Underway data including temperature, salinity, fluorometry, pigments from RVIB Nathaniel B. Palmer NBP0601 cruise in the Ross Sea Southern Ocean (CORSACS project)

Website: https://www.bco-dmo.org/dataset/3366
Version: 09 September 2010
Version Date: 2010-09-09

Project
» Controls of Ross Sea Algal Community Structure (CORSACS)

Program
» Ocean Carbon and Biogeochemistry (OCB)

Contributors	Affiliation	Role
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Dataset Description

Underway measurements from shipboard data acquisition system. Reported data include salinity, temperature, fluorescence and pigment measurements.

Methods & Sampling

Underway water samples were drawn from the shipboard seawater pumping system, so these are near surface samples. Seawater was pumped in from the surface, through the underway flow through sysem while the ship was moving.

Algal HPLC pigment samples were collected by gentle filtration under low vacuum through GF/F filters and frozen in LN for on-shore analyses. Samples were extracted in 90% acetone and analyzed using a HP 1050 HPLC system equipped with autosampler, photodiode array and fluorescence detectors. The gradient elution program utilized was a slight modification of the Zapata et al. method (2000). Complete details of the HPLC method are described elsewhere (DiTullio and Geesey 2002). Replicate injections of standard pigments (purified from algal cultures in lab) produced a coefficient of variation of 3% with a limit of detection of approximately 1 ng.

References:

DiTullio, G.R., Geesey, M.E., 2002. Photosynthetic pigments in marine algae and bacteria. In: Bitton, G. (Ed.), The Encyclopedia of Environmental Microbiology. John Wiley & Sons, Inc., New York, NY, pp. 2453-2470.

Zapata, M., Rodriguez, F., Garrido, J.L., 2000. Separation of chlorophylls and carotenoids from marine phytoplankton: a new HPLC method using a reversed phase C8 column and pyridine-containing mobile phases. Marine Ecology Progress Series 195 (29-45).

Data Processing Description

Pigment concentrations were determined using standard peak integration procedures.

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Data Files

File
underway.csv (Comma Separated Values (.csv), 98.38 KB) MD5:966f61ba97be2b6f14ea8c5ddca0f1e7 Primary data file for dataset ID 3366

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Parameters

Parameter	Description	Units
date	GMT date of sampling	YYMMDD
time	GMT time of sampling	HHMM
lat	latitude (negative denotes South)	decimal degrees
lon	longitude (negative denotes West)	decimal degrees
temp	temperature (ITS 90)	degrees Celsius
sal	salinity (PSU)	dimensionless
fluor	fluorescence	relative units
sample	sample number for pigment analysis	dimensionless
mg_dvp_a5	magnesium-2 4-divinyl phaeoporphyrin a5 monomethyl ester	nanograms/liter
chl_c2	chlorophyll c2	nanograms/liter
chl_c1	chlorophyll c1	nanograms/liter
peridinin	peridinin	nanograms/liter
fucox_but	19-prime-butanoyloxyfucoxanthin	nanograms/liter
fucox	fucoxanthin	nanograms/liter
neox	neoxanthin	nanograms/liter
prasinox	prasinoxanthin	nanograms/liter
violax	violaxanthin	nanograms/liter
fucox_hex	19-prime-hexanoyloxyfucoxanthin	nanograms/liter
diadinox	diadinoxanthin	nanograms/liter
cis_fucox	cis_fucoxanthin	nanograms/liter
allox	alloxanthin	nanograms/liter
diatox	diatoxanthin	nanograms/liter
monad	monadoxanthin	nanograms/liter
zeax	zeaxanthin	nanograms/liter
lutein	lutein	nanograms/liter
crocox	crocoxanthin	nanograms/liter
chl_a2	divinyl chlorophyll a (also called DV Chl a)	nanograms/liter
chl_a_tot	sum of chlorophyll a like compounds	nanograms/liter
carotene_a	carotene-alpha	nanograms/liter
carotene_b	carotene-beta	nanograms/liter
chl_c3	chlorophyll c3	nanograms/liter
chl_b	chlorophyll b	nanograms/liter
chl_c_MVP	Chlorophyll C monovinyl protochlorophyllide	nanograms/liter
chlide	chlorophyllide	nanograms/liter
p_phorbide	phaeophorobide a (from chlorophyll a)	nanograms/liter
p_phytin	phaeophytin a (from chlorophyll a)	nanograms/liter

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Instruments

Dataset-specific Instrument Name	High Performance Liquid Chromatograph
Generic Instrument Name	High-Performance Liquid Chromatograph
Dataset-specific Description	HP 1050 HPLC system equipped with autosampler, photodiode array and fluorescence detectors
Generic Instrument Description	A High-performance liquid chromatograph (HPLC) is a type of liquid chromatography used to separate compounds that are dissolved in solution. HPLC instruments consist of a reservoir of the mobile phase, a pump, an injector, a separation column, and a detector. Compounds are separated by high pressure pumping of the sample mixture onto a column packed with microspheres coated with the stationary phase. The different components in the mixture pass through the column at different rates due to differences in their partitioning behavior between the mobile liquid phase and the stationary phase.

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Deployments

NBP0601

Website	https://www.bco-dmo.org/deployment/57985
Platform	RVIB Nathaniel B. Palmer
Report	http://data.bco-dmo.org/CORSACS/cruises/Dunbar_Hydrography_report_NBP0601.pdf
Start Date	2005-12-17
End Date	2006-01-30
Description	This was the first of two Controls of Ross Sea Algal Community Structure (CORSACS) project cruises and was funded by the NSF Office of Polar Programs. The NBP0601 cruise was conducted in the Ross Sea in December 2005 and January 2006, Ross Sea, ca. 65.21°S-78.65°S, 164.98°E-164.70°W, and supported by NSF research grant, OPP-0338097. The 'Science Pan and Project Description' document includes details of the cruise sampling strategy. Related Files: Science Plan and Project Descriptions (PDF file)Cruise track map (PDF file)Photo of Ice Breaker Nathaniel B. Palmer on station near Beaufort Island (JPG image) Related Sites: MGDS catalog: http://www.marine-geo.org/tools/search/entry.php?id=NBP0601

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Project Information

Controls of Ross Sea Algal Community Structure (CORSACS)

Website: http://www.whoi.edu/sites/corsacs

Coverage: Ross Sea Southern Ocean

Project summary

The Controls of Ross Sea Algal Community Structure (CORSACS) project was funded by the NSF Office of Polar Programs as "Collaborative Research: Interactive Effects of Iron, Light and Carbon Dioxide on Phytoplankton

Community Dynamics in the Ross Sea". Two cruises were completed in 2006 to investigate the interactions between the primary productivity of the Ross Sea and pCO2, iron and other trace elements. Data sets of carbon, nutrient, metal, and biological measurements will be reported.

The main objective in the proposed research was to investigate the relative importance and potential interactive effects of iron, light and CO2 levels in structuring algal assemblages and growth rates in the Ross Sea. The investigators hypothesized that the interaction of these three variables largely determines the bottom-up control on these two dominant Southern Ocean phytoplankton taxa. While grazing and other loss processes are important variables in determining the relative dominance of these two taxa, the CORSACS research project was designed to focus on the bottom-up control mechanisms. It is important to understand such environmentally-driven taxonomic shifts in primary production, since they are expected to impact the fixation and export of carbon and nutrients, and the production of DMS, thus potentially providing both positive and negative feedbacks on climate.

The CORSACS investigators considered a range of ambient iron, light and pCO2 levels that span those typically observed in the Ross Sea during the growing season. That is, dissolved iron ranging from ~0.1 nM (low iron) to greater than 1 nM (high iron) (Fitzwater et al. 2000; Sedwick et al. 2000); mean irradiance (resulting from vertical mixing/self shading) ranging from less than 10% Io (low light) to greater than 40% (high light) (Arrigo et al., 1998, 1999), possibly adjusted based on field observations during the CORSACS cruises; and pCO2 ranging (Sweeney et al. 2001) from ~150 ppm (low CO2) to the probable higher levels of pCO2 - 750 ppm as a conservative estimate - that are likely to be attained later this century due to anthropogenic perturbation of the global carbon cycle (IPCC, 2001).

From the information previously available from both field observations and experiments, the investigators formulated the following specific hypotheses regarding the interactive role of iron, light and CO2 in regulating algal composition in the Ross Sea: diatoms bloom in the southern Ross Sea only under optimum conditions of high iron, light and pCO2; colonial Phaeocystis dominate under conditions of high iron with either (or both) low light or low pCO2; and solitary Phaeocystis are predominant under conditions of low iron with either (or both) low light or low pCO2.

References:

Fitzwater, S.E., K.S. Johnson, R.M. Gordon, K.H. Coale, and W.O. Smith, Jr. (2000). Trace metal concentrations in the Ross Sea and their relationship with nutrients and growth. Deep-Sea Research II, 47: 3159-3179.

Martin JH, Gordon RM, Fitzwater SE. Iron in Antarctic waters. Nature 1990 ;345(6271):156-158. Martin JH. 1990. Glacial-interglacial CO2 change: The iron hypothesis. Paleoceanography 5(1):1-13

P. N. Sedwick, G. R. DiTullio, and D. J. Mackey, Iron and manganese in the Ross Sea, Antarctica: Seasonal iron limitation in Antarctic shelf waters, Journal of Geophysical Research, 105 (C5), 11,321-11,336, 2000.

Sweeney, C. K. Arrigo, and G. van Gijken (2001). Prediction of seasonal changes in surface pCO2 in the Ross Sea, Antarctica using ocean color satellite data. 2001 Annual AGU meeting, San Fransisco, CA Dec. 10-15.

IPCC, 2001: Climate Change 2001: Synthesis Report. A Contribution of Working Groups I, II, and III to the Third Assessment Report of theIntegovernmental Panel on Climate Change [Watson, R.T. and the Core Writing Team (eds.)]. Cambridge University Press, Cambridge,United Kingdom, and New York, NY, USA, 398 pp.

Publications

Saito, M. A., Goepfert, T. J., Noble, A. E., Bertrand, E. M., Sedwick, P. N., and DiTullio, G. R.: A seasonal study of dissolved cobalt in the Ross Sea, Antarctica: micronutrient behavior, absence of scavenging, and relationships with Zn, Cd, and P, Biogeosciences, 7, 4059-4082, doi:10.5194/bg-7-4059-2010, 2010 (http://www.biogeosciences.net/7/4059/2010/bg-7-4059-2010.html)

Bertrand EM, Saito MA, Lee PA, Dunbar RB, Sedwick PN and DiTullio GR (2011) Iron limitation of a springtime bacterial and phytoplankton community in the Ross Sea: implications for vitamin B12 nutrition. Front. Microbio. 2:160. doi: 10.3389/fmicb.2011.00160 (http://www.frontiersin.org/Aquatic_Microbiology/10.3389/fmicb.2011.00160/abstract)

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Program Information

Ocean Carbon and Biogeochemistry (OCB)

Website: http://us-ocb.org/

Coverage: Global

The Ocean Carbon and Biogeochemistry (OCB) program focuses on the ocean's role as a component of the global Earth system, bringing together research in geochemistry, ocean physics, and ecology that inform on and advance our understanding of ocean biogeochemistry. The overall program goals are to promote, plan, and coordinate collaborative, multidisciplinary research opportunities within the U.S. research community and with international partners. Important OCB-related activities currently include: the Ocean Carbon and Climate Change (OCCC) and the North American Carbon Program (NACP); U.S. contributions to IMBER, SOLAS, CARBOOCEAN; and numerous U.S. single-investigator and medium-size research projects funded by U.S. federal agencies including NASA, NOAA, and NSF.

The scientific mission of OCB is to study the evolving role of the ocean in the global carbon cycle, in the face of environmental variability and change through studies of marine biogeochemical cycles and associated ecosystems.

The overarching OCB science themes include improved understanding and prediction of: 1) oceanic uptake and release of atmospheric CO2 and other greenhouse gases and 2) environmental sensitivities of biogeochemical cycles, marine ecosystems, and interactions between the two.

The OCB Research Priorities (updated January 2012) include: ocean acidification; terrestrial/coastal carbon fluxes and exchanges; climate sensitivities of and change in ecosystem structure and associated impacts on biogeochemical cycles; mesopelagic ecological and biogeochemical interactions; benthic-pelagic feedbacks on biogeochemical cycles; ocean carbon uptake and storage; and expanding low-oxygen conditions in the coastal and open oceans.

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Funding

Funding Source	Award
NSF Office of Polar Programs (formerly NSF PLR) (NSF OPP)	OPP-0338097

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