

HOT-213: Chief Scientist Report

Chief Scientist: Susan Curless

R/V Kilo Moana

July 23-27th, 2009

Cruise ID: KM0918

Departed: July 23, 2009 at 1300 (HST)

Returned: July 27, 2009 at 1000 (HST)

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

Operator: University of Hawaii

Master of the Vessel: Captain Brian Wehmeyer

Chief Scientist: Susan Curless

OTG Electronics/Deck Operations Technicians: Vic Polidoro and Kuhio Vellalos

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 2.5 hours.
- 2) Station 2, referred to as Station ALOHA (A Long Term Oligotrophic Habitat Assessment) 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, is the site of the WHOTS-6 Mooring, located at 22° 39.989'N, 157° 56.961'W will 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 will be occupied on the 4th day of the cruise for approximately 3 hours.

Upon arrival to Station Kahe a 1,300 lb. weight-test cast to 500 m, one CTD cast to 1000 m, a PRR cast, and a Hyperpro cast were to be conducted at this location on the afternoon of July 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 at 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 shallow CTD cast to 200 m, one 1000 m cast (to collect water for the Primary Production Array), and another 200 m CTD cast. These casts were 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, 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 on July 26th.

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

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

Hand held net tows of various mesh sizes were to be conducted throughout the cruise off the stern of the ship.

A trace metal sampler was to be deployed on July 24th to collect a trace metal clean surface seawater sample.

A Profiling Reflectance Radiometer (PRR) and the Hyperpro were each to be deployed for half-hour periods near noon time on July 23rd, 25th, and 26th.

A package including a Wet Labs AC9, a Chelsea Fast Repetition Rate Fluorometer (FRRf), and a SeaBird Seacat was to be used to profile the upper 200 m at Station ALOHA around noon time on July 25th and in the early morning and around noon on July 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 July 26th.

After recovering the arrays, the ship was to transit to Station 52 to conduct a one-hour 200 m CTD yo-yo cast after which the ship was to re-position within Station ALOHA to conduct two AC9/FRRf casts, one PRR cast, and a Hyperpro cast.

After the PRR, Hyperpro, and AC9/FRRf operations were completed, the deployment of Seaglider #147 was to commence. The ship was to have the small boat on standby in case the glider malfunctioned after its test dive.

When sea glider deployment and test dive operations 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, underway fluorometer, two anemometers, and the pCO₂ system.

2. SCIENCE PERSONNEL

Cruise Participant	Title	Affiliation
Karin Björkman	Research Specialist	UH/BEACH
Tara Clemente	Research Associate	UH/BEACH
Susan Curless	Chief Scientist – Res. Assoc.	UH/BEACH
Ken Doggett	Research Associate	UH/CMORE
Lance Fujieki	Computer Specialist	UH/BEACH
Adriana Harlan	Research Associate	UH/BEACH
Binglin Li	Graduate Student	UH/BEACH
Dan Sadler	Research Associate	UH/BEACH
Brett Updyke	Research Associate	UH/CMORE
Blake Watkins	Marine Engineer	UH/BEACH
Sam Wilson	Post-doc Scientist	UH/CMORE
Fernando Santiago-Mandujano	Research Associate	UH/PO
Paul Lethaby	Research Associate	UH/PO
Jefrey Snyder	Marine Technician	UH/PO
Ian Hawkins	Research Associate	UH/PO
Cameron Fumar	Undergraduate Student	UH/PO
Joseph Gum	Undergraduate Student Intern	UH/PO
Kate Achilles	Marine Educator	UH/CMORE
Martha Akina	Teacher	CMORE
Bonnie McCann	Teacher	CMORE
Scott Percival	Teacher	CMORE
Chris Bowler	Scientist	ENS/BEACH
Janice Jones	Technician	UCSB
John Dore	Scientist	MSU/BEACH
Rachel Foster	Scientist	UCSC/CMORE
Vic Polidoro	Marine Technician	OTG
Kuhio Vellalos	Marine Technician	OTG

3. GENERAL SUMMARY

Operations during the cruise were significantly compromised by two ship's equipment failures, one involved the port propulsion system, and the other involved the Appleton crane used for CTD operations.

Our departure from Snug Harbor was delayed by four hours due to the propulsion system PLC memory loss and required science operations scheduled at Station Kahe to be canceled. This was done in efforts of arriving at Station ALOHA as originally scheduled and beginning operations there on time.

During the recovery of a CTD cast shortly after arrival at Station ALOHA, the Appleton crane lost the ability to move in the directions needed to bring the package back aboard. A blockage in a hydraulic line was found and cleared, but troubleshooting the electrical and hydraulic systems of the crane halted CTD operations for 10 hours.

During the 10 hours of down time at Station ALOHA for crane repairs, some science operations not requiring the use of the crane were able to be completed, including the deployment of the

Primary Production Array before sunrise, a PRR cast, a Hyperpro cast, a net tow and the deployment of Sea Glider #147.

Once the crane was fixed and thoroughly tested with the 1300 pound weight, science operations were re-scheduled with emphasis upon preserving the 36 hour burst period of CTD work. To allow for enough time at Station ALOHA to complete this work, operations at Station Kaena were canceled.

A late arrival to Snug Harbor (1300 on July 27) was offered by the UHMC to compensate for the 4 hours spent at the dock working on the propulsion system to provide four full ship days to our program. This time was not able to be used to complete canceled operations at Station Kahe as the operations scheduled to be completed there need to be conducted at certain times of the day. The time offered was also not sufficient to complete Station Kaena operations once further time was taken away from science operations at Station ALOHA for crane repairs.

The array of floating sediment traps, the gas array, and the primary production array were deployed and recovered without any major incidents. All arrays were caught in the strong NW current shown in ADCP data to exist in the upper 200 m.

Six net tows were successfully completed; three were conducted during the day, and three at night.

Ten hand net tows were conducted off the stern.

The PRR and the Hyperpro were each deployed three times around noon.

The ATE deployment was cancelled on July 24th due to communication issues between the computer and the sampler.

The underway fluorometer did not work properly throughout the duration of the cruise.

The ADCP, pCO₂ system, thermosalinograph, and the ship's two anemometers ran without interruption throughout the cruise.

Winds were from the east between 12-15 knots throughout the cruise with seas of 2-3ft.

We arrived at Snug Harbor for off-loading on July 27th, at 1000 (HST).

Canceled operations due to ship's equipment failure include:

Station Kahe: 1000 m cast, PRR cast, Hyperpro cast

Station ALOHA: 200 m cast, full-depth (~4740 m) CTD cast

Station Kaena: near bottom (~2500 m) CTD cast

Canceled operations due to science equipment malfunction:

ATE deployment: communication errors between computer and instrument

4. R/V KILO MOANA, OFFICERS AND CREW, TECHNICAL SUPPORT

The R/V Kilo Moana continues to maintain excellent ship support for our work. The Captain and ship's crew were most helpful and accommodating throughout the cruise.

Captain Brian, Vic Polidoro, Kuhio Vellalos and the engineers always kept me informed of the repair progress for both of the ship equipment failures we encountered. The bridge was very flexible in receiving changes to our operational schedule after the ship's equipment failures occurred.

Throughout our cruise, the entire crew showed enthusiasm, concern, and dedication to our scientific mission. Engineers Bob and Roy each put in many extra hours of work with their team to fix both the ship's propulsion system and the crane. They each expressed a positive attitude while working to fix both repairs.

Technical support during this cruise was excellent. OTG personnel were available at any time to assist in our work and helped keep operations running smoothly.

5. DAILY REPORT OF ACTIVITIES (HST)

July 23, 2009

0856- Captain Brian notified science of ship's propulsion issues.

During the tests run on all of the ship's systems before departing the dock, communication between the MCC, bridge, and the port propulsion system could not be established.

After troubleshooting communication cables, it was found that one of the PLC's which accepts communication from the bridge and MCC and in turn then controls the turning of the shaft and thus the screw on the port side had lost its memory. The operating system and all the commands and tasks that the PLC is supposed to have installed on it to operate the ship's propulsion had to be re-installed and re-programmed.

It is unclear as to how this happened and it is a rare occurrence having only happened one other time back in 2007 to the bow thruster system. The engineers and Vic from OTG were instrumental in isolating and fixing this problem.

0905- Science party briefing meeting

1300- Departed Snug Harbor

1350- Safety drills

2350- Arrived at Station ALOHA

2355- 500m weight cast

July 24, 2009

0110- Sediment traps deployed 22° 45.034'N 158° 1.063'W

0130- S2C1 CTD cast to 200 m

0250- S2C2 CTD cast to 200 m

0345- During the recovery of S2C2, the primary production cast, the crane boom lost ability to boom up and knuckle out the arm to move the CTD over the landing sled area. The CTD hung in the air over the water for over 10 minutes before a solution to bring the CTD aboard was reached. The ability to slowly move the crane arm in was still working but was very slow, so the

crane operator brought the crane arm down as much as possible as the winch slowly payed out wire and two AB's, two taggers, and the OTG tech muscled the package over to the CTD sled platform.

0415- A meeting between the Chief Scientist, the engineers, OTG, and the Captain was held about the crane problems.

The engineers thought that it was an electrical issue with the controls of the crane because when the operator would use two controls at the same time (which is normal during deployment and recovery) it seemed to make the problem go away. They said that they had tested the power supply and that it was at constant voltage so they didn't think that was the problem and suggested moving the crane while monitoring the different controls with a voltmeter.

We all agreed that this would be a good thing to try and that it should be done with the 1300 pound weight for load, not the instrument package. Plus these sporadic losses of crane control create an unsafe working environment and something needed to be done to investigate further into their occurrence.

0505- Deployment of the Primary Production Array 22° 44.91'N 158° 0.45'W

0515- During the crane movement testing, (with the only permanent AB crew member on board operating the crane) the crane failed twice in performing various movements. It was observed by the AB that hydraulic pressure was dropping over 50 psi's during the moments when the crane would not move.

0532- Further crane testing, 2 more failures.

A dampening knob that can be used to decrease the fluctuations in the hydraulic pressure of the crane's system was used cranked all the way down, and then all the way up during a second round of testing and again, the crane failed twice.

What was good about this is that the problem was isolated to the hydraulic system and the engineers can now focus their work on hopefully fixing the problem.

0610- Transit to pump ship's tanks

1000- Hand net tow (B. Li)

1020- Net tow

1200- Small boat prep and testing for standby on sea glider ops

1232- Deployment of sea glider #147 22° 45.72'N 158° 0.19'W

1300- PRR

1335- Hyperpro

1420- Weight cast to test crane repairs.

After extensive trouble shooting, a restriction was found in one of the hydraulic lines on the crane. Cleaning and replacement of the hydraulic line found a clog of debris lodged at a small T section of the line. This repair seems to have fixed the failures in crane operations.

1510- Transit to pump ship's tanks

1624- S2C3- PO deep cast (~4740 m)

1701- Hand net tow (B. Li)

1737- Spike offset noticed in CTD fluorometer

1806- Cast at bottom

1905- End of deep cast- fluorometer noisy on up cast

2149- Primary production array recovery 22° 53.842'N 158° 0.260'W

We are experiencing a very strong northerly current which took the array quite far during its deployment. We will take this into account for the deployment of the gas array in efforts of preserving our new schedule.

2257- S2C4- PO shallow CTD cast to 1000 m

July 25, 2009

0059- Net tow

0209- S2C5 Gas array CTD cast to 1000 m

0439- Deployment of the gas array 22° 39.24'N 158° 0.5'W Very strong 1kt current present in the upper 200m.

0510- S2C6 CTD cast to 1000 m -fluorometer off-set at 750 dbar on downcast despite changing the cable splitter between fluorometer and ISUS before cast deployment

0637- Transit to pump ship's tanks

0756- S2C7 CTD cast to 1000 m

0810- Hand net (S. Wilson)

0822- Hand net

0901- End of cast, fluorometer replaced

1005- Net tow

1059- S2C8 CTD cast to 1000 m

1110- Hand net (B.Li)

1200- End of cast

1210- PRR

1245- Hyperpro

1316- AC9/FRRf

1416- S2C9 CTD cast to 1000 m

1542- Transit to pump ship's tanks

1700- S2C10 CTD cast to 1000 m

1705- Hand net (B.Li)

1958- S2C11 CTD cast to 1000 m

2125- Hand net (B.Li)

2200- Net tow

2257- S2C12 BEACH CTD cast to 1000 m

July 26, 2009

0026- End of cast

0030- Net tow

0100- Transit to pump ship's tanks

0157- S2C13 CTD cast to 1000 m

0329- AC9/FRRf

0458- S2C14 CTD cast to 1000 m

0700- Recovery of the Gas Array 22° 51.20'N 158° 4.83'W approx 7.6 nm from the center

0816- Hand net tow (S. Wilson)

0840- Hand net tow (K. Achilles)

1000- Net tow

1056- S2C16 CTD cast to 1000 m - end of the 36 hour period.

1203- PRR

1224- Hyperpro

1249- AC9/FRRf
1342- AC9/FRRf
1430- Transit to sediment traps.
1630- Recovery of Sediment Traps 23° 6.44'N 157° 57.40'W approx 21.6nm north of the center
1641- Weight on board
1645- Transit to Station 52
1923- Arrive at Station 52
1945- Hand net tow (B.Li)
2000- Station 52 CTD 200m yo-yo
2132- Transit Snug Harbor

July 27, 2009

1000- Arrive Snug Harbor

HOT program sub-components:

Investigator:

Dave Karl
Roger Lukas
Bob Bidigare
Mike Landry
Mark Abbott/Ricardo Letelier

Project/Institution:

Core Biogeochemistry/UH
Hydrography/UH
HPLC pigments/UH
Zooplankton dynamics/UH
Optical measurements/OSU

Ancillary programs:

Investigator:

Charles Keeling
Paul Quay
Penny Chisholm
Zehr/Church/Montoya

Various CMORE PI's
Mark Brzezinski

Project/Institution:

CO2 dynamics and intercalibration/SIO
DI13C
Prochlorococcus population dynamics/MIT
Diversity and activities of nitrogen-fixing
microorganisms/UH
Microbial RNA/DNA collection/CMORE
Silica production and dissolution rate
measurements/UCSB

Additional programs:

Investigator:

Edward Boyle
Sam Wilson

John Dore

CMORE Education
Rachel Foster

Jennifer McKay

Chris Bowler

Scott Grant

Project/Institution:

Trace metals/MIT
Reduced gases in the upper ocean: The cycling
of methane, sulfide and nitrous oxide/CMORE/UH
Field testing compact spectrometer/liquid
waveguide system for nutrient analyses. MSU
STARS Teacher at Sea Program
Assessing metabolic interactions of diatoms which
associate with symbiotic diazotrophs. UCSC
Water collection for use as a standard for oxygen
and hydrogen stable isotope analysis. OSU
Metagenomic/metatranscriptomic analysis of
phytoplankton populations at Station ALOHA. ENS
Low nutrient seawater collection to be used for
making media. UH