Phytoplankton HPLC pigment concentrations from samples collected in the Gulf of Mexico on R/V Nancy Foster cruises in May 2017 and May 2018

Website: https://www.bco-dmo.org/dataset/851250
Data Type: Cruise Results
Version: 1
Version Date: 2021-05-03

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

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

Contributors	Affiliation	Role
Landry, Michael R.	University of California-San Diego Scripps (UCSD-SIO)	Principal Investigator
Rauch, Shannon	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
This dataset is from CTD hydrocasts in the Gulf of Mexico from R/V Nancy Foster cruises in May 2017 and May 2018, which were part of a NOAA RESTORE project (aka: BLOOFINZ-GoM) to investigate the epipelagic marine nitrogen cycle, plankton dynamics, and impacts on growth and survival of larval Atlantic Bluefin Tuna (ABT). These data are meant to be used in inter-species, interregional comparisons to data from the BLOOFIN-IO study of larval Southern Bluefin Tuna in the Indian Ocean spawning region.

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Coverage

Spatial Extent: **N**:28.3358 **E**:-87.3032 **S**:25.4092 **W**:-90.1775
Temporal Extent: 2017-05-11 - 2018-05-19

Methods & Sampling

This dataset is from CTD hydrocasts in the Gulf of Mexico from R/V Nancy Foster cruises in May 2017 and May 2018, which were part of a NOAA RESTORE project (aka: BLOOFINZ-GoM) to investigate the epipelagic marine nitrogen cycle, plankton dynamics, and impacts on growth and survival of larval Atlantic Bluefin Tuna (ABT). These data are meant to be used in inter-species, interregional comparisons to data from the BLOOFIN-IO study of larval Southern Bluefin Tuna in the Indian Ocean spawning region.

HPLC pigment samples (2.2-L) were collected from Niskin bottles mounted on a 24-place rosette system

equipped with a Seabird SBE911 CTD and a Seapoint fluorometer. The samples were filtered onto GF/F filters, frozen in LN2 and stored at -85°C until analyses by the Horn Point Analytical Services Laboratory (University of Maryland Center for Environmental Science). Pigments were extracted and analyzed using an automated 1100 HPLC system with Agilent temperature-controlled autosampler, Peltier temperature-controlled column oven compartment, PDA detector and ChemStation software. The HPLC method uses a C8 column and a reversed phase, methanol-based solvent system (Van Heukelem and Thomas, 2001; Hooker et al., 2012). MVCHLa and DVCHLa are detected at 665 nm. Carotenoid and xanthophyll accessory pigments are detected at 450 nm. Concentrations were quantified from chromatograms relative to run standards using Agilent ChemStation software.

Data Processing Description

Data Processing:
ChemStation software.

BCO-DMO Processing:
- changed date form from MM/DD/YY to YYYY-MM-DD.

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Data Files

File
phyto_HPLC_pigments.csv (Comma Separated Values (.csv), 22.08 KB) MD5:11da03c139f3f87810ee8246a3d1c87f Primary data file for dataset ID 851250

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Related Publications

Hooker, S. B., Clementson, L., Thomas, C. S., Schlüter, L., Allerup, M., Ras, J., Claustre, H., Normandeau, C. et al. (2012) The fifth SeaWiFS HPLC analysis round-robin experiment (SeaHARRE-5). NASA/TM-2012-217503, NASA Greenbelt, MD, 98 p.
Methods

Selph, K.E., Swalethorp, R., Stukel, M.R., Kelly, T.B., Knapp, A.N., Fleming, K., Hernandez, T., & Landry, M.R. (2021). Phytoplankton community composition and biomass in the oligotrophic Gulf of Mexico. Journal of Plankton Research. doi:10.1093/plankt/fbab006
Methods

Van Heukelem, L., & Thomas, C. S. (2001). Computer-assisted high-performance liquid chromatography method development with applications to the isolation and analysis of phytoplankton pigments. Journal of Chromatography A, 910(1), 31–49. doi:10.1016/s0378-4347(00)00603-4
Methods

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Parameters

Parameter	Description	Units
Cruise	Cruise identifier	unitless

Station	Station number	unitless
Date	Sampling date (Central Standard (GMT-6)); format: YYYY-MM-DD	unitless
Lat	Latitude	degrees North
Long	Longitude	degrees East
Cycle	Cycle number	unitless
CTD	CTD cast number	unitless
Exp	Experiment number	unitless
Depth	Depth of sample	meters (m)
Chl_c3	Chlorophyll c3	nanograms per liter (ng/L)
Chl_c12	Chlorophyll c1+c2	nanograms per liter (ng/L)
Chlide_a	Chlorophyllide a	nanograms per liter (ng/L)
Phide_a	Pheophorbide a	nanograms per liter (ng/L)
Perid	Peridinin	nanograms per liter (ng/L)
But_fuco	19??Butanoyloxy fucoxanthin	nanograms per liter (ng/L)
Fuco	Fucoxanthin	nanograms per liter (ng/L)
Neo	Neoxanthin	nanograms per liter (ng/L)
Pras	Prasinoxanthin	nanograms per liter (ng/L)
Viola	Violaxanthin	nanograms per liter (ng/L)
Hex_fuco	19??Hexanoyloxy fucoxanthin	nanograms per liter (ng/L)

Diadino	Diadinoxanthin	nanograms per liter (ng/L)
Allo	Alloxanthin	nanograms per liter (ng/L)
Diato	Diatoxanthin	nanograms per liter (ng/L)
Zea	Zeaxanthin	nanograms per liter (ng/L)
Lut	Lutein	nanograms per liter (ng/L)
DV_Chl_b	Divinyl Chlorophyll b	nanograms per liter (ng/L)
MV_Chl_b	Monovinyl Chlorophyll b	nanograms per liter (ng/L)
DV_Chl_a	Divinyl Chlorophyll a	nanograms per liter (ng/L)
MV_Chl_a	Monovinyl Chlorophyll a	nanograms per liter (ng/L)
T_Chl_a	Total Chlorophyll a = MV_Chl_a + DV_Chl_a	nanograms per liter (ng/L)
Phytin_a	Phaeophytin a	nanograms per liter (ng/L)
Caro	Carotene	nanograms per liter (ng/L)

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Instruments

Dataset-specific Instrument Name	Seabird SBE911 CTD
Generic Instrument Name	CTD - profiler
Generic Instrument Description	The Conductivity, Temperature, Depth (CTD) unit is an integrated instrument package designed to measure the conductivity, temperature, and pressure (depth) of the water column. The instrument is lowered via cable through the water column. It permits scientists to observe the physical properties in real-time via a conducting cable, which is typically connected to a CTD to a deck unit and computer on a ship. The CTD is often configured with additional optional sensors including fluorometers, transmissometers and/or radiometers. It is often combined with a Rosette of water sampling bottles (e.g. Niskin, GO-FLO) for collecting discrete water samples during the cast. This term applies to profiling CTDs. For fixed CTDs, see https://www.bco-dmo.org/instrument/869934.

Dataset-specific Instrument Name	Seapoint fluorometer
Generic Instrument Name	Fluorometer
Generic Instrument Description	A fluorometer or fluorimeter is a device used to measure parameters of fluorescence: its intensity and wavelength distribution of emission spectrum after excitation by a certain spectrum of light. The instrument is designed to measure the amount of stimulated electromagnetic radiation produced by pulses of electromagnetic radiation emitted into a water sample or in situ.

Dataset-specific Instrument Name	Agilent 1100 HPLC system
Generic Instrument Name	High-Performance Liquid Chromatograph
Dataset-specific Description	Agilent 1100 HPLC system with temperature-controlled autosampler, Peltier temperature-controlled column oven compartment and PDA detector.
Generic Instrument Description	A High-performance liquid chromatograph (HPLC) is a type of liquid chromatography used to separate compounds that are dissolved in solution. HPLC instruments consist of a reservoir of the mobile phase, a pump, an injector, a separation column, and a detector. Compounds are separated by high pressure pumping of the sample mixture onto a column packed with microspheres coated with the stationary phase. The different components in the mixture pass through the column at different rates due to differences in their partitioning behavior between the mobile liquid phase and the stationary phase.

Dataset-specific Instrument Name	Niskin bottles
Generic Instrument Name	Niskin bottle
Generic Instrument Description	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.

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Deployments

NF1704

Website	https://www.bco-dmo.org/deployment/834975
Platform	R/V Nancy Foster
Report	https://datadocs.bco-dmo.org/docs/302/BLOOFINZ_IO/data_docs/cruise_reports/NF1704_CRUISE_REPORT.pdf
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).

NF1802

Website	https://www.bco-dmo.org/deployment/834976
Platform	R/V Nancy Foster
Report	https://datadocs.bco-dmo.org/docs/302/BLOOFINZ_IO/data_docs/cruise_reports/NF1802_CRUISE_REPORT.pdf
Start Date	2018-04-27
End Date	2018-05-20
Description	R/V Nancy Foster cruise in May 2018 as part of a NOAA RESTORE project (aka: BLOOFINZ-GoM).

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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.

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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/.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1851558
National Oceanic and Atmospheric Administration (NOAA)	NA15OAR4320071

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