CTD downcast data collected from R/V Roger Revelle cruise RR2201 in the Argo Basin in the Indian Ocean from February to March of 2022

Website: https://www.bco-dmo.org/dataset/952677
Data Type: Cruise Results
Version: 1
Version Date: 2025-02-10

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 a compilation of CTD downcast data from the R/V Roger Revelle's Indian Ocean cruise RR2201. Data were visually and statistically QA/QC'd in R after export from SBE Processing Tools. Data were not binned due to very coarse resolution of raw data (approximately 1 m). All sensors used provided calibration coefficients except for fluorescence, which was calibrated based on in situ chlorophyll-a extractions.

Table of Contents

- Coverage
- Dataset Description
  - Methods & Sampling
  - Data Processing Description
  - BCO-DMO Processing Description
  - Problem Description
- Related Publications
- Related Datasets
- Parameters
- Instruments
- Deployments
- Project Information
- Program Information
- Funding

Coverage

Location: Northwest Australia, Argo Basin, 11-17°S, 114-124°E, depth 5000m
Spatial Extent: **N**:-13.01004 **E**:121.49774 **S**:-17.18242 **W**:114.13506
Temporal Extent: 2022-02-03 - 2022-03-03

Dataset Description

See the section "Related Datasets" on this page for related data from the same CTD casts. The bottle files were compiled for bulk QA/QC in tandem with the compiled downcast data file (see associated dataset "CTD bottle data from RR2201").

Methods & Sampling

This dataset contains a compilation of CTD downcast data from the R/V Roger Revelle's Indian Ocean cruise RR2201. Raw HEX files were first converted and surface soak removed. Due to unusual settings applied to Seabird's *Seasave*, each scan in the HEX file was the average of 20 raw sensor reads yielding extremely coarse resolution. Consequently, the downcast file was not binned and instead includes an entry for every raw data entry, which is approximately 1 per meter. A compiled bottle dataset is also available (see "Related Datasets" section for the associated dataset "CTD bottle data from RR2201") and was processed in tandem with this dataset.

Primary and secondary sensors for temperature and salinity were compared and found to have no significant discrepancies. Only primary sensors were included in the final dataset.

Fluorescence data were calibrated based on a linear regression between recorded fluorescence and extracted Chlorophyll-a taken from discrete samples throughout the cruise.

All other sensors use calibration coefficients provided and are otherwise unverified.

Data Processing Description

All data was processed through SBE Processing Tools and then compiled, calibrated, and QA/QC'd using R. SBE processing tools and Seasave V7 were both version: 7.26.7.

BCO-DMO Processing Description

* Sheet 1 of submitted file "RR2201 CTD Downcast v1 (2025-01-09T22_47_53).xlsx" was imported into the BCO-DMO data system for this dataset. Table will appear as Data File: 952687_v1_rr2201-bottle-data.csv (along with other download format options).
* Row 2 was skipped and units information included there added to the "Parameters" section of the dataset.
* Values "nd" imported as missing data values.

Missing Data Identifiers:
** In the BCO-DMO data system missing data identifiers are displayed according to the format of data you access. For example, in csv files it will be blank (null) values. In Matlab .mat files it will be NaN values. When viewing data online at BCO-DMO, the missing value will be shown as blank (null) values.

* "Z" added to values in column datetimeUTC to include the time zone in the value. datetime-> datetime with timezone.

* the following columns were rounded to this number of decimal places (precision for rounding supplied by data submitter)
Lat = 3
Lon = 3
Depth/pressure = 1
temperature = 2
salinity = 2
density = 2
transmission = 3
oxygen = 1
oxygenSat = 3
par = 1
fluorescence = 3

Problem Description

The SBE911+ was configured to average every 20 scans before transmitting yielding a major reduction in profile resolution. No major instrumental failures were noted.

[table of contents | back to top]

Related Publications

Intergovernmental Oceanographic Commission; Scientific Committee on Oceanic Research; International Association for the Physical Sciences of the Oceans. (2015). The International thermodynamic equation of seawater – 2010 (TEOS-10): calculation and use of thermodynamic properties. [includes corrections up to 31st October 2015] . UNESCO. https://doi.org/10.25607/OBP-1338
Methods

Sea-Bird Scientific (2017). SBE Data Processing (Version 7.26.7, released 2017-07-26). [SOFTWARE] https://software.seabird.com/
Software

Sea-Bird Scientific (2017). Seasave V7 (Version 7.26.7, released 2017-07-26). [SOFTWARE] https://software.seabird.com/
Software

[table of contents | back to top]

Related Datasets

IsRelatedTo

Kelly, T., Kranz, S. A. (2025) **CTD bottle data collected from R/V Roger Revelle cruise RR2201 in the Argo Basin in the Indian Ocean from February to March of 2022.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2025-02-10 http://lod.bco-dmo.org/id/dataset/952687 [view at BCO-DMO]
Relationship Description: Data from the same CTD casts and bottle samples from RR2201. See the Project page for other data collected as part of this project.

Kranz, S. A. (2025) **Water column inorganic nutrient concentration and nitrate+nitrite d15N and d18O measurements from R/V Roger Revelle cruise RR2201 in the Argo Basin in the Indian Ocean from February to March of 2022.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2025-02-10 doi:10.26008/1912/bco-dmo.952591.1 [view at BCO-DMO]
Relationship Description: Data from the same CTD casts and bottle samples from RR2201. See the Project page for other data collected as part of this project.

[table of contents | back to top]

Parameters

Parameter	Description	Units
datetimeUTC	ISO8601 datetime with timezone (in UTC).	unitless
cast	Sequential and continuous cast number.	unitless
cruise	Cruise ID.	unitless
transect	Transect identifier.	unitless

event	Unique event identifier used in the cruise event log.	unitless
station	Station identifier used in the cruise event log.	unitless
longitude	Longitude in degrees east.	decimal degrees
latitude	Latitude in degrees north.	decimal degrees
depth	Calculated depth	meters (m)
pressure	Observed pressure	decibels (db)
temperature	Observed temperature	degrees Celsius (degC)
salinity	Calculated salinity according to the (TEOS-10; doi: 10.25607/OBP-1338)	Practical Salinity Units (PSU)
density	Calculated in situ density from the (TEOS-10; doi: 10.25607/OBP-1338)	kilograms per cubic meter (kg m-3)
transmission	Observed beam transmission according to factory calibration.	per meter (m-1)
oxygen	Observed oxygen concentration	micromoles of oxygen per kilogram (umol O2 kg-1)
oxygenSaturation	Calculated oxygen saturation as a ratio based on calculated equilibrium concentration of seawater at the same salinity and potential temperature.	unitless
par	Incident irradiance from 400-700 nm collected from a 2Pi sensor attached to the rosette.	micromoles of photons per meter squared per second (umol photons m-2 s-1)
fluorescence	Calculated chlorophyll-a concentration	milligrams of chlorophyll a per cubic meter (mg chl-a m-3)

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	CTD Sea-Bird SBE 911plus
Dataset-specific Description	Overall system was an SBE911+ outfitted with the following sensors: Primary temperature (sn 6140) Primary conductivity (sn2572) Pressure cell (sn 0569) Secondary temperature (sn 4924) Secondary conductivity (sn 3023) PAR Sensor (QCP2300-HP 70444) Fluorometer (SCF-3781) Altimeter (PSA-1055) Transmissometer (Wetlabs 1769) Oxygen Sensor (sn 0848)
Generic Instrument Description	The Sea-Bird SBE 911 plus is a type of CTD instrument package for continuous measurement of conductivity, temperature and pressure. The SBE 911 plus includes the SBE 9plus Underwater Unit and the SBE 11plus Deck Unit (for real-time readout using conductive wire) for deployment from a vessel. The combination of the SBE 9 plus and SBE 11 plus is called a SBE 911 plus. The SBE 9 plus uses Sea-Bird's standard modular temperature and conductivity sensors (SBE 3 plus and SBE 4). The SBE 9 plus CTD can be configured with up to eight auxiliary sensors to measure other parameters including dissolved oxygen, pH, turbidity, fluorescence, light (PAR), light transmission, etc.). more information from Sea-Bird Electronics

[table of contents | back to top]

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

[table of contents | back to top]

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.

[table of contents | back to top]

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/.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1851558
NSF Division of Ocean Sciences (NSF OCE)	OCE-1851347
NSF Division of Ocean Sciences (NSF OCE)	OCE-1851381
NSF Division of Ocean Sciences (NSF OCE)	OCE-1851395
NSF Division of Ocean Sciences (NSF OCE)	OCE-2404504

[table of contents | back to top]