

# HOT-306: Chief Scientist Report

Chief Scientist: Fernando Santiago-Mandujano

*R/V Kilo Moana*

11-15 October, 2018

Cruise ID: **KM 18-17**

Departed: 11 October at 0922 (HST)

Returned: 15 October at 0745

Vessel: *R/V Kilo Moana*

Master of the Vessel: Captain Joey Daigle Jr.

OTG Marine Technicians: Jeff Koch, 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. Three 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 October 11<sup>th</sup> 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 October 12<sup>th</sup> to 14<sup>th</sup>.
- 3) Station 50, the site of WHOTS-15 Mooring (anchor position 22° 46.045'N 157° 53.888'W) was to be occupied on October 14<sup>th</sup> for about one hour.

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 October 11<sup>th</sup>. 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 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 October 13<sup>th</sup>.

Another free-drifting array (Gas Array) was to be deployed for 24 hours for incubation experiments on October 13<sup>th</sup>. The Gas Array was to be recovered on October 14<sup>th</sup>.

A plankton net was to be towed between 1000-1400, and 2200-0200 for 30 minute intervals on October 12<sup>th</sup> and 13<sup>th</sup> at Station ALOHA.

A hand-held net was to be towed for 5-10 min intervals in between normal HOT operations by D. Caron's group. Three to four net tows were to be occurred per day.

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 October 11<sup>th</sup> and 14<sup>th</sup>.

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 October 14<sup>th</sup>.

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 October 14<sup>th</sup>.

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. After this cast, if weather conditions were favorable, a small boat would be launched to transport one member of the science party (J. Snyder) to the WHOTS buoy to replace the equilibrator of a faulty CO<sub>2</sub> measuring instrument.

Once the above operations were complete, the ship was to transit to recover the deep moored sediment traps located at 22°51.285'N, 157°53.491'W.

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, transmissometer, flow cytometer, and the meteorological package.

## 2. SCIENCE PERSONNEL

<b>Participant</b>	<b>Title</b>	<b>Affiliation/HOT Group</b>
Emily Aguirre	PhD. Candidate	USC/SCOPE
Kendra Babcock	Research Associate	UH
Macarena Burgos	Scientist	UCádiz
Eric Grabowski	Research Associate	UH/SCOPE
David Caron	Scientist	USC/SCOPE
Tara Clemente	Research Associate	UH/SCOPE
Carolina Funkey	Research Associate	UH
Vivian Merk	Postdoctoral Scholar	USC/SCOPE
Lisa Mesrop	Research Associate	USC/SCOPE
Sara Turner	Undergraduate Student	UH
Mariam Moreno	Undergraduate Student	UH
Courtney Morgan	Undergraduate Student	UH
Svetlana Natarov	Research Assistant	UH
Dan Sadler	Research Associate	UH
Fernando Santiago-Mandujano – Chief Scientist	Research Associate	UH
Eric Shimabukuro	Research Associate	UH/SCOPE
Jefrey Snyder	Marine Technician	UH
Ryan Tabata	Research Associate	UH/SCOPE
Avery Tatters	Postdoctoral Scholar	USC/SCOPE
Ksenia Trifonova	Research Associate	UH
Blake Watkins	Marine Engineer	UH
Tully Rohrer	Research Associate	UH

Julianna Diehl  
Jeff Koch

Marine Technician  
Marine Technician

OTG  
OTG

### 3. GENERAL SUMMARY

Operations at Station ALOHA were conducted with minor schedule changes without any problems.

One 1000 m CTD cast was completed at Station Kahe. Two near bottom CTD casts, twelve 1000 m CTD casts and one 200 m cast were conducted at Station ALOHA. One 200 m yo-yo CTD cast was completed near the WHOTS mooring (Station 50) with five cycles completed.

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.

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

The small boat operation to fix the CO<sub>2</sub> instrument on the WHOTS buoy was successfully completed.

The deep moored sediment traps were successfully recovered.

Six net tows for the core HOT zooplankton collection were completed successfully; three during the day, and three during the night.

Eight hand-held net tows were conducted during the cruise by D. Caron's group.

The optical package was deployed as scheduled.

The hyperpro casts were conducted as scheduled.

The thermosalinograph, fluorometer, transmissometer and flow cytometer were collecting data during the cruise.

The broad band/narrow band Ocean Surveyor ADCP was working correctly during the cruise. The Workhorse ADCP was repaired before the cruise, but still showed problems during the cruise and its measurements were not reliable.

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

The pH spectrophotometer was not working, therefore pH measurements were not taken during the cruise.

Winds were easterlies about 10 kt the first day of the cruise, decreasing to 2-6 kt and turning northerly on October 12-13, and increasing to 10 kt on October 14<sup>th</sup>. Seas were nearly flat during the cruise. Patches of *Trichodesmium* were observed near the ship on October 13<sup>th</sup>.

### 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.

Particularly commendable was the execution of the small boat operation to transport members of the science party to repair one of the instruments on the WHOTS buoy.

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)

### October 11, 2018

0922 - All aboard. Depart from Pier 35 with a slight delay due to harbor traffic

1015 - Safety briefing, Science meeting

1050 - Fire and Abandon ship drills

1202 - Arrived at Kahe Station

1218 - Problems with CTD winch and A-frame hydraulics solved before weight cast

1238 - Weight cast to 500 m with 1200 lb weight.

1315 - End of weight cast

1336 - Start hyperpro cast

1408 - End hyperpro cast

1411 - Start hand-held net tow (D. Caron)

1432 - End of net tow

1457 - Start S1C1 CTD cast to 1000 m. The first Oxygen sensor showed large differences as compared the second sensor. Fluorometer trace showed glitches between 300 and 800 m downcast. The transmissometer did not work during the cast, it showed a constant value.

1601 - End of cast

1615 - Transit to ALOHA Station.

1810 - Replaced first oxygen sensor and transmissometer cable. Reseated fluorometer connection. On-board test showed all instruments working.

### October 12, 2018

0026 - Arrived at ALOHA Station.

0056 - Deployed Wirewalker, 22 45.0024'N, 158 2.135'W

0208 - Deployed sediment traps array, 22 44.938'N, 158 1.016'W

0253 - Start S2C1 CTD cast to 200 m

0324 - End of cast

0527 - Deployed Primary Productivity array, 22 46.0426'N, 158 1.489'W.

0604 - Start hand-held net tow

0640 - End net tow

0701 - Start S2C2 CTD deep cast

0848 - Bottom of the cast, 22 44.998'N, 158 0.011'W

1109 - End of cast

1215 - Start net tow

1242 - End net tow

1306 - Start S2C3 CTD cast to 1000 m

1426 - End of cast

1439 - Start hyperpro cast

1511 - End hyperpro

1539 - Start S2C4 CTD cast to 1000 m

1641 - End of cast

1650 - Transit to pump ship's tanks

1830 - Recovering primary productivity array. 22 44.655'N, 158 1.625'W.

1852 - Recovery completed.  
1909 - Start S2C4 CTD cast to 1000 m.  
2015 - End of cast  
2023 - Start hand-held net tow  
2056 - End net tow  
2118 - Start S2C6 CTD cast to 1000 m  
2224 - End of cast  
2240 - Start net tow  
2308 - End net tow  
2311 - Start net tow  
2340 - End net tow  
2358 - Start S2C7 CTD cast to 1000 m

### **October 13, 2018**

0057 - End cast  
0204 - Start S2C8 CTD cast to 1000 m  
0311 - End of cast  
0319 - Transit to pump ship's tanks  
0431 - Start Gas array deployment  
0451 - Gas array deployed, 22 43.7318'N, 158 2.7081'W  
0512 - Start S2C9 CTD cast to 1000 m  
0620 - End of cast  
0634 - Start hand-held net tow  
0703 - End net tow  
0802 - Start S2C10 CTD cast to 1000 m  
0912 - End of cast  
0925 - Transit to pump ship's tanks  
1030 - Start hand-held net tow  
1050 - End net tow  
1057 - Start S2C11 CTD cast to 1000 m  
1158 - End cast  
1211 - Start net tow  
1218 - Steaks of Trichodesmium observed around the vessel  
1240 - End net tow  
1244 - Start net tow  
1312 - End net tow  
1357 - Start S2C12 CTD cast to 1000 m.  
1512 - End of cast  
1600 - Start hand-held net tow  
1620 - End net tow  
1646 - Start S2C13 CTD cast to 1000 m  
1800 - End cast  
1810 - Transit to pump ship's tanks  
2002 - Start S2C14 CTD cast to 1000 m  
2107 - End of cast  
2120 - Start hand-held net tow  
2150 - End net tow  
2203 - Start net tow  
2231 - End net tow  
2300 - Start S2C15 CTD cast to near-bottom

## October 14, 2018

0050 - CTD at 7 m off the bottom 22 45.989'N, 157 59.994'W  
0236 - End of cast  
0251 - Start Optics cast  
0423 - End of Optics cast  
0430 - Transit to recover Gas array  
0600 - Recovering Gas array, 22 37.425'N, 158 2.844'W  
0621 - End recovery  
0625 - Transit to recover Wirewalker  
0645 - Recovering Wirewalker, 22 36.57'N, 158 4.075'W  
0700 - End recovery  
0705 - Transit to recover sediment traps array  
0726 - Recovering sediment traps, 22 36.038'N, 158 2.569'W  
0758 - End recovery  
0800 - Transit to Station 50  
0920 - Arrived at Station 50  
0935 - Safety briefing for people participating in the small boat operation  
0944 - Start small boat operation to repair pCO<sub>2</sub> equilibrator on WHOTS-15 buoy  
1056 - Operation on WHOTS buoy completed. Equilibrator replaced and tested  
1209 - Start hyperpro cast  
1226 - Start second hyperpro cast  
1244 - Start hand-held net tow  
1315 - End net tow  
1331 - Start S50C1 CTD yo-yo cast to 200 m, near the WHOTS-15 mooring  
1445 - End of cast, 5 cycles completed  
1450 - Transit to deep sediment traps mooring location  
1630 - Arrived at mooring location. ADCP secured. Start interrogating acoustic releases and release mooring  
1740 - Recovering deep sediment traps  
1850 - Traps recovered, all equipment on board  
1855 - Transit to Pier 35  
1858 - ADCP turned on

## October 15, 2018

0745 - Arrive Honolulu Harbor, Pier 35, full offload.

### 6. HOT program sub-components:

<b>Investigator</b>	<b>Project</b>	<b>Institution</b>
Dave Karl	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 <sub>2</sub> dynamics and inter-calibration	SIO
Paul Quay	DI <sup>13</sup> 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
Dave Caron	SCOPE: DNA collection. Protistan biodiversity, trophic activities and biogeochemistry at station ALOHA	USC
Ed DeLong	SCOPE: DNA and Viral DNA collection	UH
Dan Repeta	SCOPE: DOM collection	WHOI
Angelique White	SCOPE: Diazotroph Microscopy	OSU
Morgan Linney David Karl	Characterizing free DNA at Station ALOHA	UH
Esther Mak Jon Zehr	Seawater collection to make culture media for diazotrophs	UC Santa Cruz
Anamica Bedi de Silva Kyle Edwards	Collecting water for Kyle Edwards Lab	UH