Potamocorbula amurensis

Heather Peterson

In January 1996, DWR revised the Decision 1485 benthic monitoring sampling program. Benthic data are now collected at 10 sites in the estuary: C9 Clifton Court; D16 Twitchell Island; D24 Rio Vista; P8 Rough and Ready Island; D28A Old River; D4 Collinsville; D6 Bulls Head Point (near the mothball fleet); D7 Grizzly Bay; D41 Pinole Point and D41A at the mouth of the Petaluma River. Sites D28A, D4, D7, and D41 are remnants of the historical program. The additional sites have broadened the geographic range of the program and dramatically lengthened the list of collected benthic species. Data from D4, D7, D6, D41, and D41A, in particular, have improved our ability to track the population trends of *P. amurensis* or at least have provided enough data to make the clam graphs more interesting.

Data from all current benthic monitoring sites where *P. amurensis* occurs are displayed in Figure 1.

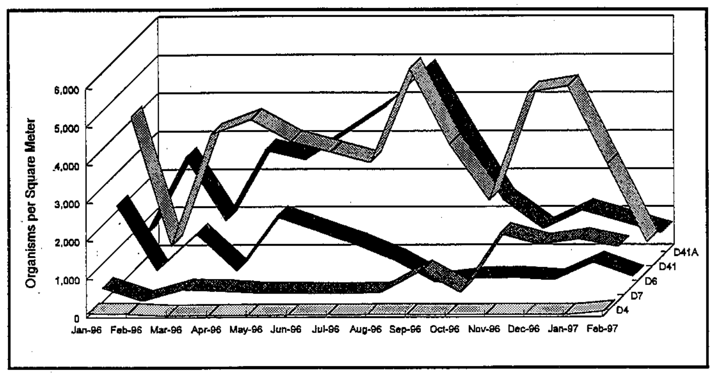

Figure 1
ABUNDANCE OF *POTAMOCORBULA AMURENSIS*, JANUARY 1996 - FEBRUARY 1997

D41A is the westernmost site in our program. As usual, abundance of *P. amurensis* in early spring was low, possibly due to high outflow in late February 1996. Populations grew steadily through the summer, peaking in August at 4900 clams/m^2. *P. amurensis* density declined through fall and winter, reaching 600 clams/m^2 by February 1997.

D41 has generally had the highest abundance of *P. amurensis* of any of the sites sampled. Trends at D41 were similar to those at D41A. Maximum clam density, in August, reached 5300 clams/m^2 at D41. In November and December 1996, while clam density was dropping at D41A, site D41 recovered to 4700-4900 clams/m^2, possibly due to recruitment from late summer spawning.

Clam density at D6 fluctuated between 500 and 2000 clams/m^2 through July, then decreased through fall and winter, with a short rise back to 600 clams/m^2 in January 1997.

Clam density at site D7 seems to show an opposite seasonality to sites farther west. High outflow in February-May 1996 may have kept the water too fresh for many clams to get established in Grizzly Bay before late summer. Populations at D7 peaked at 1700 clams/m^2 in November and remained high through early spring 1997.

Site D4 at Collinsville is the most easterly station where *P. amurensis* is found. We found one or two clams per grab (19-36 clams/m^2) consistently over the past year at this site. Clam abundance at D4 has declined and has remained low level since 1994.

Figures 2, 3, and 4 show population trends in the regions for which we have historical data.

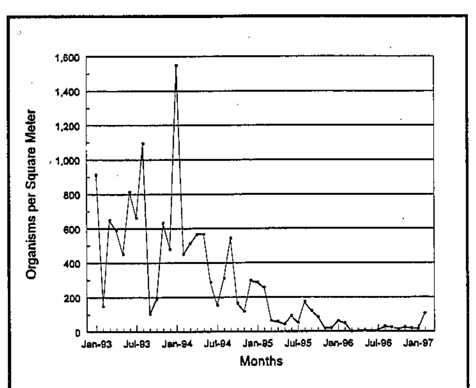

Figure 2
ABUNDANCE OF *POTAMOCORBULA AMURENSIS* AT D4, 1993-1996

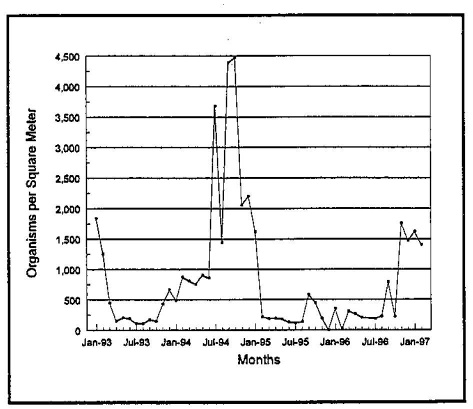

Figure 3
ABUNDANCE OF *POTAMOCORBULA AMURENSIS* AT D7, 1993-1996

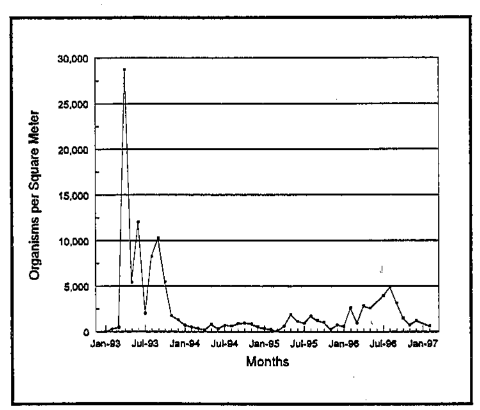

Figure 4
ABUNDANCE OF *POTAMOCORBULA AMURENSIS* AT D41A, 1993-1996

Selenium Trends in North San Francisco Bay

Samuel N. Luoma and Regina Linville, US Geological Survey, Menlo Park

Bioindicators are especially effective in monitoring selenium contamination, one of the most serious contamination problems in San Francisco Bay. The bivalves *Corbicula fluminea*, *Macoma balthica*, and *Mytilus edulis* have all been employed in past studies, either as resident or transplanted species (Risebrough 1977; Johns *et al* 1988). A distinct gradient in selenium contamination, with maximum concentrations near Carquinez Strait, was a feature of North Bay in 1976 in *Mytilus edulis* (Risebrough 1977) and 1985-1986 in *Corbicula fluminea* (Johns *et al* 1988). Selenium concentrations in suspended particulate materials were also highest near Carquinez Strait after the flood of 1986 (Cutter 1989) but were more widespread later in the year, when river inflows were reduced and residence times were longer in San Pablo Bay and Suisun Bay.

Cutter (1989) showed that the most important form of dissolved selenium in the North Bay in 1986-1990 was selenite. Selenite is readily taken up by phytoplankton, biotransformed to organo-selenium, then efficiently transferred to bivalves (clams) that ingest the phytoplankton with suspended particulate material (Luoma *et al* 1992). Bivalves accumulate selenium to concentrations about 10 times higher than the concentration in the phytoplankton. Some of the important resource species in the north bay and delta eat bivalves (sturgeon, diving ducks such as scoter and scaup, dungeness crab). Earlier studies (SWRCB 1991) showed that these predators concentrate the element in their flesh and liver to levels substantially higher than found in the bivalves. Because selenium is a potent reproductive toxin, the well-being of populations of these upper trophic level species is threatened by selenium contamination. The bivalves are good bioindicators of exposure of the resource species.

Resident bivalve communities in the North Bay and Suisun Bay are now dominated by the species *Potamocorbula amurensis*. This animal first became established in North Bay in 1986, and rapidly grew in population abundance, apparently displacing several previous residents. Recent studies, conducted in partnership with the San Francisco Bay Regional Water Quality Control Board, have begun updating understanding of selenium contamination in the bivalves of North Bay. In one phase of that study, selenium concentrations in *P. amurensis* were compared with concentrations observed in past studies in the region around Carquinez Strait. *P. amurensis* was sampled in May 1995, then repeatedly between December 1995 and June 1996 at a station in Carquinez Strait (at USGS station 8.1). The clams were collected from the subtidal zone with a VanVeen grab and 1- or 2-mm sieves. Channel depths were 8-20 meters. From 60 to 120 clams of all sizes were collected at each time and placed into containers of water collected at the site for depuration of undigested gut content. The clams were kept in this ambient water at a constant temperature room at 10°C for 48 hours. Then the clams were separated into size classes of 1-mm difference, and composite samples were constructed from similar-sized individuals. Selenium was determined by Hydride Atomic Absorption Spectrophotometry after digestion in concentrated nitric and perchloric acids at 200°C and reconstitution in hydrochloric acid.

Figure 1 shows the mean concentrations of selenium found in bivalves sampled from resident populations or translocated to the Carquinez Strait area. Studies were conducted in 1975, 1984-1986, and 1996. Selenium was first studied in North Bay in translocated *M. edulis* in 1975. Risebrough *et al* (1977) found a mean concentration of 8 ± 3 µg/g in the transplants near Carquinez Strait (one of the highest concentrations reported). In 1985 and 1986, Johns *et al* (1988) sampled resident *Corbicula amurensis* at near-monthly intervals from a station just landward of Carquinez Strait (the most seaward population of *Corbicula* in Suisun Bay at the time). In 67 samples collected over that period, they found a mean concentration of 6 ± 3 µg/g in the clams. In 1985 and 1996, oysters (*Crassostrea gigas*) were translocated to the Carquinez Strait area to study contaminant bioaccumulation (*eg*, Regional Monitoring Program 1996). Concentrations of selenium in the oysters after 3 months of deployment in summer 1995 was 4 µg/g, similar to the

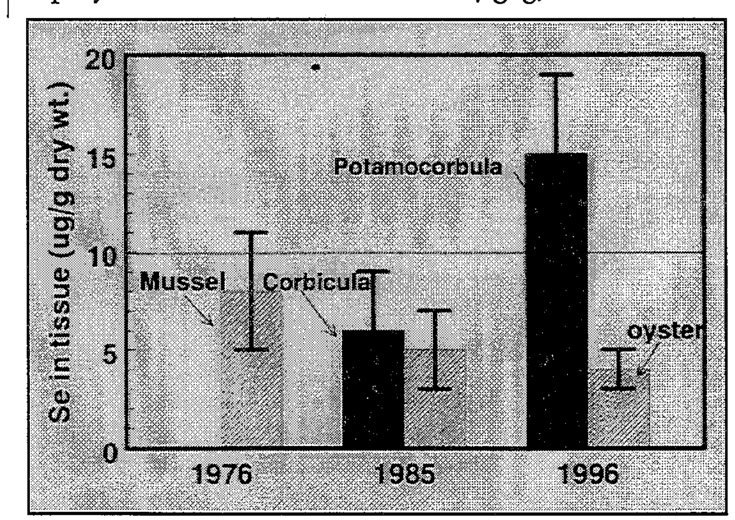

Figure 1
SELENIUM IN BIVALVES, CARQUINEZ STRAIT