

HOT-282: Chief Scientist Report

Chief Scientist: Susan Curless

R/V Kilo Moana

March 7-11, 2016

Cruise ID: **KM16-03**

Departed: March 7, 2016 at 0854 (HST)

Returned: March 11, 2016 at 0848 (HST)

Vessel: **R/V *Kilo Moana***

Master of the Vessel: Captain Jay Chavez

OTG Marine Technicians: Jeff Koch and Sonia Brugger

1. SCIENTIFIC OBJECTIVES

The objective of the cruise was to maintain a collection of hydrographic and biogeochemical data at the Hawaii Ocean Time-series (HOT) stations. Four stations were to be occupied during the cruise, in the following order:

- 1) Station 1, referred to as Station Kahe, is located at 21° 20.6'N, 158° 16.4'W and was to be occupied on March 7th for about 3 hours.
- 2) Station 2, referred to as Station ALOHA, is defined as a circle with a 6 nautical mile radius centered at 22° 45'N, 158°W. This is the main HOT station and was to be occupied March 7th, 8th, 9th and 10th.
- 3) Station 52, the site of WHOTS-12 Mooring (anchor position 22° 40.061' N, 157° 56.9654' W) was to be occupied on March 10th for about one hour.
- 4) Station 6, referred to as Station Kaena, is located off Kaena Point at 21° 50.8'N, 158° 21.8'W and was to be occupied on March 10th for approximately 3 hours.

Upon arrival to Station Kahe a ~1300 lb. weight-test cast to 500 m, one CTD cast to 1000 m, and a Hyperpro cast were to be conducted on the afternoon of March 7th. The single CTD cast was to be conducted to collect continuous profiles of various physical and chemical parameters. Water samples were to be collected at discrete depths for biogeochemical measurements. After these operations were satisfactorily completed, the ship was to deploy three SLDMB drifters and then proceed to Station ALOHA.

Upon arrival to Station ALOHA, the free-drifting sediment trap array was to be deployed. The sediment trap array was to stay in the water for about 52 hours. This was to be followed by one 1000 m cast to collect water for the Primary Productivity Array. This cast was to be followed by the deployment of the free-drifting Primary Productivity Array to incubate insitu for 12 hours. A full-depth (~4740 m) CTD cast was to be conducted after the deployment of the Primary Production array, and followed by 1000 m CTD casts at strict 3 hour intervals for at least 36 hours for continuous and discrete data collection, ending with another full-depth CTD cast at 2300 on March 9th.

Another free-drifting array (Gas Array) was to be deployed for 24 hours for incubation experiments on March 9th. The Gas Array was to be recovered on March 10th.

An Automated Trace Element (ATE) sampler was to be deployed to a depth of 10 m on March 9th.

A plankton net was to be towed three times between 1000-1400, and three times between 2200-0200 for 30 minute intervals on March 8th and 9th at Station ALOHA.

The Hyperpro was to be deployed for a half-hour period near noon time on March 7th, 8th, and 10th.

An optics package including a Wet Labs AC9, a SeaBird Seacat, and a LISST particle size and distribution analyzer was to be used to profile the upper 200 m at Station ALOHA in the early morning and around noon on March 10th.

After the 36 hour burst period of CTD work at Station ALOHA was accomplished, the ship was to transit to recover the floating Sediment Trap Array and the Gas Array on the morning of March 10th.

After recovering the arrays, the ship was to transit to Station ALOHA to conduct an optics cast. Once that operation was complete, the ship was to transit to Station 52 to conduct a one-hour 200 m CTD yo-yo cast. Once operations at Station 52 were complete, the ship was to re-position within Station ALOHA to conduct a Hyperpro cast.

Once operations at Station ALOHA were complete, the ship was to transit to Station 6, referred to as Station Kaena where a near-bottom CTD cast (~2500 m) was to be conducted to collect salinity and chlorophyll samples for calibration. After Station Kaena operations were complete, the ship was to transit back to Snug Harbor.

The following instruments were to collect data throughout the cruise: shipboard ADCP, thermosalinograph, the underway fluorometer, $p\text{CO}_2$ system, and the meteorological package.

2. SCIENCE PERSONNEL

Participant	Title	Affiliation
Susan Curless	Research Associate	UH
Brenner Wai	Research Associate	UH
Blake Watkins	Marine Engineer	UH
Brie Maillot	Technician	UH
Alexa Nelson	Research Associate	UH
Greyson Adams	Research Associate	UH
Jim Burkitt	Research Associate	UH
Eric Shimabukuro	Research Associate	UH
Tara Clemente	Research Associate	UH
Jefrey Snyder	Marine Technician	UH
Daniel McCoy	Research Associate	UH
Robert (Walt) Deppe	Research Associate	UH
Kellen Rosburg	Research Associate	UH
Karin Björkman	Research Specialist	UH
Abby Bate	Technician	UH
Timothy Burrell	Postdoctoral Researcher	UH
Elaine Luo	Graduate Student	UH
Melissa Jung	Graduate Student	HPU
Jim Deppe	Volunteer	
Elizabeth Ricci	MATE Intern	OTG
Sonia Brugger	Marine Technician	OTG
Jeff Koch	Marine Technician	OTG

3. GENERAL SUMMARY

Operations during the cruise were interrupted on two occasions and complicated by adverse weather conditions. The weather quickly worsened throughout the day of March 8th. Winds picked up from 15-20kts to 30-35kts and the seas increased from 2-4ft to 10-12ft combined with a building swell from 4-6ft to 8-10ft. A squall with gusts up to 40kts also passed through Station ALOHA on March 8th.

The first interruption to operations was on the evening of March 8th due to recovery efforts of the Primary Production Array. The array had drifted ~19 nm to the SW of the deployment site requiring a long

transit time. Upon arrival at the array location, the first approach of the surface buoy showed no visible primary floats and the surface float line was tangled with the buoy mast. On second approach, the recovery of the buoy and surface float line was successful. The primary floats and all samples were confirmed lost.

The second interruption in operations occurred when communication with the CTD was lost at 846 dbar on the upcast of S2C6, at 2338 on March 8th. The package was recovered and it was found that the termination was pulled apart when the conductors got caught underneath the shackle and the connection opened. This was caused by the excessive motion of the rosette due to severe pitching of the vessel during the high sea state.

To accommodate for the delays in operations and to safe guard our equipment, the Gas Array deployment, net tows, and the second deep CTD cast were cancelled.

One 1000 m CTD cast was completed at Station Kahe. One near bottom CTD casts and thirteen 1000 m CTD casts were conducted at Station ALOHA. One 200 m yo-yo CTD cast was completed near the WHOTS mooring (Station 52) with four cycles completed. One near bottom CTD cast was completed at Station Kaena.

The .681 wire and trawl winch were used for CTD operations.

The Sediment Trap array was deployed and recovered successfully. The array drifted 26 miles SW from the deployment site.

The Primary Production Array, was deployed but only the surface floats and buoy were recovered successfully.

Two daytime net tows for the core HOT zooplankton collection were completed successfully.

The ATE was deployed on March 9th, but a sample was not collected due technical issues with the sampler.

The Hyperpro casts (three cycles each) were successfully conducted three times around the scheduled 1400-1430 time slot on March 7th, 8th, and 10th.

The optical package (ACS/Sea Bird Seacat/LISST) was deployed two times during the cruise, once around noon and once in the early morning on March 10th. There were battery voltage issues during the night time casts causing the instruments to shut down due to insufficient power and no profile data to be collected. The day time profiles were successfully executed and data was collected.

The fluorometer, ADCP, thermosalinograph, and the ship's meteorological suite ran throughout the cruise, but intermittent problems with the logging server caused a stoppage in real time data display for about 2 hours on the first night of the cruise and longer updating times for the display for the rest of the cruise. During post cruise processing, data from the remote sensors were used to fix holes in the data set created by the logging server problems.

The $p\text{CO}_2$ system was not on board for this cruise.

Winds during the cruise were from the NW at 10-15kts, then shifted to the North at 25-30kts, and then to the NE at 20-25kts as a cold front passed through Station ALOHA. A passing squall brought gusts of 40kts on March 8th. The seas increased as the wind increased peaking at 10-12ft. A building northwesterly swell was also present, cresting at 8-10ft during the middle of the cruise.

We arrived at Snug Harbor for off-loading on March 11th, at 0848 (HST).

4. R/V *Kilo Moana* OFFICERS AND CREW, TECHNICAL SUPPORT

The R/V *Kilo Moana* provided good ship support for our work. Captain Jay Chavez and the entire ship's crew showed enthusiasm, concern, and dedication to our scientific mission.

Technical support during this cruise was also good. The OTG personnel were available at any time to assist in our work during the cruise.

5. DAILY REPORT OF ACTIVITIES (HST)

March 7, 2016

0854- Depart Snug Harbor
0951- Safety briefing with the Captain
1007- End of meeting
1012- Fire and abandon ship drills
1035- End of drills
1147- Arrive Station Kahe
1200- Weight cast to 500 m
1235- End of cast
1253- Hyperpro
1329- End of Hyperpro
1337- S1C1 1000 m CTD
1453- End of cast
1502- SLMBD Drifter #1 Deployed 21° 20.774'N 158° 16.577'W
1504- SLMBD Drifter #2 Deployed 21° 20.952'N 158° 16.583'W
1505- SLMBD Drifter #3 Deployed 21° 21.055'N 158° 16.598'W
1506- Transit ALOHA
2212- Underway Data stopped logging
2302- Begin Sediment Trap Deployment 22° 44.974'N 158° 3.261'W
2335- Array deployed
2346- Underway data logging resumed

March 8, 2016

0153- S2C1 1000 m CTD
0259- End of cast
0412- Begin PP Array Deployment
0439- Array deployed 22° 45.140'N 158° 1.116'W
0442- Recovered buoy of PP Array; lights damaged during deployment and repairs were made on deck
0456- Array re-deployed 22° 45.066'N 158° 1.027'W
0518- Underway data not saving - OTG notified
0528- S2C2 near bottom CTD
0649- Underway data still not saving
0716- 7m off the bottom 22° 44.962'N 157° 59.999'W
0924- End of cast
0930- Transit to pump ship's tanks
0935- Drizzling on station
1001- Passing through squall
1005- Underway data saving every 15 min
1117- S2C3 1000 m CTD
1238- End of cast
1300- Net Tow
1326- End of net tow
1337- Hyperpro
1422- End of Hyperpro
1428- S2C4 1000 m CTD
1539- End of cast
1633- S2C5 1000 m CTD
1756- End of cast
1800- Transit to Recover the PP Array
1948- First attempt to recover array 22° 25.115'N 158° 5.358'W Upon seeing the array, the surface float line was wrapped around the mast of the surface buoy. Suspected that the samples on the array were lost.
2046- Second attempt to recover array 22° 23.035'N 158° 6.580'W Surface floats and buoy recovered, confirmed that primary floats and all samples were lost. Shackle between surface floats and primary float line not present, large dent in buoy frame.
2052- Transit to Station ALOHA
2251- S2C6 1000 m CTD
2328- CTD unresponsive at 846 dbar on the upcast

March 9, 2016

0001- CTD Package on deck
0024- After troubleshooting, wire re-termination needed
0324- S2C7 1000 m CTD
0446- End of cast
0700- S2C8 1000 m CTD
0812- End of cast
0816- Transit to pump ship's tanks
0953- S2C9 1000 m CTD
1101- End of cast
1112- Net tow
1142- End of cast
1210- ATE
1241- End of ATE
1249- S2C10 1000 m CTD
1358- End of cast
1402- Transit to pump ship's tanks
1549- S2C11 1000 m CTD
1701- End of cast
1849- S2C12 1000 m CTD
2016- End of cast
2019- Transit to pump ship's tanks
2148- S2C13 1000 m CTD
2306- End of cast

March 10, 2016

0046- S2C14 1000 m CTD
0207- End of cast
0256- Optics 1st cast
0348- End of cast
0352- Optics 2nd cast
0446- End of cast -battery issues, no profile data recorded
0455- Transit to Sediment traps
0708- Begin trap recovery 22° 26.765'N 158° 23.144'W, 26 miles from deployment site
0727- End of recovery, transit WHOTS
1018- S52C1 200 m yo-yo
1133- End of cast, 4 cycles complete
1136- Transit Station ALOHA
1201- Optics 1st cast
1257- End of cast
1302- Optics 2nd cast
1402- End of cast
1415- Hyperpro
1450- End of Hyperpro
1500- Transit Station Kaena
1955- Arrive Station Kaena
1959- S6C1 near bottom CTD
2200- End of cast
2204- Transit Snug Harbor

March 11, 2016

0747- Arrive Snug Harbor, starboard side to pier for loading of laboratory van
0804- Begin shift of ship to port side to pier
0848- Arrive Snug Harbor, port side to pier for full offload

HOT program sub-components:

Investigator	Project	Institution
Matt Church Dave Karl Bob Bidigare	Core Biogeochemistry	UH
John Dore	Biogeochemistry QA/QC	MSU
Roger Lukas	Hydrography	UH
Mike Landry	Zooplankton dynamics	SIO
Ricardo Letelier	Optical measurements	OSU
Ancillary programs:		
Andrew Dickson	CO ₂ dynamics and intercalibration	SIO
Paul Quay	DI ¹³ C	UW
Matt Church & Ricardo Letelier	Diversity and activities of nitrogen-fixing microorganisms	UH
Sam Wilson	Reduced gases in the upper ocean: The cycling of methane, sulfide and nitrous oxide	UH
Sara Ferrón-Smith	Determination of net community production from the diurnal variability of O ₂ /Argon ratios	UH
Ed DeLong	SCOPE: DNA collection	UH
Angelique White	SCOPE: Diazotroph Microscopy	OSU
Virginia Armbrust	SCOPE: Seafloor Underway Flow Cytometer	UW
Victoria Futch	SLDMB float deployment	UH
Sara Ferrón-Smith, Abby Bate, and Tim Burrell	Gross primary production measurements using 18O method, and ETS measurements of bacterial respiration	UH
Karin Björkman	Effect of light on substrate uptake rates in Prochlorococcus	UH
Chris Schvarcz	Water collection for culture maintenance	UH
Jinxia Fu	Evaluation of Second Generation Biofuels	UH/HNEI
Rhea Foreman	Direct Determination of Dissolved Organic Nitrogen	UH