

MOCNESS and environmental data from R/V Sally Ride cruise SR2407 and SR2408 in the Gulf of California in May 2024

Website: <https://www.bco-dmo.org/dataset/996661>

Data Type: Cruise Results

Version: 1

Version Date: 2026-04-10

Project

» [Collaborative Research: Metabolic habitat barriers imposed on tropical diel vertical migrators](#) (Metabolism in Diel Migrators)

Contributors	Affiliation	Role
Maas, Amy Elizabeth	Bermuda Institute of Ocean Sciences (BIOS)	Co-Principal Investigator
Mickle, Audrey	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract

In May 2024, the R/V Sally Ride cruises SR2407 and SR2408 were conducted in the Gulf of California. The MOCNESS tow nets were deployed from May 4th to May 18th. Files from MOCNESS net tows were produced by LVpki software and include additional environmental data from the CTD. This dataset includes environmental sensor data—pressure, in situ temperature, potential temperature (θ), salinity, potential density anomaly (σ), and dissolved oxygen concentration (ml L^{-1})—alongside MOCNESS net data (net angle, volume filtered, and trip information) and associated calibration parameters. Raw environmental data are provided in .hex files with corresponding .xmlcon configuration files, while processed .pro files contain synchronized net and environmental data.

Table of Contents

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

Coverage

Location: Gulf of California Guaymas Basin and Carmen Basin

Spatial Extent: N:27.50544 E:-110.367 S:26.19667 W:-111.3148

Temporal Extent: 2024-05-04 - 2024-05-18

Methods & Sampling

In May 2024, the R/V Sally Ride cruises SR2407 and SR2408 were conducted in the Gulf of California. The MOCNESS tow nets were deployed from May 4th to May 18th. MOCNESS sampling protocols included the standard vertical 0-1000 m day night pairs as well as unpaired shorter interval tows (ranging in depths focused on 450-200 m) to capture a more detailed vertical resolution. Finally, a subset of tows were conducted in a horizontal fashion where the net was maintained at a constant depth +/- 5 m to sample communities across midwater oxygen features.

After collection different samples were preserved in formalin for later Zooscan analysis, dried as five size fractionated biomass (200, 500, 1000, 2000, 5000) samples, or preserved in ethanol for metabarcoding analysis.

Data Processing Description

Environmental data was processed by the LVpki software aboard ship.

BCO-DMO Processing Description

- Loaded 13 MOCNESS .PRO files (MOC1_01A through MOC13_13A) in regex-csv format with whitespace delimiter, using filename as resource name
- Header row taken from row 1; rows beginning with "%" skipped; missing values defined as -9999.0000, -9999.00, and -99.0
- Captured metadata from skipped comment lines into columns: tow, Date, Temperature Probe, Pressure Probe, Transmissometer, Conductivity Probe, Oxygen Probe, Fluorometer, Irradiance Probe, and Flow Meter Calibration; capture_skipped_rows_join set to false to preserve separate values per file
- Concatenated all 13 resources into single resource moc_all, mapping all fields by identical name; added file_name column from source filename
- Renamed fields: CTDDEPTH(M) to CTDDEPTH (removing unit suffix), spaces replaced with underscores in probe and calibration column names, file_name renamed to raw_data_filename
- Converted Date field from format %m/%d/%Y to %Y-%m-%d (date type)
- Split tow column using regex pattern capturing tow number, vessel name, and cruise ID into fields tow, vessel, and cruiseID
- Applied find/replace on vessel field: "Sally Ride" replaced with "R/V Sally Ride"
- Renamed resource moc_all to 996661_v1_mocness_files
- Converted time field (decimal day of year, year 2024) to ISO_DateTime_UTC in format %Y-%m-%dT%H:%M:%S (datetime type)
- Reordered fields placing vessel, cruiseID, tow, raw_data_filename, ISO_DateTime_UTC, lat, lon first, followed by measurement and instrument metadata fields
- Exported file as 996661_v1_mocness_files.csv

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

Parameters

Parameter	Description	Units
vessel	Vessel	unitless
cruiseID	Cruise identifier	unitless
tow	Tow identifier	unitless
raw_data_filename	Name of raw data files	unitless
ISO_DateTime_UTC	Datetime of sampling in ISO 8601 format	unitless
lat	Latitude of sample collection, positive is North	decimal degrees
lon	Longitude of sample collection, negative is West	decimal degrees

time	Decimal day of year	unitless
pres	Pressure	decibars (dbar)
echo	Altimeter	m
temp	Temperature of water	degrees Celsius
theta	Potential temperature	degrees Celsius
sal	Salinity	psu
sigma	Potential density anomaly	kg/m ³
angle	Net angle	degrees
flow	Measured flow counts of the net	unitless
hzvel	Net horizontal velocity	m/min
vtvel	Net vertical velocity	m/min
vol	Volume filtered in the net	m ³
net	Net number	unitless
fluor	Fluorescence	rfu
ptran	Percent transmission	%
oxygen	Dissolved Oxygen	ml/L
IrC	Irradiance Temperature	degrees Celcius
Irrad	Irradiance	W/m ²
GPSTIME	GPS time	unitless

CTDDEPTH	Depth	m
voln2	Volume filtered from second flow meter	m ³
RSP	Net response indicator	unitless
Date	Date of tow	unitless
Temperature_Probe	Temperature probe number	unitless
Conductivity_Probe	Conductivity probe number	unitless
Pressure_Probe	Pressure probe number	unitless
Oxygen_Probe	Oxygen probe number	unitless
Transmissometer	Transmissometer	unitless
Fluorometer	Fluorometer	unitless
Irradiance_Probe	Irradiance probe number	unitless
Flow_Meter_Calibration	Flow Meter Calibration	m/count

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

Instruments

Dataset-specific Instrument Name	MOCNESS system equipped with SIO electronics
Generic Instrument Name	CTD MOCNESS
Dataset-specific Description	Instrument Description: Environmental data was collected by a MOCNESS system equipped with SIO electronics (seabird 9 aboard, with connection through seabird 11 deck box). Sensors included Temperature, Pressure, Conductivity, Oxygen and a Fluorometer. Net itself was a 1-m ² MOCNESS equipped with 10 nets with 222 micron mesh.
Generic Instrument Description	The CTD part of the MOCNESS includes 1) a pressure (depth) sensor which is a thermally isolated titanium strain gauge with a standard range of 0-5000 decibars full scale, 2) A Sea Bird temperature sensor whose frequency output is measured and sent to the surface for logging and conversion to temperature by the software in the MOCNESS computer (The system allows better than 1 milli-degree resolution at 10 Hz sampling rate), and 3) A Sea Bird conductivity sensor whose output frequency is measured and sent to the surface for logging and conversion to conductivity by the software in the computer (The system allows better than 1 micro mho/cm at 10 Hz sampling rate). The data rate depends on the speed of the computer and the quality of the cable. With a good cable, the system can operate at 2400 baud, sampling all variables at 2 times per second. One sample every 4 seconds is the default, although the hardware can operate much faster. (From The MOCNESS Manual)

Dataset-specific Instrument Name	MOCNESS
Generic Instrument Name	MOCNESS
Dataset-specific Description	Instrument Description: MOCNESS sampling protocols included the standard vertical 0-1000 m day night pairs as well as unpaired shorter interval tows (ranging in depths focused on 450-200 m) to capture a more detailed vertical resolution.
Generic Instrument Description	The Multiple Opening/Closing Net and Environmental Sensing System or MOCNESS is a family of net systems based on the Tucker Trawl principle. There are currently 8 different sizes of MOCNESS in existence which are designed for capture of different size ranges of zooplankton and micro-nekton Each system is designated according to the size of the net mouth opening and in two cases, the number of nets it carries. The original MOCNESS (Wiebe et al, 1976) was a redesigned and improved version of a system described by Frost and McCrone (1974). (from MOCNESS manual)

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

Deployments

SR2407

Website	https://www.bco-dmo.org/deployment/996668
Platform	R/V Sally Ride
Start Date	2024-05-02
End Date	2024-05-11
Description	Project: Metabolic habitat barriers imposed on tropical diel vertical migrators

SR2408

Website	https://www.bco-dmo.org/deployment/996670
Platform	R/V Sally Ride
Start Date	2024-05-11
End Date	2024-05-21
Description	Project: Metabolic habitat barriers imposed on tropical diel vertical migrators

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

Project Information

Collaborative Research: Metabolic habitat barriers imposed on tropical diel vertical migrators (Metabolism in Diel Migrators)

Coverage: Guaymas Basin, Gulf of California, Mexico

NSF Award Abstract:

This project is seeking to define physiologically-accessible habitat for animals faced with changing ocean conditions. Many oceanic animals migrate daily from warm, oxygenated surface waters at night to deep, cold and hypoxic waters during the daytime, and these migrations play critical roles in oceanic ecology and biogeochemical cycles. Over their depth ranges, migrators face very different ecological and environmental demands that may lead to unique traits that in turn, influence how they respond to a warming ocean where oxygen minimum zones are also expanding. This study is combining ecological and physiological approaches during two expeditions to the Gulf of California. The investigators are measuring metabolic traits in a diverse suite of ocean animals that exhibit vertical migration to determine possible roles of oxygen and temperature in triggering changes in vertical and latitudinal distribution. They are also measuring species distributions in relation to environmental oxygen and temperature to determine ecologically-relevant thresholds of environmental tolerance. The project involves training and experiential learning for graduate and undergraduate students. In addition, engagement with educational experts and artists will generate media and lesson plans to support STEM education and Next Generation Science Standards. These activities leverage the Bermuda Institute of Ocean Sciences' Databytes and Mid-Atlantic Robotics IN Education (MARINE) programs, designed to improve ocean literacy and technological fluency and targeting students from groups traditionally underrepresented in science. Project products also include a new level for a video game that introduces the concepts of how oxygen minimum zones influence animal distribution.

Climate change is driving poleward shifts in the distributions of marine animals. These shifting edges of the range of species habitats are often interpreted as a manifestation of oxygen limitation that is presumed to occur at high water temperatures due to a mismatch between physiological oxygen supply and thermodynamically-driven oxygen demand. However, recent work by the investigators suggests that oxygen supply has evolved to meet demand regardless of temperature. These opposing views predict very different thermal thresholds for range expansion. In this study, the investigators are employing a relationship between metabolic traits to infer a unique temperature sensitivity in tropical diel vertical migrators and to map their metabolically-available habitat in the Eastern Pacific. Specifically, the investigators propose that oxygen supply does not limit metabolism in tropical migrators, even in the oxygen minimum zone. Instead, they contend that the active metabolic rate for tropical migrators is highly sensitive to temperature, and that this creates a barrier to range expansion where the aerobic scope for growth and reproduction is insufficient in cold waters. This temperature sensitivity will also allow migrators to expand poleward to newly available habitat following modest warming, rather than simply being extirpated from their native tropical habitat by excess warming. This hypothesis, if supported, would transform our mechanistic understanding of species' responses to climate change, amend our predictions of range expansion, and modify our assessment of migrator contributions to oceanic biogeochemical cycles in a warmer future ocean.

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](#)]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-2127299

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