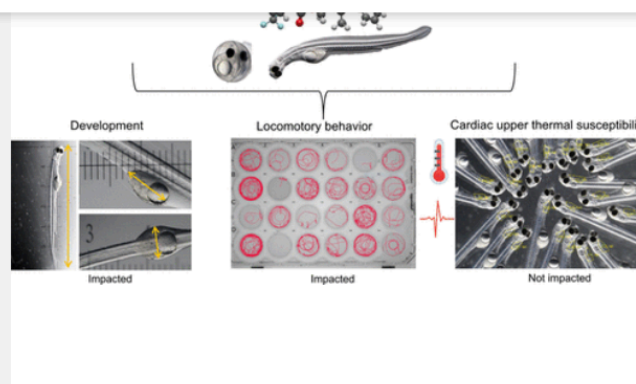


Bifenthrin, a Ubiquitous Contaminant, Impairs the Development and Behavior of the Threatened Longfin Smelt during Early Life Stages

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The Longfin Smelt (*Spirinchus thaleichthys*) population in the San Francisco Bay/Sacramento-San Joaquin Delta (Bay-Delta) has declined to ~1% of its pre-1980s abundance and, as a result, is listed as threatened under the California Endangered Species Act. The reasons for this decline are multiple and complex, including the impacts of contaminants. Because the spawning and rearing seasons of Longfin Smelt coincide with the rainy season, during which concentrations of contaminants increase due to runoff, we hypothesized that early life stages may be particularly affected by those contaminants. Bifenthrin, a pyrethroid insecticide commonly used in agricultural and urban sectors, is of concern. Concentrations measured in the Bay-Delta have been shown to disrupt the behavior, development, and endocrine system of other fish species. The objective of the present work was to assess the impact of bifenthrin on the early developmental stages of Longfin Smelt. For this, embryos were exposed to 2, 10, 100, and 500 ng/L bifenthrin from fertilization to hatch, and larvae were exposed to 2, 10, and 100 ng/L bifenthrin from one day before to 3 days post-hatch. We assessed effects on size at hatch, yolk sac volume, locomotory behavior, and upper thermal susceptibility (via cardiac endpoints). Exposure to these environmentally relevant concentrations of bifenthrin did not significantly affect the cardiac function of larval Longfin Smelt; however, exposures altered their behavior and resulted in smaller hatchlings with reduced yolk sac volumes. This study shows that bifenthrin affects the fitness-determinant traits of Longfin Smelt early life stages and could contribute to the observed population decline.