Cruise Plan

2016 RMP Bivalve Deployment Cruise

Contract # 1154

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Submitted to:

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1. Introduction

This report details plans associated with the biennial Regional Monitoring Program for Water Quality in the San Francisco Estuary (RMP) bivalve deployment cruise. This Cruise Plan was developed based upon the decisions of the RMP Technical Review Committee in 2002 to reduce the number of bivalve transplant stations from twelve to nine, utilize deployment cages rather than bags at all stations, and deploy only *Mytilus californianus*. These changes went into effect with the 2003 program and continued through the 2012 deployments. In 2014, the RMP Technical Review Committee reduced bivalve deployment transplant stations from 9 to 7 stations, 3 of which are back-up deployment sites. In addition, as instituted initially with the 2006 deployments, there is no mid-deployment maintenance cruise, as previous analyses showed no difference in bivalve growth or survival between maintained and unmaintained deployments.

2. Cruise Plan

2.1. Objectives

All sampling will be conducted from the *RV Questuary*. The objectives of the sampling effort are as follows:

1. Collect *M. californianus* from Bodega Head State Reserve.
2. Depurate the collected mussels at Bodega Marine Lab (BML) until time of deployment.
3. Conduct defouling of all collected mussels at BML prior to deployment.
4. Deploy the mussels in containment cages at seven sites throughout the San Francisco Estuary.
5. Collect a CTD water column profile at seven sites.

2.2. Personnel

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

Table 1. Personnel for 2016 RMP Bivalve Deployment Cruise

Name	Affiliation	Duties
Aroon Melwani	AMS	Bivalve collections
Jay Johnson	AMS	Bivalve collections, dive tender
Paul Salop	AMS	Cruise manager, bivalve collections, diver
Jim Elliott	AMS	Diver
David Morgan	RTC	Vessel skipper

Messrs. Johnson, Melwani, and Salop will be responsible for bivalve collections. Messrs. Salop and Elliott will perform diving operations. BML Aquatic Resources Group will assist with collections and care of bivalves while depurating at BML, and will conduct defouling operations. Captain Morgan will be responsible for vessel operation and safety. Mr. Salop will be responsible for overall cruise management, including permitting.

2.3. Cruise Schedule

This cruise schedule assumes that approximately 30 minutes will be required for operations at each site, an additional 30 to 60 minutes will be required at mooring installation sites, and the vessel proceeds between stations at approximately 12 knots. Table 2 gives a tentative schedule for cruise operations.

Table 2. Anticipated Cruise Schedule for 2016 RMP Sediment Cruise

Date	Time	Activity
June 7, 2016	0530-1200	Johnson, Melwani, and Salop collect *M. californianus* from Bodega Head State Marine Reserve, Sonoma County. Low tide (-1.3 ft MLLW) occurs at 0738. *M. californianus* are then placed in filtered seawater tanks at Bodega Marine Lab (BML) for depuration and removal of fouling organisms.
June 27, 2016	1000-1400	Melwani retrieves bivalves from BML and transports to Oakland.
June 28, 2016	0900-0915	Mobilize gear, load bivalves aboard *RV Questuary*, Emeryville Marina. Depart for YBI site.
	1000-1330	Check mooring integrity and deploy bivalves at Yerba Buena Island (BC10) and Alameda (BB71) sites. Slack current near Alameda is at 1301 (Figure 1).
June 29, 2016	0700-0715	Mobilize equipment on *R/V Questuary* at San Leandro Marina. Depart for Redwood Creek (BA40).
	0715-1430	Check mooring integrity and deploy bivalves at Redwood Creek (BA40), Dumbarton Bridge (BA30), and Coyote Creek (BA10) sites. Slack current at Dumbarton Bridge is at 0929 (Figure 2).
June 30, 2016	0900-0915	Mobilize gear, load bivalves aboard *RV Questuary*, Vallejo Marina. Depart for San Pablo Bay site.
	0915-1300	Check mooring integrity and deploy bivalves at San Pablo Bay (BD20) and Pinole Point (BD30). Slack current near San Pablo Bay site is at 1052 (Figure 3).
July 1, 2016	As needed	Scheduled makeup day as required.

2.4. Sampling Procedures

As moorings have not been visited in two years, it is possible that several moorings will require additional maintenance or replacement. Therefore, the cruise is designed with one contingency deployment day, June 13th, to account for any additional installations required.

The target for surviving bivalves retrieved at the conclusion of deployments is a minimum of 180 live organisms for status and trends (S&T) analyses. This would allow for allocation of 100 bivalves for organics analysis, microcystin split, selenium split, and archive, 10 for siloxanes, 30 for alternative flame retardants, and 30 for growth. Sites experiencing extremely high levels of mortality or catastrophic failure of cages may not be able to meet this target.

To meet this target, 240 individuals of *M. californianus* will be deployed at each of four bivalve transplantation sites for S&T analyses and three backup deployment sites (to be analyzed only upon

failure of primary deployment stations). At each site, 80 mussels will be placed in each of three cages, with four compartments holding 20 mussels each.

Approximately 1,920 mussels are needed to support S&T analyses (including mussels allocated for T-0 analyses). An additional 250 mussels will be collected to make up for mortality prior to or during deployment operations. Therefore, the total number of bivalves to be collected from Bodega Head is targeted at approximately 2,200 *M. californianus*.

2.5. Sampling Sites

Coordinates for all RMP sampling sites are shown in Table 3. All scheduled samples to be collected at each site are shown in Table 4.

Table 3. Coordinates for 2016 RMP Bioaccumulation Cruise Sampling Sites. All coordinates are listed in WGS-84 datum (See Appendix A for station locations). Coordinates for BG20 and BG30 are approximate only – dredging locations will be established at time of sampling based upon populations present.

Site	Lat	Long	Comments
T-0	38.22050	123.06550	Mussels collected from intertidal rock outcrops
BA10	37.46983	-122.06383	Coyote Creek: Channel marker “18”
BA30	37.51333	-122.13467	Dumbarton Bridge (backup site): Channel marker “14”
BA40	37.54700	-122.19500	Redwood Creek: Channel marker “4”
BB71	37.69550	-122.33967	Alameda (backup site): Channel marker “1” 1.65 nmi. SE of Hunters Point
BC10	37.81392	-122.35873	Yerba Buena Island: Piles 30m SW of Bay Bridge, center pile in only remaining set of dolphins
BD30	38.01667	-122.36750	Pinole Point: Channel marker “P”; no ground line – mooring within body length of pile
BD20	38.05900	-122.42367	San Pablo Bay (backup site): Channel marker “4.” New as of 2006, approx. 1 nmi from channel marker “1” (replaced in 2006)
BG20	38.05570	-121.80593	Sacramento River (residents only): Channel marker “8” N of Sherman Island
BG30	38.02362	-121.80048	San Joaquin River (residents only): Channel marker “8” 0.75 nmi. E of Antioch Marina

Table 4. Sample Matrix for 2016 RMP Bioaccumulation Samples

SITE CODE	REGION	Organics (PAHs, PBDEs)	Growth / DFW	Se	Algal Toxins	Microcystins	Emerging Cont.	Archive
T-0	N/A	x	x	x	x	x	x	x
BA10	South Bay	x	x	x	x	x	x	x
BA30[1]	South Bay	x[1]	x	x[1]	x[1]	x[1]	x[1]	x
BA40	South Bay	x	x	x	x	x	x	x
BB71[1]	Central Bay	x[1]	x	x[1]	x[1]	x[1]	x[1]	x
BC10	Central Bay	x	x	x	x	x	x	x
BD30	North Bay	x	x	x	x	x	x	x
BD20[1]	North Bay	x[1]	x	x[1]	x[1]	x[1]	x[1]	x
BG20[2]	Rivers	x[2]	x[2]	x[2]	x[2]	x[2]	x[2]	x[2]
BG30[2]	Rivers	x[2]	x[2]	x[2]	x[2]	x[2]	x[2]	x[2]
T-1	N/A		x					
TOTAL		7	11	7	7	7	7	10

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]Will be analyzed from residents only – no transplants

2.6. Sample Handling

Sample handling instructions for all bivalve samples are shown in Table 5.

Table 5. Sample Handling for 2016 RMP Bioaccumulation Samples

Sample	Shipping Destination	Container	Analyzing Lab	Target Mass (g ww)	Handling Requirements
Organics + special studies (PBDEs, PAHs, Se, algal toxins, archives)	AXYS	1 gallon zip-top bag		1 gallon zip-top bag	Collect xxx organisms (10 for PAHs, 5 for PBDEs, 5 for Se, 10 for algal toxins …70 for organics archive), do not rinse, wrap in two layers of aluminum foil, place in zip-top bag, freeze or place on dry ice.
PBDEs	"	"	AXYS	10	"
PAHs	"	"	AXYS	20	"
Se	"	"	BAL	10	"
Algal toxins	"	"	UCSC	5	"
Archive	"	"	TBD	136	"
Emerging Contaminants (placeholder)	SIU	TBD	SIU	TBD	TBD
Growth	AMS	1 gallon zip-top bag, double-bagged	AMS	N/A	Collect 30 organisms, rinse with site water, place in zip-top bags, freeze or place on dry ice.

2.7. Sample Labeling

The sample ID labeling system used for the 2016 cruise is as follows:

RMP-16BC-XXXX

Where:

RMP	=	Project
16	=	Cruise Year
BC	=	Matrix (Bioaccumulation Cruise)
XXXX	=	Unique ID number

2.8. Current Charts

Predicted currents associated with planned dive operations are shown in the following figures.

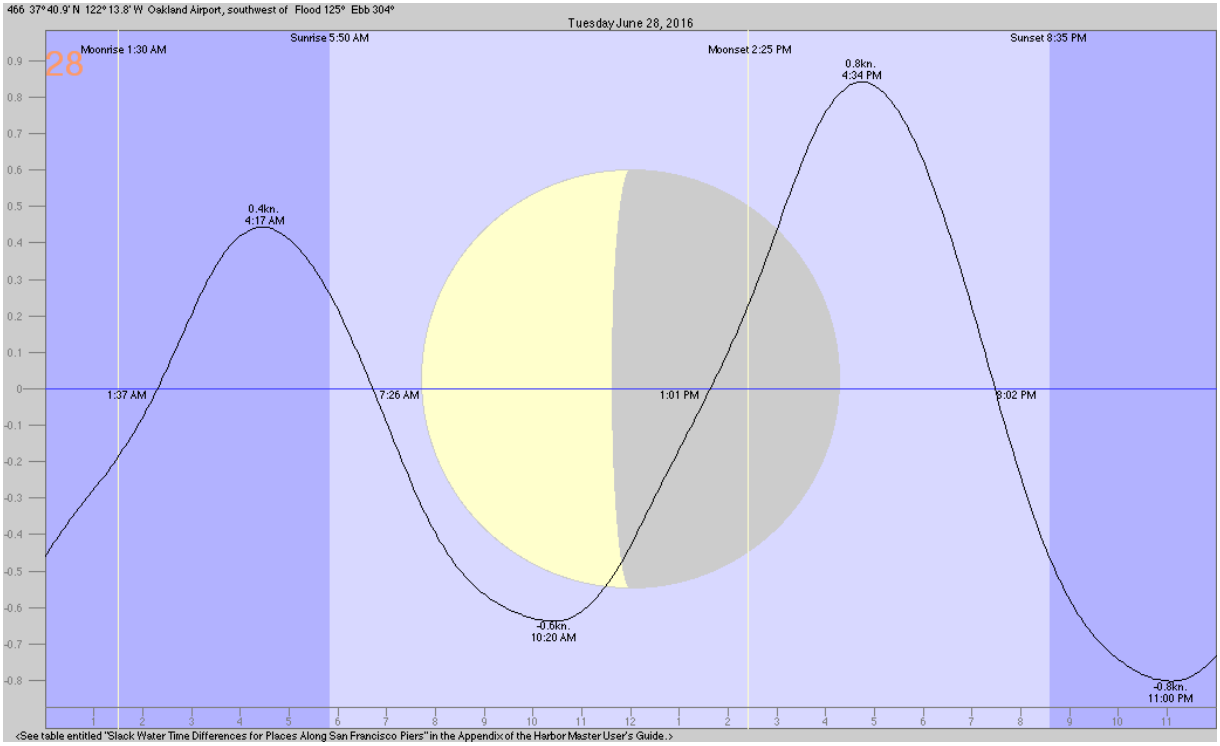

Figure 1. Currents near Alameda on June 28, 2016.

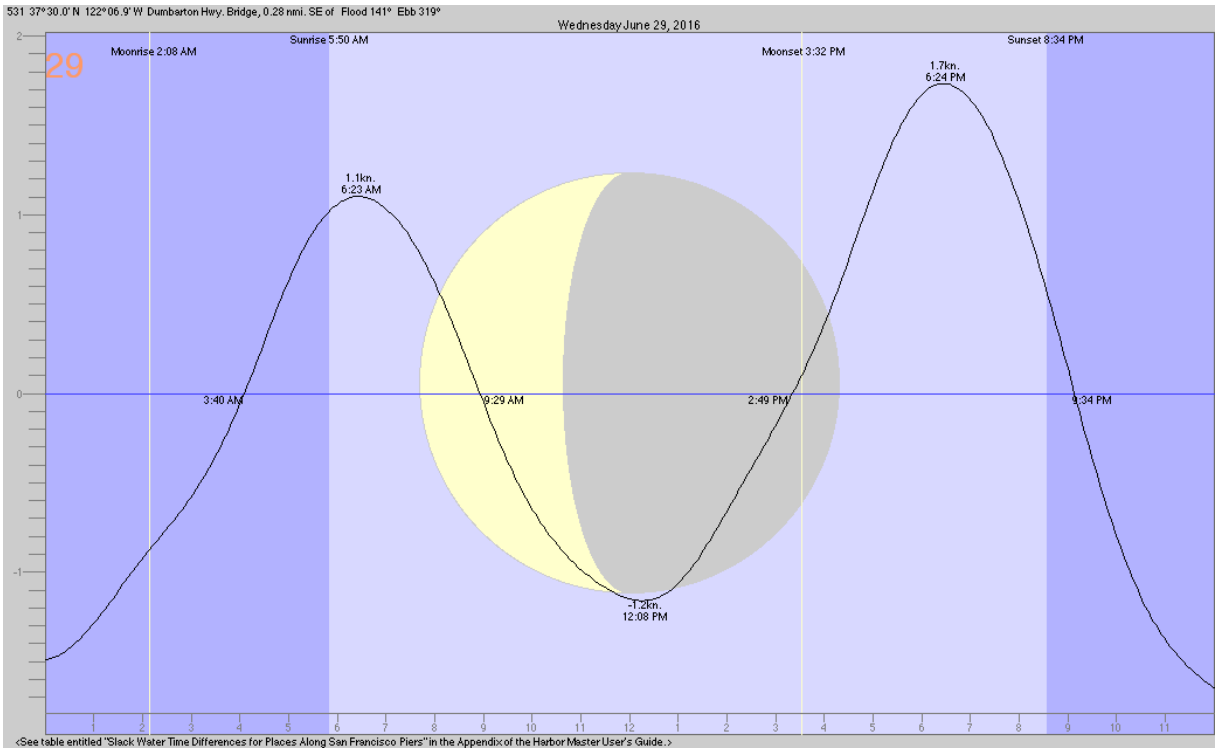

Figure 2. Currents near Dumbarton Bridge on June 29, 2016.

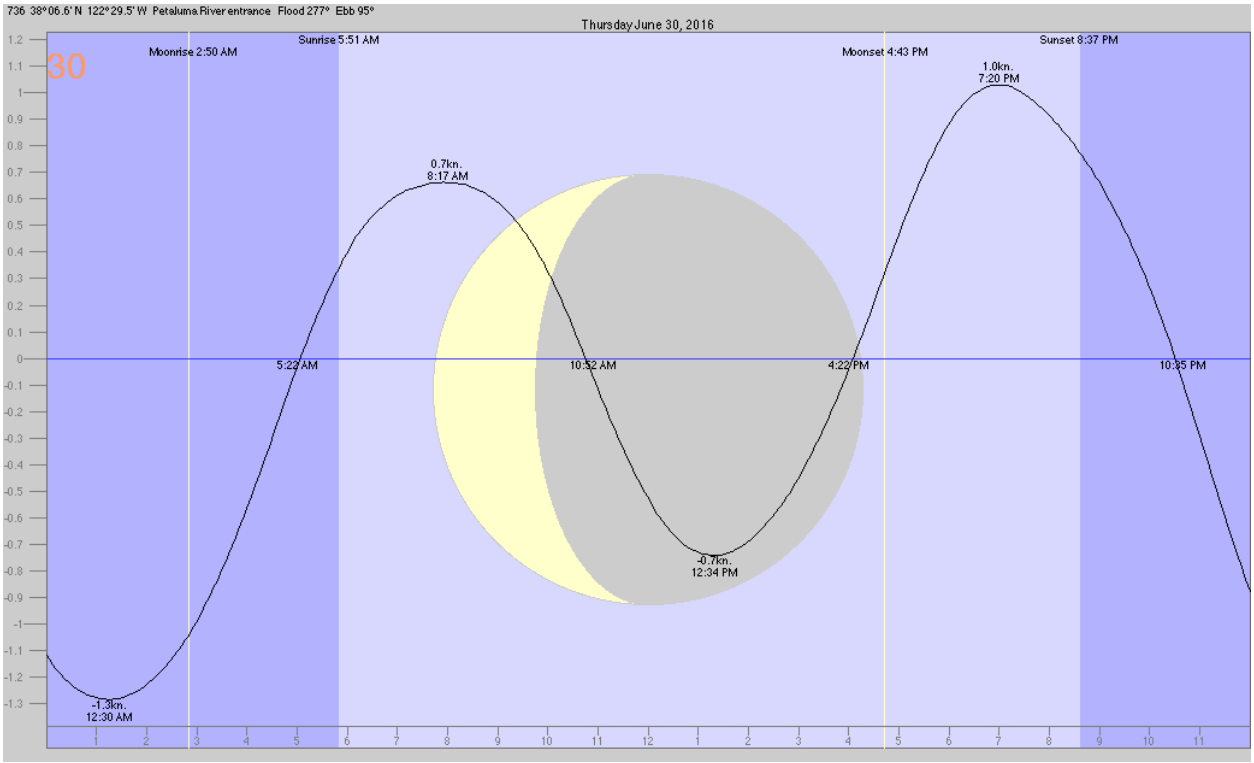

Figure 3. Currents near Petaluma River entrance on June 30, 2016.

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