

Alongtrack data from ship's Data Acquisition System (DAS) from R/V Thomas G. Thompson cruise TN277 in the Eastern North Pacific Ocean in 2012 (POWOW project)

Website: <https://www.bco-dmo.org/dataset/3758>

Data Type: Cruise Results

Version: 1

Version Date: 2012-10-24

Project

» [Seasonal and decadal changes in temperature drive Prochlorococcus ecotype distribution patterns](#) (POWOW)

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Abstract

Alongtrack data from ship's Data Acquisition System (DAS) from R/V Thomas G. Thompson cruise TN277 in the Eastern North Pacific Ocean in 2012. Data were collected along the cruise track from the ship's IMET sensors, thermosalinograph, Knudsen, and GPS.

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Coverage

Spatial Extent: N:32.70665 E:-117.225355 S:21.247275 W:-158.342478

Temporal Extent: 2012-03-01 - 2012-03-11

Dataset Description

Data collected along the cruise track from the ship's IMET sensors, thermosalinograph, Knudsen, and GPS. Unprocessed ADCP, gravity, and multibeam underway data are also available from BCO-DMO upon request by emailing info@bco-dmo.org. These are raw data that cannot be served online in their current format.

Acquisition Description

The DAS system collects data at an operator selected interval; this interval is usually set at 1 sample every 5 seconds. The data are collected from IMET sensors, SBE-21 Thermosalinograph, EM302 or Knudsen, C-Nav GPS and Winch systems. The data are time, date and position tagged. A new file is started each day at GMT 0:00 and ends at 23:59:55 (depending on the data storage interval). Filename extensions are Julian Day. (From [University of Washington vessel information](#))

Thermosalinograph calibration data for DAS data follows:

Conductivity calibration coefficients:

$$m = 4.6$$

$$a = 0.00000523250085$$

$$b = 0.49686504$$

$$c = -4.21206317$$

$$d = -0.0000877310216$$

Temperature calibration coefficients:

$$f = 2610.082$$

$$a = 0.00364763429$$

$$b = 0.000596620785$$

$$c = 0.0000159326489$$

$$d = 0.00000120111676$$

External Temperature calibration coefficients:

$$f = 2676.423$$

$$a = 0.00368121106$$

$$b = 0.00058938925$$

$$c = 0.0000151014632$$

$$d = 0.00000122956892$$

PAR sensor calibration coefficient:

$$\text{dry} = 1.63\text{E-}17$$

Processing Description

BCO-DMO made the following modifications:

- Parameter names were changed to conform to BCO-DMO conventions.
- Blanks were replaced with 'nd'.
- + signs preceding latitude values were removed.
- lat and lon values that were obviously erroneous were replaced with 'nd' (e.g. negative latitude values, longitude values of -500).
- humidity and sea surface temperature columns were removed because all values were nd (humidity) and -9.999, or -2 (sea surface temp).
- Values containing unreadable characters were replaced with 'nd'.

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Parameters

Parameter	Description	Units
yday	Yearday (GMT).	unitless
month_gmt	Month of year (GMT).	mm (01 to 12)
day_gmt	Day of month (GMT).	dd (01 to 31)
year	4-digit year.	YYYY
time_gmt	Nav computer GMT time.	HH:MM:SS
date_gmt	Nav computer GMT date.	dd-mm-YYYY
lat	Nav computer latitude; positive = north.	decimal degrees
lon	Nav computer longitude; positive = east.	decimal degrees
temp	Thermosalinograph temperature.	degrees Celsius
cond	Thermosalinograph conductivity.	Seimens/meter
sal	Thermosalinograph salinity.	PSU
depth_w	Water depth.	meters
chl_raw	Thermosalinograph chlorophyll.	volts
light_trans_v	Thermosalinograph light transmission.	volts
PAR	PAR in microEinsteins per square meter per second.	$\mu\text{E}/\text{m}^2/\text{sec}$

radiation_s	IMET short wave radiation.	watts/square meter
temp_air	IMET air temperature.	degrees Celsius
press_bar	IMET barometric pressure	millibars
wind_speed	True wind speed.	knots
wind_dir	True wind direction.	degrees
wind_speed_r	Relative wind speed.	knots
wind_dir_r	Relative wind direction.	degrees
wind_speed_avg	Average true wind speed.	knots
wind_dir_avg	Average true wind direction.	degrees
sound_vel	Sound velocity.	meters/second
head	Gyro compass heading	degrees true
cog	Nav computer course over ground.	degrees true
speedlog	Doppler speed log.	knots
sog	Nav computer speed over ground.	knots
winch_no	Winch ID number: 0 = Hydro Winch 1; 1 = Trawl Winch; 2 = Hydro Winch 2.	unitless
wire_out	Number of meters of wire out.	meters
wire_rate	Wire rate.	meters/minute
wire_tension	Wire tension in pounds.	lbs
ISO_DateTime_UTC	Date/Time (UTC) ISO8601 formatted. T indicates start of time string; Z indicates UTC.	YYYY-mm-ddTHH:MM:SSZ

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Instruments

Dataset-specific Instrument Name	Thermosalinograph
Generic Instrument Name	Thermosalinograph
Dataset-specific Description	SBE 21 SeaCAT Thermosalinograph measured conductivity and temperature. Refer to the following (PDFs) from the TN277 (POWOW1) cruise: Temperature calibration data Temperature calibration report Conductivity calibration data Conductivity calibration report
Generic Instrument Description	A thermosalinograph (TSG) is used to obtain a continuous record of sea surface temperature and salinity. On many research vessels the TSG is integrated into the ship's underway seawater sampling system and reported with the underway or alongtrack data.

Dataset-specific Instrument Name	Fluorometer
Generic Instrument Name	Fluorometer
Dataset-specific Description	See the WetLabs ECO Fluorometer characterization sheet (PDF) from TN277 (POWOW1) cruise.
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	Wet Labs CSTAR Transmissometer
Generic Instrument Name	Wet Labs CSTAR Transmissometer
Dataset-specific Description	See the Wet Labs C-Star calibration sheet (PDF) from the TN277 (POWOW1) cruise.
Deployments	
Generic Instrument Description	A highly integrated opto-electronic design to provide a low cost, compact solution for underwater measurements of beam transmittance. The instrument is capable of either free space measurements, or through the use of an optical flow tube, flow-through sampling with a pump. It can be used in profiling, moored, or underway applications. more information from Wet Labs

TN277

Website	https://www.bco-dmo.org/deployment/58867
Platform	R/V Thomas G. Thompson
Report	http://dmoserv3.whoi.edu/data_docs/POWOW/POWOW1-cruise_report.pdf
Start Date	2012-02-29
End Date	2012-03-11
Description	<p>The POWOW#1 cruise was a trip of opportunity to sample along temperature gradients and test out new protocols. The primary goal of this cruise was to measure the abundance, diversity and activity of Prochlorococcus and associated bacterial and viral communities across temperature (and other environmental) gradients to understand how climate change may impact ocean ecology and biogeochemistry. There are many additional scientific and broader impact goals including characterizing oxidative stress and investigating nitrogen uptake/utilization molecular diversity. Cruise information and original data are available from the NSF R2R data catalog.</p>

Project Information

Seasonal and decadal changes in temperature drive *Prochlorococcus* ecotype distribution patterns (POWOW)

Website: <http://oceanography.ml.duke.edu/johnson/research/powow/>

Coverage: Eastern North Pacific Ocean

Project also known as 'Prochlorococcus Of Warming Ocean Waters' (POWOW). The two numerically-dominant ecotypes of the marine cyanobacterium *Prochlorococcus* partition the surface ocean niche latitudinally, with ecotype eMIT9312 dominant in the 30 degree N to 30 degree S region and eMED4 dominant at higher latitudes. These ecotypes may account for 25-50% of primary production in open ocean ecosystems, but this percentage is dependent on which ecotype dominates. The relative abundance of the two ecotypes follows a log-linear relationship with temperature, with the transition from eMIT9312 to eMED4 occurring at approx. 18 degrees C. From these descriptive data, it has been hypothesized that temperature is the primary driver of relative abundance. Their contribution to net primary production, however, appears to be independent of temperature, suggesting temperature regulates ecotype dominance through photosynthesis-independent mechanisms. To test these hypotheses, the PIs are undertaking a series of field and lab studies to investigate the effect of temperature change on the distribution of these ecotypes. Two cruises in the North Pacific will trace the transitions from eMIT9312- to eMED4-dominated regions, with one cruise during the winter and the other during summer. They have hypothesized that the ratio of ecotype abundance will move latitudinally with the seasonal shift in temperature gradient: migration of the 18 degrees C isotherm northward in the summer will be matched by a similar migration of the 1:1 ecotype transition point. Multiple crossings of the 18 degrees C isotherm are proposed, and the summer cruise will also follow the isotherm to the Western US coast to gain insight on physical and geochemical influences. Environmental variables such as nutrient concentrations, light/mixing depths, and virus /grazing based mortality, which may impinge on the relationship between temperature and ecotype ratio, will be assessed through a series of multivariate analyses of the collected suite of physical, chemical and biological data. Seasonal comparisons will be complemented with on-deck incubations and lab competition assays (using existing and new isolates) that will establish, for the first time, how fitness coefficients of these ecotypes relate to temperature. As latitudinal shifts in temperature gradient and migration of ecotypes during seasonal warming likely share common features

with high latitude warming as a consequence of climate change, the investigator's analyses will contribute important biological parameters (e.g., abundances, production rates, temperature change coefficients) for modeling biological and biogeochemical responses to climate change. This research will be integrated with that of committed collaborators, generating data sufficient for ecosystem-scale characterizations of the contributions of temperature (relative to other forcing factors) in constraining the range and seasonal migration of these numerically dominant marine phototrophs. Publications produced as result of this research: Rowe, J.M., DeBruyn, J.M., Poorvin, L., LeCleir, G.R., Johnson, Z.I., Zinser, E.R., and Wilhelm, S.W. 2012. Viral and bacterial abundance and production in the Western Pacific Ocean and the relation to other oceanic realms. *FEMS Microbiology Ecology*, 72, p. 359. DOI: 10.1111/j.1574-6941.2011.01223.x Morris, J.J., Lenski, R.E. and E.R. Zinser. 2012. The Black Queen Hypothesis: Evolution of Dependencies through Adaptive Gene Loss. *mBio*, 3, p. e00036-12. DOI: 10.1128/mBio.00036-12 Morris, J.J., Johnson, Z.I., Szul, M.J., Keller, M., and Zinser, E.R. 2011. Dependence of the cyanobacterium *Prochlorococcus* on hydrogen peroxide scavenging microbes for growth at the ocean's surface. *PLoS One*, 6(2), p. 16805. DOI:10.1371/journal.pone.0016805 Ringuet, S., Sassano, L., and Johnson, Z.I. 2011. A suite of microplate reader-based colorimetric methods to quantify ammonium, nitrate, orthophosphate and silicate concentrations for aquatic nutrient monitoring. *Journal of Environmental Monitoring*. DOI:10.1039/C0EM00290A Ritchie, A.E. and Johnson, Z.I. 2012. Abundance and genetic diversity of aerobic anoxygenic phototrophic bacteria of coastal regions of the Pacific Ocean. *Applied and Environmental Microbiology*, 78, p. 2858. DOI: 10.1128/AEM.06268-11

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Funding

Funding Source	Award
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