Size fractionated mesozooplankton biomass, elemental and stable isotope measurements derived from plankton net tows conducted on R/V Roger Revelle cruise RR2201 (BLOOFINZ-IO) in the Argo Basin region off NW Australia during January-March 2022

Website: https://www.bco-dmo.org/dataset/956590
Data Type: Cruise Results
Version: 1
Version Date: 2025-03-28

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
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Abstract
This dataset contains size fractionated mesozooplankton biomass, elemental and stable isotope measurements derived from plankton net tows conducted from the cruise RR2201 of R/V Roger Revelle (BLOOFINZ-IO, January-March 2022) in the Argo Basin region off NW Australia.

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Coverage

Location: Northwest Australia, Argo Basin
Spatial Extent: **N**:-13.01 **E**:121.51 **S**:-17.19 **W**:113.96

Temporal Extent: 2022-01-31 - 2022-03-02

Methods & Sampling

This dataset is derived from mesozooplankton net tows in the Indian Ocean Argo Basin off Northwestern Australia carried out from the R/V Roger Revelle cruise in January to March 2022, which were part of an NSF-OCE project (aka: BLOOFINZ-IO) led by Prof. Michael R. Landry to investigate the epipelagic marine nitrogen cycle, plankton dynamics, and impacts on growth and survival of larval Southern Bluefin Tuna (SBT). The cruise report can be found at http://hdl.handle.net/1834/43464. These data are meant to be used in inter-species, interregional comparisons to data from the BLOOFIN-GoM study of larval Atlantic Bluefin Tuna (ABT) in the Gulf of Mexico spawning region.

Oblique net tows were taken to obtain estimates of mesozooplankton standing stocks and grazing over the depth range of the upper mixed layer and the full euphotic zone. Generally, we sampled during midday (1000-1200 h) and midnight (2100-0300 h) hours repeatedly over 3-4 days following a drogued drifter (termed "Cycles"), allowing estimates of diel vertical migrant biomass by difference within the same water parcel. Additional transect stations were also sampled at variable times of the day. We used a 1-meter (m) diameter ring net with a 202-micrometer (µm) mesh size to sample the full euphotic zone, and a 60-centimeter (cm) diameter Bongo (aka: Bongo-60) net with one net having a 202-µm mesh size and the other a 50-µm mesh size to sample the upper mixed layer. All nets were Nitex mesh and fitted with General Oceanics flow meters in the center of the opening to measure volume filtered. Depth of tow was controlled by a depth sensor on the hydrowire and exact depths recorded by a depth logger fitted to the net frames. Net tow contents from the Ring net and Bongo-60 202-µm mesh sized nets were anesthetized with ice-cold carbonated water and split with a Folsom splitter, with half preserved in 4% buffered formalin and half further split into two quarters. Each quarter was size-fractionated using nested sieves into five size classes: 0.2-0.5, 0.5-1, 1-2, 2-5, and >5 millimeters (mm). In the quarter dedicated for measuring biomass, each size fraction was concentrated on a preweighed 202-µm Nitex filter, rinsed with isotonic ammonium formate to remove sea salt, dried at 60 degrees Celsius (°C), and stored dry in sealed containers with desiccant. The other quarter was dedicated to measuring gut pigments for estimating mesozooplankton grazing. Net content from the Bongo-60 50-µm mesh sized net was treated similarly except that half was preserved in formalin, and half split into 0.05-0.1, 0.1-0.2, and >0.2 mm size fractions using nested sieves and dried for measuring biomass.

In the laboratory, dry filters were weighed on an analytical balance and filter preweights subtracted to calculate zooplankton dry weight for each size fraction. Zooplankton dry weight in milligrams per square meter (mg m-2) was calculated from the measured volume, depth of tow, and fraction of sample analyzed. The dried sample was subsequently scraped off the filter, ground to a powder with a mortar and pestle, and subsampled by weight for carbon (C), nitrogen (N), and stable isotope (13C and 15N) analyses.

CN subsamples were weighed in small tin boats, packed into pellets, and analyzed by a standard elemental analyzer, isotope ratio mass spectrometry (EA-IRMS) at the Stable Isotope Facility at University of California, Davis (https://stableisotopefacility.ucdavis.edu/). The system consists of a PDZ Europa ANCA-GSL elemental analyzer interfaced to a PDZ Europa 20-20 isotope ratio mass spectrometer (Sercon Ltd., Cheshire, UK). Acetanilide, USGS41, and facility internal standards was used for instrument stability and corrections for both elemental and isotopic measurements on every run. C and N biomass estimates (mg m-2) were computed for each size fraction from C:DW and N:DW ratios. Stable isotope values are reported in standard delta (‰) notation relative to atmospheric N2 and Vienna Pee Dee Belemnite for carbon.

Data Processing Description

Data processing was carried out in Microsoft Excel and Access.

Sample % carbon (C), % nitrogen (N), C:N ratio, delta 13C and 15N were only measured in two night and two day net tows on Cycles, and not on any transect stations. For this reason, biomass in C and N per square meter is only calculated for Cycles. For each Cycle, averages in % C and % N were calculated for each net type, in each size fraction, and for day and night, respectively (n=2). These averages were then applied to estimate C and N per square meter from all Cycle net tows.

BCO-DMO Processing Description

- Imported original file "BCO_DOM_BLOOFINZ-IO_mesozooplankton_size_fractionated_biomass_data.xlsx" into the BCO-DMO system.
- Marked "nd" as a missing data value (missing data are empty/blank in the final CSV file).
- Renamed fields to comply with BCO-DMO naming conventions.
- Converted date-time fields to ISO 8601 format.
- Rounded "Depth" column to 1 decimal place and all other numeric columns to 4 deicmal places.
- Saved final file as "956590_v1_bloofinz-io_mesozooplankton_biomass_and_isotopes.csv".

Problem Description

In comparison with other datasets and expectations, it is likely that the 0.05-0.1 mm size fraction from the Bongo-60 50-um mesh size nets is underestimated, likely due to retention of small organisms on the 100-um sieve. This would also result in an overestimation of the 0.1-0.2 mm size fraction. Depending on their applications data users may consider adding the two size fractions together into a 0.05-0.2 mm size fraction.

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Data Files

File
956590_v1_bloofinz-io_mesozooplankton_biomass_and_isotopes.csv (Comma Separated Values (.csv), 53.27 KB) MD5:cd7eb7dfbb739d787da9526b18d8c331 Primary data file for dataset ID 956590, version 1

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Related Publications

Landry, M. R. (2025). R/V Roger Revelle Cruise RR2201 BLOOFINZ-IO Cruise Report. Eastern Indian Ocean larval tuna habitat study 20 January – 14 March 2022. http://hdl.handle.net/1834/43464
General

Landry, M. R., & Swalethorp, R. (2021). Mesozooplankton biomass, grazing and trophic structure in the bluefin tuna spawning area of the oceanic Gulf of Mexico. Journal of Plankton Research, 44(5), 677–691. https://doi.org/10.1093/plankt/fbab008
Methods

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Parameters

Parameter	Description	Units
Cruise	Cruise identifier	unitless
Tow_ID	Tow identifier, counts all ring net and Bongo-60 net deployments for formalin preservation, biomass and gut fluorescence measurements	unitless
Haul	Haul identifier, counts all ring net, Bongo-60 net an live net deployments	unitless

Station	Station number	unitless
Cycle	Cycle_day number; each cycle is a multi-day experiment following a satellite tracked drifter.	unitless
ISO_DateTime_UTC	Date and time (UTC) in ISO8601 format	unitless
ISO_DateTime_Local	Local date time net went in the water (Central Standard (GMT+8)) in ISO 8601 format	unitless
Time_of_day	Day or night indicator: 1 = day, 2 = night	unitless
Lat	Latitude	degrees North
Long	Longitude	degrees East
Net_type	Net identifier	unitless
Mesh_size	Mesh size identifier	micrometers (um)
Depth	Depth	meters (m)
Tow_Duration	Tow duration in format: HH:MM	unitless
Vol	Sample volume	cubic meters
DW_0d05_0d1_mm	Dry weight of the 0.05-0.1mm size class	milligrams dry weight per square meter (mg DW m-2)
DW_0d1_0d2_mm	Dry weight of the 0.1-0.2mm size class	milligrams dry weight per square meter (mg DW m-2)
DW_0d2_0d5_mm	Dry weight of the 0.2-0.5mm size class	milligrams dry weight per square meter (mg DW m-2)
DW_0d5_1_mm	Dry weight of the 0.5-1mm size class	milligrams dry weight per square meter (mg DW m-2)
DW_1_2_mm	Dry weight of the 1-2mm size class	milligrams dry weight per square meter (mg DW m-2)
DW_2_5_mm	Dry weight of the 2-5mm size class	milligrams dry weight per square meter (mg DW m-2)

DW_gt_5_mm	Dry weight of the >5mm size class	milligrams dry weight per square meter (mg DW m-2)
DW_gt_0d2_mm_TOTAL	Total dry weight of the >0.2mm size classes	milligrams dry weight per square meter (mg DW m-2)
DW_TOTAL	Total dry weight	milligrams dry weight per square meter (mg DW m-2)
C_0d05_0d1_mm	Carbon biomass of the 0.05-0.1mm size class	milligrams carbon per square meter (mg C m-2)
C_0d1_0d2_mm	Carbon biomass of the 0.1-0.2mm size class	milligrams carbon per square meter (mg C m-2)
C_0d2_0d5_mm	Carbon biomass of the 0.2-0.5mm size class	milligrams carbon per square meter (mg C m-2)
C_0d5_1_mm	Carbon biomass of the 0.5-1mm size class	milligrams carbon per square meter (mg C m-2)
C_1_2_mm	Carbon biomass of the 1-2mm size class	milligrams carbon per square meter (mg C m-2)
C_2_5_mm	Carbon biomass of the 2-5mm size class	milligrams carbon per square meter (mg C m-2)
C_gt_5_mm	Carbon biomass of the >5mm size class	milligrams carbon per square meter (mg C m-2)
C_TOTAL	Total Carbon biomass	milligrams carbon per square meter (mg C m-2)
N_0d05_0d1_mm	Nitrogen biomass of the 0.05-0.1mm size class	milligrams nitrogen per square meter (mg N m-2)
N_0d1_0d2_mm	Nitrogen biomass of the 0.1-0.2mm size class	milligrams nitrogen per square meter (mg N m-2)
N_0d2_0d5_mm	Nitrogen biomass of the 0.2-0.5mm size class	milligrams nitrogen per square meter (mg N m-2)
N_0d5_1_mm	Nitrogen biomass of the 0.5-1mm size class	milligrams nitrogen per square meter (mg N m-2)
N_1_2_mm	Nitrogen biomass of the 1-2mm size class	milligrams nitrogen per square meter (mg N m-2)
N_2_5_mm	Nitrogen biomass of the 2-5mm size class	milligrams nitrogen per square meter (mg N m-2)

N_gt_5_mm	Nitrogen biomass of the >5mm size class	milligrams nitrogen per square meter (mg N m-2)
N_TOTAL	Total Nitrogen biomass	milligrams nitrogen per square meter (mg N m-2)
pcntC_0d05_0d1_mm	Carbon percentage (%) of the 0.05-0.1mm size class	percentage (%)
pcntC_0d1_0d2_mm	Carbon percentage (%) of the 0.1-0.2mm size class	percentage (%)
pcntC_0d2_0d5_mm	Carbon percentage (%) of the 0.2-0.5mm size class	percentage (%)
pcntC_0d5_1_mm	Carbon percentage (%) of the 0.5-1mm size class	percentage (%)
pcntC_1_2_mm	Carbon percentage (%) of the 1-2mm size class	percentage (%)
pcntC_2_5_mm	Carbon percentage (%) of the 2-5mm size class	percentage (%)
pcntC_gt_5_mm	Carbon percentage (%) of the >5mm size class	percentage (%)
pcntC_TOTAL	Total sample percentage (%) of carbon	percentage (%)
pcntN_0d05_0d1_mm	Nitrogen percentage (%) of the 0.05-0.1mm size class	percentage (%)
pcntN_0d1_0d2_mm	Nitrogen percentage (%) of the 0.1-0.2mm size class	percentage (%)
pcntN_0d2_0d5_mm	Nitrogen percentage (%) of the 0.2-0.5mm size class	percentage (%)
pcntN_0d5_1_mm	Nitrogen percentage (%) of the 0.5-1mm size class	percentage (%)
pcntN_1_2_mm	Nitrogen percentage (%) of the 1-2mm size class	percentage (%)
pcntN_2_5_mm	Nitrogen percentage (%) of the 2-5mm size class	percentage (%)
pcntN_gt_5_mm	Nitrogen percentage (%) of the >5mm size class	percentage (%)
pcntN_TOTAL	Total sample percentage (%) of nitrogen	percentage (%)
C_N_0d05_0d1_mm	C:N ratio of the 0.05-0.1mm size class	milligrams carbon per milligram nitrogen (mg C (mg N)-1)

C_N_0d1_0d2_mm	C:N ratio of the 0.1-0.2mm size class	milligrams carbon per milligram nitrogen (mg C (mg N)-1)
C_N_0d2_0d5_mm	C:N ratio of the 0.2-0.5mm size class	milligrams carbon per milligram nitrogen (mg C (mg N)-1)
C_N_0d5_1_mm	C:N ratio of the 0.5-1mm size class	milligrams carbon per milligram nitrogen (mg C (mg N)-1)
C_N_1_2_mm	C:N ratio of the 1-2mm size class	milligrams carbon per milligram nitrogen (mg C (mg N)-1)
C_N_2_5_mm	C:N ratio of the 2-5mm size class	milligrams carbon per milligram nitrogen (mg C (mg N)-1)
C_N_gt_5_mm	C:N ratio of the >5mm size class	milligrams carbon per milligram nitrogen (mg C (mg N)-1)
C_N_TOTAL	Total C:N ratio	milligrams carbon per milligram nitrogen (mg C (mg N)-1)
d13C_0d05_0d1_mm	Bulk 13C isotopic value (d13C) of the 0.05-0.1mm size class	delta 13C (‰)
d13C_0d1_0d2_mm	Bulk 13C isotopic value (d13C) of the 0.1-0.2mm size class	delta 13C (‰)
d13C_0d2_0d5_mm	Bulk 13C isotopic value (d13C) of the 0.2-0.5mm size class	delta 13C (‰)
d13C_0d5_1_mm	Bulk 13C isotopic value (d13C) of the 0.5-1mm size class	delta 13C (‰)
d13C_1_2_mm	Bulk 13C isotopic value (d13C) of the 1-2mm size class	delta 13C (‰)
d13C_2_5_mm	Bulk 13C isotopic value (d13C) ratio of the 2-5mm size class	delta 13C (‰)
d13C_gt_5_mm	Bulk 13C isotopic value (d13C) ratio of the >5mm size class	delta 13C (‰)
d13C_TOTAL	Total sample bulk 13C isotopic value (d13C)	delta 13C (‰)
d15N_0d05_0d1_mm	Bulk 15N isotopic value (d15N) of the 0.05-0.1mm size class	delta 15N (‰)
d15N_0d1_0d2_mm	Bulk 15N isotopic value (d15N) of the 0.1-0.2mm size class	delta 15N (‰)

d15N_0d2_0d5_mm	Bulk 15N isotopic value (d15N) of the 0.2-0.5mm size class	delta 15N (‰)
d15N_0d5_1_mm	Bulk 15N isotopic value (d15N) of the 0.5-1mm size class	delta 15N (‰)
d15N_1_2_mm	Bulk 15N isotopic value (d15N) of the 1-2mm size class	delta 15N (‰)
d15N_2_5_mm	Bulk 15N isotopic value (d15N) ratio of the 2-5mm size class	delta 15N (‰)
d15N_gt_5_mm	Bulk 15N isotopic value (d15N) ratio of the >5mm size class	delta 15N (‰)
d15N_TOTAL	Total sample bulk 15N isotopic value (d15N)	delta 15N (‰)

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Instruments

Dataset-specific Instrument Name	Bongo-60
Generic Instrument Name	Bongo Net
Dataset-specific Description	We used a 60-cm diameter Bongo net with 202-µm and 50-µm Nitex mesh nets.
Generic Instrument Description	A Bongo Net consists of paired plankton nets, typically with a 60 cm diameter mouth opening and varying mesh sizes, 10 to 1000 micron. The Bongo Frame was designed by the National Marine Fisheries Service for use in the MARMAP program. It consists of two cylindrical collars connected with a yoke so that replicate samples are collected at the same time. Variations in models are designed for either vertical hauls (OI-2500 = NMFS Pairovet-Style, MARMAP Bongo, CalVET) or both oblique and vertical hauls (Aquatic Research). The OI-1200 has an opening and closing mechanism that allows discrete "known-depth" sampling. This model is large enough to filter water at the rate of 47.5 m3/minute when towing at a speed of two knots. More information: Ocean Instruments, Aquatic Research, Sea-Gear

Dataset-specific Instrument Name	General Oceanics flow meter
Generic Instrument Name	Flow Meter
Dataset-specific Description	We used a 1-m diameter ring net with a 202-µm Nitex mesh and a 60 cm diameter Bongo net one side with a 202-µm mesh and the other a 50-µm mesh. General Oceanics flow meters were fitted in the center of the opening of each of the three nets to measure volume filtered.
Generic Instrument Description	General term for a sensor that quantifies the rate at which fluids (e.g. water or air) pass through sensor packages, instruments, or sampling devices. A flow meter may be mechanical, optical, electromagnetic, etc.

Dataset-specific Instrument Name	Folsom splitter
Generic Instrument Name	Folsom Plankton Splitter
Dataset-specific Description	Net tow contents were anesthetized with ice-cold carbonated water and split with a Folsom splitter.
Generic Instrument Description	A device for sub-sampling of plankton and ichthyoplankton samples by splitting, developed by Dr. Folsom of the Scripps Institute of Oceanography. Ideally suited for splitting plankton samples with minimal debris. A measured volume of plankton sample is placed in the undivided section of the drum. This is rotated 120 degrees to divide the stirred sample with a separating blade. Standard Methods suggests splitting until a subsample of 200-500 individuals is obtained.

Dataset-specific Instrument Name	PDZ Europa 20-20 IRMS
Generic Instrument Name	PDZ Europa 20-20 isotope ratio mass spectrometer
Dataset-specific Description	The continuous flow system consisted of a PDZ Europa ANCA-GSL elemental analyzer coupled to a 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 15N, 13C, 18O, and 34S in a host of applications. The analyzer has been purposely designed to measure 2H by continuous flow methodology and is also suitable to analyze the light stable isotopes in all the commonly measured gases: H2, N2, NO, N2O, O2, CO, CO2, SO, and SO2.

Dataset-specific Instrument Name	PDZ Europa ANCA-GSL CHN analyzer
Generic Instrument Name	PDZ Europa ANCA-GSL elemental analyzer
Dataset-specific Description	The continuous flow system consisted of a PDZ Europa ANCA-GSL elemental analyzer coupled to a PDZ Europa 20-20 isotope ratio mass spectrometer.
Generic Instrument Description	The ANCA-GSL module allows samples such as soil, viscous liquids, plant material, and organic compounds, to be analyzed directly by using Dumas combustion for 15N, 13C, and 34S or pyrolysis for 18O and D. It also allows isotope analysis of abundant gases from septum sealed containers. During combustion mode, a capsule containing the sample falls into the combustion tube and is converted in the presence of oxygen to CO2, N2, NOx, and H2O. An elemental copper stage reduces NOx, a MgClO4 trap removes water vapor, a switchable Carbosorb trap can be used to remove CO2 (for 15N only analyses) and a GC column separates CO2 from N2 (allowing dual isotope analysis). Modified packings, a Nafion dryer and different GC column allow 34S analysis. The sample preparation unit consists of a 66-place autosampler for unattended operation (larger options are available), 2 furnaces able to operate to 1100 deg C, and an on-board microprocessor. The analyzer is capable of dual isotope analysis of 15N and 13C. For CO (18O), H2 (2H), N2 (15N), CO2 (13C), CO2 (18O), and SO2 (34S) with precisions between 0.1 and 3 dependent on the element.

Dataset-specific Instrument Name	1-m ring net
Generic Instrument Name	Ring Net
Dataset-specific Description	We used a 1-m diameter ring net with 202-µm Nitex mesh.
Generic Instrument Description	A Ring Net is a generic plankton net, made by attaching a net of any mesh size to a metal ring of any diameter. There are 1 meter, .75 meter, .25 meter and .5 meter nets that are used regularly. The most common zooplankton ring net is 1 meter in diameter and of mesh size .333mm, also known as a 'meter net' (see Meter Net).

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Deployments

RR2201

Website	https://www.bco-dmo.org/deployment/916293
Platform	R/V Roger Revelle
Report	http://hdl.handle.net/1834/43464
Start Date	2022-01-20
End Date	2022-03-14
Description	See more information at R2R: https://www.rvdata.us/search/cruise/RR2201

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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

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