**Benthic Invertebrates**

## Tab 1

## What are benthic organisms?

Benthic organisms are creatures that live at the bottom of water bodies. This includes common invertebrates (animals without backbones) like clams, shrimp, and crabs and other less-known creatures including worms, small crustaceans called amphipods, and aquatic insects. Some benthic organisms live in or on the soft mud of the San Francisco Estuary, while others attach themselves to rocks and other hard surfaces. There are also benthic vertebrates (animals with backbones) that include various fish species. **[Read more]**

Many benthic organisms are filter feeders. They pump water through their bodies or through holes in the mud to catch food suspended in the water. Others graze on food they find in and on the bottom. Filter feeders and grazers eat phytoplankton, zooplankton, other benthic organisms, or decaying organic debris of aquatic or terrestrial origins. **[Read less]**

## Why are benthic organisms important?

* Benthic organisms are central part of the estuarine food web, consuming and consumed by other creatures. Every winter during low-tides, thousands of migrating shorebirds feast upon uncovered clams, crabs, and worms found in the mudflats. Humans can also take advantage of the low tides to harvest these organisms. Certain fish species, including juvenile salmon, striped bass, and sturgeon, also consume many types of benthic organisms. **[Read more]**
* A large percentage of the benthic organisms found in the SF Estuary are non-native, and some of these species can have negative effects on the health of the estuary. For example, non-native clams can filter out much of the available phytoplankton, outcompeting the zooplankton who in turn are major sources of fish food.
* Historically, shrimp supported a large commercial fishery in San Francisco Bay, and California’s commercial Dungeness crab fishery still depends upon crabs that spend the first two years of their life growing in the SF Estuary.
* Changes in benthic organisms’ populations can be indications of larger changes in the physical conditions and water quality of the SF Estuary, including alterations in pollution levels, freshwater inflows, salinity, and sediment composition. **[Read less]**

## Tab 2

## How are they monitored?

### Department of Water Resources Benthic Organism Study

The Department of Water Resources’ Benthic Organism Study measures the composition (what kinds?), abundance (how many?), diversity (how many kinds?), and distribution (where are they?) of benthic organisms as part of the IEP’s Environmental Monitoring Program (EMP). Changes in their composition, abundance, diversity, and distribution are documented within the SF Estuary, from San Pablo Bay east through the upper Estuary to the mouths of the Sacramento, Mokelumne, and San Joaquin Rivers. **[Read more]**

Ten sites are currently sampled. Because different benthic species live in different parts of the Estuary, the sites represent a wide range of habitats of varying sizes and physical conditions, including different salinity levels and types of sediment. Sites range from narrow freshwater channels in the Delta to broad estuarine bays. Samples are collected monthly. From 1975 to 1979, biannual sampling was conducted in late spring and fall. Monthly sampling began in June 1980 and ended in October 2003. Samples were collected quarterly from October 2003 through October 2005, after which monthly sampling was resumed. Additional samples are also collected at each site for sediment analysis.

In the field, samples are collected with a PONAR grab from a research vessel, and are sieved to remove mud and sand. The sieved samples are preserved and sent to a taxonomist who counts and identifies all organisms larger than 0.5 millimeter long in the laboratory.

To learn more about the methods used to measure benthic organisms, click here. **[Read less]**

### Department of Fish and Wildlife San Francisco Bay Study

EMP monitoring sites are too far up the estuary to sample many species of crab or shrimp, but the CDFW San Francisco Bay Study surveys collect crabs and shrimp monthly using an otter trawl. Thirty-five fixed monitoring stations are distributed evenly throughout four sub-regions of the estuary, including South, Central, San Pablo, and Suisun Bays.

More information on benthic organisms and their monitoring can be found in the DWR Benthic Organism **Meta Data** ,the **Benthic BioGuide**, the **Benthic Dictionary**, and the CDFW **San Francisco Bay Study**.

For more information regarding sampling techniques, please contact **Betsy Wells**.