**Proposed Zooplankton Text for WQ Conditions Report on CA Estuaries Portal**

**Tab 1-**

**What are they?**

**Zooplankton** are small aquatic invertebrates (animals without backbones) that drift in the water with prevailing currents. Although they do not have the ability to swim against currents, some use behaviors, such as vertical migration, to maintain their approximate positions in the estuary. There are many different types of zooplankton in the San Francisco Estuary (SFE); including mysids, copepods, cladocerans, rotifers, and some amphipods.

Zooplankton can live in the open-water portion of the estuary (pelagic), near the bottom of the water column (epibenthic), while others live on submerged aquatic vegetation. Some zooplankton are grazers that eat **phytoplankton**, ciliates, and detritus, while others are predatory and eat smaller zooplankton.

**Why are they important?**

Zooplankton are an important component of the aquatic food web of the SFE. They eat **phytoplankton** and in turn are eaten by other zooplankton, aquatic insects, and **fish**; thereby providing an important link between primary producers and fish. Most larval and juvenile fish eat zooplankton. Some smaller fish, such as Delta Smelt and Longfin Smelt, rely on zooplankton for food throughout their lives.

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Historically, the most abundant zooplankton species in the upper SFE were the calanoid copepod *Eurytemora affinis* and the native mysid *Neomysis mercedis*. Both were important food for pelagic **fish,** including Delta Smelt, Longfin Smelt, and Striped Bass. Many changes have occurred in the SFE that have altered the aquatic food web, including the introduction of several non-native invasive species. Currently, the most abundant zooplankton species is the non-native cyclopoid copepod *Limnoithona tetraspina.* Although more abundant than any copepod has ever been in the estuary, they may be difficult for visual predators like fish to find and utilize as a food source because of their small size and motionless behavior.

Since monitoring began in 1972, most of the zooplankton in the upper SFE have declined in abundance, particularly native species. In 1986, the non-native clam ***Potamocorbula amurensis***  was introduced to the SFE. This filter feeding clam drastically reduced the available phytoplankton in the low salinity zone and altered the foodweb, causing many zooplankton species to decline. This has been implicated as one of the many potential causes for the dramatic decline of several open water (pelagic) fish species—commonly known as the **Pelagic Organism Decline** (POD). In addition to their importance in the food web, changes in the abundance, distribution, and community composition of zooplankton in the estuary can be indications of larger changes in the physical conditions of the SFE, including alterations in freshwater flows, salinity, and temperature.

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**Tab 2-**

**How are they monitored?**

**Department of Fish and Wildlife’s Zooplankton Study**

The California Department of Fish and Wildlife’s Zooplankton Study determines the composition (what kinds?), abundance (how many?), and distribution (where are they?) of zooplankton in the upper SFE as part of the Interagency Ecological Program’s Environmental Monitoring Program (EMP). The Zooplankton Study monitors zooplankton in the upper SFE from San Pablo Bay east through the Delta.

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Seventeen fixed sites are currently sampled monthly. Three additional fixed sites are sampled monthly only when specific conductance is below twenty milliSiemens per centimeter. Additional floating (non-fixed) sites are sampled in the entrapment zone. Entrapment zone sites are sampled where the bottom specific conductivity is two milliSiemens per centimeter and six milliSiemens per centimeter.

Since 1995, zooplankton samples from each site have been collected monthly during the DWR Discrete Water Quality Monitoring. **Water quality** and **phytoplankton** samples are also collected at each site. Prior to 1995, zooplankton was not always sampled during the winter, and in some years was sampled twice monthly during spring and summer.

Three types of equipment are used at each sampling site to target different sizes of zooplankton: 1) a pump for sampling microzooplankton <1.0 mm, including rotifers, copepod nauplii, and adult copepods of the genus *Limnoithona*; 2) a modified Clarke-Bumpus (CB) net for sampling mesozooplankton 0.5-3.0 mm, including cladocerans, copepodids (immature copepods), and adult copepods; and 3) a macrozooplankton net for sampling zooplankton 1-20 mm, which targets mysid shrimp.

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More information on zooplankton monitoring in the upper San Francisco Estuary can be found on the **CDFW Zooplankton Study** website, as well as the **EMP Zooplankton Metadata.**