DISTRIBUTIONAL ECOLOGY OF ICHTHYOPLANKTON AND INVERTEBRATE MACROZOOPLANKTON IN THE VICINITY OF A HAWAIIAN COASTAL POWER PLANT

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ABSTRACT

Distribution of nearshore zooplankton with emphasis on fish larvae was described in the vicinity of a power plant on the leeward coast of Oahu. Of 215 identifiable taxa of fish larvae encountered, the 15 most abundant made up about 90% of the total catch. The most abundant larvae were of oceanic species and of reef species which spawn demersal eggs. Abundances of most fish eggs and larvae were maximal in summer.

Three principal patterns of horizontal, offshore distribution were found: an inshore (0.2 km) maximum, a neritic (0.5-1.0 km) maximum, and a random pattern. All oceanic fish larvae except scombrids had a random pattern. Larvae of most inshore fish, scombrids, and non-oceanic invertebrate zooplankters had inshore and neritic abundance peaks.

During the day, all taxa were more abundant at 3 m than the surface, *or had no detectable difference between these depths. At night, all* but two taxa (both oceanic fish larvae) maintained their daytime vertical distribution, or moved toward the surface.

Water movement was described as an aid in understanding zooplankton distributions. The dominant current vectors were tidal, reversing, parallel to shore, and increased with distance from shore. Due to NE winds, surface current velocities were greater, and more westward, than velocities at 3 m. Using pelagic fish eggs as tracers, water movement through the inshore sampling area was documented, and passage time was estimated to be 6 - 12 hours. Movement of water offshore and its return inshore was also detected by following the movements of Crystallodytes cookei eggs.

Large, short-term temporal variations in zooplankton abundance at the inshore station were attributed to diel factors which increased catches at night and to water circulation. At night, abundance of neritic and oceanic zooplankters was positively correlated, and abundance of inshore zooplankters was negatively correlated, with tide height. Daytime correlations were not significant, or very weak and negative. Currents parallel to shore were associated with higher concentrations of oceanic and neritic zooplankters; offshore current vectors were associated with increased concentrations of inshore zooplankters. Transient water parcels were identifiable not only by the zooplankton composition, but also by physical characteristics.

The current pattern off leeward Oahu is conducive to plankton retention near the island if the plankters avoid surface waters: passive displacement decreases with depth. Plankton sampling in conjunction with drogue drift studies showed that vagile zooplankters avoided offshore movement of surface water, while pelagic fish eggs did not. There were indications that the plankters avoided offshore movement by descending. Most animals with inshore distributional maxima avoided the surface water, but less so at night; this was not the case for zooplankters with random horizontal distributions.

Impact of the Kahe Point power plant was examined by sampling zooplankton entering the leaving the cooling system, and by comparing distributions in the effluent plume with those in control areas. There was not an increase in percent mortality (as determined by neutral red vital staining), but there was a decrease (median = 40%) in numbers of copepods leaving the power plant. The estimated annual loss of live

zooplankton due to the power plant exceeded 600 kg carbon. Changes in zooplankton abundance in the effluent plume were attributable to stratification which allowed bouyant fish eggs to rise to the surface, and to entrainment of subsurface water and attendant zooplankton during plume dilution. The present impact of the power plant does not seem great. Intake and discharge of water at the surface by the power plant can minimize impact on the zooplankton.