Chlorine dioxide is a broad spectrum bactericide, fungicide, virucide and algaecide that is effective at low concentrations and short contact times (USEPA 1999). Chlorine dioxide attacks micro-organisms by oxidizing the cellular membrane components causing cell destruction. In the environment, chlorine dioxide rapidly photolyzes when exposed to UV light and because of its high reactivity, it will breakdown rapidly in natural waters containing moderate amounts of organic matter. The breakdown products are chloride ion and oxidized products of organic matter.

Due to its mode of action and short life in the environment, DEP found no literature to support the hypothesis that the use of chlorine dioxide by the pulp mill had a significant effect on the algae in the bay, or that the proliferation of HABs could in any way be linked to the use of chlorine dioxide. Additionally, due to its broad spectrum biocidal action, there is no evidence that chlorine dioxide preferentially reacts with desirable algal species while simultaneously stimulating harmful algal blooms. As described above, the evidence indicates that the HABs were correlated to nutrient loading, and that restoring the nutrient regime to that observed during the 1988-1991 time period would protect healthy, well balanced biology communities.

The series of HABs from 2002 to 2005 described above resulted in a significant adverse effect on the trophic functioning of Perdido Bay's fauna (Livingston 2010). The biomass of consumer trophic levels (including commercially valuable shrimp, crab, and fish species) in Perdido Bay decreased markedly after the occurrence of *H. akashiwo* blooms **(Figure 29)**. This is evidence that the level of nutrient loading responsible for the HABs interfered with the designated use of the bay, and that reducing nutrients to the level that occurred prior to the HAB proliferation would return the system to a healthy, well-balanced state.

Livingston developed a Fish/Infauna/Invertebrate Index (FII) to describe the health of estuaries based on trophic relationships. The index includes determining the biomass (g/m^2) of herbivores, omnivores, and three levels of carnivores (primary= C1, secondary= C2, and tertiary=C3). **Figure 29** depicts the pattern and distribution of the various Fish/Infauna/Invertebrate Index trophic levels in Perdido Bay over the 19-year study period. Herbivore biomass was present mainly in the limited seagrass beds of upper Perdido Bay, but herbivores were reduced during the period of increased nutrient loading. Herbivore biomass increased during periods of low nutrient loading and when *Heterosigma* concentrations were low (1998–1999; 2003–2004; 2006). Omnivore biomass increased during periods of high nutrient loading and when *Heterosigma* concentrations were high (1995–2000; 2003–2005).

Site specific information in support of Establishing Numeric Nutrient Criteria for Perdido Bay