Phytoplankton and nutrients from R/V Sagar Kanya, R/V Sagar Sampada SK256, SS263, SS273, SS286 in the N. Arabian Sea from 2009-2011 (Arabian Sea Noctiluca project)

Website: https://www.bco-dmo.org/dataset/3952
Version: 2013-05-22

Project
» Quantitative importance and trophic role of Noctiluca blooms in the Arabian Sea (Arabian Sea Noctiluca)

Contributors	Affiliation	Role
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Dataset Description

Phytoplankton abundance for diatoms, dinoflagellate and Trichodesmium, nutrients and ctd data from Northern Arabian Sea, 2009-2011.

The data are subject to restricted access. Please contact the PI for access, jgoes@bigelow.org.

Methods & Sampling

During the cruise, seawater samples were collected with a 5-l Niskin® sampler mounted on a Sea Bird Electronics® CTD rosette using JGOFS prescribed clean techniques (Knap et al., 1996). Calibrated sensors mounted on the CTD provided vertical profiles of salinity, temperature and dissolved O2. The salinity sensor was calibrated against Autosal® Salinometer measurements, while the dissolved O2 sensor was calibrated against measurements using the Winkler method with the high-precision amperometric end point detection (Langdon, 1984). Quality control was guided by the National Oceanographic Data Center Report and included duplicate profile, depth duplication and inversion checks, as well as data range and large temperature and inversion checks (Boyer and Levitus, 1994).

Chlorophyll-a concentrations corrected for phaeophytin were measured by the fluorometric method, whereas phytoplankton production rates were measured using 14C labeled NaHCO3 incubations under simulated in-situ conditions in plexiglass tanks placed on the deck in full sunlight and in running seawater (Knap et al., 1996).

Microscopic identification and enumeration of phytoplankton was undertaken on duplicate samples that were fixed with 1% Lugol's iodine in 3% buffered formaldehyde solution and stored in cool and dark conditions to allow the cells to settle. Prior to microscopic analysis, samples were concentrated to 5-10 ml by carefully siphoning out the top layer through a 10um Nitex® filter wrapped around the tip of a thin tube. Although examination of the siphoned layer under the microscope indicated that no visible cells were lost by this method of concentration, cell abundance estimated using this method only applies to >10um cells. Cell density was counted by transferring 1ml replicates of the concentrated sample on to a Sedgwick-Rafter® slide and counted with an Olympus Inverted microscope (Model IX 50) at 200x magnification. Identification of

phytoplankton was based on standard taxonomic keys, and was in most cases undertaken up to the species level (Tomas, 1997).

Data Processing Description

Sampling and Analytical Methodology:
Methodologies are provided in Knap, A., A. Michaels, A. Close, H. Ducklow, and A. Dickson (1996), Protocols for the Joint Global Ocean Flux Study (JGOFS) core measurementsRep. 19 170 pp, Scientific Committee on Oceanic Research, International Council of Scientific Unions. Intergovernmental Oceanographic Commission, Bergen, Norway.
The analytical precisions and limits of detection of each of the variables measured are provided in Knap et al (1996).

References:
Boyer, T. & Levitus, S. Quality control of oxygen, temperature and salinity data. 65 National Oceanographic Data Center, Washington, D.C. (1994).
Knap, A., A. Michaels, A. Close, H. Ducklow, and A. Dickson (1996), Protocols for the Joint Global Ocean Flux Study (JGOFS) core measurementsRep. 19 170 pp, Scientific Committee on Oceanic Research, International Council of Scientific Unions. Intergovernmental Oceanographic Commission, Bergen, Norway.
Langdon, C. Dissolved oxygen monitoring system using a pulsed electrode: design, performance and evaluation. Deep Research I 31, 1357-1367 (1984).
Tomas, C. R. Identifying Marine Phytoplankton. 858 (Academic Press, 1997).

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Data Files

File
Noctiluca_ArabianSea.csv (Comma Separated Values (.csv), 1.22 MB) MD5:bb6a33aa73505f0d6ad290e0fc220855 Primary data file for dataset ID 3952

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Parameters

Parameter	Description	Units
cruise_id	cruise identification	none
sta_id	station identification	none
station	station number	none
date	date (GMT)	yyyymmdd
lat	latitude; north is positive	decimal degrees
lon	longitude; east is positive	decimal degrees

press	pressure	decibars
depth	depth	meters
temp	temperature measured by ctd	degrees Celsius
potemp	potential temperature	degrees Celsius
cond_mS	conductivity	milliSiemens/centimeter
sal	salinity	none
sigma_t	sigma_t density	kilograms per meter^3 -(minus) 1000
density	density	kilograms per meter^3
sound	sound velocity	meters/second
trans	light transmission	percent
turbidity	turbidity	Nephelometric Turbidity Units (NTU)
pH	pH of seawater	none (pH scale 0-14)
O2_umol_kg	oxygen concentration	micromoles /kilogram
NO2	nitrite concentration	micromoles/liter
NO3	nitrate concentration	micromoles/liter
NH3_pw	ammonium concentration	micromoles/liter
PO4	phosphate concentration	micromoles/liter
SiO4	silicate concentration	micromoles/liter
chl_raw	raw chlorophyll-a	volts

chl_a_ug_l	chlorophyll-a	micrograms/liter
chl_a_mg_m3	chlorophyll-a	milligrams/meter^3
diatom_tot	total diatoms	cells/liter
dino_tot	total dinoflagellates	cells/liter
trichodesmium_tot	total trichodesmium	trichomes/liter
production_mgC_m3_day	production	milligrams Carbon/cubic meter/day
year	year	
mon	month	
day	day	
yrday	sequential day of year with Jan. 1 as yrday 1.	

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Instruments

Dataset-specific Instrument Name	CTD Sea-Bird
Generic Instrument Name	CTD Sea-Bird
Dataset-specific Description	Calibrated sensors mounted on the CTD provided vertical profiles of Salinity, Temperature and dissolved O2.
Generic Instrument Description	Conductivity, Temperature, Depth (CTD) sensor package from SeaBird Electronics, no specific unit identified. This instrument designation is used when specific make and model are not known. See also other SeaBird instruments listed under CTD. More information from Sea-Bird Electronics.

Dataset-specific Instrument Name	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	Inverted Microscope
Generic Instrument Name	Inverted Microscope
Dataset-specific Description	Olympus Inverted microscope (Model IX 50)
Generic Instrument Description	An inverted microscope is a microscope with its light source and condenser on the top, above the stage pointing down, while the objectives and turret are below the stage pointing up. It was invented in 1850 by J. Lawrence Smith, a faculty member of Tulane University (then named the Medical College of Louisiana). Inverted microscopes are useful for observing living cells or organisms at the bottom of a large container (e.g. a tissue culture flask) under more natural conditions than on a glass slide, as is the case with a conventional microscope. Inverted microscopes are also used in micromanipulation applications where space above the specimen is required for manipulator mechanisms and the microtools they hold, and in metallurgical applications where polished samples can be placed on top of the stage and viewed from underneath using reflecting objectives. The stage on an inverted microscope is usually fixed, and focus is adjusted by moving the objective lens along a vertical axis to bring it closer to or further from the specimen. The focus mechanism typically has a dual concentric knob for coarse and fine adjustment. Depending on the size of the microscope, four to six objective lenses of different magnifications may be fitted to a rotating turret known as a nosepiece. These microscopes may also be fitted with accessories for fitting still and video cameras, fluorescence illumination, confocal scanning and many other applications.

Dataset-specific Instrument Name	Niskin bottles
Generic Instrument Name	Niskin bottle
Dataset-specific Description	5 liter 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.

Dataset-specific Instrument Name	Salinometer
Generic Instrument Name	Salinometer
Dataset-specific Description	Autosal® Salinometer
Generic Instrument Description	A salinometer is a device designed to measure the salinity, or dissolved salt content, of a solution.

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Deployments

SK256

Website	https://www.bco-dmo.org/deployment/59032
Platform	ORV Sagar Kanya
Start Date	2009-02-02
End Date	2009-02-23

SS263

Website	https://www.bco-dmo.org/deployment/59033
Platform	ORV Sagar Kanya
Start Date	2009-02-27
End Date	2009-03-14

SS273

Website	https://www.bco-dmo.org/deployment/59034
Platform	R/V Sagar Sampada
Start Date	2010-03-05
End Date	2010-03-15

SS286

Website	https://www.bco-dmo.org/deployment/59035
Platform	R/V Sagar Sampada
Start Date	2011-03-02
End Date	2011-03-22

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Project Information

Quantitative importance and trophic role of Noctiluca blooms in the Arabian Sea (Arabian Sea Noctiluca)

Until the late 90's *Noctiluca miliaris*, a large heterotrophic dinoflagellate was a minor component of phytoplankton populations in the northern Arabian Sea, appearing in bloom form only sporadically during the Southwest Monsoon (SWM, summer monsoon) and in coastal regions predisposed to upwelling and deep slope water intrusions. Since then *N. miliaris* blooms have increased in frequency, intensity and distribution, but with the majority of blooms being observed during the Northeast monsoon (NEM, winter monsoon). Large blooms of these organisms have now become more pervasive and widespread throughout the Gulf of Oman and in the western and central Arabian Sea replacing diatom-dominating blooms of the NEM that were seen frequently during the multi-disciplinary Arabian Sea, Joint Global Ocean Flux Studies (JGOFS). There is particular concern that the emergence of *N. miliaris* blooms and their association with waters that are nutrient-rich and undersaturated with respect to oxygen may be indicative of eutrophication of the Arabian Sea ecosystem. Such concerns are consistent with recent indications that the Arabian Sea is becoming more productive and that its permanent oxygen minimum zone is intensifying due to increased organic matter export from the euphotic zone. There is also concern that the replacement of diatoms by *N. miliaris* is potentially having a large impact on the food web and carbon cycling in the Arabian Sea.

This project will carry out a targeted field program aimed at understanding the emergence and fate of *N. miliaris* blooms. In particular the project will investigate 1) the environmental conditions facilitating large *N. miliaris* blooms in the Arabian Sea and 2) the trophic role of *N. miliaris* blooms and 3) implications of these blooms for carbon cycling and biogeochemical processes in the Arabian Sea. This field study has been devised in consultation with colleagues at the National Institute of Oceanography (NIO) & the Space Applications Centre in India who have offered ship time on board the India's research vessel R/V *Sagar Kanya* and laboratory facilities at NIO at no cost to this project. An existing collaboration with the Sultan Qaboos University (SQU), Oman will also allow access to data from an ongoing field program in the northern Arabian Sea.

This project will provide training to two US undergraduate students at Bigelow Laboratory and one graduate student from Univ. Texas (UT) will be involved full time. This project will provide an opportunity for students from the US to work alongside students from India. Through this truly international collaborative effort the project will encourage scientific curiosity about the response of marine ecosystems to climate change as well as foster a cross-cultural exchange of ideas. The investigators will leverage education and outreach efforts through development of a website which will be linked to Bigelow Laboratory's existing algal blooms and the Univ. Maine COSEE-OESS website. This website will be translated into Hindi, the official language of India and into Arabic, the language of Oman. This web-based resource will be tailored for non-specialist audiences with strong emphasis on visuals. At the UT Marine Science Institute. a radio segment on this research will be written for *Science and the Sea*, a radio program produced for National Public Radio, and played on most public radio stations nationwide (http://scienceandthesea.org/)

Associated programs: OCB Ocean Chemistry and Biochemistry) and SIBER (Sustained Indian Ocean Biochemistry and Ecosystem Research). SIBER is cosponsored by IMBER (Integrated Marine Biogeochemistry and Ecosystem Research) and IOGOOS (Indian Ocean Global Ocean Observing System).

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1121022

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