

## HYPOXIA - PROJECT SUMMARY

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### **Overview:**

The objective of this project is to determine whether sub-lethal exposure to hypoxia during early life stages leads to sub-optimal growth and differential mortality. This project will use biogeochemical proxies in fish ear stones (otoliths) retrospectively to identify periods of hypoxia exposure. This project will capitalize on patterns of geochemical proxies such as Mn/Ca and I/Ca incorporated into otoliths to identify patterns of sub-lethal hypoxia exposure and ask whether exposure results in differential growth and survival patterns compared to non-exposed fish. The project will compare consequences of hypoxia exposure in several species from the Gulf of Mexico, the Baltic Sea, and Lake Erie, thus examining the largest anthropogenic hypoxic regions in the world spanning freshwater, estuarine, and marine ecosystems.

### **Intellectual Merit :**

Hypoxia is a growing global threat that impairs the health and functioning of marine ecosystems. Although the potential impacts of hypoxic exposure are severe, there is little known about the consequences of systemic, sub-lethal exposure to hypoxic events for individuals, populations and communities of fishes. This lack of knowledge is primarily because current biomarkers of hypoxic exposure are limited to identifying recent (1 day) exposure and provide no information about long term exposure patterns. In contrast, the work proposed here will employ long-term, permanent markers incorporated into fish otoliths to identify life-long patterns of sub-lethal hypoxia exposure far beyond time spans currently achievable using molecular markers. Further, this work will focus on species living in the northern Gulf of Mexico, the Baltic Sea and Lake Erie, among the world's largest anthropogenic hypoxic regions; it will allow cross-system comparisons among geographic regions and marine and freshwater ecosystems. The results from this project will thus provide unprecedented insight into effects of hypoxia exposure in three major basins using novel biogeochemical proxies, thereby paving the way for a fuller understanding of the impacts of 'dead zones' on coastal resources

### **Broader Impacts :**

Although hypoxia is a global problem, citizens in many regions of the world, including the western part of the northern Gulf of Mexico, have little awareness about anthropogenic oxygen depletion and its impact on coastal resources. We propose to increase awareness of hypoxia-related issues by disseminating curriculum to high schools in southern Texas that are dominated by Hispanic and Latino American students. As a part of this program, two high school teachers will be sponsored to participate in the NOAA "Teacher At Sea" program, where they will gain first-hand experience in biological sampling in the northern Gulf of Mexico "Dead Zone" and create a blog about their experiences. These teachers will help lead teacher training workshops at the University of Texas for 13 additional high school teachers to implement hypoxia-related curriculum in their classrooms. In addition, this project will contribute significantly to basic information for critical stakeholder groups in Baltic Sea and Great Lakes fisheries via ICES and the Great Lakes Fisheries Commission. Two graduate students and one Postdoc will also be supported in part by this project.