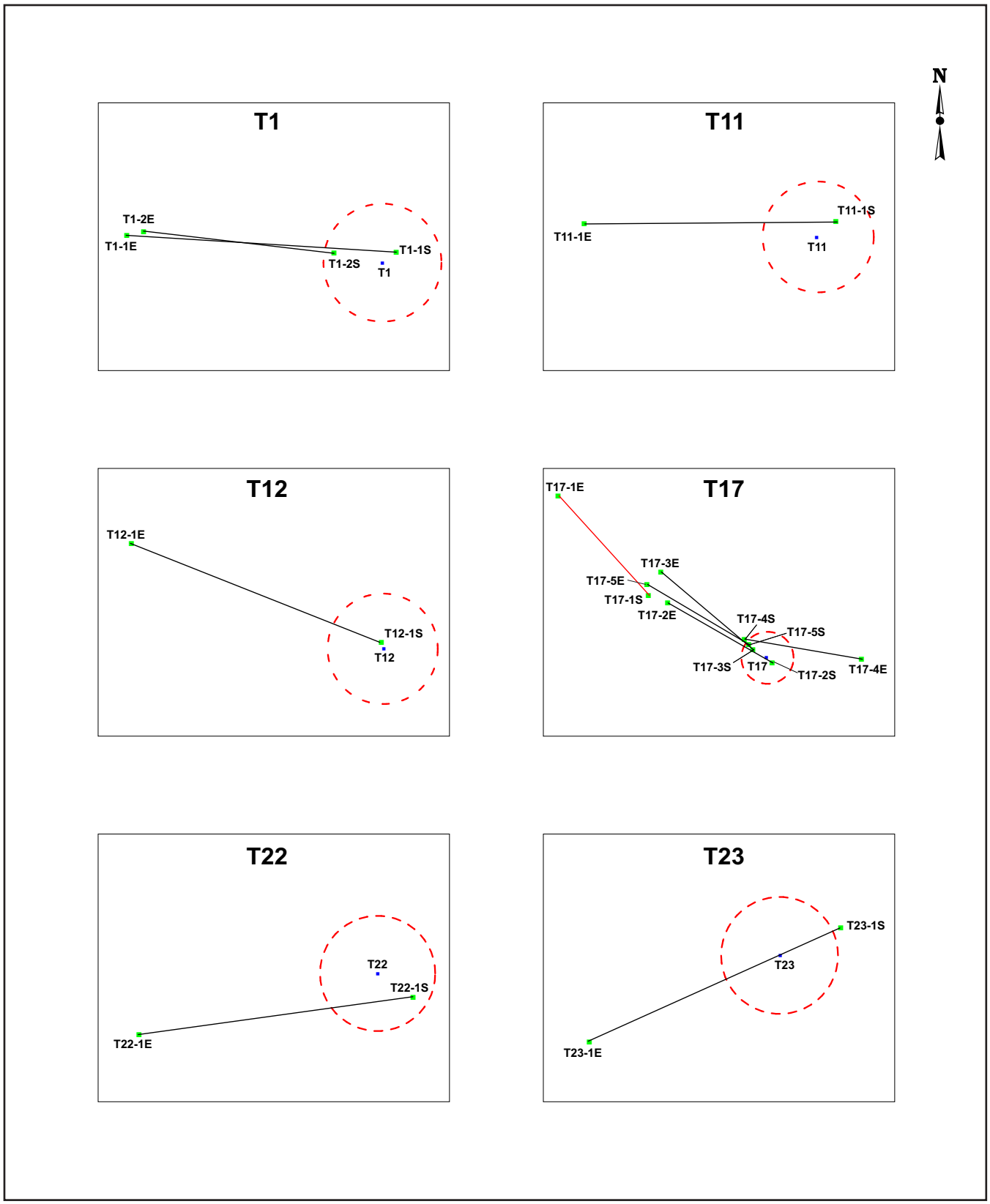

Figure C-3. Quality assurance plots of distance to station for otter trawl hauls, March and April 2013.

Red circle represents 100 meter distance from nominal trawl station center point.
Blue lines represent trawl path while net is on the bottom.
Trawl endpoints are labeled by station name, haul number, start (S) and end (E).

Orange County Sanitation District, California.

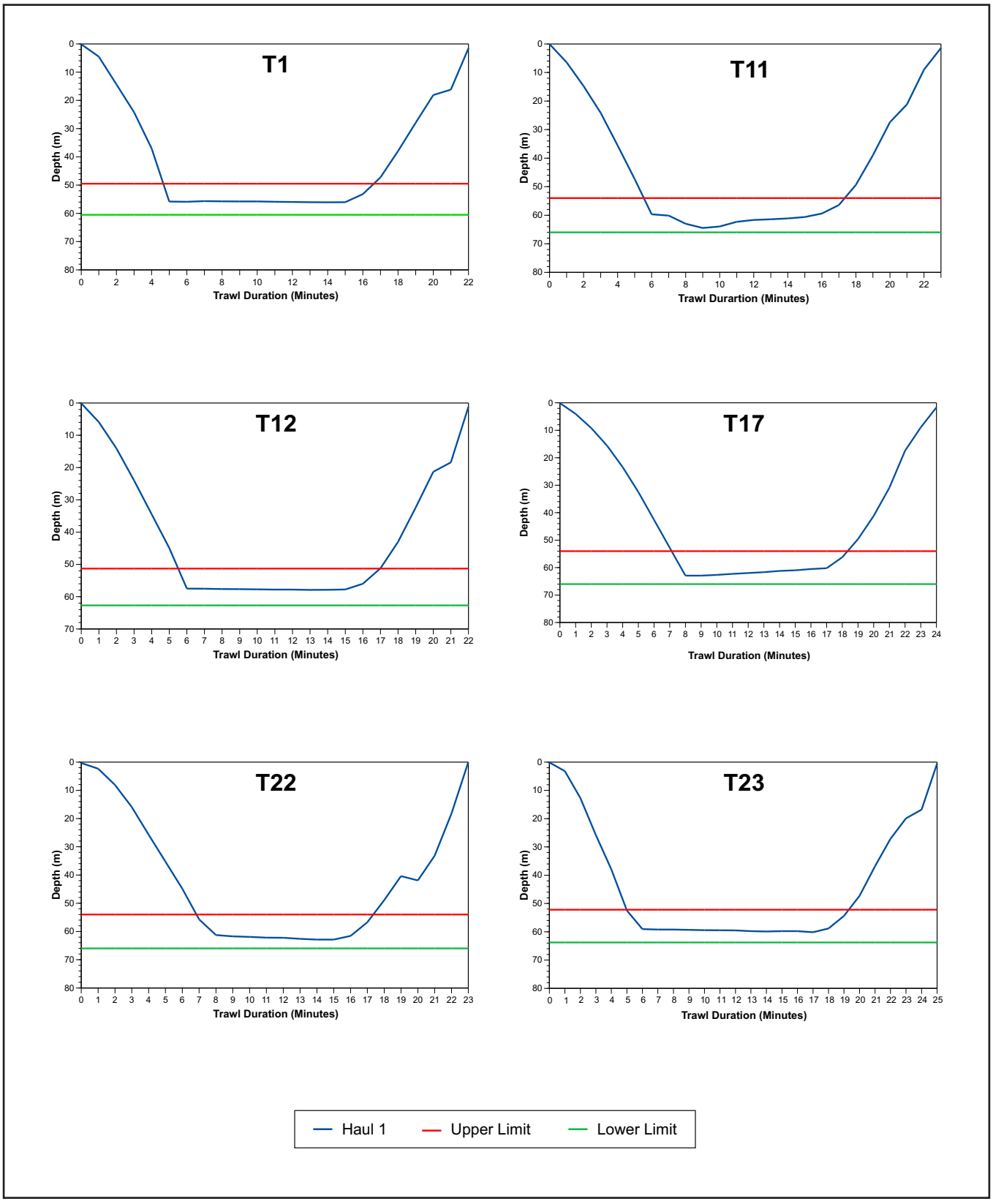

Figure C-4. **Quality assurance plots of trawl depth and trawl duration per haul for otter trawl stations, March and April 2013.**
Upper and lower limit lines are ± 10% of nominal trawl depth.

Orange County Sanitation District, California.

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