

# Advanced Laser Fluorescence Analyzer (ALFA) data from the western Arabian Sea acquired on the R/V Roger Ravelle in June 2023

**Website:** <https://www.bco-dmo.org/dataset/942699>

**Data Type:** Cruise Results

**Version:** 1

**Version Date:** 2024-11-01

## Project

» [RAPID - Assessing the response of the Seychelles-Chagos Thermocline Ridge ecosystem to an Indian Ocean Dipole event](#) (SCTR\_IOD)

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## Abstract

We participated in the Indo-US EKAMSAT-PILOT cruise undertaken in the western Arabian Sea in May - June 2023. EKAMSAT is a collaborative Indo-US field campaign funded by the Ministry of Earth Sciences, Govt. of India and the Office of Naval Research, focused on the acquisition of contemporary oceanographic and atmospheric datasets deemed critical for improving the predictive skills of operational monsoon models. During the pre-monsoon season, akin to the warm pool that forms in the Western Equatorial Indian Ocean, there is a warm pool that forms in the Eastern Arabian Sea situated roughly west of the coast of Kerala. Our overarching objectives were two fold: 1) to understand whether phytoplankton communities of the warm pool were significantly different from those within the warm pool and from the surrounding waters and 2) whether there is a fundamental shift in phytoplankton functional types and their biomass following the onset of the summer monsoon. During the cruise our study area came under the influence of cyclone Biparjoy which led to a fundamental shift in phytoplankton functional types and biomass.

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## Coverage

**Location:** Western Arabian Sea

**Spatial Extent:** N:12.535988 E:68.272372 S:11.601503 W:66.406712

**Temporal Extent:** 2023-06-11 - 2023-06-21

## Methods & Sampling

When the instrument is used for underway sampling, the ALF is connected to the ship's uncontaminated

seawater flow-through system allowing for continuous measurements in water drawn from approximately 5m below the surface

The Automatic Laser Fluorometric Analyzer (ALFA) is a state-of-the-art instrument, that combines high-resolution spectral measurements of blue (405 nm) and green (532 nm) laser-stimulated fluorescence, with spectral deconvolution techniques to estimate CDOM, phytoplankton variable fluorescence (Fv/Fm), Chl a and three types of phycobiliprotein pigments.

## Data Processing Description

The fluorescence intensities attributable to each of the variables are normalized to the water Raman and expressed as relative fluorescence units (RFU). The Raman-normalized Chl a (679nm) and CDOM (508nm) fluorescence signals stimulated by the blue laser allow for measurements of Chl a and CDOM, respectively, while the Raman-normalized PE fluorescence signatures stimulated with the green laser allow for detection and quantitative assessment of three PE-containing groups of phytoplankton. These include the:

- 1) PE-1 peak at 565nm from blue water oligotrophic cyanobacteria with high phycourobilin/phycoerythrobilin (PUB/PEB) ratios,
- 2) PE-2 peak at 578nm from green water cyanobacteria with low-PUB/PEB ratios that usually thrive in coastal mesohaline waters, and
- 3) PE-3 peak at 590 nm attributable to eukaryotic photoautotrophic cryptophytes that are rich in phycobiliproteins and often abundant in coastal, and estuarine environments and in enclosed bays (Chekalyuk and Hafez, 2008; Chekalyuk et al., 2012, Goes et al. 2014).

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## Parameters

*Parameters for this dataset have not yet been identified*

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## Instruments

<b>Dataset-specific Instrument Name</b>	Automatic Laser Fluorometric Analyzer (ALFA)
<b>Generic Instrument Name</b>	Wet Labs Aquatic Laser Fluorescence Analyzer (ALFA)
<b>Generic Instrument Description</b>	WET Labs' Aquatic Laser Fluorescence Analyzer (ALFA) provides spectrally and temporally resolved measurements of key bio-environmental variables in oceanic, coastal, and fresh waters. Operation modes allow underway shipboard measurements and discrete sample analysis for accurate assessments of pigment biomass, phytoplankton community structure and physiology. Features • Spectral deconvolution of overlapped fluorescence bands with Raman normalization • Improved assessment of chlorophyll concentrations for estimating phytoplankton biomass • Discrimination of 5 phycobiliprotein pigments for structural phytoplankton characterization • Fluorescence assessment of chromophoric dissolved organic matter (CDOM) • Measures variable fluorescence, Fv/Fm, with correction for background CDOM fluorescence • Instrument software allows real-time data analysis and display with GPS coordinates and time more information from Wet Labs

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## Deployments

### RR2306

<b>Website</b>	<a href="https://www.bco-dmo.org/deployment/942702">https://www.bco-dmo.org/deployment/942702</a>
<b>Platform</b>	R/V Roger Revelle
<b>Start Date</b>	2023-06-08
<b>End Date</b>	2023-06-26

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## Project Information

### **RAPID - Assessing the response of the Seychelles-Chagos Thermocline Ridge ecosystem to an Indian Ocean Dipole event (SCTR\_IOD)**

**Coverage:** Southwestern Tropical Indian Ocean (5 and 15 degrees S)

#### NSF Award Abstract:

Phytoplankton constitute the base of the marine food web. Their diversity, productivity and abundance have a huge influence on fisheries. For example, seasonal increases in phytoplankton biomass caused by the surge of deep ocean nutrient rich waters into the upper sunlit layers in the Equatorial Indian Ocean lead to an increase in tuna stocks. However, non-periodic increases of sea surface temperatures in the Seychelles-Chagos Thermocline Ridge region in the eastern Equatorial Indian Ocean, a phenomenon known as the Indian Ocean Dipole, weakens deep ocean water surge, which seems to alter phytoplankton community structure and to reduce phytoplankton's productivity to the detriment of tuna stocks. Yet, the impact from such unpredictable events is not fully understood. This project investigates the impacts of an ongoing Indian Ocean Dipole, one of the most severe on record, on phytoplankton. The broader impacts of the project relate to its value to inform fisheries management plans in that area. Data derived from this study is valuable to understand and predict wider changes in the food web in a region that is coming under increasing pressures of global warming. All the data is made publicly available.

The research team is working with South Korean collaborators to understand how changes in phytoplankton biomass and in deep chlorophyll maxima may be linked to changes in phytoplankton productivity and growth rates due nutrient and/or iron limitation as a result of the weakening of deep-water upwelling. The team is also investigating the impact of the dipole event on cell size of dominating phytoplankton populations. Finally, they are testing if the phytoplankton community rely primarily on recycled as opposed to new nitrogenous nutrients for photosynthesis and growth during dipole events. The hypotheses are tested through extensive biological, hydro-chemical and biogeochemical measurements that include: 1) microscopic, Flow Cytometry, FlowCAM and HPLC pigment based analysis of phytoplankton biomass, community composition and size structure and Fast Repetition Rate based measurements of phytoplankton photosynthetic competency along a cruise track and different depths in the water column, and 2) on-deck incubation based photosynthesis and nutrient uptake experiments. In situ measurements and sample collection is carried out as part of the Korea-US inDian Ocean Scientific (KUDOS) Research Program cruise (April-May 2020) on board the Korea Institute of Ocean Sciences and Technology Ship R/V Isabu, one of the only multi-disciplinary oceanographic cruises planned for the Seychelles-Chagos Thermocline Ridge region during the dipole event.

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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## Funding

<b>Funding Source</b>	<b>Award</b>
<a href="#">NSF Division of Ocean Sciences (NSF OCE)</a>	<a href="#">OCE-2019983</a>

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