

Cruise Report

2016 RMP Bivalve Deployment Cruise

Contract # 1154

July 7, 2016

Submitted to:

San Francisco Estuary Institute

Submitted by:



4749 Bennett Drive, Suite L
Livermore, CA 94551
925-373-7142

1. Introduction

This report describes activities associated with the 2016 bivalve deployment cruise of the Regional Monitoring Program (RMP). Measurement of contaminant concentrations in transplanted bivalves accumulated during dry season deployment is designed to provide long-term data on the bioaccumulation of select trace elements and trace organic compounds in tissue throughout the Estuary.

Contaminant bioaccumulation in transplanted bivalve tissues is measured by collecting bivalves from sites that are known to have low contaminant concentrations and transplanting them to mooring locations in the Estuary. *Mytilus californianus* were collected from Bodega Head on June 7, 2016, and stored in filtered seawater tanks located at the Bodega Marine Laboratory (BML) until their deployment. While undergoing depuration, Bodega Marine Laboratory staff inspected mussels and scrubbed clean of fouling organisms to minimize potential spread of nonresident species associated with their deployment in San Francisco Bay.

AMS divers attached bivalves to moorings at seven sites on June 28 – July 1, 2016. For 2016, primary deployment locations included Redwood Creek, Coyote Creek, Yerba Buena Island, and Pinole Point; additional deployments were made at secondary sites Dumbarton Bridge, Alameda, and San Pablo Bay, and will only be analyzed in the event of the loss of mooring or extensive mortality experienced at one of the primary locations. At each site, bivalves were deployed in three cages, targeting four compartments holding twenty-five bivalves in each cage.

As first conducted beginning with the 2006 deployments, in 2016 there is no mid-deployment maintenance cruise scheduled, as previous analyses showed no difference in bivalve growth or survival between maintained and unmaintained deployments. Bivalve retrieval is scheduled for October 2016.

2. Cruise Report

2.1. Objectives

All water-based sampling was conducted from the *RV Questuary*. The objectives of the sampling effort were:

1. Collect *M. californianus* from Bodega Head State Marine Reserve and conduct a de-fouling operation on each bivalve during depuration.
2. Deploy bivalves at seven sites within San Francisco Bay.
3. Record a CTD profile at each station.

2.2. Personnel

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

Table 1. Personnel for 2016 RMP Water Cruise

Name	Affiliation	Duties	Contact
Paul Salop	AMS	Cruise Manager, diver, T-0 collections	salop@amarine.com
Jim Elliott	AMS	Diver, Dive Tender	jim.elliottmarine@gmail.com
Jay Johnson	AMS	Diver, Dive Tender, T-0 collections	johnson@amarine.com
Aroon Melwani	AMS	T-0 collections, Dive Tender	linder@amarine.com
Jennifer Sun	SFEI	Observer, bivalve preparations	jennifers@sfei.org
Jonas Donnenfeld	SFEI	Observer, bivalve preparations	jonasd@sfei.org
David Morgan	RTC	<i>RV Questuary</i> skipper	dmorgan@sfsu.edu

2.3. Sampling Activities

Sampling activities for the 2016 RMP Bivalve Deployment Cruise are shown in Table 2.

Table 2. Sampling Activities for 2016 RMP Bivalve Deployment Cruise

Date	Time	Activity
June 7, 2016	0600-1100	Mr. Salop, Dr. Melwani, and Mr. Johnson collected <i>M. californianus</i> from Bodega Head. The mussels were transferred to BML where they were placed in polyethylene aquaculture grow-out bags and suspended in filtered seawater tanks.
June 27, 2016	1000-1500	Dr. Melwani retrieved <i>M. californianus</i> from BML and transferred to Richmond.
June 28, 2016	0830-0933	Mobilized gear aboard <i>RV Questuary</i> , Emeryville Marina. Departed for Yerba Buena Island site (BC10).
	1000-1050	Deployed bivalves at YBI site. Departed for Alameda site (BB71).
	1126-1235	Deployed bivalves at Alameda site. Departed for Emeryville Marina.
	1315-1345	Arrived at Emeryville Marina and demobilized vessel. Bivalves stored on vessel overnight. Mr. Salop refilled dive tanks.
June 29, 2016	0630-0655	Mobilized gear aboard <i>RV Questuary</i> , Emeryville Marina. Departed for Redwood Creek (BA40) site.
	0820-1000	Installed new mooring and deployed bivalves at Redwood Creek site. Departed for Coyote Creek site (BA10).
	1030-1105	Arrived Coyote Creek. Divers assessed the situation and determined a safe dive was not possible due to equipment issues and wind / current conditions. Departed for Emeryville Marina.
	1355-1420	Arrived Emeryville Marina and demobilized vessel. Mr. Salop refilled dive tanks. Mr. Johnson retained bivalves for T-0 analysis for transport to AMS. Bivalves stored on vessel overnight.
June 30, 2016	0845-0900	Mobilized gear aboard <i>RV Questuary</i> , Vallejo Municipal Marina. Departed for San Pablo Bay site (BD20).
	0950-1042	Installed mooring and deployed bivalves at San Pablo Bay site. Departed for Pinole Point site (BD30).
	1110-1137	Deployed bivalves at Pinole Point site. Departed for Vallejo Municipal Marina.

Date	Time	Activity
	1220-1235	Arrived Vallejo Municipal Marina and demobilized vessel. Bivalves stored on vessel overnight. Mr. Salop refilled dive tanks.
July 1, 2016	0750-0833	Mobilized gear aboard <i>RV Questuary</i> , Emeryville Marina. Departed for Coyote Creek site (BA10).
	1015-1115	Deployed bivalves at Coyote Creek site. Departed for Dumbarton Bridge site (BA30).
	1135-1210	Deployed bivalves at Dumbarton Bridge site. Departed for Emeryville Marina.
	1335-1405	Arrived Emeryville Marina and demobilized vessel. Mrs. Salop and Johnson retained all equipment for transport to AMS.

2.4. Sampling Sites

RMP sampling sites are summarized in Table 3 and shown in Appendix 3. The target allocation of mussels to each lab per analysis is shown in Table 4. Actual numbers of bivalves deployed at each station are summarized in Table 5.

Table 3. Coordinates for RMP Bivalve Stations for 2016.

Site	Lat	Long	Comments
T-0	38.22050	-123.06550	Mussels collected from intertidal rock outcrops
BA10	37.46983	-122.06383	Channel marker “B” (formerly “18”)
BA30	37.51333	-122.13467	Channel marker “14”
BA40	37.54700	-122.19500	Channel marker “4”
BB71	37.69550	-122.33967	Channel marker “1” 1.65 nmi. SE of Hunters Point
BC10	37.81392	-122.35873	Pilings 30m SW of Bay Bridge, center pile in only remaining dolphin
BD30	38.01667	-122.36750	Channel marker “P”; no ground line – mooring within body length of pile
BD20	38.05900	-122.42367	Channel marker “4.” Channel marker replaced in 2014.

Table 4. Target Number of Mussels and Sample Mass For Each Site (all sites receive the same amount)

Sample	Analyzing Lab	Target Mass (g ww)	Target Number of Individuals	Comments
Organics + special studies		180	100	
<i>PBDEs</i>	AXYS	10	5	
<i>PAHs</i>	AXYS	20	10	
<i>Se</i>	BAL	10	5	
<i>Algal toxins</i>	UCSC	5	10	
<i>Archive</i>	TBD	135	70	
Emerging Contaminants (analytes TBD)	SIU	60	30	
Growth	AMS	N/A	30	
Contingency/Loss			80	
		240	240	

Table 5. Mussels deployed during 2016 Bivalve Deployment Cruise

SITE CODE	REGION	Target	Actual	Comment
T-0	N/A	180	180	Archived 6/29/16
BA10	South Bay	300	300	
BA30 ¹	South Bay	300	294	Insufficient mussels for full allotment at final dive site
BA40	South Bay	300	300	
BB71 ¹	Central Bay	300	300	
BC10	Central Bay	300	275	One compartment opened during dive operations causing loss of 25 mussels
BD30	North Bay	300	300	
BD20 ¹	North Bay	300	300	
BG20 ²	Rivers	N/A	N/A	
BG30 ²	Rivers	N/A	N/A	
T-1	N/A	30	TBD	Growth only

Notes:

¹Back up deployment site. Samples will be deployed and processed using the same methods as the primary sites but will only be analyzed by the laboratory if the primary sites cannot be sampled. Samples from the backup sites will be archived even if the primary stations are sampled.

²Analysis to be performed on resident *Corbicula fluminea* only. Due to small size of individual clams, allocation of bivalves will be made on mass / volume basis.

2.5. Discussion

2.5.1. New Installations

One new mooring was installed over the course of cruise operations.

- At the Redwood Creek site (BA40), the shackle securing the buoy line to the earth anchor had failed; a new buoy, buoy line, and shackle were therefore secured to the existing earth anchor.

2.5.2. Use of Contingency Day

The combination of a tide that turned from flood to ebb just over thirty minutes prior to predicted, strong winds in opposition to current, and a required mooring replacement earlier in the day led divers to discontinue dive operations on June 29th without completing all target sites. Dive operations were completed at the two remaining sites on Friday, July 1st.

2.5.3. Yerba Buena Island Installation

Divers deployed mussels at the last remaining dolphin proximate to the historic deployment location to the south of the Eastern span of the Bay Bridge and the north of the Coast Guard facility. Several of the piles making up the dolphin have broken off below surface but remain secured to the center pile. The dolphin will likely endure through the three-month deployment, but is thought unlikely to be available for safe, secure deployment in 2018. We recommend looking at alternative locations / methodologies for this site in advance of 2018 deployments.

2.5.4. Sample Identification

The sample ID system that will be applied for all samples is as follows:

RMP-16BR-XXXX

Where:

RMP	=	Project
16	=	Cruise Year
BR	=	Matrix (Bivalve Retrieval)
XXXX	=	Unique ID number

3. Appendix A – Map of Deployment / Collection Locations for 2016 RMP Bioaccumulation Program

