

HOT-240 Chief Scientist's Report

Chief Scientist: Craig Nosse
R/V *Kilo Moana*
March 23-27, 2012

Cruise ID: **KM 12-05**

Departed: March 23, 2012 at 0900 (HST)

Returned: March 27, 2012 at 0900 (HST)

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

Master of the Vessel: Captain Gray Drewry

OTG Marine Technicians: Dan Fitzgerald and Ben Colello

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 the first day of the cruise for about 2 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 during the 2nd, 3rd, and 4th days of the cruise.
- 3) Station 52, the site of WHOTS-8 Mooring (anchor position: 22°40.1572'N, 157°57.0225'W) was to be occupied on the 4th day of the cruise 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 the 4th day of the cruise for about 2 hours.

Upon arrival to Station Kahe a 1000 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 23rd. 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 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 CTD cast (to collect water for the Primary Productivity Array). The cast was to be followed by the deployment of the free-drifting Primary Productivity Array to incubate in situ for 12 hours. A full depth (~4740 m) CTD cast was to be conducted after the deployment of the Primary Productivity Array, followed by 1000 m CTD casts at strict 3 hour intervals for at least 36 hours for continuous and discrete data collection, with another full-depth CTD cast at 2300 on March 25th.

Another free-drifting array (Gas Array) was to be deployed for 24 hours for incubation experiments on March 25th. The Gas Array was to be recovered on March 26th.

An Automated Trace Element (ATE) sampler is usually deployed on HOT cruises but it was not brought on the cruise as it is in the process of being repaired.

A plankton net was to be towed between 1000-1400, and 2200-0200 for 30 minute intervals on March 24th and 25th at Station ALOHA.

The Hyperpro was to be deployed for a half-hour period near noon time on March 23rd, 24th and 26th.

A package including a Wet Labs AC9, a Chelsea Fast Repetition Rate Fluorometer (FRRf), 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 time of March 26th.

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 26th.

After recovering the arrays, 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 completed, the ship was to reposition within Station ALOHA to conduct an ACS/AC9/FRRf/LISST cast, a Hyperpro cast and a 200 m CTD cast.

Once operations at Station ALOHA were completed, an APEX drifter from the University of Washington was to be deployed. After deployment 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, meteorological suite, underway fluorometer and $p\text{CO}_2$.

2. SCIENCE PERSONNEL

Participant	Title	Affiliation/HOT Group
Susan Curless	Research Associate	UH/BEACH
Adriana Harlan	Research Associate	UH/BEACH
Dan Sadler	Research Associate	UH/BEACH
Brett Updyke	Research Associate	UH/BEACH
Blake Watkins	Marine Engineer	UH/BEACH
Donn Viviani	Graduate Student	UH/BEACH
Shimi Rii	Graduate Student	UH/BEACH
Sean Jungbluth	Graduate Student	UH/BEACH
Jefrey Snyder	Marine Technician	UH/PO
Cameron Fumar	Research Associate	UH/PO
Craig Nosse	Research Associate	UH/PO
Joseph Gum	Research Technician	UH/PO
Sandra Martinez-Garcia	Postdoctoral Researcher	UH/CMORE
Dan Fitzgerald	Marine Technician	OTG
Ben Colello	Marine Technician	OTG
Ashley Stinson	OTG Intern	UNOLS - MATE

3. GENERAL SUMMARY

Operations at Station Kahe were conducted as planned. A 500 m weight-test cast, 1000 m CTD cast and a Hyperpro cast were all completed.

The weather conditions during the transit to Station ALOHA were poor and remained poor once arriving on station. Sustained winds in excess of 35 knots were observed during the transit. On station, initial conditions were 12' seas with winds ranging from 25-30 knots. The weather forecast indicated continued poor weather for March 24th with no predicted relief until the morning of March 26th.

After assessing the weather conditions, the sediment trap array was deployed. It was decided to postpone the deployment of the Primary Productivity Array as it was scheduled to be recovered in the evening of March 24th when weather conditions were predicted to remain poor. The Primary Productivity Array deployment, accompanying CTD cast to collect water for the array and the accompanying daytime Hyperpro cast were postponed until March 25th.

Since the 1000 m Primary Productivity CTD cast was postponed, the first CTD cast at Station ALOHA became the near-bottom cast. When the CTD approached the surface at the completion of the near-bottom cast, several kinks were observed in the conducting wire just above the termination. The Caley CTD winch is equipped with 0.322 three-conductor wire. At least one of the observed kinks had 1-2 outer armor strands broken. As the winch continued to reel in more wire, a kink entered the Caley crane docking head and more outer strands started to break. The crane boom had to be extended upward so that the kink would not proceed further into the docking head and still allow for the CTD to be retrieved on to the deck. During this maneuver the CTD hit the ship's stern railing a couple of times and landed on it once. The CTD was brought safely down on to the deck by science party and crew.

The exact cause of the wire kinks could not be determined. Kinks can develop during zero tension and snap loading of the wire which can occur during heavy weather conditions. Motion compensation was enabled on the Caley winch but zero tension was observed while the CTD was at the surface both during deployment and recovery when motion compensation was disabled. Motion compensation also had to be disabled while the CTD was at depth on a couple of occasions as there are issues with the Caley winch level wind and special care has to be taken as the wire approaches the end of the drum.

Since weather conditions continued to be poor (winds above 25 knots with seas greater than 12') and a thorough investigation into the wire kinks could not be expedited, it was decided to switch CTD operations to the 0.680 coaxial conducting wire on the *Kilo Moana* trawl winch. Switching to the trawl winch required the construction of an electrical and physical termination for the 0.680 wire as well as rearranging equipment on the back deck and in the staging bay, and also relocating the rosette.

The first CTD cast using the 0.680 wire and trawl winch was a 1000 m cast. This cast experienced communication errors and at 180 dbar of the upcast, all communication was lost to the CTD and it had to be brought immediately back on deck. Upon inspection and testing, it seemed that the electrical part of the termination had a problem maintaining a connection to ground. The grounding connection to the outer wire armor was repaired within the termination and another 1000 m CTD cast was conducted. During the second cast, the CTD could not activate the carousel to close any of the 24 bottles for water samples. It was decided to reterminate and use different connectors for the electrical termination.

Subsequent CTD casts were successful with no connection errors or carousel problems. The trawl winch does not have motion compensation and the sea state frequently required slow winch speeds (10-15 meters per minute) through the majority of the downcasts. The kinked 0.322 wire, transfer to the 0.680 wire and trawl winch, the connection errors with the 0.680 termination and/or connector, and slow trawl winch speeds all contributed to the loss of a lot of science time. A rough estimate is that 19.5 hours were lost. Also, the Primary Productivity array could not be deployed as water could not be collected for the array when needed on March 25th.

Operations not completed due to equipment failures:

Underway $p\text{CO}_2$

Operations not completed due to weather conditions:

Gas Array

Operations not completed due to weather conditions and subsequent equipment failures:

Primary Productivity Array

36 hours of CTD sampling at strict 3 hour intervals

Phycoerythrin cast

Second near-bottom CTD cast at Station ALOHA

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

Five net tows for the HOT zooplankton collection were completed successfully; two during the day and three during the night. A third day net tow was called off in order to expedite CTD casts.

The Hyperpro was deployed and recovered successfully two times near noon. The Hyperpro cast that regularly accompanies the Primary Productivity Array was not conducted.

The optical package ACS/AC9/FRRf/LISST was deployed two times during the cruise, once in the early morning and once around noon. The early morning deployment did not return a full dataset.

The APEX drifter from the University of Washington was successfully deployed.

The fluorometer, thermosalinograph and the ship's meteorological suite ran without interruption during the cruise. The underway $p\text{CO}_2$ system would not operate and requires additional parts for repair.

Winds were from the east throughout the cruise; in the 25-35 knot range during the first three days of the cruise, dropping under 20 knots for the remainder of the cruise. Swell was about 12-13 feet for the first three days of the cruise until dropping to about 5-6 feet.

We arrived at Snug Harbor for off-loading on March 27th at 0900 (HST). We were delayed for about an hour outside Honolulu Harbor due to a high volume of ship traffic.

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

The officers and crew of R/V *Kilo Moana* provided dedicated support to help us recover as much science time as possible under the challenging conditions. OTG personnel worked beyond their posted watch schedule in order to assist our work. This included loading day when several OTG technicians worked to try and resolve a grounding issue with the 0.322 wire.

5. DAILY REPORT OF ACTIVITIES (HST)

23 March 2012

0858 Depart Snug Harbor

0940 Safety meeting/Fire and Abandon Ship drills

1130 Arrive Station Kahe

1150 Weight-test cast to 500 m

1245 Hyperpro cast

1315 S1C1 - 1000 m CTD cast

1500 Transit ALOHA

2300 Arrive ALOHA

2354 Sediment trap deployment delayed as ship's Radio Direction Finder (RDF) will not power up

24 March 2012

0054 Sediment trap deployed at: 22 45.969 N, 157 59.988 W
0357 S2C1 - Near Bottom (~4740 m) CTD cast
0621 Reached 6 m off bottom at 4809 db at 22 45.020 N, 158 0.076 W
0847 Wire kinked at surface, Chief Mate and Captain called
0855 CTD on deck
1130 Net tow
1210 Net tow
1330 Rosette craned over to use 0.680
1440 S2C2 - 1000 m CTD cast
1655 Communication error terminates cast
1721 Transit to pump tanks
1956 S2C3 - 1000 m CTD cast
2214 CTD on board, no bottles tripped
2232 Net tow
2311 Net tow
2345 Transit to pump tanks

25 March 2012

0628 S2C4 - 1000 m CTD cast
1001 S2C5 - 1000 m CTD cast
1155 Transit to pump tanks
1309 S2C6 - 1000 m CTD cast
1638 S2C7 - 1000 m CTD cast
2013 S2C8 - 1000 m CTD cast
2206 Net tow
2246 Transit to pump tanks
2346 S2C9 - 1000 m CTD cast

26 March 2012

0215 AC9/Optics cast
0415 Transit to Sediment traps
0530 Recover traps at 22 35.136 N, 158 11.490 W
0615 Transit to ALOHA
0710 S2C10 - 1000 m CTD cast
0936 Transit to WHOTS
1015 S52C1 - 200 m yo-yo cast
1135 Transit to pump tanks
1214 Hyperpro cast
1248 AC9/Optics cast
1449 S2C11 - 200 m CTD cast
1600 Deployed APEX drifter at 22 40.215 N, 158 1.445 W
1605 Transit to Snug Harbor initially, then reroute to Station Kaena
2032 S6C1 - Near bottom (~2500 m) CTD cast
(Bottom of cast was 2445 dbar, 6 m off bottom at 21 20.765 N, 158 21.775 W)
2315 Transit to Snug Harbor

27 March 2012

0700 Delayed outside of Honolulu due to high volume of ship traffic
0900 Arrive Snug Harbor - Full Offload

HOT program sub-components:

Investigator	Project	Institution
*Matt Church	Core Biogeochemistry	UH
*Dave Karl		
*Bob Bidigare		
*Roger Lukas	Hydrography	UH
*Mike Landry	Zooplankton dynamics	SIO
*Ricardo Letelier	Optical measurements	OSU
Ancillary programs:		
Charles Keeling	CO ₂ dynamics and intercalibration	SIO
Paul Quay	DI ¹³ C	SIO
*Matt Church	Diversity and activities of nitrogen-fixing microorganisms	UH
Additional programs:		
Dave Karl (via Sam Wilson)	Reduced gases in the upper ocean: The cycling of methane, sulfide and nitrous oxide	UH/Moore
*Matt Church (via Donn Viviani)	Bacterial production and EOC at Station ALOHA	UH
Dave Karl (via Sandra Martinez-Garcia)	Microbial respiration in the NPSG	UH
Henrieta Dulaiova and Ken Buesseler	Japanese radionuclide release sampling	UH
Jonathan Zehr (via Anne Thompson and Brandon Carter)	UCYN-A Ecology	UCSC
Steve Riser and Ken Johnson	Integration of pH sensor into Apex profiling floats	UW/MBARI
Julie Robidart	Methodology work on DNA + RNA extraction protocols for ESP	MBARI/UCSC
*Kathleen Ruttenberg (via Rebecca Briggs)	SOEST Biogeochemical Analytical Facility quality control samples and LNSW collection	UH
Dave Karl (via Daniela del Valle)	Effect of iron on methylphosphonic consumption	UH
Dave Karl (via Marona Segura-Noguera)	Sampling strategy testing for elemental analysis using electron microscopy. LNSW collection for nutrient analysis via LLWC.	UH
Matt Church (via Shimi Rii)	Investigation of temporal changes in picoeukaryote diversity at Station ALOHA	UH
Matt Church/Dave Karl (via Sam Wilson and Daniela Bottjer)	Nitrogen fixation methodology comparison	UH
Adina Paytan	O ¹⁸ natural abundance	UCSC

* Denotes HOT program sub-components, ancillary programs and additional programs that were compromised due to decreased amount of science time at Station ALOHA.