HOT-278: Chief Scientist Report

Chief Scientist: R. Walter Deppe
R/V *Kilo Moana*
November 12-16, 2015

Cruise ID: **KM 15-18**
Departed: November 12, 2015 at 0850 (HST)
Returned: November 16, 2015 at 0735
Vessel: **R/V *Kilo Moana***
Master of the Vessel: Captain Gray Drewry
OTG Marine Technicians: Trevor Young and Jeff Koch

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 November 12th 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 November 12-15th.
3) Station 52, the site of WHOTS-12 Mooring (anchor position 22° 40.061' N, 157° 56.9654' W) was to be occupied on for about one hour on November 15th.
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 November 15th for about 3 hours.

Upon arrival to Station Kahe a ~1300 lb. weight-test cast to 1000 m, one CTD cast to 1000 m, and a Hyperpro cast were to be conducted on the afternoon of November 12th. 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 53 hours. This was to be followed by a 1000 m CTD cast for preparation of the Primary Productivity Array. This 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 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 at 2300 on November 14th.

Another free-drifting array (Gas Array) was to be deployed for 24 hours for incubation experiments on November 14th. The Gas Array was to be recovered on November 15th.

A plankton net was to be towed between 1000-1400, and 2200-0200 for 30 minute intervals on November 13th and 14th at Station ALOHA.

A manta trawl for collecting plastic was to be towed behind the ship at scheduled times during the cruise. Three tows were to be conducted along a transect from off of Kaena Point to Station ALOHA during the transit on November 12th and three tows were to be conducted between CTD casts at Station ALOHA on November 13th and 14th.

The Repeta diaphragm pump was to be deployed a total of three times in the early morning on November 13th, 14th, and 15th. The intake hose was to be attached to a polypropylene deployment line and lowered to about 15 meters for sample collection.

The Hyperpro (a profiling unit with one up-looking and one down-looking hyperspectral radiometer, a WET Labs ECO-BB2F triplet, temperature and conductivity sensors), was to be deployed on November 12th and 13th and twice on November 15th.

A trace metal free sample was to be collected by the ATE sampler on November 14th at Station ALOHA.

A modified optics package including 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 on November 15th.

After the 36 hour burst period of CTD work at Station ALOHA was accomplished, the ship was to transit to recover the floating Gas Array and the Sediment Trap Array on the morning of November 15th.

After recovering the arrays, the ship was to transit to Station ALOHA to conduct a Hyperpro 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 another 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, pCO_2 system, and the meteorological package. A filtration system for plastic debris was to be connected to an outlet of the underway seawater system to sample continuously throughout the cruise

2. SCIENCE PERSONNEL

Participant	**Title**	**Affiliation**
Susan Curless	Research Associate	UH
Dan Sadler	Research Associate	UH
Lance Fujieki	Research Associate	UH
Alex Nelson	Research Associate	UH
Brenner Wai	Research Associate	UH
Roman Battisti	Technician	UH
Brie Maillot	Technician	UH
Eric Shimabukuro	Research Associate	UH
Greyson Adams	Research Associate	UH
Jim Burkitt	Research Associate	UH
Blake Watkins	Marine Engineer	UH
Fenando Santiago-Mandujano	Research Associate	UH
Jefrey Snyder	Marine Technician	UH
Daniel McCoy	Research Associate	UH

Walt Deppe	Research Associate	UH
Glenn Carter	Professor	UH
Ken Doggett	Research Associate	UH
Ger van den Eng	Scientist	MarCy
Sara Ferron	Post-Doc	UH
Sarah-Jeanne Royer	Post-Doc	UH
Randelle Bundy	Post-Doc	WHOI
Jordan Wingenroth	Undergraduate Student	WHOI
Kelsey Maloney	Undergraduate Student	UH
Rachel Chang	Undergraduate Student	UH
Jeff Koch	Marine Technician	OTG
Trevor Young	Marine Technician	OTG

3. GENERAL SUMMARY

Operations during the cruise were modified significantly from plans due to rough seas and strong winds at Station ALOHA. Winds from the ENE at 25-30 kts and an 8-10 ft swell were present during transit to Station ALOHA. Upon arriving at Station ALOHA, winds were 25 kts and the swell was 8-10 ft. Conditions eased to 20-25 kt winds and 8 ft swells early on the morning of November 13th but increased throughout the day to winds from the ENE at around 25 kts and 8-10 ft seas. The evening of November 14th, easterly winds picked up to mostly between 25 to 30 kts, occasionally exceeding 30 kts, and seas increased to 10-13 ft. These conditions continued for the remainder of time at Station ALOHA and we continued to experience these rough conditions during the transit back from Station ALOHA until we were protected on the leeward side of Oahu.

There was one issue with the provided equipment that should be addressed before our next cruise on this ship. During the deep cast, the Caley winch (with heave compensation running) had a brief run-away with speeds in excess of 60 m/min. An emergency stop was implemented at 4583 dbar on the downcast and the problem was troubleshooted by engineering. After a successful test of the system following a restart of the winch controls, the cast was resumed successfully with the auto-rendering and heave compensation turned off. Heave compensation ran properly in all subsequent casts on the cruise, but none were sent below 1020 dbar. The source of this problem is not understood for certain since the tension was below the rendering set point of 4,900 lbs (and even below the default set point of 3,000 lbs). Possible reasons for this problem and working solutions should be investigated thoroughly before the Caley winch is used with heave compensation during a near-bottom cast.

One 1000 m CTD cast was completed at Station Kahe. One near bottom CTD cast and eleven 1000 m CTD casts were conducted at Station ALOHA. 30-hours of the planned 36-hour burst CTD casts were completed successfully.

Three net tows for the core HOT zooplankton collection were completed successfully; two during the day (1230 on 11/13 and 1000 on 11/14), and one during the night (2200 on 11/13).

The ATE was successfully deployed on November 14th.

Three of the Hyperpro casts (three cycles each) were successfully conducted at these times: 1252 on November 12th, and 1000 and 1400 on November 15th.

The modified optical package (Sea Bird Seacat/LISST) was deployed one time during the cruise in the early morning on November 15th.

The three planned Repeta pump deployments were conducted successfully at 0118 on November 13th, 0057 on November 14th, and 0200 on November 15th. An additional Repeta pump was conducted at 1224 on November 15th to collect 25-m water that was planned to be collected during the WHOTS cast.

The fluorometer, ADCP, thermosalinograph, and the ship's meteorological suite ran without interruption during the cruise. The underway seawater plastic filtration system functioned properly.

The pCO2 system was not functioning properly during the cruise. The LICOR detector was unstable and had an irregular ticking sound, possibly the chopper motor, and should be serviced by the manufacturer.

We arrived at Snug Harbor for off-loading on November 16th, at 0735 (HST). After the OTG radioisotope van was unloaded from the ship, the ship was flipped and secured for off-loading by 0817 (HST).

The following operations were cancelled due to the rough seas and winds experienced during the cruise in order to preserve the safety of the personnel and equipment:

1. All six manta trawl tows were cancelled.
2. Deployments of the Sediment Traps, Primary Production Array, and Gas Array were all cancelled due to deployment conditions and forecasted recovery conditions that were too rough for safe and successful operations.
3. The Primary Production CTD cast (scheduled 0200 on 11/13) was cancelled since the purpose of the cast is to collect water for the Primary Production Array.
4. The Hyperpro cast scheduled for 1330 on 11/13 was cancelled due to the cancellation of the primary production experiment.
5. Three-out-of-six net tows for the core HOT zooplankton collection were cancelled (scheduled for 2230 on 11/13 and for 1200 and 2200 on 11/14).
6. The last two CTD casts in the 36-hour burst were cancelled: HPLC and PO-3 (the second near-bottom cast at ALOHA). The trend of increased sea state and wind, as well as some undesirable shock loads observed in the tension readout during deployments of the most recent casts (one in excess of 2700 lbs), influenced this decision.
7. The WHOTS yo-yo CTD cast to 200 m was cancelled. Conditions had not improved.
8. The Station Kaena near-bottom CTD cast was cancelled. Conditions had not improved.

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

The R/V *Kilo Moana* provided good ship support for our work. Captain Gray Drewry and the entire ship's crew showed enthusiasm, concern, and dedication to our scientific mission. The input and safety concerns of the Captain and crew were very valuable in the decision-making process for determining when conditions were too rough to conduct operations safely. The winch run-away problem experienced on the deep cast needs to be addressed on a mechanical level but all personnel involved in the incident handled their duties responsibly and found a temporary solution that allowed for the near-bottom cast to be completed.

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)

November 12, 2015

0850- Depart Snug Harbor
0930- Captain's briefing and safety drills
1131- Arrive Station Kahe
1153- Weight cast to 1000 m
1235- Recover weight
1252- Hyperpro
1336- S1C1 1000 m cast
1459- End of cast
1510- Transit ALOHA
1810- Slow down for manta trawl
1820- Cancel manta trawl transect due to swell and wind conditions
2310- Arrive Station ALOHA

November 13, 2015

0118- Deploy Repeta pump from stern
0151- Recover Repeta pump
0458- S2C1 Near bottom CTD
0700- All-stop at 4583 dbar, winch drum appeared to be in free-fall. Engineering attempted to troubleshoot issue, downcast on stand-by
0722- Winch operator running test on heave comp which required raising the CTD ~10 m to 4576
0724- Resume cast after restarting winch controls
0733- 12m off the bottom @ 22° 45.025'N, 158° 0.016'W
0955- End of cast
1003- Transit to pump tanks
1134- S2C2 1000 m CTD
1252- End of cast
1320- Net Tow
1350- End of tow
1406- S2C4 1000 m CTD
1519- End of cast
1658- S2C4 1000 m CTD
1838- End of cast
1845- Transit to pump tanks
1957- S2C5 1000 m CTD
2122- End of cast
2210- Net Tow
2238- End of tow
2252- S2C6 1000 m CTD

November 14, 2015

0005- End of cast
0057- Deploy Repeta pump
0125- Recover Repeta pump
0154- S2C7 1000 m CTD
0301- End of cast
0445- S2C8 1000 m CTD
0608- End of cast
0615- Transit pump run
0758- S2C9 1000 m CTD
0900- End of cast

1000- Net Tow
1027- End of tow
1035- ATE sampling
1105- End ATE sampling
1107- S2C10 1000m CTD
1240- End of cast
1357- S2C11 1000m CTD
1535- End of cast
1656- S2C12 1000 m CTD
1810- End of cast
1815- Transit pump run
2009- Cancel planned CTD operations and standby to see how conditions develop

November 15, 2015

0200- Deploy Repeta pump
0220- Recover Repeta pump
0325- Deploy optics package
0450- Optics recovered
0500- Transit to WHOTS mooring
1000- Start hyperpro
1050- End hyperpro
1224- Deploy Repeta pump
1245- Recover Repeta pump
1400- Start hyperpro
1449- End hyperpro
1454- Transit to Kaena Station
1955- Arrive Kaena Station. CTD cast cancelled due to rough conditions,
2000- Transit to Snug Harbor

November 16, 2015

0735- Arrive Snug Harbor
0817- Ship flipped and secured for off-loading

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 inter-calibration	SIO
Paul Quay	$DI^{13}C$	SIO

Matt Church	SCOPE: Diversity and activities of nitrogen-fixing microorganisms	UH
Sam Wilson	SCOPE: Reduced gases in the upper ocean: The cycling of methane, sulfide and nitrous oxide	UH
Erica Goetze	Temporal stability of copepod populations at Station ALOHA	UH
Sara Ferron-Smith	SCOPE: Determination of net community production from the diurnal variability of O2/Argon ratios CMORE: Methane production at Station ALOHA	UH
Ed DeLong	SCOPE: DNA collection	UH
Angelicque White	SCOPE: Diazotroph microscopy sampling	OSU
Virginia Armbrust	SCOPE: Seaflow Underway Flow Cytometer	UW
Ken Doggett & Ger van den Engh	CMORE: Fluorescence measurements on phototrophs CMORE: Radioisotope incorporation experiments.	UH
Sarah-Jeanne Royer & Sara Ferron-Smith	SCOPE: Plastic debris from Honolulu harbor to ALOHA station and its release of carbon gases	UH
Sarah-Jeanne Royer	SCOPE: Oxygen production in the dark at station ALOHA	UH
Randelle Bundy	SCOPE: Iron Uptake from Isolated Marine Siderophores SCOPE: Measure metal-binding ligands in a vertical profile	WHOI
Greyson Adams	SCOPE: Developing techniques relating to Particulate Carbon / Particulate Nitrogen sample collection	UH
Oscar Sosa	CMORE: Microbiological Cultivation	UH

Ancillary experiments and sample collections not conducted due to rough conditions:

Sara Ferron-Smith	CMORE: Deep water for d15N-nitrate standards CMORE: Gross primary production at Station ALOHA	UH
Roman Battisti	SCOPE: DOC leaching	UH