

Cruise Plan

2016 RMP Bivalve Retrieval Cruise

Contract # 1231

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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 San Francisco Bay (RMP) bivalve retrieval 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. Retrieve *Mytilus californianus* (MCAL) deployed at seven sites during the deployment cruise (June 28 – July 1, 2016).
2. As available, divide surviving bivalves as follows:
 - 120 bivalves for preparation of homogenate and analysis of PBDEs and PAHs (AXYS), Se (BAL), algal toxins (UCSC), and preparation of an archive (AMS).
 - 30 bivalves for analysis of emerging contaminants (SIU)
 - 30 bivalves for analysis of growth by AMS
3. Obtain survival data at each transplant site.
4. Conduct maintenance operations on the deployment sites themselves to prepare for future deployments employing acoustic release devices.
5. Harvest 30 T-1 MCAL from Bodega Head for analysis of growth only.
6. Harvest resident *Corbicula fluminea* (CFLU) from two sites, historic San Joaquin River and Sacramento River stations.
7. Collect a CTD water column profile at nine sites (7 transplant and 2 resident sites)

2.2. Personnel

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

Table 1. Personnel for 2016 RMP Bivalve Retrieval Cruise

Name	Affiliation	Duties
Paul Salop	AMS	Cruise manager, diver, CFLU collections
Winn McEnergy	AMS	Diver, CFLU collections
Steve Pengilley	Tenera	Dive tender
David Morgan	RTC	Vessel skipper

Mr. McEnery and Mr. Salop will perform diving responsibilities. 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, 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 Bivalve Retrieval Cruise

Date	Time	Activity
Sept 30, 2016	1500-2000	Salop / Melwani harvests T-1 mussels for analysis of growth.
Oct 4, 2016	0700-0745	Mobilize gear aboard <i>RV Questuary</i> , Vallejo Marina. Depart for Pinole Point site.
	0900-1300	Check mooring integrity and retrieve bivalves at Pinole Point (BD30) and San Pablo Bay (BD20) sites. Slack current near San Pablo Bay site is at 0952 (Figure 1).
Oct 5, 2016	0700-0715	Mobilize gear, load bivalves aboard <i>RV Questuary</i> , Emeryville Marina. Depart for Redwood Creek site.
	0830-1400	Check mooring integrity and retrieve bivalves at Redwood Creek (BA40), Dumbarton Bridge (BA30), and Coyote Creek (BA10) sites. Slack current at Dumbarton Bridge is at 0956 (Figure 2).
Oct 6, 2016	0800-0815	Mobilize gear, load bivalves aboard <i>RV Questuary</i> , Emeryville Marina. Depart for Alameda site.
	0915-1300	Check mooring integrity and retrieve bivalves at Alameda (BB71) and Yerba Buena Island (BC10) sites. Slack current near Alameda is at 0951 (Figure 3).
Oct 7, 2016	0800-1300	Scheduled makeup dive day as required.
TBD	TBD	Collect CFLU at BG20 and BG30

2.4. Sampling Procedures

All diving operations will be conducted by divers working in pairs and tethered together. Where appropriate, the vessel will tie up to the deployment sites and the vessel crew will attach a safety line (floating line with large life ring on end) to the structure as needed. The divers will enter the water, descend to the bottom, and locate the ground line to the mooring. When the ground line has been located, its attachment to the piling will be examined by feeling for abrasion and looseness in the knots and cable ties. After this examination, the divers will proceed along the ground line, checking its integrity. At the mooring, the earth anchors will be checked to confirm that they have not worked out of the bottom and that serious erosion of bottom sediments has not occurred around them. The divers will next ascend the mooring line to the bivalve cages and remove the cages from the mooring lines. In preparation for transition to use of acoustic releases in the future, divers will, if possible, release the moorings from the

earth anchors and return this equipment to surface with attached cages. If moorings are unable to be released, then divers will remove individual cages and leave the moorings in place. The divers will then return to the surface by retracing their route along the ground line and piling.

When the bivalves are onboard the vessel, they will be carefully packaged for shipment to the analytical laboratories. Upon return to the surface, all bivalves will be removed from the cages, placed into a cleaned cooler, and mixed well. Dead bivalves will be counted and collected for on-land disposal. Appropriate numbers of the live organisms will be allocated for chemical analyses and growth. Bivalves for chemical analysis will be processed first. After apportioning, all bivalves will be quick frozen on dry ice. All bags will be labeled by station, date, species, analysis, and quantity of bivalves they contain. Bivalves for chemical analysis will remain frozen on-board the vessel until the conclusion of the sampling day.

At the conclusion of the cruise, the bivalves for chemical analysis will be shipped to the appropriate analytical laboratories for analysis and long-term archive. AMS will retain any remaining bivalves for analysis of growth.

2.5. Sampling Sites

Coordinates for all RMP bioaccumulation monitoring 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. 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	Channel marker “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 set of piles
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.
BG20	38.05967	-121.79167	Channel marker “8” N of Sherman Island
BG30	38.02117	-121.80533	Channel marker “8” 0.75 nmi. E of Antioch Marina

Table 4. Bivalve Allocations for 2016 RMP Bioaccumulation Samples

SITE CODE	REGION	AXYS ³	Emerg. Cont - SIU	Growth - AMS ³
T-0	N/A	120	30	30
BA10	South Bay	120	30	30
BA30 ¹	South Bay	0 ¹	0 ¹	0 ¹
BA40	South Bay	120	30	30
BB71 ¹	Central Bay	0 ¹	0 ¹	0 ¹
BC10	Central Bay	120	30	30
BD30	North Bay	120	30	30
BD20 ¹	North Bay	0 ¹	0 ¹	0 ¹
BG20 ²	Rivers	#	#	#
BG30 ²	Rivers	#	#	#
T-1	N/A			
# Analyses		7	7	7

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.

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.

³Allocation of homogenate for analysis of PAHs and PBDEs, selenium, algal toxins, and long-term archive will be made by AXYS from whole bivalves, and aliquots delivered directly to labs.

2.6. Sample Handling

The target number of bivalves to be allocated to each lab are shown in . Sample handling instructions for all bivalve samples are shown in Table 5. Laboratory contacts are provided in Table 6.

Table 5. 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
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	136	70
Emerging Contaminants	SIU	60	30
Growth	AMS	N/A	30

Table 6. Sample Handling for 2016 RMP Bioaccumulation Samples

Sample	Container	Handling Requirements
Trace Elements	N/A	Not collected in 2016
AXYS Bulk Sample	1 gallon zip-top bag	Collect 150 organisms do not rinse, wrap in two layers of aluminum foil, place in zip-top bags, freeze or place on dry ice.
Algal Toxins	N/A	Collected as split from organics homogenate. Sample material forwarded from AXYS to lab via AMS.
Selenium	N/A	Collected as split from organics homogenate. Sample material forwarded from AXYS to lab via AMS.
Archive	N/A	Collected as split from organics homogenate. Sample material forwarded from AXYS to lab via AMS.
Emerging Contaminants	N/A	Collected as split from organics homogenate. Sample material forwarded from AXYS to lab via AMS.
Growth	1 gallon zip-top bag, double-bagged	Collect 30 organisms, rinse with site water, place in zip-top bags, freeze or place on dry ice.

Table 7. Laboratory Contacts / Shipping Info

Lab	Address	Contact
AXYS	AXYS Analytical Services Ltd. 2045 Mills Rd. Sidney, BC Canada V8L 5X2	Kalai Pillay 250-655-5834 kpillay@axys.com
BAL	Brooks Applied Laboratories 18804 Northcreek Parkway, Suite 100 Bothell, WA 98107	Tiffany Stillwater 206-632-6017 tiffany@brooksapplied.com
UCSC	UCSC - Ocean Sciences, EMS A316 1156 High St. Santa Cruz, CA 98011	Raph Kudela 831-459-3290 kudela@ucsc.edu
SIU	1125 Lincoln Drive Life Science II, Room 251, Southern Illinois University Carbondale, IL 62901	Da Chen 618-453-6946 dachen@siu.edu

2.7. Sample Labeling

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

RMP-16BC-XXXX-##

Where:

RMP	=	Project
16	=	Cruise Year
BC	=	Matrix (Bioaccumulation Cruise)
XXXX	=	Unique ID number
##	=	Aliquot number (for archive samples only)

2.8. Current Charts

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

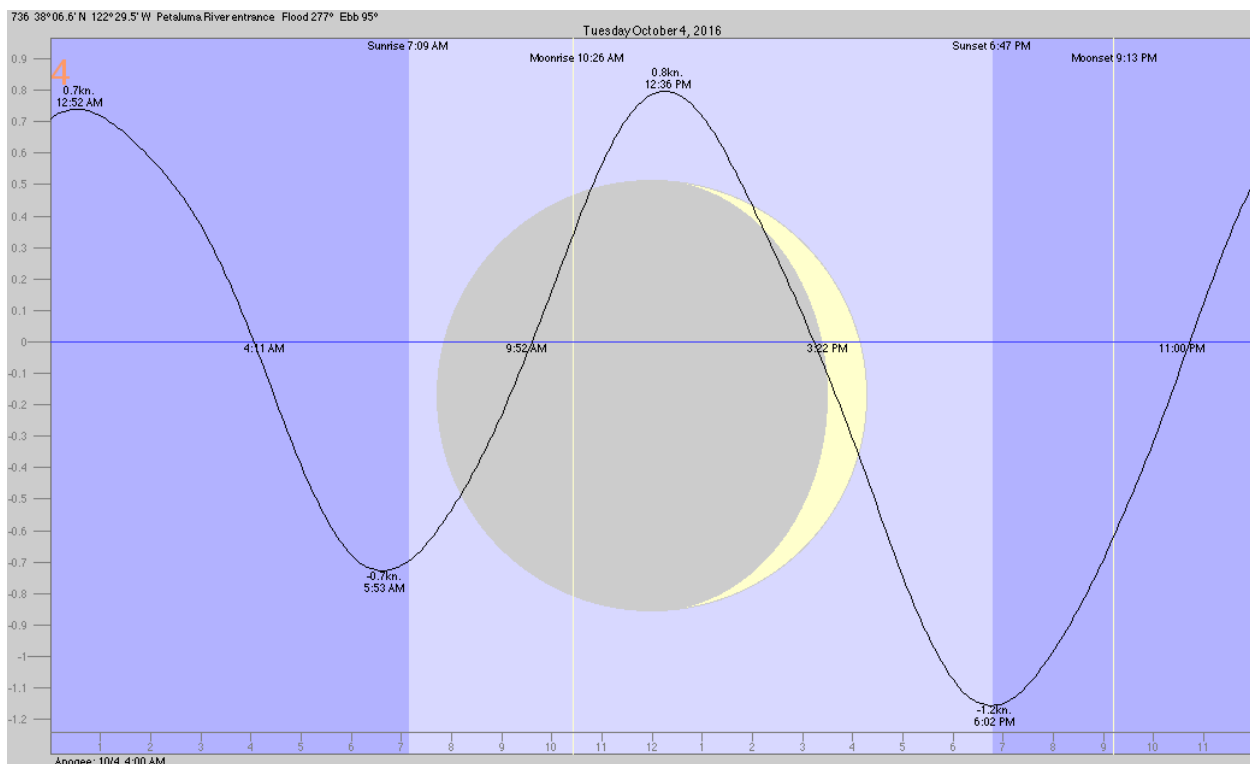


Figure 1. Currents near Petaluma River Entrance on October 4, 2016

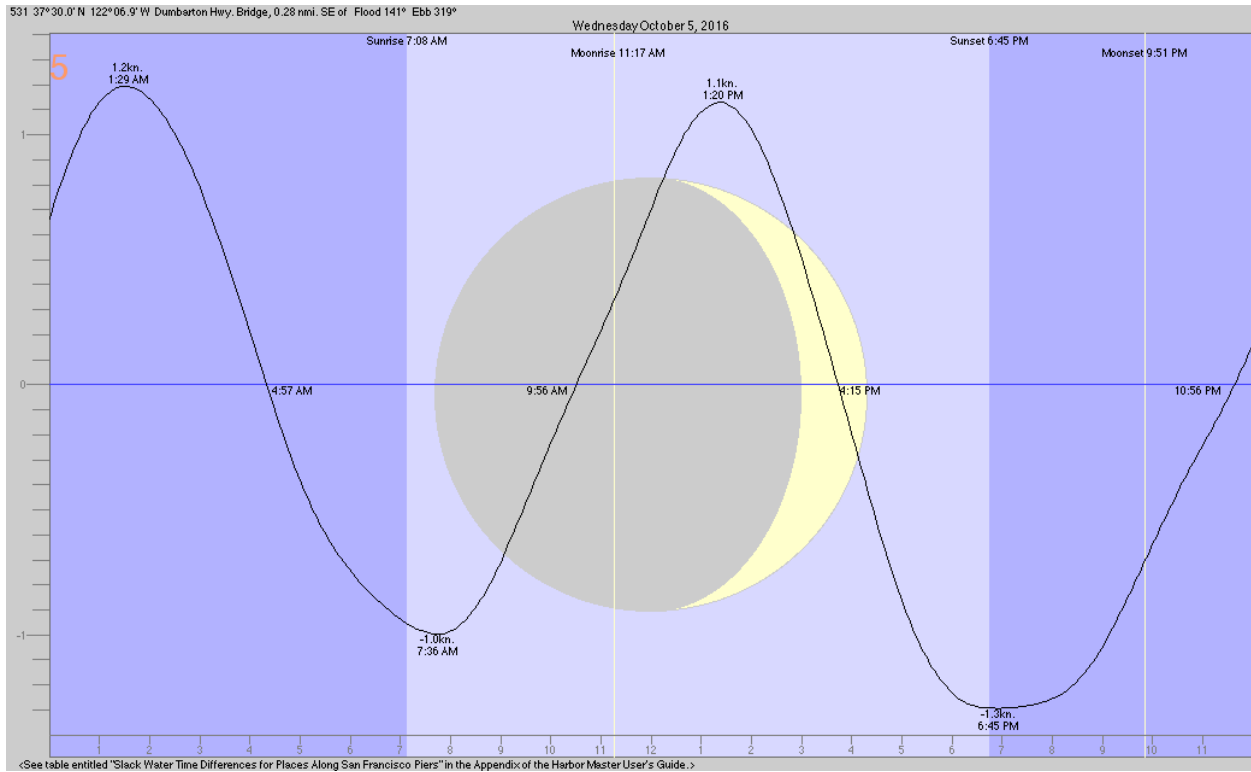


Figure 2. Currents near Dumbarton Bridge on October 5, 2016.

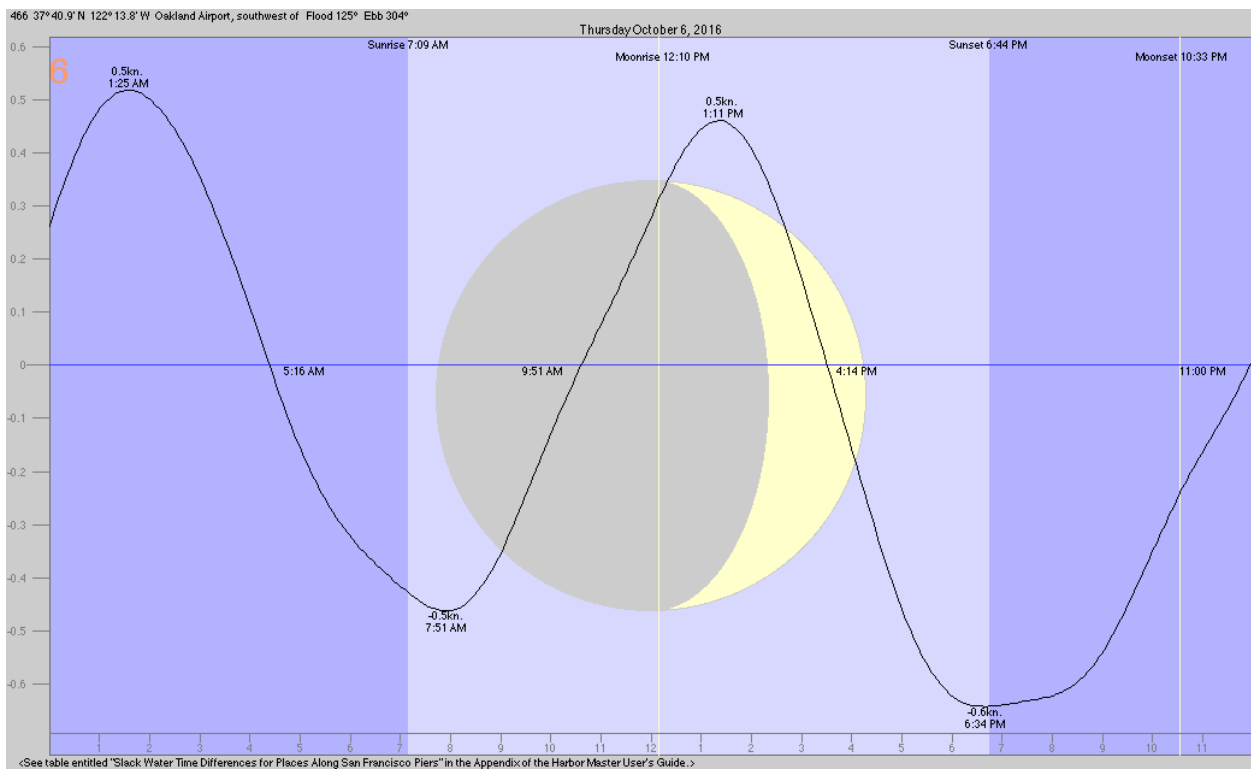


Figure 3. Currents near Oakland Airport on October 6, 2016.

2.9. Discussion

As detailed previously, AMS divers will take steps during the dive operations to transition from diver-deployments to deployments via acoustic release systems beginning in 2018.

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

