RMP REGIONAL MONITORING PROGRAM FOR WATER QUALITY IN SAN FRANCISCO BAY

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Regional Monitoring Program

for Water Quality in San Francisco Bay

Cruise Report

2018 Bivalve Deployment Cruise

Contract #1343

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Contribution #903

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APPLIED marine SCIENCES

1. Introduction

This report describes activities associated with the 2018 bivalve deployment cruise of the Regional Monitoring Program for Water Quality in San Francisco Bay (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 15, 2018, 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 deployed moorings at seven sites on June 18-19, 2018. For 2018, 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 2018 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 2018.

2. Cruise Report

2.1. Objectives

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

1. Obtain required permits / permissions to support deployments at seven locations.
2. Collect *M. californianus* from Bodega Head State Marine Reserve and conduct a de-fouling operation on each bivalve during depuration.
3. Deploy bivalves at seven sites within San Francisco Bay.
4. 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 2018 RMP Water Cruise

Name	Affiliation	Duties	Contact
Sara Driscoll	AMS	T-0 collections	thomas@amarine.com
Ryan Driscoll	UCSC	T-0 collections	rmdriscoll@gmail.com
Clifton Herrmann	AMS	Deployments	herrmann@amarine.com
Winn McEnery	AMS	Technical Lead, T-0 collections	johnson@amarine.com
Paul Salop	AMS	T-0 collections, deployments (7/18)	linder@amarine.com
Ila Shimabuku	SFEI	Deployments (7/17)	ilas@sfei.org
David Bell	RTC	*R/V Questuary* skipper	dbell@sfsu.edu

2.3. Sampling Activities

Sampling activities for the 2018 RMP Bivalve Deployment Cruise are shown in Table 2.

Table 2. Sampling Activities for 2018 RMP Bivalve Deployment Cruise

Date	Time	Activity
June 15, 2018	0600-1100	Msrs. Driscoll, Driscoll, McEnery, and Salop collected *M. californianus* from Bodega Head. The mussels were transferred to BML where they were cleaned of fouling organisms, placed in polyethylene aquaculture grow-out bags, and suspended in filtered seawater tanks.
July 16, 2018	1100-1400	Mobilized equipment on vessel *RV Questuary* at Paradise Marina and performed a test deployment of deployment setup
	0900-1330	Dr. Melwani retrieved *M. californianus* from BML and transferred to vessel at Paradise Cay Marina.
July 17, 2018	0545-0635	Mobilized gear aboard *RV Questuary*, Paradise Cay Marina. Conducted safety briefing. Departed for Coyote Creek site (BA10).
	0915-0950	Deployed bivalves at Coyote Creek site. Departed for Dumbarton Bridge site (BA30).
	1005-1035	Deployed bivalves at Dumbarton Bridge site. Departed for Redwood Creek (BA40) site.
	1055-1105	Deployed bivalves at Redwood Creek site. Departed for Dumbarton Bridge site (BA30) to ensure release device was properly disabled.
	1125-1130	Disabled release device at BA30. Departed for Hunter's Point site (BB71).
	1217-1230	Deployed bivalves at Hunter's Point site. Departed for YBI site (BC10).
	1316-1355	Deployed bivalves at YBI. Departed for Paradise Cay.
	1425-1510	Arrived at Paradise Cay and demobilized vessel. Bivalves stored on vessel overnight.
July 18, 2018	0630-0708	Mobilized gear aboard *RV Questuary*, Paradise Cay. Departed for Pinole Point site (BD30).
	0820-1000	Deployed bivalves at Pinole Point site. Departed for San Pablo Bay site (BD20).
	1030-1105	Deployed bivalves at San Pablo Bay site. Departed for Paradise Cay.
	1355-1420	Arrived Paradise Cay and demobilized vessel. Prepared T-0 bivalves and placed on dry ice for transport to AMS.

2.4. Sampling Sites

RMP sampling sites are summarized in Table 3 and shown in Appendix A. Actual numbers of bivalves deployed at each station are summarized in

Table 4.

Table 3. Actual Coordinates for RMP Bivalve Stations for 2018.

Site	Lat	Long	Comments
T-0	38.22050	-123.06550	Mussels collected from intertidal rock outcrops
BA10	37.47021	-122.06407	Adjacent to channel marker "B"
BA30	37.51377	-122.13491	Southeast of channel marker "14"
BA40	37.54737	-122.19524	North / northeast side of channel marker "4"
BB71	37.69547	-122.33933	South of channel marker "1"
BC10	37.81325	-122.35902	Southeast of previous monitoring site
BD30	38.01650	-122.36789	Approx 10 m west of channel marker "P"
BD20	38.05839	-122.43928	West of channel marker "4."

Table 4. Mussels deployed during 2018 Bivalve Deployment Cruise

SITE CODE	REGION	Target	Actual	Comment
T-0	N/A	150	200	Archived 7/18/18; additional 50 set aside for contingency
BA10	South Bay	300	300	
BA30[1]	South Bay	300	300	
BA40	South Bay	200	200	
BB71[1]	Central Bay	200	200	
BC10	Central Bay	200	200	
BD30	North Bay	200	200	
BD20[1]	North Bay	200	200	
BG20[2]	Rivers	N/A	N/A	Residents, to be collected Oct 2018
BG30[2]	Rivers	N/A	N/A	
T-1	N/A	30	TBD	Growth only, to be collected Oct 2018

Notes:
[1]Back 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.
[2]Analysis to be performed on resident *Corbicula fluminea* only. Due to small size of individual clams, allocation of bivalves will be made on volume basis.

2.5. Discussion

2.5.1. Permitting / Permissions

2018 deployments marked the transition from use of diver-based deployments to deployed moorings using acoustic release devices for retrieval. This change necessitated additional permissions / permits to be obtained from various oversight agencies. These included:

- A lease for six sites within California State Lands Commission jurisdiction; this lease runs for a term of six years and will need to be renewed prior to the 2024 deployments (2018 contact: Dobri Tutov, Dobri.Tutov@slc.ca.gov).

- A permit for seven sites within Bay Conservation and Development Commission jurisdiction that allows deployments from June through October of a given year, with no apparent expiration date; it is recommended that AMS / SFEI confirm this with BCDC contact prior to 2020 deployments (2018 contact: Ethan Levine, ethan.lavine@bcdc.ca.gov).

- A letter of authorization for deployment at one site (Yerba Buena Island) from US Coast Guard Waterways Management Division; the letter will need to be renewed prior to each deployment year (2018 contact: Rachel Zamora, Rachel.C.Zamora@uscg.mil).

2.5.2. Bivalve Deployments

The target for surviving bivalves retrieved at the conclusion of deployments is a minimum of 150 live organisms to have enough tissue mass for the planned laboratory analyses. The mussels are to be allocated as follows: 100 bivalves for analysis of PAHs, selenium, algal toxins, and generation of archives, 25 bivalves for analysis of microplastics, and 25-30 for analysis of growth. Sites experiencing extremely high levels of mortality or catastrophic failure of cages may not be able to meet these targets.

To meet this target, 200 individuals of *M. californianus* were deployed at each of four bivalve transplantation sites for S&T analyses and three backup deployment sites (to be archived but only analyzed upon failure of primary deployment stations). At each site, 100 mussels were placed in each of two cages, with four compartments holding 25 mussels each. At sites BA10 and BA30, an additional cage containing 100 mussels was deployed to account for high mortality often exhibited at South Bay sites.

2.5.3. Acoustic Release Devices

Deployments were configured with cages secured to a buoy above the acoustic release and the acoustic release was secured to the bottom by a 70-lb pyramid anchor. A typical configuration is shown in Figure 1.

Figure 1. Typical Deployment Mooring Setup

Prior to deployments all units were tested with the deck box at AMS to ensure expected communications were present. Two of the eight units tested did not respond to communication attempts. These units were taken apart and technicians discovered that the power source was not connected in one unit and in the other unit the motor cable was incorrectly plugged into the circuit board. This was fixed and resolved the issue with communications. These two acoustic releases were subsequently negatively pressurized with a vacuum (to no greater than -5 PSIG) and sealed with Deck Purge/Box Model 120/125 to insure leaking would not occur on/during deployment.

In general, deployments went very smoothly. At six of the stations, AMS was able to communicate successfully with the release devices post-deployment, indicating that releases should respond to surface commands from the deck box controller at time of retrieval. At the seventh station (YBI), the release device did not respond to a signal from the surface, which may indicate that the unit will not respond to the command to release given from the surface. AMS will be prepared for the eventuality of diving at this station to retrieve the mooring, as well as any other stations that might be required.

2.5.4. Deployment Locations

Location of YBI was altered due to the presence of a work crew aboard a tug boat engaged in activity very close to the YBI pre-2018 site. Consequently, YBI 2018 was moved to the southwest (Figure 2).

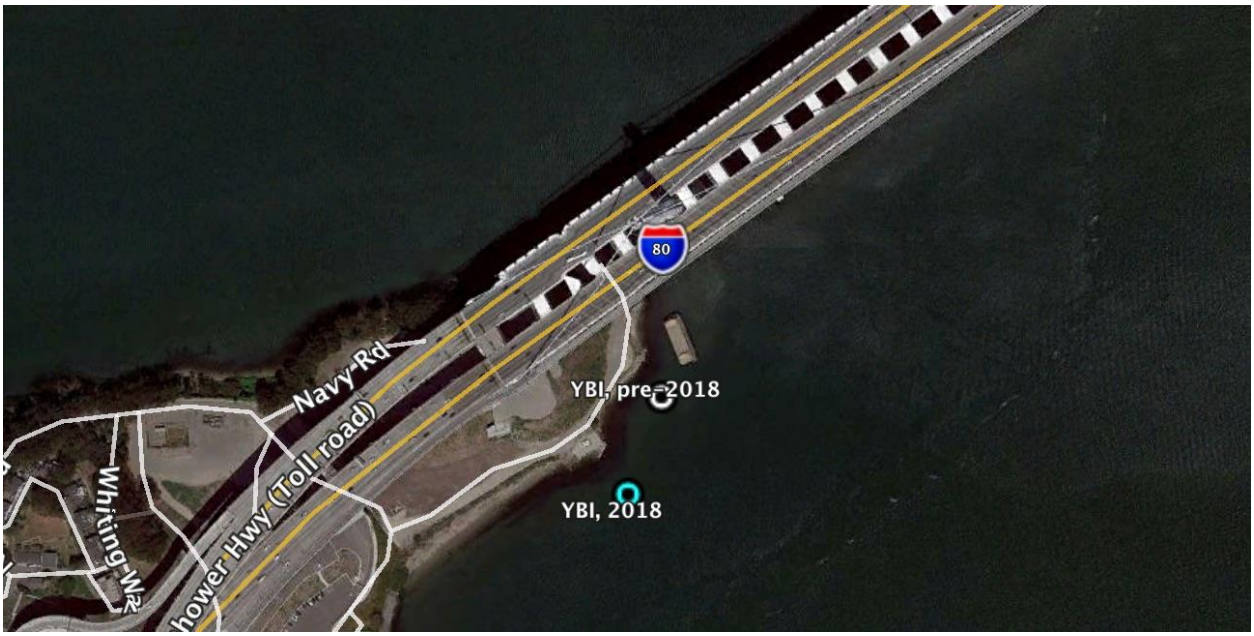

Figure 2. Location of 2018 YBI Mooring Relative to Previous Deployment Site

3. Appendix A – Map of Deployment / Collection Locations for 2018 RMP Bioaccumulation Program