Metatranscriptomes - BioLINCS from R/V Kilo Moana KM1125 in the Oligotrophic North Pacific Ocean about 200 miles north of Oahu, North of Station ALOHA from September 2011 (C-MORE project)

Website: https://www.bco-dmo.org/dataset/517534
Version: 06 June 2014
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Project
» Center for Microbial Oceanography: Research and Education (C-MORE)

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Dataset Description

Diel metatranscriptome study
Data from the accession numbers listed below can be accessed from NCBI (http://www.ncbi.nlm.nih.gov/).

GenBank accession numbers
BioProject: (PRJNA244754)
SRA: Metagenomes (SRP041215 and SRP042245)

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Parameters

Parameters for this dataset have not yet been identified

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Deployments

KM1125

Website	https://www.bco-dmo.org/deployment/58729
Platform	R/V Kilo Moana
Start Date	2011-09-06
End Date	2011-09-21
	*/ BioLINCS (Biosensing Lagrangian Instrumentation and Nitrogen Cycling Systems — Tracking nitrogen in the open ocean) 06–21 September, 2011 • North of Station ALOHA Objective:

Description	Researchers on the BioLINCS cruise will use a variety of drifting instruments to study how marine microbes take up and transform nitrogen compounds in the open ocean. About the cruise: During the BioLINCS cruise, the research vessel Kilo Moana will spend 14 days near a patch of open ocean about 200 miles north of Oahu. Conditions in this area are similar to those at Station ALOHA, a mid-ocean research site that for almost 25 years has provided researchers with a wealth of background information about the chemistry, biology, and currents of the open Pacific. Researchers on the Kilo Moana will conduct a number of experiments to study marine bacteria and archaea. (Archaea are single celled organisms that look similar to bacteria, but which are in an entirely separate biological domain.) The BioLINCS researchers are particularly interested in how these microbes take up nitrogen and convert it into different forms (nitrogen cycling). These experiments involve deploying a variety of research equipment in the ocean and allowing this equipment to drift with the currents for days at a time. Some of these drifting ("Lagrangian") instruments are incubators, which allow researchers to run experiments on microbes in the environment from which the microbes were collected (in situ). One of the largest of these drifting instruments is called the Environmental Sample Processor (ESP). The ESP will allow researchers to use the DNA of marine microbes to figure out what organisms are present. It will also be used to determine the abundances of genes necessary for taking up dissolved nitrogen gas from seawater—a process known as "nitrogen fixation." While the Kilo Moana follows these arrays of drifting instruments, researchers on the ship will collect water samples at various depths and acquire physical, chemical, and biological data throughout the water column. They will also conduct incubation experiments on board the ship using the collected seawater. The water-column data, shipboard measurements, and incubation experiments will allow researchers on the ship to understand the biological-chemical links (or "biogeochemical processes") occurring in the water column. The water-column data will also become part of the long-term scientific record for Station ALOHA. About the science: Conditions around Station ALOHA are typical of the mid-Pacific, with extremely clear water and low populations of microscopic photosynthetic organisms (primary producers), which form the basis for marine food webs. Primary producers are relatively sparse in the open ocean because the surface water contains very low concentrations of the chemicals (nutrients) that they need to grow. Oceanographers use the term "oligotrophic" to describe such low-nutrient waters, thus the acronym forStation ALOHA: "A Long-term Oligotrophic Habitat Assessment.' One of the most important nutrients for primary producers is nitrogen, which can take several different chemical forms (nitrate, nitrite, ammonium, etc.). Different types of marine microbes use different forms of nitrogen as "fertilizer." In the open ocean, the "waste" from one group of microbes typically serves as an energy source or as a nutrient for another group of microbes. This biologically-controlled process of converting compounds from one form to another is called "biogeochemical cycling." During the BioLINCS cruise, researchers will focus on learning about the biogeochemical cycling of nitrogen compounds. Nitrogen gas is the only form of nitrogen that is available in high concentrations near the sea surface. However, only a few organisms exist that can take up nitrogen gas. These organisms "fix" nitrogen, converting nitrogen gas into energy-rich, "reduced" forms of nitrogen, such as ammonium, which can be utilized by other organisms. Thus nitrogen-fixing organisms can be thought of as providing fertilizer for other organisms. In fact, nitrogen fixation by microbes fuels most of the primary production in the surface waters of the open ocean. In addition to being used by primary producers, nitrogen compounds are also nutrients for other marine microbes that do not necessarily rely on sunlight and photosynthesis for survival. These microbes get their energy not from light, but rather by absorbing reduced chemicals directly from seawater. In doing so, they convert these compounds from one chemical form to another. This is analogous to animals eating food (which contains reduced carbon) and converting it to carbon dioxide (an oxidized form of carbon), which is then released to the atmosphere Although population densities of primary producers are relatively low in open-ocean areas, these areas cover much of the Earth's surface. As the dominant organisms in this immense environment, marine microbes are critically important in maintaining the climate of the Earth. They also supply approximately a third of the oxygen in the our atmosphere. In addition to providing oxygen, marine microbes have other important effects the atmosphere. Some of them release nitrous oxide (N_2O), which is a greenhouse gas. Others release compounds such as dimethyl sulfide (DMS), which influence the formation of clouds. Because of all these interactions between the open ocean and the atmosphere, studying the nitrogen cycle of the open ocean is more than an academic exercise. The results from the BioLINCS experiments could help improve computer models that predict how life in the oceans will respond to increasing carbon dioxide in the atmosphere, global warming, and ocean acidification. Related Files: BioLINCS Home C-MORE BioLINCS Site (no login required) C-MORE BioLINCS Members Site (login required) Cruise information and

	original data are available from the NSF R2R data catalog.

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Project Information

Center for Microbial Oceanography: Research and Education (C-MORE)

Website: http://cmore.soest.hawaii.edu/

Coverage: North Pacific Subtropical Gyre (large region around 22 45 N, 158 W)

Project summary

The **Center for Microbial Oceanography: Research and Education** (C-MORE) is a recently established (August 2006; NSF award: EF-0424599) NSF-sponsored Science and Technology Center designed to facilitate a more comprehensive understanding of the diverse assemblages of microorganisms in the sea, ranging from the genetic basis of marine microbial biogeochemistry including the metabolic regulation and environmental controls of gene expression, to the processes that underpin the fluxes of carbon, related bioelements and energy in the marine environment. Stated holistically, C-MORE's primary mission is: *Linking Genomes to Biomes*.

We believe that the time is right to address several major, long-standing questions in microbial oceanography. Recent advances in the application of molecular techniques have provided an unprecedented view of the structure, diversity and possible function of sea microbes. By combining these and other novel approaches with more well-established techniques in microbiology, oceanography and ecology, it may be possible to develop a meaningful predictive understanding of the ocean with respect to energy transduction, carbon sequestration, bioelement cycling and the probable response of marine ecosystems to global environmental variability and climate change. The strength of C-MORE resides in the synergy created by bringing together experts who traditionally have not worked together and this, in turn, will facilitate the creation and dissemination of new knowledge on the role of marine microbes in global habitability.

The new Center will design and conduct novel research, broker partnerships, increase diversity of human resources, implement education and outreach programs, and utilize comprehensive information about microbial life in the sea. The Center will bring together teams of scientists, educators and community members who otherwise do not have an opportunity to communicate, collaborate or design creative solutions to long-term ecosystem scale problems. The Center's research will be organized around four interconnected themes:

- (Theme I) microbial biodiversity,
- (Theme II) metabolism and C-N-P-energy flow,
- (Theme III) remote and continuous sensing and links to climate variability, and
- (Theme IV) ecosystem modeling, simulation and prediction.

Each theme will have a leader to help coordinate the research programs and to facilitate interactions among the other related themes. The education programs will focus on pre-college curriculum enhancements, in service teacher training and formal undergraduate/graduate and post-doctoral programs to prepare the next generation of microbial oceanographers. The Center will establish and maintain creative outreach programs to help diffuse the new knowledge gained into society at large including policymakers. The Center's activities will be dispersed among five partner institutions:

- Massachusetts Institute of Technology,
- Woods Hole Oceanographic Institution,
- Monterey Bay Aquarium Research Institute,
- University of California at Santa Cruz and
- Oregon State University

and will be coordinated at the University of Hawaii at Manoa.

Related Files:

Strategic plan (PDF file)

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Funding

Funding Source	Award
US Department of Energy (DOE)	unknown C-MORE DOE
NSF Division of Biological Infrastructure (NSF DBI)	DBI-0424599
Gordon and Betty Moore Foundation (GBMF)	unknown C-MORE Moore

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