Abundance and size distribution of abandoned (ghost) Phaeocystis colonies from profiles conducted during R/V Polar Star cruises in the Ross Sea, Antarctica between 2001 and 2005.

Website: https://www.bco-dmo.org/dataset/768570
Data Type: Cruise Results
Version: 2
Version Date: 2019-06-12

Project
» Interannual Variability in the Antarctic-Ross Sea (IVARS): Nutrients and Seasonal Production (IVARS)

Contributors	Affiliation	Role
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Abstract
Abundance and size distribution of abandoned (ghost) Phaeocystis colonies from profiles conducted during R/V Polar Star cruises in the Ross Sea, Antarctica between 2001 and 2005.

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Coverage

Spatial Extent: **N**:-76.4095 **E**:180 **S**:-77.668 **W**:171.067
Temporal Extent: 2001-12-20 - 2005-02-01

Dataset Description

Abundance and size distribution of abandoned (ghost) Phaeocystis colonies from profiles conducted during R/V Polar Star cruises in the Ross Sea, Antarctica between 2001 and 2005.

Related dataset (collected during the same profiles):
IVARS Marine Snow Profiles: https://www.bco-dmo.org/dataset/719478

Methods & Sampling

Methodology:

A marine snow imaging system was lowered through the water column to acquire photographs of aggregates but these images also included abandoned (ghost) Phaeocystis colonies that are enumerated in this data set.

The imaging system consisted of a collimated strobe system and either a 35-mm film camera (Lobsiger Deepslope 6000; Years 1 - 3) or a digital camera (Insite Pacific Scorpio; Year 4) mounted on an aluminum frame. The system was lowered at a rate of 10 m min-1 through the water column, acquiring ca. six images min-1 at an interval of ca. 1.7 m throughout the entire water column. Illumination was provided by a pair of strobe lights (Deep Sea Power and Light) positioned to produce an 8.4-cm deep beam of uniform, collimated light 66 or 79 cm from the camera lens. Aggregates larger than 0.5 mm within this volume (3 - 15 L, depending on the camera, lens and resultant geometry) are quantified from images taken by a camera that is mounted perpendicular to the long axis of the light beam, which can subsequently be distinguished and quantified by digital analysis. Ambient light illuminates particles in front of and behind this light beam and invalidates the calculation of illuminated volume. Thus, profiles were obtained near local midnight whenever possible (24-h photoperiods occurred throughout all cruises) to minimize this interference; images with the frame visible, due to ambient light, were discarded. The depth of first aggregate counts ranged from 30 - 88 m (a function of water clarity and solar angle). A Sea-Bird SeaCat CTD and 25-cm SeaTech transmissometer mounted on the camera frame provided continuous measurements of temperature, salinity and optical transmission. These data were used to calculate the depth at which each image was acquired. All film (Tmax 400) and images were returned to the laboratory for processing except for short sections viewed at sea to assess camera operation. The films were developed and then digitized to JPG format either in house, using a Nikon camera and macro lens (3767 x 2368), or commercially (3544 x 2341).

Data Processing Description

The images were analyzed with Image Pro Plus, with a final resolution of the digitized images (2048 x 1536 pixels) of 4.2 pixels mm-1. Digital images were analyzed directly with a final resolution of 4.2 Pixels mm-1. To insure that the same portion of each image was analyzed, an area of Interest (AOI) was created within the region of maximum illumination. This AOI was positioned to the same location within each image before particles were counted. Within this AOI, Phaeocystis were identified by the analyst and counted separately from the much more abundant marine snow aggregates.

BCO-DMO Data Manager Processing Notes:
* station information added to marine snow data from separate Excel spreadsheet.
* various date formats in the date column changed to ISO 8601 (yyyy-mm-dd)
* longitude was decimal degrees with directional (W E), corrected so longitude negative for W, positive for E.
* replaced comma in station comment with ; to better support export as csv format
* removed padded whitespaces
From originally submitted profiles in individual Excel sheets:
* copied and pasted contests of sheets (contained data by profile) into two separate tables to concatenate all the profiles together. Split into two "datasets" for marine snow and Phaeocystis ghost colonies.
* Some sheets in the original file had two separate tables in each of the sheets (for profiles that didn't have canister letter). Separate datasets made for particles per liter and ghost colonies.
* Changed column names so they could be imported into BCO-DMO data system (column names can't start with number or contain > or - characters. e.g. column named "0.0 - 0.5" changed to "bin_0_0_to_0_5" and "> 2.5 - 3.0" changed to "bin_gt_2_5_to_3_0"

version 2 (2019-06-12) replaces version 1 (2019-05-28):
* The latitude and longitude maximum and minimum bounds updated. The latitude changed to negative values. The latitude and longitude in the dataset itself remain unchanged as they were accurate.

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Data Files

File
ghost_colonies.csv (Comma Separated Values (.csv), 38.87 KB) MD5:fa38b307e1b1b1276ce755e4eb1c350e Primary data file for dataset ID 768570

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Parameters

Parameter	Description	Units
cruise_name	Name of the cruise which includes the year number and sequence number (For example, IVARS 1-1 is the first year and the first of two cruise)	unitless
Canister	An internal reference to the film canister, if applicable. This is included to enable future resarchers to positively identify the correct film	unitless
Station	Station number as assigned during the cruise. Many are at the same location but individual numbers are used to allow separation based on time	unitless
Latitude	Latitude. Negative = South	decimal degrees (DD)
Longitude	Longitude. Negative = West	decimal degrees (DD)
depth	Depth	meters (m)
date_local	Calendar Date in local (Christchurch, NZ) (NZST/NZDT)	unitless
In_water_time_local	Local time (HH:MM:SS) when the camera lowering began. Local time (Christchurch, NZ) (NZST/NZDT)	unitless
In_water_DateTime_UTC	Timestamp (UTC) when the camera lowering began in standard ISO 8601:2004(E) format YYYY-mm-ddTHH:MM:SSZ	yyyy-MM-dd'T'HH:mm'Z'
particles_per_L	Total number of particles larger than 0.5mm in diameter per liter number/liter	count
bin_0_0_to_0_5	Number of particles per liter number/liter between 0 and 0.5mm in size	count
bin_gt_0_5_to_1_0	Number of particles per liter number/liter between 0.5 and 1.0mm in size	count
bin_gt_1_0_to_1_5	Number of particles per liter number/liter between 1.0 and 1.5mm in size	count
bin_gt_1_5_to_2_0	Number of particles per liter number/liter between 1.5 and 2.0mm in size	count
bin_gt_2_0_to_2_5	Number of particles per liter number/liter between 2.0 and 2.5mm in size	count
bin_gt_2_5_to_3_0	Number of particles per liter number/liter between 2.5 and 3.0mm in size	count
bin_gt_3_0_to_3_5	Number of particles per liter number/liter between 3.0 and 3.5mm in size	count
bin_gt_3_5_to_4_0	Number of particles per liter number/liter between 3.5 and 4.0mm in size	count
bin_gt_4_0_to_4_5	Number of particles per liter number/liter between 4.0 and 4.5mm in size	count
bin_gt_4_5	Number of particles per liter number/liter larger than 4.5mm in size	count

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Instruments

Dataset-specific Instrument Name	We used a custom-built marine snow imaging system
Generic Instrument Name	Camera
Dataset-specific Description	See methodology
Generic Instrument Description	All types of photographic equipment including stills, video, film and digital systems.

Dataset-specific Instrument Name	
Generic Instrument Name	CTD Sea-Bird SEACAT
Generic Instrument Description	The CTD SEACAT recorder is an instrument package manufactured by Sea-Bird Electronics. The first Sea-Bird SEACAT Recorder was the original SBE 16 SEACAT developed in 1987. There are several model numbers including the SBE 16plus (SEACAT C-T Recorder (P optional))and the SBE 19 (SBE 19plus SEACAT Profiler measures conductivity, temperature, and pressure (depth)). More information from Sea-Bird Electronics.

Dataset-specific Instrument Name	
Generic Instrument Name	Sea Tech Transmissometer
Generic Instrument Description	The Sea Tech Transmissometer can be deployed in either moored or profiling mode to estimate the concentration of suspended or particulate matter in seawater. The transmissometer measures the beam attenuation coefficient in the red spectral band (660 nm) of the laser lightsource over the instrument's path-length (e.g. 20 or 25 cm). This instrument designation is used when specific make and model are not known. The Sea Tech Transmissometer was manufactured by Sea Tech, Inc. (Corvalis, OR, USA).

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Deployments

IVARS_cruises

Website	https://www.bco-dmo.org/deployment/770343
Platform	USCGC Polar Star
Start Date	2001-12-20
End Date	2005-02-01

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Project Information

Interannual Variability in the Antarctic-Ross Sea (IVARS): Nutrients and Seasonal Production (IVARS)

Coverage: Southern Ross Sea

NSF Award Abstract:

During the past few decades of oceanographic research, it has been recognized that significant variations in biogeochemical processes occur among years. Interannual variations in the Southern Ocean are known to occur in ice extent and concentration, in the composition of herbivore communities, and in bird and marine mammal distributions and reproductive success. However, little is known about the interannual variations in production of phytoplankton or the role that these variations play in the food web. This project will collect time series data on the seasonal production of phytoplankton in the southern Ross Sea, Antarctica. Furthermore, it will assess the interannual variations of the production of the two major functional groups of the system, diatoms and Phaeocystis Antarctica, a colonial haptophyte. The Ross Sea provides a unique setting for this type of investigation for a number of reasons. For example, a de facto time-series has already been initiated in the Ross Sea through the concentration of a number of programs in the past ten years. It also is well known that the species diversity is reduced relative to other systems and its seasonal production is as great as anywhere in the Antarctic. Most importantly, seasonal production of both the total phytoplankton community (as well as its two functional groups) can be estimated from late summer nutrient profiles. The project will involve short cruises on the US Coast Guard ice breakers in the southern Ross Sea that will allow the collection of water column nutrient and particulate after data at specific locations in the late summer of each of five years. Additionally, two moorings with in situ nitrate analyzers moored at fifteen will be deployed, thus collecting for the first time in the in the Antarctic a time-series of euphotic zone nutrient concentrations over the entire growing season. All nutrient data will be used to calculate seasonal production for each year in the southern Ross Sea and compared to previously collected information, thereby providing an assessment of interannual variations in net community production. Particulate matter data will allow us to estimate the amount of export from the surface layer by late summer, and therefore calculate the interannual variability of this ecosystem process. Interannual variations of seasonal production (and of the major taxa of producers) are a potentially significant feature in the growth and survival of higher trophic levels within the food web of the Ross Sea. They are also important in order to understand the natural variability in biogeochemical processes of the region. Because polar regions such as the Ross Sea are predicted to be impacted by future climate change, biological changes are also anticipated. Placing these changes in the context of natural variability is an essential element of understanding and predicting such alterations. This research thus seeks to quantify the natural variability of an Antarctic coastal system, and ultimately understand its causes and impacts on food webs and biogeochemical cycles of the Ross Sea.

Related publications:

Smith, W.O., Jr., M.S. Dinniman, J.M. Klinck, and E. Hofmann. 2003. Biogeochemical climatologies in the Ross Sea, Antarctica: seasonal patterns of nutrients and biomass. **Deep-Sea Res. II** 50: 3083-3101.

Smith, W.O., Jr., A.R. Shields, J.A. Peloquin, G. Catalano, S. Tozzi, M.S. Dinniman and V.A. Asper. 2006. Biogeochemical budgets in the Ross Sea: variations among years. **Deep-Sea Res. II** 53: 815-833.

Tremblay, J.-E. and *W.O. Smith, Jr.* 2007. Phytoplankton processes in polynyas. In: Polynyas: Windows to the World's Oceans (W.O. Smith, Jr. and D.G. Barber, eds.), Elsevier, Amsterdam, Pp. 239-270.

Smith, W.O. Jr. and D.G. Barber (Eds.). 2007. Polynyas: Windows to the World's Oceans. Elsevier, Amsterdam. 437 pp.

Smith, W.O. Jr. and D.G. Barber. 2007. Polynyas and climate change: a view to the future. In: Polynyas: Windows to the World's Oceans (W.O. Smith, Jr. and D.G. Barber, eds.), Elsevier, Amsterdam, Pp. 409-417.

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Peloquin, J. A., and *W. O. Smith, Jr.* 2007. Phytoplankton blooms in the Ross Sea, Antarctica: Interannual variability in magnitude, temporal patterns, and composition. **J. Geophys. Res.** 112: C08013, doi:10.1029/2006JC003816.

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Smith, W.O. Jr., V. Asper, S. Tozzi, X. Liu and S.E. Stammerjohn. 2011a. Surface layer variability in the Ross Sea, Antarctica as assessed by in situ fluorescence measurements. **Prog. Oceanogr.** 88: 28-45 (doi: 10.1016/j.pocean.2010.08.002).

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Liu, X. and *W.O. Smith, Jr.* 2012. A statistical analysis of the controls on phytoplankton distribution in the Ross Sea, Antarctica. **J. Mar. Systems** 94: 135-144.

Smith, W.O. Jr., P.N. Sedwick, K.R. Arrigo, D.G. Ainley, and A.H. Orsi. 2012. The Ross Sea in a sea of change. **Oceanography** 25: 44-57.

Peloquin, J., C. Swan, N. Gruber, M. Vogt, H. Claustre, J. Ras, J. Uitz, J-C. Marty, R. Barlow, M. Behrenfeld, R. Bidigare, H. Dierssen, G. DiTullio, E. Fernandez, C. Gallienne, S. Gibb, R. Goericke, L. Harding, E. Head, P. Holligan, S. Hooker, D. Karl, T. Knap, M. Landry, R. Letelier, C.A. Llewellyn, M. Lomas, M. Lucas, A. Mannino, J.-C. Marty, B. G. Mitchell, F. Müller-Karger, N. Nelson, C. O'Brien, B. Prezelin, D. Repeta, *W. O. Smith, Jr.,* D. Smythe-Wright, R. Stumpf, A. Subramaniam, K. Suzuki, C. Trees, M. Vernet, K. Wasmund, and S. Wright. 2014. The MAREDAT global database of high performance liquid chromatography marine pigment measurements. **Earth System Science Data** 5: 109-123.

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Asper, V.L. and *W.O. Smith, Jr.* Variations in the abundance and distribution of aggregates in the Ross Sea, Antarctica. **Deep-Sea Res. I** (submitted).

Smith, W.O., Jr. and D.E. Kaufman. Particulate organic carbon climatologies in the Ross Sea: evidence for seasonal acclimations within phytoplankton. **Prog. Oceanogr.** (submitted).

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Funding

Funding Source	Award
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