



**Regional Monitoring Program  
for Water Quality in San Francisco Bay**

**Cruise Report**

**SFEI Contribution# 1168**

**2023 RMP Sediment Cruise**

**Contract #1649**

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Prepared for the San Francisco Estuary Institute  
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## 1. Introduction

This report outlines details from the annual Regional Monitoring Program for Water Quality in the San Francisco Estuary (RMP) sediment cruise, conducted July 24 – 27, 2023. The Regional Monitoring Program conducts routine monitoring of water, sediment and biological tissue. For 2023, sampling operations entailed dry season collections at 16 RMP sediment sampling sites.

## 2. Cruise Report

### 2.1. Objectives

All sampling was conducted from the *RV Questuary* operated by Cal Maritime. The objectives of the sampling effort were to collect the following:

1. Profile the water column at each of the 16 sediment stations for temperature, salinity, electrical conductivity, optical backscatter, dissolved oxygen, density, and pressure by Applied Marine Sciences (AMS).
2. Collect direct pH measurements from the interstitial water found in the undisturbed sediment in the grab at 16 stations by AMS.
3. Collect surface (top 5 cm) sediment samples from 16 stations plus 1 field blank and 1 field replicate for analysis of:
  - Sediment Quality Parameters (total solids, TN, total organic carbon) by ALS.
  - Sediment Grain Size by ALS
  - PFAS by SGS AXY
  - Bisphenols by SGS AXYS
  - Polybrominated Diphenyl Ethers and total solids by SGS AXYS
4. Collect sediment samples for special studies:
  - Collect samples from 3 stations (plus one field replicate) for QACs by Bill Arnold / University of Minnesota
5. Collect sediment samples from the 4 historical / fixed stations for long-term archive at NIST.
6. Collect sediment samples from 16 stations for short-term archives.
7. Send archive samples from two stations for analysis of:
  - Polybrominated Diphenyl Ethers and Total Solids by SGS AXYS

### 2.2. Personnel

The personnel and work assignments for this cruise are shown in Table 1.

**Table 1. Personnel for 2023 RMP Sediment Cruise**

Name	Affiliation	Duties
Paul Salop	AMS	Cruise Manager, Field Sampling 7/24-7/27
Ellen Goldenberg	AMS	Field Sampling, 7/24
Jackie Mohay	AMS	Field Sampling, 7/25-7/26

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Colin Bowser	AMS	Field Sampling, 7/25
Theresa Venello	AMS	Field Sampling, 7/27
Amy Kleckner	SFEI	SFEI contact
Don Yee	SFEI	Field Sampling, 7/24
Martin Trinh	SFEI	Field Sampling, 7/27
Jennifer Dougherty	SFEI	Field Sampling, 7/24 – 7/26
Kayli Paterson	SFEI	Field Sampling, 7/26 – 7/27
Ezra Miller	SFEI	Field Sampling, 7/25
Shira Bezalel	SFEI	Photographer, 7/24
Chris Brown	CSUM	CSUM contact
Nicolas Shields	CSUM	Captain <i>RV Questaruy</i>
Stephen Kielar	CSUM	Tech/Deckhand <i>RV Questuary</i>

Mr. Salop was responsible for oversight of sampling operations; compliance with cruise plan, quality assurance guidelines, and field operations manual; maintenance of the sample field log; chain-of-custody procedures; and CTD profiling. Ms. Kleckner was responsible for coordination of SFEI field personnel. AMS and SFEI personnel were jointly responsible for sample collection and sample processing. Captain Shields was responsible for vessel operation and safety.

### 2.3. Sampling Activities

Sampling activities for the 2023 RMP Water Cruise are shown in Table 2.

**Table 2. Sampling Activities for 2023 RMP Sediment Cruise**

Date	Time	Activity
July 19, 2023	1100 – 1300	AMS personnel transported and mobilized all sampling gear aboard vessel <i>RV Questuary</i> at Pittsburg Yacht Club.
July 24, 2023	0800 – 0902	SFEI and AMS personnel mobilized all sampling gear aboard vessel at Safe Harbor Marina, Emeryville. Conducted safety briefing and departed for CB049S.
	1027 – 1108	Sampled CB049S, departed for CB001S.
	1140 – 1225	Sampled CB001S, departed for BD31.
	1342 – 1430	Sampled BD31, departed for BC11.
	1555 – 1645	Sampled BC11, departed for Safe Harbor Marina.

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Date	Time	Activity
	1705 – 1735	Arrived Safe Harbor Marina and demobilized vessel. Angels Courier Service retrieved all samples for transport to AMS.
July 25, 2023	0800-1000	Cal Maritime personnel transited vessel from Safe Harbor Marina to Westpoint Harbor Marina.
	1000 – 1054	SFEI and AMS personnel mobilized all sampling gear aboard vessel at Westpoint Harbor Marina, Redwood City. Conducted safety briefing and departed for SB051S.
	1143 – 1220	Sampled SB051S, departed for CB050S.
	1247 – 1310	Sampled CB050S, departed for CB048S.
	1328 – 1420	Sampled CB048S, departed for SB002S.
	1528 – 1602	Sampled SB002S, departed for Redwood City Marina.
	1650 – 1920	Arrived at Westpoint Harbor Marina and demobilized vessel. Angels Courier Service retrieved all samples for transport to AMS.
July 26, 2023	0730 – 0802	SFEI and AMS personnel mobilized all sampling gear aboard vessel at Westpoint Harbor Marina. Conducted safety briefing and departed for LSB049S.
	0845 – 0924	Sampled LSB049S, departed for LSB048S.
	0940 – 1011	Sampled LSB048S, departed for LSB002S.
	1020 – 1103	Sampled LSB002S, departed for BA10.
	1119 – 1150	Sampled BA10, departed for LSB050S.
	1240 – 1320	Sampled LSB050S, departed for Westpoint Harbor Marina.
	1417 – 1433	Arrived at Westpoint Harbor Marina and demobilized vessel. Angels Courier Service retrieved all samples for transport to AMS.
July 27, 2023	0700 – 0731	SFEI and AMS personnel mobilized all sampling gear aboard vessel at Westpoint Harbor Marina. Conducted safety briefing and departed for SB046S.
	0800 – 0838	Sampled SB046S, departed for SB050S.
	0851 – 0927	Sampled SB050S, departed for BA41.
	0941 – 1029	Sampled BA41, departed for Westpoint Harbor Marina.
	1115 – 1142	Arrived at Westpoint Harbor Marina and demobilized vessel. AMS transported all samples and sampling equipment to AMS.

## 2.4. Discussion

All sites were sampled per the cruise plan. However, some changes to the original cruise plan were made in the field.

- Collection of the field blank sample for PBDEs was collected at site BD31 rather than site CB001S.
- Collection of the field duplicate for QAC was collected at site LSB049S rather than site BC11.
- The NIST 10 mL archives were collected directly from the grab using field-cleaned stainless-steel implements and immediately field frozen within NIST-supplied cryovials. The 22 mL Teflon vials, however, were not received until midway through the cruise and were only available for the final day of sampling. The NIST 22 mL archive for site BA10 was collected as described above for the 10 mL archives. 22 mL archives for the remaining three sites (BA41, BC11, and BD31)

were collected by filling a 250 mL PFAS container provided by SGS AXYS, placing on wet ice on the vessel, transferring to a refrigerator at AMS at the conclusion of each day, then homogenizing with pre-cleaned stainless implements and transferring to the NIST containers. This transfer process was completed at AMS on the afternoon of July 27<sup>th</sup>, which is reflected in PrepPreservation collection info provided by AMS for CEDEN templates.

As detailed in an August 3<sup>rd</sup> email, SFEI's Sea-Bird CTD may be nearing the end of its useful life. CTD data was recorded successfully at thirteen of the sixteen stations. For the other three stations (BA41, BA10, and BD31), the CTD initiated and a datafile was generated, but no actual data was able to be extracted. AMS will follow up with Sea-Bird to attempt to troubleshoot the issue and will continue discussions re: plans for CTD usage for the upcoming Water Cruise.

Additionally, some metadata for tide cycle, wind speed, wind direction, and current speed were not recorded in the field. This information was later obtained through historical archives from Weather Underground ([wunderground.com](http://wunderground.com)) and NOAA Tides & Currents ([tidesandcurrents.noaa.gov](http://tidesandcurrents.noaa.gov)).

All samples were received by laboratories the week of July 31 (ALS, SGS AXYS, and University of Minnesota) or August 7 (NIST, SGS AXYS PBDE archives). One of the coolers containing samples for grain size analysis arrived at ALS slightly above the recommended temperature of 6°C, but the laboratory proceeded with analysis. The two coolers shipped to SGS AXYS the week of July 31 got separated somewhere in the customs process, and one of the two coolers was delayed an additional day in delivery.

Short-term archives are currently stored in a -20 C freezer at AMS. They will remain at AMS until archives generated through the nearshore sampling efforts conducted by Moss Landing Marine Labs are available for archival. It is anticipated all samples from these two efforts will be transferred to Schaefer's late fall 2023.

## 2.5. Sample Labeling

The sample ID labeling system used for the 2023 cruise is as follows:

RMP-23SC-XXXX-Y

Where:

RMP	=	Project
23	=	Cruise Year
SC	=	Matrix (Sediment Cruise)
XXXX	=	Unique ID number
Y	=	Unique aliquot number (applies only to archives)

## 2.6. Sampling Sites

2023 RMP Sediment Cruise sampling sites are listed in Table 3. All samples collected are listed in Table 4. Sample containers and sample handling procedures are summarized in Table 5. Weather conditions encountered at time of sampling are shown in Table 6.

**Table 3. 2023 RMP Sediment Cruise Site Coordinates and Water Depth.** Sample depths are not corrected for tidal action.

Site Code	Latitude		Longitude		Depth (m)	Sediment Character and Comments
	Target	Actual	Target	Actual		
BA10	37.46823888	37.46816	-122.0639734	-122.06373	2.2	Semi-unconsolidated fines, shell hash
BA41	37.55903527	37.55936	-122.2105770	-122.21029	2.2	Semi-unconsolidated fines with worms
BC11	37.82232768	37.82199	-122.3492815	-122.34969	6.8	NR
BD31	38.02412178	38.02445	-122.3636830	-122.36361	6.6	Fines, fine sand
CB001S	37.87631112	37.87650	-122.3615019	-122.36100	2.3	Semi-consolidated fines
CB048S	37.67051199	37.67002	-122.3841123	-122.38383	1.3	Unconsolidated fines, anoxic layer, diatom layer
CB049S	37.88012193	37.88029	-122.3399716	-122.33999	1.8	Semi-unconsolidated fines
CB050S	37.64436243	37.64434	-122.3372313	-122.33678	4.7	Semi-unconsolidated fines, <i>Ampeliska</i>
LSB002S	37.47912655	37.47928	-122.0779838	-122.07788	8.0	Unconsolidated fines
LSB048S	37.48713633	37.48712	-122.0846540	-122.08450	5.7	Unconsolidated fines, small shell hash
LSB049S	37.49563406	37.49543	-122.0957543	-122.09569	4.3	Unconsolidated fines, very soft
LSB050S	37.47849557	37.47857	-122.0762538	-122.07628	4.4	Unconsolidated fines
SB002S	37.61019366	37.61022	-122.1673764	-122.16744	1.3	Semi-unconsolidated fines
SB046S	37.56803314	37.56823	-122.1646760	-122.16449	1.8	Fines, sand, shell hash
SB050S	37.57839475	37.57847	-122.1736463	-122.17351	2.0	Fines, shell
SB051S	37.61148093	37.61483	-122.2864597	-122.28673	11.4	Lightly consolidated fines

**Table 4. 2023 RMP Sediment Samples Collected by Site (does not include QA samples).**

SITE CODE	REGION <sup>1</sup>	C T D <sup>2</sup>	pH	T N_ A L S	T O C_ T S_ A L S	P C M S_ C_ A L S	P F A S_ A X Y S	A R C H_ T E_ 2 5 0	A R C H_ O R G _ 6 0	A R C H_ N I S T_ 1 0	A R C H_ N I S T_ 2 2	A R C H_ B P/ P B D E	A R C H_ P F A S	Q A C _ U M N	pH (av g.)
BA10	LSB		x	x	x	x	x	x	x	x	x	x	x		7.2
BA41	SB		x	x	x	x	x	x	x	x	x	x	x		7.5
BC11	CB	x	x	x	x	x	x	x	x	x	x	x	x	x	7.0
BD31	SPB		x	x	x	x	x	x	x	x	x	x	x		7.4
CB001S	CB	x	x	x	x	x	x	x	x			x	x		7.3
CB048S	CB	x	x	x	x	x	x	x	x			x	x		7.4
CB049S	CB	x	x	x	x	x	x	x	x			x	x		7.2
CB050S	CB	x	x	x	x	x	x	x	x			x	x		7.3
LSB002S	LSB	x	x	x	x	x	x	x	x			x	x		7.1
LSB048S	LSB	x	x	x	x	x	x	x	x			x	x	x	7.0
LSB049S	LSB	x	x	x	x	x	x	x	x			x	x	x	7.4
LSB050S	LSB	x	x	x	x	x	x	x	x			x	x		7.3
SB002S	SB	x	x	x	x	x	x	x	x			x	x		7.4
SB046S	SB	x	x	x	x	x	x	x	x			x	x		7.8



SITE CODE	REGION <sup>1</sup>	CTD <sup>2</sup>	pH	TN_A_LS	TOC_TS_A_LS	PCMS_C_A_LS	PFAS_A_X_Y_S	ARCH_T_E_25_0	ARCH_O_R_G_6_0	ARCH_N_IS_T_10	ARCH_N_IS_T_22	ARCH_B/P/P_B_D_E	ARCH_P_F_A_S	QAC_U_M_N	pH (avg.)
SB050S	SB	x	x	x	x	x	x	x	x			x	x		7.5
SB051S	SB	x	x	x	x	x	x	x	x			x	x		7.1
<b>Total</b>	-	13	16	16	16	16	16	16	16	4	4	16	16	3	-

Notes:

<sup>1</sup> CB = Central Bay, LSB = Lower South Bay, SB = South Bay, and SPB = San Pablo Bay.

<sup>2</sup> Sea-Bird CTD did not record data at three of the sixteen sampled stations.

**Table 5. Containers and Sample Handling for 2023 RMP Sediment Cruise.**

Analyte Code	Parameters	Container	Handling Requirements
CTD	CTD	None	Measurements on board vessel
pH	pH	None	Measurements on board vessel
PFAS_AXYS	PFAS	250 ml HDPE, unlined lid	Collect directly from grab. Fill 80%. Store on wet ice. Freeze at end of day.
TN ALS	Total Nitrogen	8 oz jar	Store and ship on wet ice.
TOC TS ALS	Total Organic Carbon/Total Solids	8 oz jar	Store and ship on wet ice.
PCMSC ALS	Wentworth Particle Size Determination	16 oz jar	Store and ship on wet ice.
BP/PBDE_AXYS	Bisphenols/PBDEs/Total Solids	250 ml (8 oz) amber glass jar with Teflon lined lid	Fill 80%. Store on wet ice. Freeze at end of day.
ARCH_BP/PBDE	Short Term Archive for Bisphenols/PBDEs	250 ml (8 oz) amber glass jar with Teflon lined lid	Fill 80%. Store on wet ice. Freeze at end of day.
ARCH_TE_250	Short Term Archive Composite	250 ml PE jar	Fill ~80% full. Put in cooler on wet ice after collection, freeze at end of day.
ARCH_ORG_60	Short Term Archive Composite	60 ml amber or clear glass jar with Teflon lined lid	Fill 2/3 full. Store on wet ice. Freeze at end of the day.
ARCH_NIST_22	Long Term Archive	22 ml Teflon vial (3 per site)	Collect directly from grab. Fill to ~8-20 ml. Place on dry ice after collection.
ARCH_NIST_10	Long Term Archive for PFAS	10 ml cryovial (3 per site)	Collect directly from grab. Fill to ~8 ml. Place on dry ice after collection.
ARCH_PFAS	Short Term Archive for PFAS	250 ml HDPE unlined lid	Collect directly from grab. Fill ½ full. Store on wet ice. Freeze at end of the day.
QAC_UMN	QACs	Qorpack bottles (~250 ml) and lids	Fill ~ 80% full. Put in cooler on wet ice after collection, freeze at end of day.

**Table 6. Weather Conditions for 2023 RMP Sediment Cruise.**

Site	Sea State	Current (kts)	Tide Stage	Wind Speed (kts)	Wind Dir.	Cloud Cover, % Overcast
BA10	Calm	0.3	Ebb	5	NW	0
BA41	Calm	0	Slack	5-15	W	10
BC11	Choppy	0.3	Flood	10-30	W	10
BD31	Choppy	0.5	Flood	10-30	W	30
CB001S	Moderate Chop	0.2	Flood	10-15	W	75
CB048S	Light Chop	0	Slack	18	WNW	0
CB049S	Light Chop	0	Slack	5-15	N	70
CB050S	Light Chop	0.2	Flood	8-10	NW	0
LSB002S	Calm	0.3	Ebb	0-5	NW	0
LSB048S	Calm	0.3	Ebb	0-5	NW	0
LSB049S	Calm	0.3	Ebb	0-5	NW	10
LSB050S	Light Chop	0.1	Ebb	10-15	NW	0
SB002S	Light Chop	0.5	Flood	10-12	NW	10
SB046S	Calm	0.4	Slack	1-5	NW	10
SB050S	Calm	0.3	Slack	1-5	NW	10
SB051S	Light Chop	0.5	Ebb	25	NW	0