

Geochemical concentrations of elements measured in eye lenses of three Gulf of Mexico fish species collected from 2021-2023

Website: <https://www.bco-dmo.org/dataset/962710>

Data Type: Other Field Results

Version: 1

Version Date: 2025-05-29

Project

» [Collaborative Research: Shifting the Hypoxia Paradigm – New Directions to Explore the Spread and Impacts of Ocean/Great Lakes Deoxygenation](#) (HypoxiDigm / Project Breathless)

Contributors	Affiliation	Role
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Abstract

This dataset includes geochemical concentrations of elements measured in eye lenses of Atlantic Croaker, Red Drum, and Southern Flounder sampled in Matagorda Bay, Texas, USA.

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Coverage

Location: Matagorda Bay, Texas, USA

Spatial Extent: N:29.009 E:-91.80883333 S:27.6796764 W:-97.3201482

Temporal Extent: 2021-07-16 - 2023-07-01

Methods & Sampling

Fish collection locations and associated information are found in an accompanying dataset for this project: <https://www.bco-dmo.org/dataset/916418>.

Fish eye lenses were embedded in epoxy and sectioned laterally to expose the midplane for analyses. Eye lens elemental analyses were conducted at the SUNY College of Environmental Science and Forestry using laser ablation inductively coupled plasma mass spectrometry. Transects were ablated from one side of the eye lens to the other. Standard reference materials included a National Institute of Standards and Technology glass standard (NIST-612) and a fish protein certified reference material (DORM-4). Sequential measurements of analytes are provided in sections following the onset of the laser traversing the distance across each eye lens for a given fish ID number. Scan speeds were 5 microns per second for Atlantic Croaker and Southern Flounder, and 7 microns per second for Red Drum.

Data Processing Description

Data were corrected using certified reference materials and converted to parts per million (ppm) concentrations. Transects were then processed using a 7-point running median followed by a 7-point running mean to remove outliers and high-frequency fluctuations inherent to ICP-MS measurements that were not of ecological relevance for this study.

BCO-DMO Processing Description

- Imported fish collection location data (file "916418_v2_fish_collection_locations.csv").
- Imported original file "NSF EyeLensData Compiled_Merged_Upload.xlsx" into the BCO-DMO system.
- Flagged "NAN" as a missing data value (missing data are empty/blank in the final CSV file).
- Added the following columns from the fish collection location data file to this dataset by joining on Fish_ID: Station_Latitude, Station_Longitude, Date_Collected, Species.
- Saved the final file as "962710_v1_fish_eye_lens_chemistry.csv".

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Related Datasets

IsRelatedTo

Walther, B., Oster, J. (2025) **Collection locations, dates, and weight and length measurements of individuals of three fish species from the Matagorda Bay region of Texas in the northwestern Gulf of Mexico from 2021 to 2023**. Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 2) Version Date 2025-04-15 doi:10.26008/1912/bco-dmo.916418.2 [[view at BCO-DMO](#)]
Relationship Description: The "collection locations" dataset contains information for all Fish ID numbers reported in related datasets.

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Parameters

Parameter	Description	Units
FishID	Unique identifier number for each individual fish included in the project. IDs include a prefix of "MB" (Matagorda Bay) or "PB" (Project Breathless) followed by a unique sequence of digits.	unitless
Species	Latin binomial (Genus species) of each individual collected	unitless
Time	Time in seconds of laser traversal across one side of the eye lens to the other in a palindromic sequence	seconds
Li7	Concentration of Lithium isotope 7	parts per million (ppm)
B11	Concentration of Boron isotope 11	parts per million (ppm)
Mg25	Concentration of Magnesium isotope 25	parts per million (ppm)

S32	Concentration of Sulfur isotope 32	parts per million (ppm)
S34	Concentration of Sulfur isotope 34	parts per million (ppm)
Ca43	Concentration of Calcium isotope 43	parts per million (ppm)
Mn55	Concentration of Manganese isotope 55	parts per million (ppm)
Cu63	Concentration of Copper isotope 63	parts per million (ppm)
Zn66	Concentration of Zinc isotope 66	parts per million (ppm)
Se78	Concentration of Selenium isotope 78	parts per million (ppm)
Sr88	Concentration of Strontium isotope 88	parts per million (ppm)
Hg199	Concentration of Mercury isotope 199	parts per million (ppm)
Hg202	Concentration of Mercury isotope 202	parts per million (ppm)
Pb208	Concentration of Lead isotope 208	parts per million (ppm)
Station_Latitude	Collection location latitude in decimal degrees; positive values = North	decimal degrees
Station_Longitude	Collection location longitude in decimal degrees; negative values = West	decimal degrees
Date_Collected	Date of fish collection	unitless

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Instruments

Dataset-specific Instrument Name	Thermo Scientific iCAP TQ ICP-MS
Generic Instrument Name	Thermo Fisher Scientific iCAP TQ inductively coupled plasma mass spectrometer
Dataset-specific Description	Eye lens elemental analyses were conducted using laser ablation inductively coupled plasma mass spectrometry.
Generic Instrument Description	A benchtop triple quadrupole (TQ) inductively coupled plasma mass spectrometer (ICP-MS) with a four channel peristaltic pump, three plasma gas flow controllers, and four QCell mass flow controllers. The iCAP TQ utilises triple quadrupole technology which allows the analyte signal to be isolated from interferences, enabling the analysis of complex or high-matrix samples. The high frequency (4 MHz) quadrupole mass analyser has pre and post filters for isolation of wanted ions. The instrument features Peltier cooled high purity quartz or perfluoroalkoxy alkane (PFA), and low volume, baffled cyclonic or double pass spray chambers to efficiently filter out larger aerosol droplets for improved plasma stability. A reaction finder method development assistant aids easy method development. The plasma system is designed to rapidly adapt to changing matrices and provide robustness for challenging samples such as highly volatile organic solvents. The argon ICP ion source has a digital, solid state radiofrequency generator, and dynamic frequency impedance matching the plasma at 27 MHz. The iCAP TQ has applications in trace element analysis of solid or liquid (particularly sediment or sea water) samples. It has a nebuliser default flow rate of 400 uL/min.

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Project Information

Collaborative Research: Shifting the Hypoxia Paradigm - New Directions to Explore the Spread and Impacts of Ocean/Great Lakes Deoxygenation (HypoxiDigm / Project Breathless)

Coverage: Central Baltic Sea; Lake Erie; and Lavaca Bay, Texas

NSF Award Abstract:

Ocean oxygen loss (deoxygenation) is increasing due to climate warming. This warming, together with nutrient loading, is causing many marine and freshwater systems to experience increasing episodes of hypoxia (low oxygen) of greater duration and intensity. Impacts on fish and fisheries have been difficult to quantify; direct observation has been challenged by a lack of long-term exposure indicators. This team has successfully refined the use of fish chemical biomarkers in fish otoliths (earstones) to directly assess lifetime hypoxia exposure in fishes. This project will those findings to look for additional biomarkers and models, to expand our understanding of how hypoxia affects fish and their food webs, contaminant transfers, and ecosystem services including economic impacts. The project includes a unique way of training students in science communication, posing the question: What forms of media and "messaging strategies" about deoxygenation are most effective at raising public awareness and understanding? Students are developing entries for PlanetForward's Storyfest, which is a contest to tell compelling stories to foster environmental understanding and solutions. Students from historically underrepresented, economically disadvantaged backgrounds are particularly sought out to participate. The investigators will engage with regional, national, and international management agencies and other relevant stakeholder groups to share information.

This project encompasses a novel, linked set of interdisciplinary studies of food webs, and ecosystem services assessment. The thematic questions explored in this project are: 1. How does hypoxia alter habitat use for fishes? 2. How does hypoxia-altered habitat use and habitat productivity change food webs? 3. How does hypoxia affect/enhance trophic transfer of methylmercury? 4. How do hypoxia-induced changes in food webs affect aquatic ecosystem services? The set of linked studies will employ chemical analyses of otoliths and eye lenses, combined with chemical analyses of muscle tissues (Questions 1 and 3), physiologically-structured food web modeling informed by monitoring time-series (Questions 2 and 4), and a scoping workshop to

address ecosystem services (Question 4). The investigators are using a "trans-basin" comparative approach to system-specific responses, studying fishes in Lake Erie, the Baltic Sea, and a Gulf of Mexico estuary. They study three species from each system that represent different degrees of benthic reliance, to discern differential responses to the increasingly hypoxic environment. This research provides novel insight about variable biotic responses to oxygen loss and the impacts on ecosystem functioning.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1924011

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