CTD cast sheets from R/V Thomas G. Thompson and R/V Kilo Moana cruises TN277, KM1301, and KM1312 in the Eastern North Pacific Ocean from 2012-2013 (POWOW project)

Website: https://www.bco-dmo.org/dataset/3749
Data Type: document
Version: 23 May 2014
Version Date: 2014-05-23

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

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Dataset Description

CTD cast sheets (PDF) with basic information regarding when/where the CTD rosette was deployed and the niskin bottles that were sampled for various measurements. Cast sheets are provided from the POWOW1 (TN277), POWOW2 (KM1301) and POWOW3 (KM1312) cruises.

Methods & Sampling

Each station number is a new location. Cast numbers start at 1 for each station. CTD numbers are unique and sequential across stations/casts. Niskin bottles were sampled in the order listed on the cast sheet, from left to right (e.g. pH/DIC were sampled first, etc.).

Data Processing Description

BCO-DMO merged separate files for each cast sheet into one single PDF containing all sheets for each cruise (POWOW1 and POWOW2).

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Data Files

File
CTD_cast_sheets.csv (Comma Separated Values (.csv), 435 bytes) MD5:aa0ba7ad3526c11a81d0631fc8484d49 Primary data file for dataset ID 3749

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Parameters

Parameter	Description	Units
cruise_name	Name of the cruise.	text
cruise_id	Official cruise identifier.	text
PDF_link	Link to the PDF document.	text

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Instruments

Dataset-specific Instrument Name	CTD Sea-Bird 9
Generic Instrument Name	CTD Sea-Bird 9
Generic Instrument Description	The Sea-Bird SBE 9 is a type of CTD instrument package. The SBE 9 is the Underwater Unit and is most often combined with the SBE 11 Deck Unit (for real-time readout using conductive wire) when deployed from a research vessel. The combination of the SBE 9 and SBE 11 is called a SBE 911. The SBE 9 uses Sea-Bird's standard modular temperature and conductivity sensors (SBE 3 and SBE 4). The SBE 9 CTD can be configured with auxiliary sensors to measure other parameters including dissolved oxygen, pH, turbidity, fluorometer, altimeter, etc.). Note that in most cases, it is more accurate to specify SBE 911 than SBE 9 since it is likely a SBE 11 deck unit was used. more information from Sea-Bird Electronics

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Deployments

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	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.

KM1301

Website	https://www.bco-dmo.org/deployment/505095
Platform	R/V Kilo Moana
Report	http://dmoserv3.whoi.edu/data_docs/POWOW/POWOW2-cruise_report.pdf
Start Date	2013-01-10
End Date	2013-02-08
Description	From the cruise report: The POWOW#2 cruise was the second in a series of cruises to study the influence of temperature and other environmental variables on Prochlorococcus, its viruses and other members of the microbial community. 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. Cruise information and original data are available from the NSF R2R data catalog.

KM1312

Website	https://www.bco-dmo.org/deployment/515629
Platform	R/V Kilo Moana
Report	http://dmoserv3.whoi.edu/data_docs/POWOW/POWOW3-cruise_report.pdf
Start Date	2013-07-01
End Date	2013-07-28
Description	From the cruise report: The POWOW#3 cruise was the third in a series of cruises to study the influence of temperature and other environmental variables on Prochlorococcus, its viruses and other members of the microbial community in the Northern Pacific Ocean. 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. The official title of the project is "Collaborative Research: Seasonal and decadal changes in temperature drive Prochlorococcus ecotype distribution patterns" and it is part of NSF #1031064 (Duke) and 1030518 (UTK). Cruise information and original data are available from the NSF R2R data catalog.

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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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