Analysis of San Francisco Bay Environmental Conditions as they relate to Organismal Abundance

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Abstract

The purpose of this study is to analyze trends in environmental conditions in the San Francisco Bay and to determine whether these environmental factors have a significant impact on organismal growth. This study analyzed temperature, salinity, and ocean current data collected from six different field sites located in the central region of the San Francisco Bay through July, 2010. This environmental data was compared to organismal growth on recruitment devices located at each site. The recruitment devices consisted of two 6”x12” PVC plates and one mesh wrapping containing two Tufty kitchen scrub pads. Settled organisms included native and invasive crustaceans, bryozoans, polychaetes, nudibranchs, and tunicates. Protected field sites in the East Bay experiencing maximum currents between 20-30 cm/s and average temperatures of 16-18.4 °C demonstrated the most overall growth. The relationship between variation in salinity and organismal growth is unclear and further study addressing tidal considerations is necessary.

Physical and Biological Conditions in the San Francisco Bay

The San Francisco Bay is the largest estuary on the Pacific Coast. An estuary is a body of water where freshwater from rivers and lakes mixes with salt water from the ocean. San Francisco Bay is a shallow straited (partially mixed) estuary with two layers of water. The upper layer is supplied by river water and is less dense and brackish while the deep layer is supplied by the ocean and is denser and more saline. Salinity in this type of estuary varies longitudinally so as to virtually creating a unique environment of nutricrich water and saltness where an abundance of life can thrive. Since the estuary is partially protected by large land masses, strong ocean currents push through the narrow bay entrance under the Golden Gate Bridge and quickly dissipate as they move further into the bay. These currents change direction approximately twice a day according to the high and low tides cycle (see Figure 1). Temperature and saltness are not as easily linked in the San Francisco Bay as they are in the open ocean. In the open ocean, cold water sinks due to its high saltness and density while in the bay, the coldest water comes from different tidal places depending on the season (either from snow run off or the ocean). Because of mixing in the water column and the relative contributions of fresh and salt water, temperature and saltness change drastically both spatially (at different locations in the Bay) and temporally (in different seasons and different years).

Due to ever increasing trade and traffic in the SF Bay, a phylogenetically diverse assemblage of non-native species, including various invertebrates, fish, and plants have been introduced into the Bay. This study investigates several physical characteristics of six different field sites in the central bay and compares these physical characteristics to spatiotemporal growth of bryozoans, tunicates, tunicates and tunicates. Recruitment devices were designed to collect data on organismal abundance. Each field site had two devices at different locations along the dock. The top plate was approximately one meter above the bottom plate to allow differentiation at separate depths. A thermometer and temperature logger were used to measure real-time salinity and temperature. The temperature logger was attached to the top loop of the device and a brick was attached to the bottom to keep the settling plates and Tufted oriented vertically in the water column.

Physical and biological measurements were taken weekly. This study, organism abundance was recorded in the following categories: “abundant” if more than 100 specimens were visible, “present” if 10-100 specimens were visible, “few” if less than 10 were visible, and “absent” if none were visible on the settling plate.

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Biological Materials, Methods and Monitoring

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