Cruise Report
Regional Monitoring Program
Bivalve Maintenance Cruise #6
July 27–29, 1994

1.0 INTRODUCTION

This report describes activities associated with the dry-season bivalve maintenance cruise of the Regional Monitoring Program for Toxic Contaminants in the San Francisco Estuary. Measurement of contaminant bioaccumulation in transplanted bivalves is one component of this program that is designed to provide long-term data on concentrations of trace metals and organic compounds, as well as toxicity throughout the estuary. Also being measured are water and sediment concentrations of trace metals and organic compounds. Moreover, in addition to sampling in the estuary, water is also being collected from the Sacramento and San Joaquin rivers upstream of the delta.

Contaminant bioaccumulation in bivalves is being measured in this program by collecting bivalves from sites that are known to be clean and transplanting them to locations in the Estuary. Three species of bivalves, *Mytilus californianus*, *Crassostrea gigas*, and *Corbicula fluminea*, are deployed at different locations depending upon the expected range of salinity. *M. californianus* is deployed at the most saline sites, which are from San Pablo Bay southward to the Dumbarton Bridge, *C. gigas* is deployed at intermediate salinities between Grizzly Bay and San Pablo Bay and south of the Dumbarton Bridge, and *C. fluminea* is deployed at freshwater or brackish sites east of Carquinez Strait. *M. californianus* is collected from Bodega Head, *C. gigas* is obtained from a commercial grower in Tomales Bay, and *C. fluminea* is collected from Lake Isabella in Kern County.

Bivalves are attached to moorings at 15 sites. Triplicate moorings at three of the 15 sites, Davis Point, Horseshoe Bay, and Alameda, serve as controls for local effects monitoring (LEM) programs at Central Contra Costa, EBMUD, and the City and County of San Francisco (CCSF) wastewater discharges, respectively.

2.0 CRUISE REPORT

2.1 Objective

The objective of this cruise was:

1) Check and maintain bivalve moorings at 15 sites.

2.2 Personnel

The personnel and work assignments for this cruise were as follows:
<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
<th>Duties</th>
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<tbody>
<tr>
<td>David Bell</td>
<td>AMS</td>
<td>Diver</td>
</tr>
<tr>
<td>Patrick Conroy (7/27)</td>
<td>CCSF</td>
<td>Vessel skipper</td>
</tr>
<tr>
<td>Dane Hardin</td>
<td>AMS</td>
<td>Cruise Manager, Dive Master</td>
</tr>
<tr>
<td>Michael Kellogg (7/29)</td>
<td>CCSF</td>
<td>Vessel skipper</td>
</tr>
<tr>
<td>Brian Sak (7/28)</td>
<td>CCSF</td>
<td>Vessel skipper</td>
</tr>
</tbody>
</table>

2.3 Activities

3/14/94 0700–0730 Mobilized gear at R/V Rincon Point, South Beach Harbor, departed for Alameda station.

0800–0935 Checked and maintained triplicate moorings at Alameda station, removing fisherman’s anchor from west mooring, departed for Redwood Creek station.

1015–1045 Checked and maintained mooring at Redwood Creek station, departed for Dumbarton Bridge station.

1100–1125 Checked and maintained mooring at Dumbarton Bridge station, departed for Coyote Creek station.

1140–1208 Checked and maintained mooring at Coyote Creek station, departed for Yerba Buena Island station.

1345–1409 Checked and maintained mooring at Yerba Buena Island station, departed for Alameda to refuel vessel.

1430–1500 Refueled vessel, departed for South Beach Harbor.

1520–1540 Demobilized gear.

3/15/94 0700–0730 Mobilize gear at R/V Rincon Point, South Beach Harbor, departed for Horseshoe Bay station.

0801–0901 Checked and maintained triplicate moorings at Horseshoe Bay station, departed for Red Rock station.

0934–1003 Checked and maintained mooring at Red Rock station, departed for San Pablo Bay station.
1030–1105 Checked and maintained mooring at San Pablo Bay station, departed for Petaluma river station.

1137–1221 Checked and maintained mooring at Petaluma River station, departed for Pinole Point station.

1323–1355 Checked and maintained mooring at Pinole Point station, departed for Davis Point station.

1428–1510 Checked and maintained triplicate moorings at Davis Point station, departed for Napa River station.

1527–1556 Checked and maintained mooring at Napa River station, departed for Vallejo Marina.

1605–1630 Demobilized gear.

3/16/94 0715–0730 Mobilized gear at R/V Rincon Point, Vallejo Marina, departed for Grizzly Bay station.

0820–0920 Checked and maintained mooring at Grizzly Bay station, half of mooring missing, installed insurance line on remaining portion of mooring, departed for Sacramento River station.

1000–1027 Checked and maintained mooring at Sacramento River station, departed for San Joaquin River station.

1046–1119 Checked and maintained mooring at San Joaquin River station, departed for Vallejo Marina to refuel vessel and return dock key.

1215–1245 Refueled vessel, returned key, departed for South Beach Harbor.

1530-1600 Demobilized gear, departed for home.

2.4 Discussion

*Bivalve and Mooring Condition*

Moorings and bivalves were generally in good condition (Table 1), although moorings at two sites will require close scrutiny and preventive maintenance in the future. The most serious situation is at Grizzly Bay where half of the mooring was missing. Examination of the remains of the missing mooring suggest that the mooring line may have abraded. This is probably a result of the single-point mooring design employed at this shallow site. To
ensure that the buoys were not visible during low tides and to provide sufficient space for attachment of the bivalve bags, separate mooring lines with single buoys were secured to each of the two earth anchors at this site. Such a single-point mooring in shallow water allows the buoy and mooring line to pump back and forth in response to passing surface waves, abrading the mooring line and its protective length of garden hose at their point of contact with the earth anchor. A second line was attached to the remaining mooring to ensure that it remains in place until the bivalves are retrieved in September. In the future, the mooring lines will be removed and replaced annually at this site. The other site that warrants close scrutiny is San Pablo Bay. The ground line and eyes of the earth anchors at this site are now approximately 24 in off the bottom, suggesting that substantial erosion has taken place. If this trend continues, we will remove the lines from the earth anchors and re-screw the anchors into the bottom. If such erosion is cyclic or if the bathymetry at the time the mooring was installed was caused by sediments deposited from high runoff and delta outflow, re-screwing the anchors into the bottom risks burial of the ground line and earth anchors by future deposition. Deposition was observed at Coyote Creek and Petaluma River, where the eyes of the earth anchors were buried in the mud approximately 4 in.

General Comments

All cruise objectives were achieved despite strong winds and heavy seas during most of the cruise. Nevertheless, a potentially serious situation occurred at Pinole Point. During the dive conditions were typical for this site, with winds of 20–25 kts and seas of 3–4 ft. As the divers were returning to the surface, the boat came untied from the piling and began drifting away. Consequently, they had to hang on to the piling in heavy seas while the boat maneuvered back to pick them up. If the boat had been anchored at this site, as is sometimes the case, it would have been very difficult for the skipper to single-handedly recover the anchor and operate the boat in the heavy seas. As it was, it was not easy for the skipper to position the boat to successfully toss a life ring to the divers. If the skipper had been washed overboard during this operation, a life-threatening situation would have occurred for both the divers and the skipper. Consequently, it is imperative that a dive tender be on board the vessel during all future diving operations.

Table 1. Observations of Bivalve Condition

<table>
<thead>
<tr>
<th>Site Name</th>
<th>Comments</th>
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<tbody>
<tr>
<td>Coyote Creek</td>
<td>zero visibility, earth anchor eyes buried in mud approximately 4 in, no apparent fouling</td>
</tr>
<tr>
<td>Dumbarton Bridge</td>
<td>zero visibility, moderate fouling by hydroids and ascidians, mussel byssal threads present</td>
</tr>
<tr>
<td>Redwood Creek</td>
<td>visibility 1.5 ft, moderate fouling by hydroids and ascidians, mussel byssal threads present</td>
</tr>
<tr>
<td>Alameda (triplicate)</td>
<td>zero visibility, fisherman’s anchor and line wrapped around west mooring (no apparent damage to mooring) moderate fouling by hydroids, mussel byssal threads present</td>
</tr>
</tbody>
</table>
Yerba Buena Island: visibility 0.5 ft, heavy fouling by hydroids, mussel byssal threads present.

Horseshoe Bay (triplicate): visibility 2 ft, heavy fouling by hydroids, mussel byssal threads present, several holes repaired in bags.

Red Rock: visibility 0.5 ft, moderate fouling by hydroids, mussel byssal threads present.

Pinole Point: visibility 0.5 feet, moderate fouling by hydroids, mussel byssal threads present.

San Pablo Bay: visibility 0.5 ft, earth anchor eyes approximately 24 in from the bottom due to erosion, moderate fouling by hydroids, oyster shells sounded full.

Petaluma River: zero visibility, ground line and earth anchor eyes buried in mud approximately 4 in, very little fouling, mussel byssal threads not apparent, but oyster shells sounded full.

Davis Point (triplicate): zero visibility, little fouling, oyster shells sounded full.

Napa River: zero visibility, little fouling, oyster shells sounded full.

Grizzly Bay: visibility 0.5 ft, half of mooring missing with two bags of clams and one bag of oysters, no apparent fouling, remaining oyster shells and clam shells sounded full.

Sacramento River: zero visibility, no apparent fouling, clam shells sounded full.

San Joaquin River: zero visibility, no apparent fouling, clam shells sounded full.