HOT-311: Chief Scientist Report

Chief Scientist: Fernando Santiago-Mandujano

R/V *Kilo Moana*

1-5 May, 2019

Cruise ID: **KM 19-07**
Departed: 1 May at 0851 (HST)
Returned: 5 May at 0730
Vessel: **R/V *Kilo Moana***
Master of the Vessel: Captain Joey Daigle Jr.
OTG Marine Technicians: Jeff Koch and Julianna Diehl

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 May1st 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 May 2nd – 4th.
3) Station 50, the site of WHOTS-15 Mooring (anchor position 22° 46.045'N 157° 53.888'W) was to be occupied on May 4th 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 May 4th for about 2 hours.

Upon arrival to Station Kahe a 1300 lb. weight-test cast to 500 m, a Hyperpro cast, and a CTD cast to 1000 m were to be conducted on the afternoon of May 1st. The single CTD cast was to be conducted to collect a continuous profile 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 Wirewalker was to be deployed, followed by the deployment of the free-drifting sediment trap array. These two arrays were to stay in the water for about 52 hours. This was to be followed by a 200 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 May 3rd.

Another free-drifting array (Gas Array) was to be deployed for 24 hours for incubation experiments on May3rd. The Gas Array was to be recovered on May 4th.

A plankton net was to be towed between 1000-1400, and 2200-0200 for 30 minute intervals on May 2nd and 3rd at Station ALOHA.

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 at noon time on May 1st, 2nd and 4th.

An optical package including a package consisting of a SeaBird Seacat with temperature, conductivity, fluorometer, and pressure sensors, 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 May 4th.

After the 36 hour burst period of CTD work and the optical cast at Station ALOHA were accomplished, the ship was to transit to recover the floating Gas Array, the Wirewalker, and the Sediment Trap Array on the morning of May 4th.

After recovering the arrays, the ship was to transit to Station 50 (WHOTS-15 mooring) to conduct a one-hour 200 m CTD yo-yo cast.

Once the above operations were complete, the ship was to transit to Station Kaena to conduct a near-bottom CTD cast.

After all operations were complete, the ship was to transit back to Honolulu Harbor, Pier 35.

The following instruments were to collect data throughout the cruise: shipboard ADCP, thermosalinograph, underway fluorometer, SeaFlow, inline C-Star Transmissometer, and the IFCB; and the meteorological package.

2. SCIENCE PERSONNEL

Participant	Title	Affiliation/HOT Group
Kendra Babcock	Research Associate	UH
Sara Bower	Undergraduate Student	UH
Anamica Bedi	Graduate Student	UH
Tim Burrell	Research Associate	UH/SCOPE
Ana Maria Cabello Perez	Scientist	UCSC
Tara Clemente	Research Associate	UH/SCOPE
Dan Fitzgerald	Research Associate	UH
Carolina Funkey	Research Associate	UH
Gwen Gallagher	Scientist	U. Chicago
Eric Grabowski	Research Associate	UH/SCOPE
Olivia Holstine	Undergraduate Student	UH
Fernando Carvalho Pacheco	Technician	BATS
Tully Rohrer	Research Associate	UH
Dan Sadler	Research Associate	UH
Fernando Santiago-Mandujano – Chief Scientist	Research Associate	UH
Kendra Turk-Kubo	Scientist	UCSC
Jacob Waldbauer	Scientist	U. Chicago
Amy Zimmerman	Scientist	U. Chicago
Blake Watkins	Marine Engineer	UH
Julianna Diehl	Marine Technician	OTG
Jeff Koch	Marine Technician	OTG

3. GENERAL SUMMARY

Operations during the cruise were conducted without any major problems.

One 1000 m CTD cast was completed at Station Kahe. Two 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 50) with five cycles completed, and one near-bottom cast was conducted at Staion Kaena (Station 6). The fluorometer displayed bad data during some of the CTD casts, apparently due to a faulty cable.

The ship's Dynacon CTD winch with .322 wire were used for CTD deployments using the A-frame. Maximum CTD lowering speed was 50 m/min. Low CTD speeds (~30 m/s) were needed during the first ~200 m of downcasts, to prevent large tension fluctuations and slack in the CTD wire.

The Sediment Traps, Wirewalker, Primary Production and Gas Arrays were all deployed and recovered successfully.

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

The optical package was deployed as scheduled.

The hyperpro casts were conducted as scheduled.

The thermosalinograph, fluorometer, SeaFlow, inline C-Star Transmissometer, and the IFCB were collecting data during the cruise.

The ADCP systems (OS38 narrow band, and WH300), were working during the cruise. The OS38 broad band was turned off during the cruise, as OTG is troubleshooting an apparent problem with the system.

The ship's meteorological suite ran without interruption during the cruise.

Winds were easterlies about 20 kt early in the cruise, decreasing to 10-15 kt and turning southeasterlies for the rest of the cruise. Seas were about 4-5 feet. Strong winds and rain were present in the morning of May 4th during the passing of a weather front. A strong northwestward current (~ 1 kt) in the upper 100 m was persistent during the cruise. The sediment traps and other arrays drifted nearly 20 nm northwest from ALOHA Station.

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

The R/V *Kilo Moana* continues to maintain very good ship support for our work. Captain Daigle and the ship's crew showed flexibility, enthusiasm, concern, and dedication to our scientific mission.

Technical support during this cruise was very good. OTG personnel were available to assist in our work during the cruise.

5. DAILY REPORT OF ACTIVITIES (HST)

May 1, 2019

0851 - All aboard. Depart from Pier 35
0940 - Safety briefing, Science meeting

1027 - Fire and Abandon ship drills
1130 - Arrived at Kahe Station
1151 - Weight cast to 500 m with 1300 lb weight.
1219 - End of weight cast
1240 - Start hyperpro cast
1315 - End hyperpro cast
1332 - Start S1C1 CTD cast to 1000 m.
1452 - End of cast
1507 - Transit to ALOHA Station.
2230 - Arrived at Station ALOHA. Start sediment traps deployment

May 2, 2019

0000 - Sediment traps deployed: 22 45.2355'N, 158 2.3923'W
0025 - Begin Wirewalker deployment
0037 - End Wirewalker deployment: 22 45.2576'N, 158 1.3147'W
0213 - Start S2C1, 200 m CTD cast
0246 - End of S2C1 CTD cast
0444 - Deployed Primary Productivity array, 22 44.6085'N, 158 3.1860'W.
0519 - Start S2C2 CTD deep cast
0708 - Bottom of the cast, 8 m off the bottom: 22 45.0082'N, 158 0.0192'W
Fluorometer shows offset in the low end of its range.
Visual inspection shows that the CTD wire is rusty at the drum base
0921 - End of cast
1057 - Start S2C3 CTD cast to 1000 m
1214 - End of cast
1233 - Start net tow
1301 - End net tow
1316 - Start hyperpro cast
1332 - Replaced CTD fluorometer with SN 3095 (removed SN 3831)
1355 - End hyperpro
1407 - Start S2C4 CTD cast to 1000 m
Fluorescence offsets during upcast 180 to 200 and 40 to 140 dbar.
1526 - End of cast
1540 - Transit to pump ship's tanks
1618 - Replaced CTD fluorometer cable.
1619 - Transit to pump ship's tanks
1704 - Start S2C5 CTD cast to 1000 m
Fluorescence offset again at 350 dbar and above 140 dbar, upcast.
1815 - End of cast
1900 - Recovering primary productivity array. 22 50.5617' N, 158 7.1375'W.
1923 - Recovery completed.
2008 - Start S2C6 CTD cast to 1000 m.
2133 - End of cast
2157 - Start net tow
2223 - End net tow
2228 - Start net tow
2255 - End net tow
2309 - Start S2C7 CTD cast to 1000 m

May 3, 2109

0024 - End cast
0035 - Transit to pump ship's tanks
0210 - Start S2C8 CTD cast to 1000 m
Possibly bad fluorescence downcast 110-115 dbar
0315 - End of cast
0410 - Start Gas array deployment
0427 - Gas array deployed, 22 44.3388'N, 158 0.7425'W
0459 - Start S2C9 CTD cast to 1000 m
0610 - End of cast
0802 - Start S2C10 CTD cast to 1000 m
0859 - End of cast
0906 - Transit to pump ship's tanks
1058 - Start S2C11 CTD cast to 1000 m
1159 - End cast
1213 - Start net tow
1243 - End net tow
1248 - Start net tow
1317 - End net tow
1402 - Start S2C12 CTD cast to 1000 m.
1516 - End of cast
1657 - Start S2C13 CTD cast to 1000 m
1814 - End cast
1830 - Transit to pump ship's tanks
1954 - Start S2C14 CTD cast to 1000 m
2103 - End of cast
2158 - Start net tow
2230 - End net tow
2254 - Start S2C15 CTD cast to near-bottom

May 4, 2019

0045 - CTD at 8 m off the bottom, 22 44.9777'N, 157 59.9597'W
0241 - End of cast
0255 - Start Optics cast
0440 - End of Optics cast
0444 - Transit to recover Gas array
0600 - Arrived at Gas array location. Rain squalls passing through
Recovery delayed due to weather conditions (winds 26 kt, gusting to 30 kt)
0644 - Recovering Gas array, 22 54.2999'N, 158 8.5829'W
0658 - End recovery
0659 - Transit to recover sediment traps
0800 - Recovering sediment traps, 23 1.9872'N, 158 10.3949'W
0823 - End recovery
0825 - Transit to recover Wirewalker
0902 - Recovering Wirewalker, 23 1.2162'N, 158 8.4549'W
0913 - End recovery
0919 - Transit to Station 50
1218 - Start hyperpro cast
1249 - End hyperpro cast
1329 - Start S50C1 CTD yo-yo cast to 200 m, near the WHOTS-15 mooring,
1449 - End of yo-yo cast, 5 cycles completed

1612 - Transit to Station Kaena
2140 – Arrived at Kaena Station
2148 – Start S6C1 CTD cast to 2500 m
2356 – End cast

May 5, 2019

0010 – Transit to Honolulu
0730 - Arrive Honolulu Harbor, Pier 35, full offload.

6. HOT program sub-components:

Investigator	Project	Institution
Dave Karl	Core Biogeochemistry	UH
John Dore	Biogeochemistry QA/QC	MSU
James Potemra	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
Matthew McCarthy Tom Guilderson	Sediment trap samples to look at amino acid-based paleo proxies to examine propagation of exported production into coral polyps and skeletons.	UCSC
Matt Church	Diversity and activities of nitrogen-fixing microorganisms	UM/FLBS
Sam Wilson	Reduced gases in the upper ocean: The cycling of methane, sulfide and nitrous oxide.	UH
Sara Ferrón-Smith	Determination of gross primary production from the euphotic zone in situ, using the drifting primary production array	UH
Ed DeLong	SCOPE: DNA and Viral DNA collection	UH
Daniel Repeta	SCOPE: DOM collection	WHOI
Angelique White	SCOPE: Diazotroph Microscopy	OSU
Ana Maria Cabello Perez Kendra Turk-Kubo	Learning to Live Together: Exploring How Two Uncultured Marine Microbes are Evolving a Close	UCSC

	Partnership	
Jacob Waldbauer Amy Zimmerman Gwen Gallagher	Forging the Missing Link: A Protein-Level View of Marine Microbial Ecology	U. Chicago
Kathleen Ruttenberg Danielle Hull	Collect QA/QC samples used for nutrient analyses	SOEST Lab for Analytical Biochemistry
Anamica Bedi Kyle Edwards	The Effect of Light Availability of Breadth-of-Resistance in Picoeukaryotes	UH
Britt Henke Jon Zehr	Filtered water collection	UCSC
Cedric Fichot	Marine photoproduction of methane	Boston U.
Christopher Schvarcz Grieg Steward	Cultivation of marine protists and their viruses from the oligotrophic open ocean, Station ALOHA	UH
Eric Grabowski David Karl	Ratio and decomposition experiments on sediment trap array	UH