CMORE Suva, Fiji to Honolulu, Hawaii Cruise (April 15-26, 2007)
Cruise Participant Activities

Goals and Sampling Activities of the BEACH (Biogeochemical & Ecological Analysis of Complex Habitats) from the University of Hawaii
(BEACH lab cruise participants: Karin Bjorkman, Claire Mahaffey, Blake Watkins, Donn Viviani, Ken Doggett, Susan Curless, Matthew Church)

1) Identify prominent trends in plankton biomass, biomass structure, and elemental stoichiometry
2) Examine variability in plankton growth and metabolism (production, nutrient assimilation, respiration, and N_2 fixation)
3) Evaluate variations in dissolved nutrient (inorganic and organic) concentrations and stoichiometry

To achieve these objectives, we plan to collect discrete seawater samples from vertical profiles using the CTD rosette at 8 stations in the various biogeochemical proveniences transected during this cruise. These profiles will allow us to exaime vertical variability in plankton growth, biomass, and stoichiometry along gradients in temperature, light, and nutrients. In addition, to increase our spatial sampling resolution, samples will be collected (~3 time daily) from the near surface ocean via the ship's underway, uncontaminated seawater intake system.

***CTD Cast Water Requirements**:*

HPLC: 4 liters @ 15, 45, 100, 125, 150, 200 m-Cast 3
N_2 fixation: 20 liters @ 15, 45 m- Cast 3
PC/PN: 4 liters @ 15, 45, 100, 125, 150, 200 m- Cast 3
Part. P: 4 liters @ 15, 45, 100, 125, 150, 200 m- Cast 1
Part. Si: 4 liters @ 15, 45, 100, 125, 150, 200 m- Cast 1
CH_4/N_2O: 1.5 liters @ 15, 45, 100, 125, 150, 200m-Cast 1
DNA/RNA: 4 liters @ 15, 45, 100, 125, 150, 200, 300, 500, 750, 1000 m-Cast 2, 3
PvE: 1.5 liters@ 15, 125 m- Cast 1
Flow cyto: 0.2 liters @ 15, 45, 100, 125, 150, 200m Cast 1, 3
Bact. Prod: 0.5 liter @ 15, 45, 100, 125, 150, 200 m - Cast 1
O_2 concentrations: 1 liter @ 15, 45, 100, 125, 150, 200, 300, 500, 750, 1000- Cast 2
Nutrients: 2 liters @ 15, 45, 100, 125, 150, 200, 300, 500, 750, 1000 m- Cast 2
ETS/CTC: 1 liter @ 15, 45, 100, 125, 150, 200, 300, 500, 750, 1000 m Cast 2
ATP: 2 liters @ 15, 45, 100, 125, 150, 200- Cast 1
PO_4^{3-} turnover/uptake: 2 liters@ 15, 45, 100, 125, 150, 200m Cast 1

Goals and Sampling Activities of WHOI group
(Repeta lab cruise participants: Maria del Mar Nielo Cid)

1) Examine latitudinal variability in upper ocean concentrations of colored dissolved organic matter (20-40 L from 20-30 m depth) at 8 major stations.

2) Examine latitudinal changes in trace metal ligands. Collect 2 x 200L trace metal free seawater from upper ocean using TM Teflon line/pump at each of the 8 major stations.
3) Evaluate influence of Fe and Fe ligands on organic matter dynamics (6-8 liters of 20 m water) at Station 4.
4) Evaluate DOC degradation (2 liters from 1200 m, 4 liters from 20 m) at Station 2

***CTD Cast Water Requirements**:*

20-40 L from 20-30 m depth at all stations- Cast 3
2 x 200L trace metal free seawater using TM Teflon line/pump all stations
6-8 liters @20 m at Station 4- Cast 3
2 liters @1200 m, 4 liters @ 20 m from Station 2-Cast 2

Goals and Sampling Activities of MIT group
(Chisholm cruise participants: Suzanne Kern)

1) isolation of new *Prochlorococcus* strains-2 liters (surf, Chl max, and depth between mixed layer and Chl max) @ all stations)
2) isolation of cyanophage
3) stable isotope probing to identify grazers of *Prochlorococcus* and *Synechococcus* (Stations 2, 4, 6)-8 liter <5 m water
4) *Prochlorococcus* gene expression 2 liters (surface mixed layer, Chl max, and 150m) @ all stations.
5) We will also collect flow cytometry and community DNA samples for counting and identifying *Prochlorococcus* in seawater used for isolation and expression studies.

***CTD Cast Water Requirements**:*

4 liters @ surf, Chl max, and depth between mixed layer and Chl max at all stations. Cast 1
8 liters @5 m at Stations 2, 4, 6 Cast 1

Goals and Sampling Activities of UCSC group
(Zehr lab cruise participants: Ian Hewson)

Following on from work conducted on KM0703, I'll be taking large-volume samples to examine bacterioplankton community transcriptomics and metagenomics. The fundamental question we are attempting to answer from this study is: How variable is community composition and community gene expression from place to place in the ocean, and is this variability associated with geochemical features? While we focus our efforts (i.e. screen for) genes involved in nitrogen cycling, our approaches (microarray-based screening etc) have the potential to examine 'dominant' expression – i.e. the most abundant transcripts.

Specifically, I'll collect large volumes of surface (3 – 8 m) seawater using a trio of high volume, air-driven peristaltic pumps (deployed together over the transom),

and divide this into two samples. The first (ca. 100 – 150L) will be filtered immediately for use in metagenomics surveys; the second will be filtered for transcriptomics. A further 100L of seawater will be kept in PC carboys in a flow-through incubator and filtered in the opposite light phase (i.e. dark if the original was filtered in the light and vv). Our filtration is by positive air pressure, 142mm filters, and in the >5 μm, and 5 – 0.2 μm size fractions. I may also run the filtrate through a 30 kDa filter to obtain the virus- and colloidal high MW size fraction at 1 or 2 stations; however this is not the focus of our research.

***Water Requirements**:*

Large volumes of surface (3 – 8 m) seawater samples collected using a trio of high volume, air-driven peristaltic pumps. No CTD cast requirements.

Goals and Sampling Activities of OSU group
(Letelier lab cruise participants: Angel White and Marnie Zirbel)

1) Optical determinations of upper ocean biogeochemical variables: optics package with AC-9, AC-S, PE, CDOM, and Chl *a* fluorometers. Deployment of this package would require 1hr for a 200m cast.

2) We will also be taking discrete samples for size-fractionated PE, PAM fluorometry, Particulate P (size fractionated), and collecting *Trichodesmium* colonies from net tows.

***CTD Cast Water Requirements**:*

20.5 liters @5, 40, 100, 200 m—SF Part. P- Cast 1, SF PE-Cast 3, PAM-Cast 1

Goals and Sampling Activities of Dalhousie group
(Moore lab cruise participants: Bob Moore and Stephen Punshon)

1) We plan to study the distribution, production and loss rates of dissolved hydrogen and its relationship to nitrogen fixation.

Dissolved hydrogen will be measured in the upper water column – mainly 0-100 m at each station. We also hope to make frequent measurements on water from the ship's underway system. If such measurements are feasible it will provide us with information on the diurnal variability of dissolved hydrogen concentrations.

Net loss rates (microbial) of hydrogen will be measured during 24 h dark incubation experiments.

Net production of hydrogen (light) will require 12 h incubations with bottles held under natural light on deck and maintained at sea surface temperature. We propose to conduct these incubations under the same light conditions as the N-15 incubations. Prior to incubation the water might be purged with H_2-free air to lower the concentration of H_2 to below atmospheric equilibrium.

***CTD Cast Water Requirements**:*

Profiles

600 ml for each bottle sample -including bottle flushing (depth range mainly 0-100 m).-Cast 1

Surface water incubations

Light and dark incubations, both requiring 4 L from the same depth as the shallower N-15 incubation (30 m). Dark incubations (for determining H_2-uptake rates will 4 liters but may be carried out on near surface samples. Whether pumped water can be used will depend on comparisons being made between pumped water and water collected using a non-contaminating vessel.-Cast 3

Goals and Sampling Activities of UH group
(Steward lab cruise participants: Alex Culley)

1) Viral diversity along biogeochemical gradients (depth profiles)
2) Viral/bacterial abundances by microscopy (depth profiles)
3) Viral concentrates for isolations

CTD Cast Water Requirements*:*

1-2 liters from 8 depths in the
upper 200 m, and 2-3 liters 3 depths >200 m-Cast 1, 2

Goals and Sampling Activities of UH group
(Rappé lab cruise participants: Darin Hayakawa and Misty Miller)

1) Assaying spatial distributions of microbial community structure based on rRNA fingerprinting and sequencing
2) QPCR based methods focusing on SAR11 subgroups
3) Membranes for whole cell counts (FISH)
4) Archiving live bacterioplankton samples by cyropreservation of seawater

Water Requirements:

4 liters at 6 depths in upper 200 m, 6 depths 200-1000 m at each station-Cast 2, 3

Goals and Sampling Activities of MBARI group
(Kolber lab cruise participants: Arlene Haffa)

1) Underway FRRf-for assessing spatial variability in photophysiological responses of photoautotrophs.
2) Benchtop FRRf-used for assessing photophysiology from discrete samples collected from vertical CTD profiles.

CTD Cast Water Requirements*:*

0.5 liter from selected depths in the upper 200 m; 1 liter from selected depths at selected stations-Cast 1

Goals and Sampling Activities of GaTech group
(Montoya lab cruise participants: Jason Landrum)

1) Stable isotope (^{13}C and ^{15}N) natural abundance size fractionated zooplankton sample collections.
2) Compound-specific $d^{15}N$ measurements

Water Requirements*:*

All samples collected using meter nets.

Measurement	Group Responsible
Pigments	BEACH
Photosynthesis	BEACH
Bacterial Production	BEACH
Rates of N_2 fixation and diversity of N_2 fixing microorganisms	BEACH
Chlorophyll *a* concentrations	BEACH
Particulate Carbon / Nitrogen/ Phosphorus/ Silica	BEACH
Picoplankton abundances-*Prochlorococcus*, *Synechococcus*, non-pigmented, and pigmented eukaryotes	BEACH
Phosphorus cycling	BEACH
CH_4 and N_2O concentrations	BEACH
Nutrients (NO_3^-+NO_2^-, Si, PO_4^{3-}, DOC, TDN, TDP)	BEACH
O_2 concentrations	BEACH
Production, respiration	BEACH
DOC degradation	WHOI
Fe and Fe Ligand availability	WHOI
cDOM concentrations	WHOI
Prochlorococcus gene expression and isolations	MIT
Cyanophage isolations	MIT
Stable isotope probing for *Prochlorococcus* grazing	MIT
Flow cytometry and community DNA for *Prochlorococcus*	MIT
Metgenomics and transcriptomics of bacterioplankton	UCSC
PAM fluorometry	OSU
Size fractionated Particulate P	OSU
Size fractionated phycoerythrin	OSU
Optical profiles of PE, Chl, cDOM, light attenuation/absorption	OSU
H_2 gas concentrations, production, and removal	Dalhousie
Viral diversity, abundances, and isolations	UH-Steward lab
Bacterioplankton diversity (rRNA based) SAR11 quantification Bacterioplankton cultivation/isolation	UH-Rappé lab
Photosynthetic physiology (FRRF)	MBARI
^{13}C and ^{15}N natural abundances of zooplankton, compound specific stable isotope abundances	Ga Tech