

Stable isotope compositions (carbon, nitrogen, and sulfur) of muscle tissue in three species of fish from the Matagorda Bay region of Texas in the northwestern Gulf of Mexico from 2021 to 2023

Website: <https://www.bco-dmo.org/dataset/961706>

Data Type: Other Field Results

Version: 1

Version Date: 2025-05-14

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
Walther, Benjamin	Texas A&M, Corpus Christi (TAMU-CC)	Principal Investigator
Oster, Jacob	Texas A&M, Corpus Christi (TAMU-CC)	Student
Rauch, Shannon	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract

This dataset describes stable isotope compositions (carbon, nitrogen, and sulfur) of muscle tissue in three species of fish (Red Drum *Sciaenops ocellatus*, Southern Flounder *Paralichthys lethostigma*, and Atlantic Croaker *Micropogonias undulatus*) in the Matagorda Bay region of Texas in the northwestern Gulf of Mexico. Fish carcasses were obtained from anglers at boat docks, fish cleaning stations, or other locations in the region. Fish were also obtained from bait shops where the proprietors verified the fish were sourced from the Matagorda Bay study region. These fish will be dissected to subsample white muscle tissue from each fish (skin and scales removed). Muscle samples were then dried, pulverized, and analyzed for stable isotope compositions to assess potential shifts in dietary or habitat-specific residence patterns within and between species. This dataset is part of a larger project assessing fish dietary and habitat use patterns in response to environmental stressors including hypoxia and pollutant accumulation.

Table of Contents

- [Coverage](#)
- [Dataset Description](#)
 - [Methods & Sampling](#)
 - [Data Processing Description](#)
 - [BCO-DMO Processing Description](#)
- [Related Publications](#)
- [Related Datasets](#)
- [Parameters](#)
- [Instruments](#)
- [Project Information](#)
- [Funding](#)

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 carcasses were obtained from anglers at boat docks, fish cleaning stations, or other locations in the region. Fish were also obtained from bait shops where the proprietors verified the fish were sourced from the Matagorda Bay study region. These fish will be dissected to subsample white muscle tissue from each fish (skin and scales removed). Fish muscle tissue was dehydrated, pulverized to a fine powder, and packed into individual tin capsules for stable isotope analyses. All isotope analyses were conducted at the University of California, Davis Stable Isotope Facility. Analytical methods follow those described by Walther & Torrance (2024) and Valenza et al. (2025).

Additional text describing methods below are from <https://stableisotopefacility.ucdavis.edu/>

Samples were analyzed for ^{13}C and ^{15}N isotopes using a PDZ Europa ANCA-GSL elemental analyzer interfaced to a PDZ Europa 20-20 isotope ratio mass spectrometer (Sercon Ltd., Cheshire, UK). Samples are combusted at 1000 degrees Celsius ($^{\circ}\text{C}$) in a reactor packed with chromium oxide and silvered copper oxide. Following combustion, oxides are removed in a reduction reactor (reduced copper at 650°C). The helium carrier then flows through a water trap (magnesium perchlorate and phosphorous pentoxide). N_2 and CO_2 are separated on a Carbosieve GC column (65°C , 65 milliliters per minute (mL/min)) before entering the IRMS. During analysis, samples are interspersed with several replicates of at least four different laboratory reference materials. The long-term standard deviation is 0.2 ‰ for ^{13}C and 0.3 ‰ for ^{15}N . The final delta values, delivered to the customer, are expressed relative to international standards VPDB (Vienna Pee Dee Belemnite) and Air for carbon and nitrogen, respectively.

Stable isotope ratios of ^{34}S in solid samples are measured using an Elementar vario ISOTOPE cube interfaced to an Isoprime PrecisiON IRMS (Cheadle Hume, Stockport, UK). Samples are combusted at 1000°C in a reactor packed with tungsten oxide and elemental copper. Immediately following combustion, sample gases are reduced with elemental copper at 900°C and subsequently pass through a buffering reactor filled with quartz chips held at 900°C . SO_2 and CO_2 are then separated by purge and trap, allowing for full separation and peak focusing. Following separation, the SO_2 adsorption trap is heated and the sample SO_2 passes directly to the IRMS for measurement.

During analysis, samples are interspersed with replicates of several laboratory reference materials to monitor and allow for correction of any potential variation in drift and linearity. Final ^{34}S delta values are obtained after adjusting the provisional measurements such that correct ^{34}S delta values for laboratory quality assurance materials are obtained. The long-term reproducibility of this method is ± 0.4 ‰.

Data Processing Description

Data are provided as reported by the analytical facility without additional processing. Duplicate samples from some fish were analyzed separately to assess within-fish variation. Those results are provided separately and indicated as duplicates within the dataset.

BCO-DMO Processing Description

- Imported fish collection location data (file "916418_v2_fish_collection_locations.csv")
- Imported original file "SIA_Data_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 "961706_v1_fish_muscle_stable_isotopes.csv".

[[table of contents](#) | [back to top](#)]

Related Publications

Valenza, A. N., Steube, T. R., & Walther, B. D. (2025). Limited Shifts in Sulfur Stable Isotopes in Response to Hypoxia Exposure of Atlantic Croaker, *Micropogonias undulatus*. *Estuaries and Coasts*, 48(3).
<https://doi.org/10.1007/s12237-025-01506-3>
Methods

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.

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
Duplicate	Number indicating duplicate (1 or 2)	unitless
Species_Code	Code indicating whether fish was a Red Drum ("RD"), Atlantic Croaker ("CR") or Southern Flounder ("FL").	unitless
Species	Latin binomial (Genus species) of each individual collected	unitless
C13	Stable isotope ratio of carbon (d13C)	permil (‰)
N15	Stable isotope ratio of nitrogen (d15N)	permil (‰)
S34	Stable isotope ratio of sulfur (d34S)	permil (‰)
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

Instruments

Dataset-specific Instrument Name	Elementar vario ISOTOPE cube
Generic Instrument Name	Elemental Analyzer
Generic Instrument Description	Instruments that quantify carbon, nitrogen and sometimes other elements by combusting the sample at very high temperature and assaying the resulting gaseous oxides. Usually used for samples including organic material.

Dataset-specific Instrument Name	PDZ Europa ANCA-GSL elemental analyzer
Generic Instrument Name	Elemental Analyzer
Generic Instrument Description	Instruments that quantify carbon, nitrogen and sometimes other elements by combusting the sample at very high temperature and assaying the resulting gaseous oxides. Usually used for samples including organic material.

Dataset-specific Instrument Name	Isoprime PrecisiON IRMS
Generic Instrument Name	Isotope-ratio Mass Spectrometer
Generic Instrument Description	The Isotope-ratio Mass Spectrometer is a particular type of mass spectrometer used to measure the relative abundance of isotopes in a given sample (e.g. VG Prism II Isotope Ratio Mass-Spectrometer).

Dataset-specific Instrument Name	PDZ Europa 20-20 isotope ratio mass spectrometer
Generic Instrument Name	PDZ Europa 20-20 isotope ratio mass spectrometer
Generic Instrument Description	The PDZ Europa 20-20 is a dedicated continuous flow isotope ratio mass spectrometer for hyphenated stable isotope analyses able to measure ¹⁵ N, ¹³ C, ¹⁸ O, and ³⁴ S in a host of applications. The analyzer has been purposely designed to measure ² H by continuous flow methodology and is also suitable to analyze the light stable isotopes in all the commonly measured gases: H ₂ , N ₂ , NO, N ₂ O, O ₂ , CO, CO ₂ , SO, and SO ₂ .

[[table of contents](#) | [back to top](#)]

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 use 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.

[[table of contents](#) | [back to top](#)]

Funding

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

[[table of contents](#) | [back to top](#)]