Pacific Biocomplexity Cruise 3 Prospectus

- Funded Projects:

Primary

Oceanic N2 Fixation and Global Climate
Grant: NSF Biocomplexity ***OCE99-81545***
PI's: A. Michaels, D. Capone & Ajit Subramaniam, *University of Southern California*, E. Boyle, *Massachusetts Institute of Technology*, D.Karl, *University of Hawaii - Manoa*, E. Carpenter, *Romberg Tiburon Center*, R. Siefert, *University of Maryland - Center for Environmental Sciences*, D. Sigman *Princeton University*

Ancillary

Factors Affecting, and Impact of Diazotrophic Microorganisms in the Western Equatorial Atlantic Ocean
Grant: NSF Biocomplexity ***OCE99-81371***
PI's: D. Capone & Ajit Subramaniam, *University of Southern California*, E. Carpenter, *Romberg Tiburon Center*, D. Olson, *University of Miami School of Marine & Atmospheric Sciences*, R. Hood, *University of Maryland - Center for Environmental Sciences*, S. Sanudo-Wilhelmy, *SUNY - Stony Brook*

Dusty Skies and Varied Waters
Grant: NASA SIMBIOS (MTPE) ***53-4854-7320***
PI's: A. Subramaniam, *ESSIC, University of Maryland*, D. Capone, *University of Southern California*, E. Carpenter, *Romberg Tiburon Center*

Underway pCO2 Measurements in the Western Equatorial North Atlantic and Subtropical North Pacific: The Importance of Synchronous Supporting Measurements
Grant: National Oceanic and Atmospheric Administration/Office of Global Programs *GC02-373*
PI's: P. Yager, *U. Ga.*

The impact of nitrogen fixation on carbon sequestration: a reassessment of the inorganic carbon system in LNLC regions
Grant: U.S. Department of Energy *DE-FG02-02ER63472*
PI's: P. Yager, *U. Ga.*

Purpose:

Research will focus on nitrogen (N) and carbon (C) cycling in the upper water column, particularly on the role of N_2 fixing organisms, such as the planktonic cyanobacterium *Trichodesmium*, in providing new N to these systems. Routine analyses include CTD/inorganic nutrient characterization from 0 to 1000m, phytoplankton and *Trichodesmium* specific biomass and abundance, primary productivity, inorganic N uptake, natural abundance analysis of PON and inorganic pools, N_2 fixation rates, and optical characterization of the water column.

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Specific experimental and analytical tasks will include:

- Assessment of *Trichodesmium* population abundance by direct counts and chlorophyll a analyses
- Total phytoplankton population abundance by direct counts and chlorophyll a analyses
- N_2 fixation by *Trichodesmium* by C_2H_2 reduction and $^{15}N_2$ uptake
- Phytoplanktonic N assimilation (new and regenerated) by ^{15}N
- ^{14}C productivity for both *Trichodesmium* and nanoplankton
- Phosphorus pools and dynamics
- Inorganic nutrient profiles
- Large volume filtration of surface waters by pumping on station
- Underway aerosol sampling for dust
- Profiles of particulate C & N mass and natural abundance ($d^{15}N$, $d^{13}C$)
- Measurements of normalized water leaving radiance, remote sensing reflectance, down welling irradiance, upwelling radiance, particulate and dissolved fraction absorption , surface chromophoric dissolved organic matter fluorescence along track.
- On deck Mesocosm experiments requiring surface water collected by either clean sampler (Dunker) deployed by crane, or collected off zodiac by surface diver (weather permitting). We anticipate 3 experiments each of about 5 days duration per leg
- Shallow (200m) floating sediment trap deployments
- Recovery of two deep (> 5000m) sediment traps at two primary stations- Rusty 1 & 2

Schedule:

We will undertake two major legs on RV Revelle.

Leg 1, from 13 Jul to 5 Aug, will have a primary goal of recovering two deep sediment trap moorings at each of our two stations, Rusty 1 & Rusty 2 (locations below). We are expecting that the most westerly mooring will require dragging because of a faulty Edgetech acoustic release.

Limited sampling will be undertaken during the transit to the first major station. We have budgeted 24 h of station time on the outbound leg, assuming about 6h sampling on each of 4 days. We will undertake an abbreviated set of operations at these station, including 2 to 3 CTD casts (typically to 500m, with one deeper to 1000m), net sampling and optics deployments. Long stations (2 & 3 days) are anticipated at the

major stations. However, if mooring recovery goes smoothly, we will attempt to truncate these stations in order to allow more sampling time on the return transit.

As time and conditions allow, we may deploy 1- 2 floating sediment traps for periods of 5- 14 days. Alternatively, traps may be deployed on the return transit to be picked up on leg 2.

Leg 2, from 5 Aug to 23 Aug, will be our Process leg focusing on collections and experiment on the biology and chemistry of the upper water column. We will primarily operate within about a 500m radius of the Hawaiian Island Archipeligo. There will be no firm cruise track. Rather, we will determine the cruise track ad hoc, based on current satellite (SeaWiFS/ MODIS) imagery and the presence of chlorophyll and thermal features. An example cruise track from our last process cruise on RV Kilo Moana last October is given in Fig. 2.

Stations will be undertake each day, commencing at about 0500- 0600 with CTD, net (including MOCNESS deployments), optics, and surface water pumping occurring for about 8- 10h before relocating. Limited night sampling (CTD & plankton net collection) will occur. Depending on circumstances (e.g. presence of surface bloom), we may occupy a station for > 1 day. We anticipate several floating sediment trap deployments on leg 2.

A very brief port call will be required on 16 Aug to put off 2 scientists (Michaels and Carpenter) and take on 1 (Doney) and offload the MOCNESS system.

Steaming days calculated @ 12 knots

Track	Miles	Transit time	Transit Sta	Main Sta	Tot h	Days	Depart	Arrive
		d	d	d				
Loading Honolulu								
Leg 1 to Rusty01	1250	4.34	1	2		7.34	7/13/2003 8:00	7/18/2003 16:10
Rusty01 to Rusty02	950	3.30	1	3		7.30	7/20/2003 16:10	7/24/2003 23:20
Rusty02 to Honolulu	2200	7.64	1			8.64	7/27/2003 23:20	8/5/2003 14:40
Total			3	5.25	198	23.28		
In port				0.25			8/5/2003 20:40	
Second Leg						17.5		8/23/2003 8:40

Rusty01:	25 59.97N	174 59.27W
Rusty02:	27 59.85N	170 00.69E

Figure 1. Cruise Track RV Revelle Leg 1

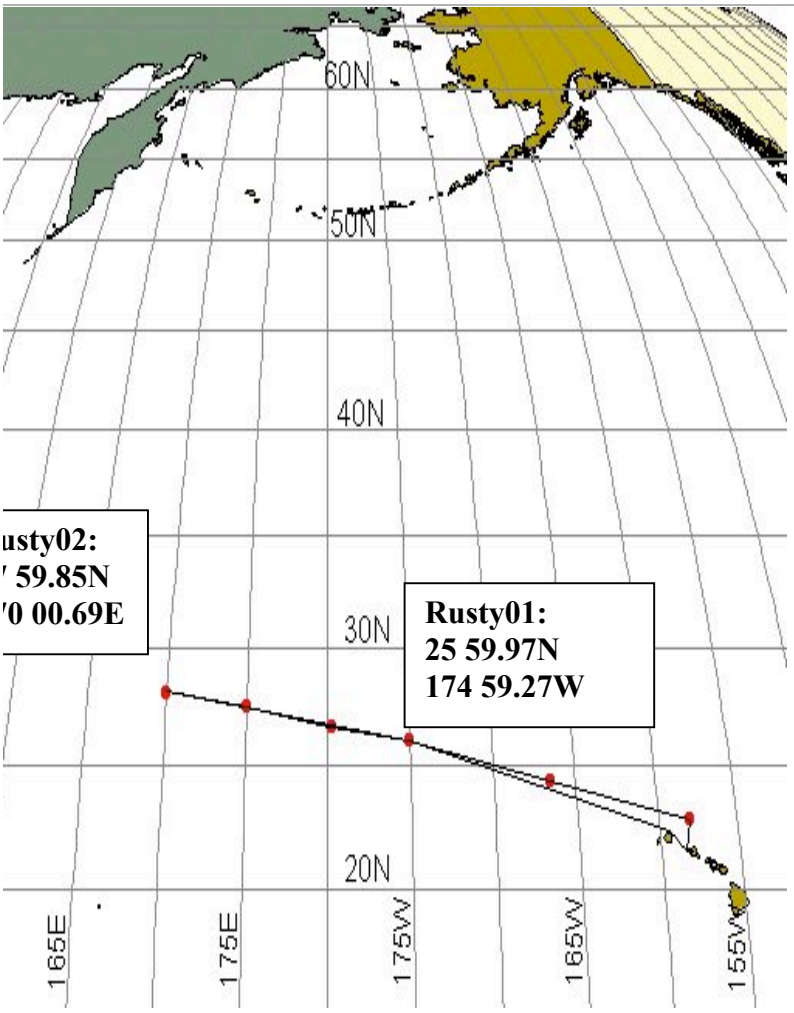
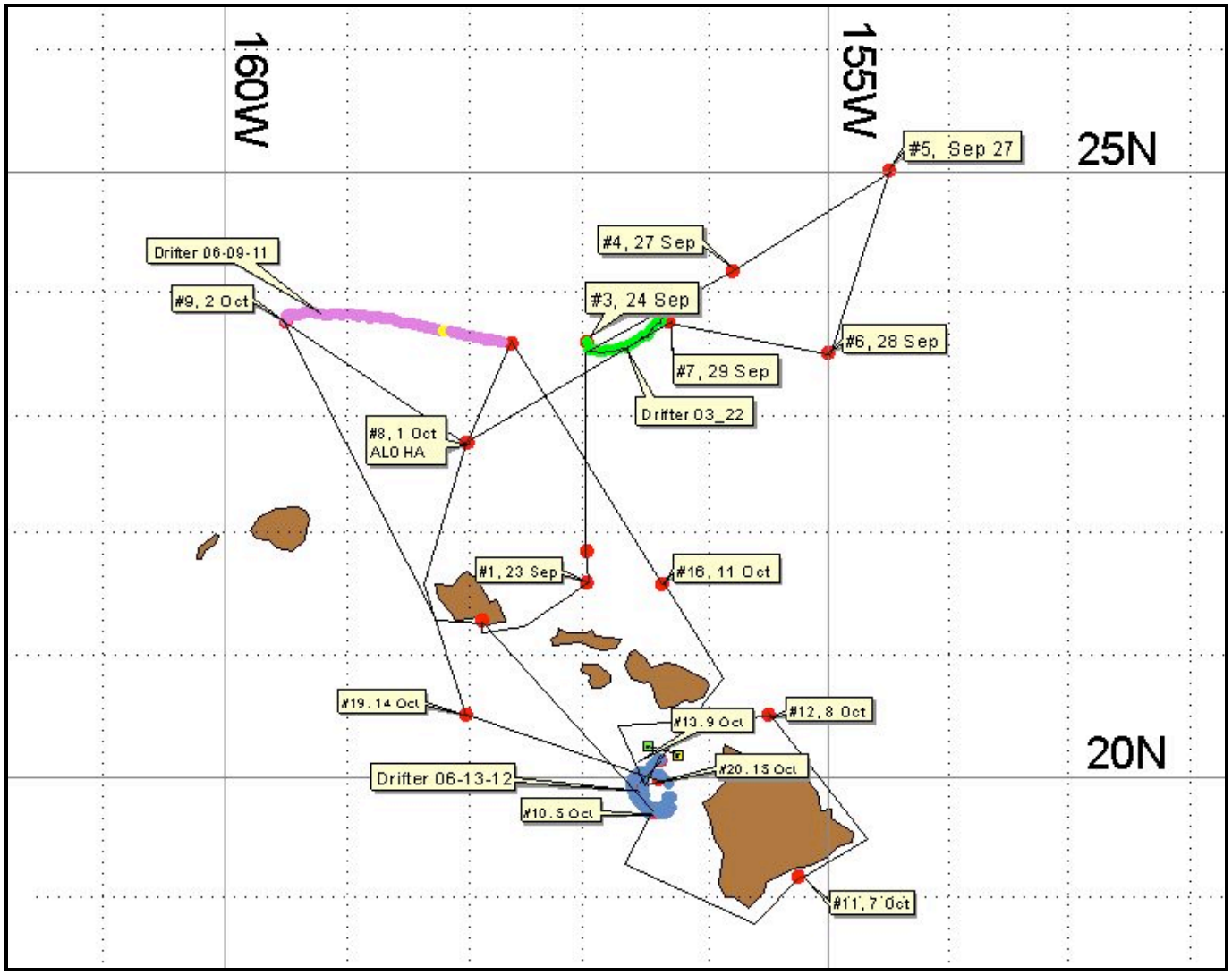


Figure 2. Example cruise track from previous Process cruise (RV Kilo MOANA Oct 2002):



Equipment:

- CTD Rosette: with minimum 24 x 10L Niskins (Back-up unit also, if available)
    - Dissolved Oxygen Sensor for CTD
    - Altimeter for CTD
    - Fluorometer for CTD
    - Transmissometer (25 cm path) for CTD
    - Underwater PAR for CTD
    - Surface PAR for CTD
- Salinometer for discrete salinity samples (PI supplied)
- Dissolved Oxygen Titration system for discrete oxygen samples (PI supplied)
- Quarter Meter MOCNESS (PI supplied)
    - Fluorometer for MOCNESS
    - Conductivity sensor for MOCNESS
    - Temperature sensor for MOCNESS
- Underway System with:
    - GPS Position
    - Differential GPS
    - Ship Gyro Heading
    - Ship Speed
    - Barometric Pressure
    - Sea Surface Salinity
    - Sea Surface Temperature
    - Air Temperature
    - Relative Humidity
    - Precipitation
    - Solar Radiation PSP
    - Solar Radiation PIR
    - Wind Speed
    - Wind Direction
    - Fluorometer
    - Water Depth
- Flowing sea water on deck for incubators
- Radioactive isotope van x 2
- Scintillation counter
- Distilled Water: 20 gal/day
- Milli-Q Water: 20 gal/day
- Autoclave
- Conducting 0.322 cable for CTD deployment to 3000 meters
- Hydrowire 0.250 cable for optics cage and other various deployments
- Mooring winch for floating sediment trap deployments
- Trawl winch for mooring recovery operations
- Zodiac

Contacts:

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Cruise Questions/Logistics Concerns

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ROSTER

	LEG 1			LEG 2A			LEG 2B		
	13-Jul	5-Aug		6-Aug	16-Aug		16-Aug	23-Aug	
1	**Siefert**	**Ron**	**UMD**	**Capone**	**Doug**	**USC**	**Capone**	**Doug**	**USC**
2				Michaels	Tony	USC			
3	Neumann	Michael	USC	Neumann	Michael	USC	Neumann	Michael	USC
4				Burns	Jay	USC	Burns	Jay	USC
5	Smith	Jerry	USC	Gunderson	Troy	USC	Gunderson	Troy	USC
6	Schimoeller	Reni	USC	Finzi	Juliette	USC	Finzi	Juliette	USC
7	Mahaffey	Claire	USC	Mahaffey	Claire	USC	Mahaffey	Claire	USC
8	Sohm	Jill	USC	Sohm	Jill	USC	Sohm	Jill	USC
9				Protopopadakis	Lia	USC	Protopopadakis	Lia	USC
10	Hewson	Ian	USC	Hewson	Ian	USC	Hewson	Ian	USC
11	Steele	Josh	USC	Steele	Josh	USC	Steele	Josh	USC
12	Roberts	Quinn	USC	Roberts	Quinn	USC	Roberts	Quinn	USC
13				Carpenter	Ed	SFSU			
14				Govil	Sarah	SFSU	Govil	Sarah	SFSU
15				Pluvinage	Sybelle	SFSU	Pluvinage	Sybelle	SFSU
16	Koch	Florian	SFSU	Eberl	Renate	SFSU	Eberl	Renate	SFSU
17	Rogoff	Dana	SFSU	Rogoff	Dana	SFSU	Rogoff	Dana	SFSU
18	Lew	Kevin	SFSU	Lew	Kevin	SFSU	Lew	Kevin	SFSU
19	Blough	Neil	UMD	Subramaniam	Ajit	UMD	Subramaniam	Ajit	UMD
20	delVecchio	Rosanna	UMD	Pantoja	Silvio	UConcep	Pantoja	Silvio	UConcep
21	Harris	Beverly	UMD	Lorca	Gisella	UConcep	Lorca	Gisella	UConcep
22				Chen	Ying	UMD	Chen	Ying	UMD
23				Westberry	Toby	UCSB	Westberry	Toby	UCSB
24				Knapp	Angie	Princeton	Knapp	Angie	Princeton
25	Cooley	Sarah	UGa	Cooley	Sarah	UGa	Cooley	Sarah	UGa
26				Shipe	Rebecca	UCLA	Shipe	Rebecca	UCLA
27				Curtaz	Jessica	UCLA	Curtaz	Jessica	UCLA
28	Shea	Alexandra	UH	Bjorkman	Karin	UH	Bjorkman	Karin	UH
29	Morris	Paul	UH	Morris	Paul	UH	Morris	Paul	UH
30	Clemente	Tara	UH	White	Angel	OSU	White	Angel	OSU
31	Holl	Carrie	GT	Holl	Carrie	GT	Holl	Carrie	GT
32	Alawahari	Lahini	SIO	Zhang	Lingzhi	**Volunteer**	Zhang	Lingzhi	**Volunteer**
33	Meador	Travis	SIO						
34							Doney	Scott	WHOI
35				Hynes	Annette	WHOI	Hynes	Annette	WHOI
36	SIO Tech		**SIO**	SIO Tech		**SIO**	SIO Tech		**SIO**
37	SIO Tech		**SIO**	SIO Tech		**SIO**	SIO Tech		**SIO**