Section 2
Background

Mission Bay is a prominent feature of the San Diego coastline. This shallow, mesotidal estuary covers approximately 1862 ha (4600 acres) and has been modified extensively from its original appearance (e.g. Chapman 1963, Herron et al. 1972, Crooks 1998, Dexter and Crooks 2000). Historically, Mission Bay was an estuary of the San Diego River and was dominated by tidal salt marsh and mud flats. Beginning in the late 19th century, the bay was developed as a recreational and commercial resource for the City of San Diego, and it now constitutes the largest aquatic park on the west coast of the United States (California Coastal Commission 1987). The San Diego River was separated from the Mission Bay inlet by a permanent dike in the late 1940s (Herron et al. 1972), and the bay subsequently was dredged and reshaped to alter the circulation and create islands (Figure 2).

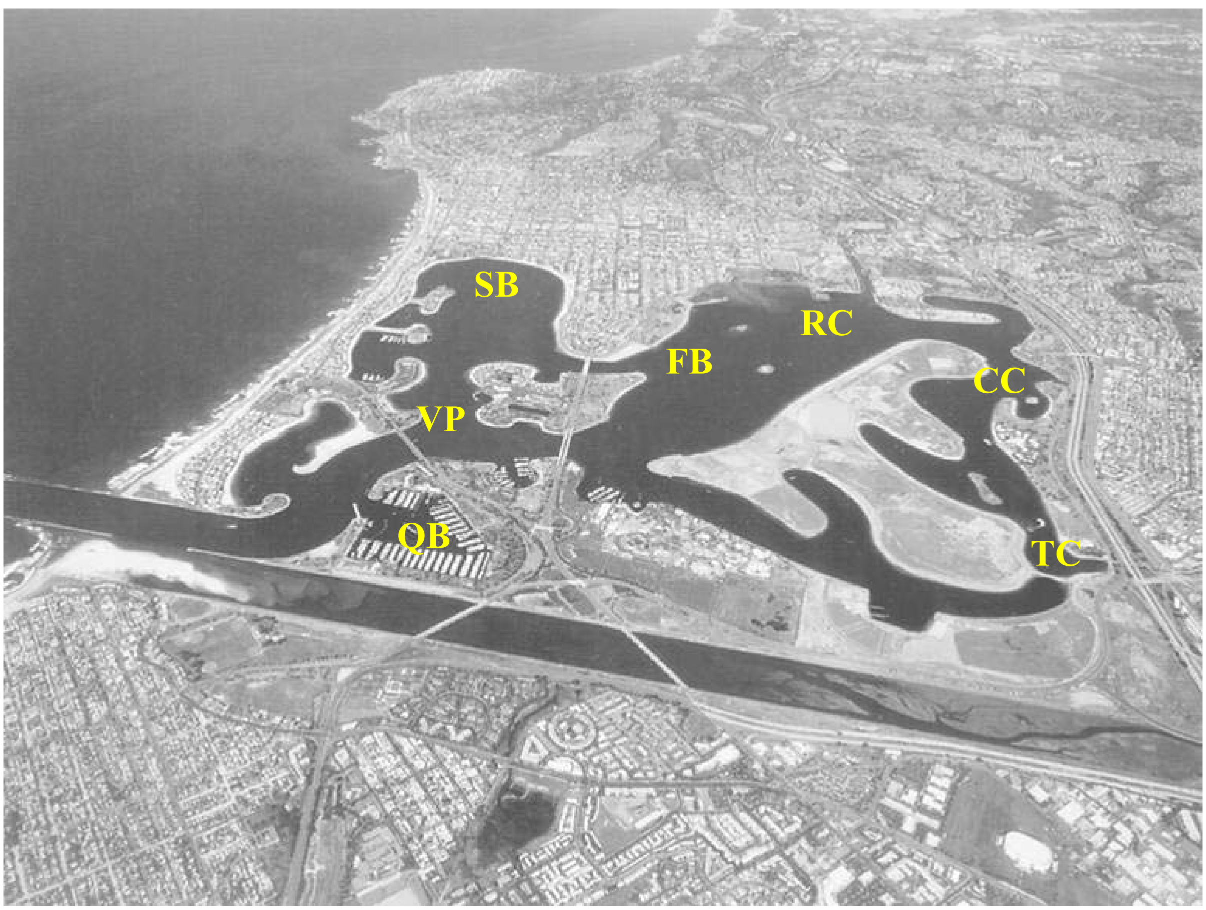

Figure 2. Oblique aerial view of Mission Bay showing approximate locations of sampling sites at Tecolote Creek Inlet (TC), Cudahy Creek Inlet (CC), Rose Creek Inlet (RC), Fiesta Bay (FB), Sail Bay (SB), and Ventura Point (VP). Quivira Basin (QB) also is indicated.

Circulation

Since the diversion and channelization of the San Diego River in the 1950s, inputs of fresh water into Mission Bay have come primarily from three major creeks (Rose Creek, Tecolote Creek, Cudahy Creek). In addition, over 100 storm drains empty into the bay, providing substantial input during wet weather periods (City of San Diego 1992, 1994, Largier et al. 1997, 2003). Circulation within the bay represents a gradient, with regions near the mouth of the bay affected strongly by tidal flow through the inlet and areas in the eastern section of the bay (the back bay) showing little tidal influence. All freshwater channels that empty into the bay are equipped with dry-weather diversion systems, and during periods of low or no rainfall there is little freshwater influence and very long retention times in the back bay (Levin 1983, Largier et al. 2003).

Circulation within Mission Bay is highly seasonal. During the summer, the back bay experiences little circulation or freshwater input. Over the course of the summer, waters in the back bay become progressively warmer and hypersaline due to insolation and the effects of evaporation. By contrast, waters near the mouth (the front bay) are cooler and less saline, reflecting considerable exchange of water with the coastal ocean. During the winter, waters throughout the bay cool down substantially. Following rainfall events, the back bay receives freshwater inflow from the watershed and generally becomes cooler and less saline than tidally-dominated regions near the mouth of the bay. The cool, fresh water from creeks and storm drains may form a low density surface lens that moves seaward over the warmer, saltier, landward-moving water beneath (Largier et al. 2003). The development of this salt wedge seems to be most pronounced in the back bay and may lead to more rapid flushing of water in the back bay, compared to times when freshwater inflow is reduced or absent.

Water Quality

The back bay also is impacted to a greater extent by eutrophication than better-flushed regions of the bay. Water quality has been found to vary throughout Mission Bay, with contamination decreasing with increasing distance from major sources of freshwater input (Stockwell et al. 1977). Concentrations of nutrients, coliform bacteria and lead have been reported in excess of the EPA standards for certain uses (RWQCB 1994). Elevated nutrient levels often seem to result from runoff or overflow or breakage of sewer lines that feed into the bay. Historically, the three creeks, especially Rose Creek, have been major sources of nutrients to the back bay, while the western portion of the bay has received nutrients from street runoff. Dissolved oxygen levels also have been variable throughout the bay, with measured concentrations ranging from 3.0-10.8 mg l^{-1} (Brabon 1976, Dexter 1983, City of San Diego 1994).

Plankton

Prior to this study, existing information on plankton communities in Mission Bay was scarce. Within Quivira Basin (Figure 2), phytoplankton populations exhibited a large abundance increase during March-April, with minimum densities in the early fall. The abundance of diatoms peaked in the spring, contributing substantially to the March-April abundance maximum, while dinoflagellate populations exhibited peaks in both spring and fall (Fairbanks 1969). Zooplankton populations in Mission Bay also had not been studied in detail prior to this program. Observations had indicated that the zooplankton community was dominated by copepods, with representation by larval forms of benthic species on a seasonal basis. Substantial interannual variability was apparent in populations of both phytoplankton and zooplankton, with differences between consecutive years exceeding a factor of 10 in some cases (R. Kaufmann, unpublished data).

Sediment Quality

Sediment input to Mission Bay also is seasonal and occurs primarily from Rose Creek and Tecolote Creek (City of San Diego 1994). Sediment quality and composition vary throughout the bay. In relatively well-flushed areas, sandy sediments are evident, whereas portions of the bay with poor circulation tend to retain fine sediments with a high content of silt, clay and organic material (Dexter 1983). Elevated levels of heavy metals have been identified in sediments from several locations, including the mouth of Rose Creek (SAIC 1983). Sediments in Mission Bay also contain detectable levels of polycyclic aromatic hydrocarbons (PAHs), with higher concentrations in the back bay and lower concentrations in the front bay (Gauthier 1994). Sediment characteristics may affect local fauna. The growth, behavior and survival of juvenile white seabass (*Atractoscion nobilis*) and California halibut (*Paralichthys californicus*) were influenced by exposure to sediments from some areas of Mission Bay (Stransky 1998).

Benthic Community

Eelgrass (*Zostera marina*) is abundant in the bay, covering approximately 495 ha (1222 acres), according to a 1992 estimate (City of San Diego 1994). Beds of this type are scarce in Southern California and represent important habitats for numerous fish species (City of San Diego 1990). The benthic macrofaunal community in Mission Bay historically was dominated by polychaete worms (primarily *Lumbrinereis* sp.), mollusks and arthropods (Dexter 1983). In recent years, the exotic mussel, *Musculista senhousia*, has become established in the bay and has become a dominant member of the benthic community (Dexter and Crooks 2000). Dexter and Crooks (2000) reported that stations in the back bay contained 30-55% polychaetes and 32-45% mollusks, while their single front bay station had 84% polychaetes and 4% mollusks. Benthic communities showed distinct gradients from back bay to front bay. Sites in the back bay were dominated by *M. senhousia* and characterized by a low abundance and diversity of benthic macrofauna, while species richness was highest in the front bay (Dexter and Crooks 2000).

Large Fauna

Surveys have found 92 species of birds in Mission Bay, including 70 water-associated species and a number of species that are listed as endangered or threatened at the federal and state levels. Mission Bay is home to the federally endangered least tern, brown pelican, and lightfooted clapper rail, as well as the Belding's savannah sparrow, western snowy plover, peregrine falcon, California gull, and California horned lark (City of San Diego 1990, 1994).