Particulate organic matter and isotope data from R/V Nancy Foster cruises NF1704 and NF1802 in the Gulf of Mexico in May of 2017 and 2018.

Website: https://www.bco-dmo.org/dataset/841446
Data Type: Other Field Results
Version: 1
Version Date: 2021-02-24

Project
» Collaborative Research: Mesoscale variability in nitrogen sources and food-web dynamics supporting larval southern bluefin tuna in the eastern Indian Ocean (BLOOFINZ-IO)
» Effects of Nitrogen Sources and Plankton Food-Web Dynamics on Habitat Quality for the Larvae of Atlantic Bluefin Tuna in the Gulf of Mexico (GoMex Tuna Foodweb B)

Program
» Second International Indian Ocean Expedition (IIOE-2)

<table>
<thead>
<tr>
<th>Contributors</th>
<th>Affiliation</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stukel, Michael</td>
<td>Florida State University (FSU)</td>
<td>Principal Investigator</td>
</tr>
<tr>
<td>Kelley, Thomas</td>
<td>Florida State University (FSU)</td>
<td>Co-Principal Investigator</td>
</tr>
<tr>
<td>York, Amber D.</td>
<td>Woods Hole Oceanographic Institution (WHOI BCO-DMO)</td>
<td>BCO-DMO Data Manager</td>
</tr>
</tbody>
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Abstract
Particulate organic matter and isotope data from R/V Nancy Foster cruises NF1704 and NF1802 in the Gulf of Mexico in May of 2017 and 2018.

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Coverage

Spatial Extent: **N**:28.3358 **E**: -84.47 **S**: 24.96 **W**: -90.1779

Dataset Description
In addition to the funding sources listed in the "Awards" section, this dataset was partially funded by:

National Oceanic and Atmospheric Administration's RESTORE Program Grant (Project Title: Effects of nitrogen sources and plankton food-web dynamics on habitat quality for the larvae of Atlantic bluefin tuna
in the Gulf of Mexico) under federal funding opportunity NOAA-NOS-NCCOS-2017-2004875, including
NOAA JIMAR Cooperative Agreement, award #NA16NMF4320058, NOAA CIMAS Cooperative Agreement,
award #NA15OAR4320064, and NOAA CIMEAS Cooperative Agreement, award #NA15OAR4320071.

**Acquisition Description**

Methodology summary:

Particulate organic carbon, nitrogen, and isotopes were measured at 6 depths spanning the euphotic zone
(surface to deep chlorophyll maximum). 2-L samples were vacuum filtered through pre-combusted glass
fiber (GF/F) filters. Filters were wrapped in pre-combusted aluminum foil and stored at -80°C. On land,
samples were fumigated with HCl vapor to remove inorganic carbon, dried, and placed inside a tin cup for
C/N and isotopic analysis at the UC Davis stable isotope facility. For additional details, see Stukel et al.
(2021).

Sampling and analytical procedures:

Particulate organic carbon, nitrogen, and isotopes were measured at 6 depths spanning the euphotic zone
(surface to deep chlorophyll maximum). 2-L samples were vacuum filtered through pre-combusted glass
fiber (GF/F) filters. Filters were wrapped in pre-combusted aluminum foil and stored at -80°C. On land,
samples were fumigated with HCl vapor to remove inorganic carbon, dried, and placed inside a tin cup for
C/N and isotopic analysis at the UC Davis stable isotope facility. For additional details, see Stukel et al.
(2021).

**Processing Description**

**BCO-DMO Processing Notes:**
- data submitted in Excel file "Particulate Organic Matter and Isotopes.xlsx" Sheet1 extracted to csv
- added conventional header with dataset name, PI name, version date
- renamed columns to conform with BCO-DMO naming conventions (removed spaces and special
  characters)
- formatted Date to ISO (yyyy-mm-dd)
- removed blank rows

**Related Publications**

and pigment flux within and beneath the euphotic zone in the oligotrophic, open-ocean Gulf of Mexico.
Journal of Plankton Research. doi:[10.1093/plankt/fbab001](https://doi.org/10.1093/plankt/fbab001)

**Results**

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**Parameters**
<table>
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<tr>
<th>Parameter</th>
<th>Description</th>
<th>Units</th>
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<tr>
<td>Cruise</td>
<td>Name of cruise</td>
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<tr>
<td>Cycle</td>
<td>Lagrangian experiment number</td>
<td>unitless</td>
</tr>
<tr>
<td>Date</td>
<td>Date (local) of collection and incubation</td>
<td>unitless</td>
</tr>
<tr>
<td>Cast</td>
<td>CTD-Niskin rosette cast number</td>
<td>unitless</td>
</tr>
<tr>
<td>lon</td>
<td>Longitude, west is negative</td>
<td>decimal degrees</td>
</tr>
<tr>
<td>lat</td>
<td>Latitude, south is negative</td>
<td>decimal degrees</td>
</tr>
<tr>
<td>Depth</td>
<td>Depth</td>
<td>meters</td>
</tr>
<tr>
<td>Particulate_organic_carbon</td>
<td>Particulate organic carbon (POC)</td>
<td>millimols of carbon per cubic meter (mmol C m(^{-3}))</td>
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<td>Particulate_nitrogen</td>
<td>Particulate nitrogen (PN)</td>
<td>millimols of nitrogen per cubic meter (mmol C m(^{-3}))</td>
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<tr>
<td>d13C</td>
<td>d(13)C ((\delta^{13})C) of particulate organic carbon</td>
<td>per mil (0/00)</td>
</tr>
<tr>
<td>d15N</td>
<td>d(15)N ((\delta^{15})N) of particulate nitrogen</td>
<td>per mil (0/00)</td>
</tr>
</tbody>
</table>

### Instruments

<table>
<thead>
<tr>
<th>Dataset-specific Instrument Name</th>
<th>Generic Instrument Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Niskin bottle</td>
<td>Niskin bottle</td>
<td>A Niskin bottle (a next generation water sampler based on the Nansen bottle) is a cylindrical, non-metallic water collection device with stoppers at both ends. The bottles can be attached individually on a hydrowire or deployed in 12, 24, or 36 bottle Rosette systems mounted on a frame and combined with a CTD. Niskin bottles are used to collect discrete water samples for a range of measurements including pigments, nutrients, plankton, etc.</td>
</tr>
<tr>
<td>Dataset-specific Instrument Name</td>
<td>Mass Spectrometer</td>
<td></td>
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<tr>
<td>-------------------------------</td>
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<tr>
<td>Generic Instrument Name</td>
<td></td>
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<tr>
<td>Dataset-specific Description</td>
<td>Elementar Vario EL Cube or Micro Cube elemental analyzer (Elementar Analysensysteme GmbH, Hanau, Germany) interfaced to either an Isoprime VisION IRMS (Elementar UK Ltd, Cheadle, UK) or a PDZ Europa 20-20 isotope ratio mass spectrometer (Sercon Ltd., Cheshire, UK).</td>
<td></td>
</tr>
<tr>
<td>Generic Instrument Description</td>
<td>General term for instruments used to measure the mass-to-charge ratio of ions; generally used to find the composition of a sample by generating a mass spectrum representing the masses of sample components.</td>
<td></td>
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</table>

### Deployments

**NF1704**

- **Website**: [https://www.bco-dmo.org/deployment/834975](https://www.bco-dmo.org/deployment/834975)
- **Platform**: R/V Nancy Foster
- **Start Date**: 2017-05-07
- **End Date**: 2017-06-02
- **Description**: R/V Nancy Foster cruise in May 2017 as part of a NOAA RESTORE project (aka: BLOOFINZ-GoM).
Project Information

Collaborative Research: Mesoscale variability in nitrogen sources and food-web dynamics supporting larval southern bluefin tuna in the eastern Indian Ocean (BLOOFINZ-IO)

Coverage: Eastern Indian Ocean, Indonesian Throughflow area, and the Gulf of Mexico

NSF Award Abstract:

The small area between NW Australia and Indonesia in the eastern Indian Ocean (IO) is the only known spawning ground of Southern Bluefin Tuna (SBT), a critically endangered top marine predator. Adult SBT migrate thousands of miles each year from high latitude feeding areas to lay their eggs in these tropical waters, where food concentrations on average are below levels that can support optimal feeding and growth of their larvae. Many critical aspects of this habitat are poorly known, such as the main source of nitrogen nutrient that sustains system productivity, how the planktonic food web operates to produce the unusual types of zooplankton prey that tuna larvae prefer, and how environmental differences in habitat quality associated with ocean fronts and eddies might be utilized by adult spawning tuna to give their larvae a greater chance for rapid growth and survival success. This project investigates these questions on a 38-day expedition in early 2021, during the peak time of SBT spawning. This project is a US contribution to the 2nd International Indian Ocean Expedition (IIOE-2) that advances understanding of biogeochemical and ecological dynamics in the poorly studied eastern IO. This is the first detailed study of nitrogen and carbon cycling in the region linking Pacific and IO waters. The shared dietary preferences of SBT larvae with those of other large tuna and billfish species may also make the insights gained broadly applicable to understanding larval recruitment issues for top consumers in other marine ecosystems. New information from the study will enhance international management efforts for SBT. The shared larval dietary preferences of large tuna and billfish species may also extend the insights gained broadly to many other marine top consumers, including Atlantic bluefin tuna that spawn in US waters of the Gulf of Mexico. The end-to-end study approach, highlights connections among physical environmental variability, biogeochemistry, and plankton food webs leading to charismatic and economically valuable fish production, is the theme for developing educational tools and modules through the "scientists-in-the-schools" program of the Center for Ocean-Atmospheric Prediction Studies at Florida State University, through a program for enhancing STEM learning pathways for underrepresented students in Hawaii, and through public outreach products for display at the Birch Aquarium in San Diego. The study also aims to support an immersive field experience to introduce talented high school students to marine research, with the goal of developing a sustainable marine-related educational program for underrepresented students in rural northwestern Florida.

Southern Bluefin Tuna (SBT) migrate long distances from high-latitude feeding grounds to spawn exclusively in a small oligotrophic area of the tropical eastern Indian Ocean (IO) that is rich in mesoscale
structures, driven by complex currents and seasonally reversing monsoonal winds. To survive, SBT larvae must feed and grow rapidly under environmental conditions that challenge conventional understanding of food-web structure and functional relationships in poor open-ocean systems. The preferred prey of SBT larvae, cladocerans and Corycaeidae copepods, are poorly studied and have widely different implications for trophic transfer efficiencies to larvae. Differences in nitrogen sources - N fixation vs deep nitrate of Pacific origin - to sustain new production in the region also has implications for conditions that may select for prey types (notably cladocerans) that enhance transfer efficiency and growth rates of SBT larvae. The relative importance of these N sources for the IO ecosystem may affect SBT resiliency to projected increased ocean stratification. This research expedition investigates how mesoscale variability in new production, food-web structure and trophic fluxes affects feeding and growth conditions for SBT larvae. Sampling across mesoscale features tests hypothesized relationships linking variability in SBT larval feeding and prey preferences (gut contents), growth rates (otolith analyses) and trophic positions (TP) to the environmental conditions of waters selected by adult spawners. Trophic Positions of larvae and their prey are determined using Compound-Specific Isotope Analyses of Amino Acids (CSIA-AA). Lagrangian experiments investigate underlying process rates and relationships through measurements of water-column 14C productivity, N2 fixation, 15NO3- uptake and nitrification; community biomass and composition (flow cytometry, pigments, microscopy, in situ imaging, genetic analyses); and trophic fluxes through micro- and mesozooplankton grazing, remineralization and export. Biogeochemical and food web elements of the study are linked by CSIA-AA (N source, TP), 15N-constrained budgets and modeling. The project elements comprise an end-to-end coupled biogeochemistry-trophic study as has not been done previously for any pelagic ecosystem.

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.

Effects of Nitrogen Sources and Plankton Food-Web Dynamics on Habitat Quality for the Larvae of Atlantic Bluefin Tuna in the Gulf of Mexico (GoMex Tuna Foodweb B)

Coverage: Gulf of Mexico

Amendment #136: Current stock assessments for the Gulf of Mexico require better ecosystem understanding to effectively evaluate how bottom-up processes limit or enhance Atlantic Bluefin Tuna recruitment. The objective of this proposal is to elucidate the underlying mechanisms that link variability in nitrogen sources and food-web fluxes in the Gulf of Mexico to habitat quality, feeding, growth and survival for Atlantic Bluefin Tuna larvae. This proposal addresses the Program Priority: Comprehensive understanding of living coastal and marine resources, food web dynamics, habitat utilization, protected areas, and carbon flows, specifically "(d) Food web structure and dynamics, trophic linkages, and/or predator-prey relationships, especially projects that develop and/or apply new techniques or technologies".

Program Information

Second International Indian Ocean Expedition (IIOE-2)

Website: https://web.whoi.edu/iioe2/

Coverage: Indian Ocean
Description from the program website:
The Second International Indian Ocean Expedition (IIOE-2) is a major global scientific program which will engage the international scientific community in collaborative oceanographic and atmospheric research from coastal environments to the deep sea over the period 2015-2020, revealing new information on the Indian Ocean (i.e. its currents, its influence upon the climate, its marine ecosystems) which is fundamental for future sustainable development and expansion of the Indian Ocean's blue economy. A large number of scientists from research institutions from around the Indian Ocean and beyond are planning their involvement in IIOE-2 in accordance with the overarching six scientific themes of the program. Already some large collaborative research projects are under development, and it is anticipated that by the time these projects are underway, many more will be in planning or about to commence as the scope and global engagement in IIOE-2 grows.

Focused research on the Indian Ocean has a number of benefits for all nations. The Indian Ocean is complex and drives the region's climate including extreme events (e.g. cyclones, droughts, severe rains, waves and storm surges). It is the source of important socio-economic resources (e.g. fisheries, oil and gas exploration/extraction, eco-tourism, and food and energy security) and is the background and focus of many of the region's human populations around its margins. Research and observations supported through IIOE-2 will result in an improved understanding of the ocean's physical and biological oceanography, and related air-ocean climate interactions (both in the short-term and long-term). The IIOE-2's program will complement and harmonise with other regional programs underway and collectively the outcomes of IIOE-2 will be of huge benefit to individual and regional sustainable development as the information is a critical component of improved decision making in areas such as maritime services and safety, environmental management, climate monitoring and prediction, food and energy security.

IIOE-2 activities will also include a significant focus on building the capacity of all nations around the Indian Ocean to understand and apply observational data or research outputs for their own socio-economic requirements and decisions. IIOE-2 capacity building programs will therefore be focused on the translation of the science and information outputs for societal benefit and training of relevant individuals from surrounding nations in these areas.

A Steering Committee was established to support U.S. participation in IIOE-2. More information is available on their website at https://web.whoi.edu/iioe2/.

### Funding

<table>
<thead>
<tr>
<th>Funding Source</th>
<th>Award</th>
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<tbody>
<tr>
<td>National Oceanic and Atmospheric Administration (NOAA)</td>
<td>NA16NMF4320058</td>
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<td>NSF Division of Ocean Sciences (NSF OCE)</td>
<td>OCE-1851347</td>
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