HOT 313: Chief Scientist Report

Chief Scientist: Dan Sadler
R/V *Kilo Moana*

Cruise ID: **KM 19-12**
Departed: June 30, 2019 at 0835 (HST)
Returned: July 4, 2019 at 0704 (HST)
Vessel: **R/V *Kilo Moana***
Master of the Vessel: Captain Joey Daigle
OTG Marine Technicians: Jeff Koch, Patrick A'Hearn

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 and during the cruise along with the recovery of the deep moored traps, events were to occur 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 June 30th 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 June 30th – July 3rd.
3) Station 50, the site of WHOTS-15 Mooring (anchor position 22° 46.045'N 157° 53.888'W) was to be occupied for about one hour on July 3rd.
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 July 3rd for about 2 hours.

Upon arrival to Station Kahe a ~1300 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 June 30th. 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 the CTD cast, aerial drone operations would commence. After these operations were satisfactorily completed, the ship was to proceed to Station ALOHA.

Upon arrival to Station ALOHA, a 1000 m CTD cast for preparation of the Primary Productivity Array was to be conducted followed by deployment of the WireWalker and the free-drifting sediment trap array. These two arrays were to stay in the water for about 54 hours. This 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 centered over Station ALOHA, 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 July 2nd.

The lowered-ADCP was to collect current measurements on down- and up-cast. The 600 kHz LADCP, operating in single ping, was to record measurements internally at a rate of 4 kHz and data was to be downloaded after each cast via RS422 connection.

The free-drifting Gas array was to be deployed for 24 hours for incubation experiments on July 2nd.

A plankton net was to be towed three times between 1000-1400, and three times between 2200-0200 for 30 minute intervals on July 1st and 2nd at Station ALOHA.

The Hyperpro was to be deployed for a half-hour period near ~1400 on June 30th, July 1st, and 3rd.

An optics 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 July 3rd.

After the optics package and 36 hour burst period of CTD work at Station ALOHA was accomplished, the ship was to transit to recover the Gas array, the WireWalker and the Sediment Trap array on the morning of July 3rd.

After recovering the arrays, the ship was to transit to Station 50 to conduct a one-hour 200 m CTD yo-yo cast. The ship was to remain 0.25 nm, downwind and down current from Station 50, after completion of the CTD yo-yo to gather one hour of shipboard ADCP for comparison to WHOTS-15 ADCP data. Once operations at Station 50 were complete, the ship was to re-position within Station ALOHA to conduct a Hyperpro cast.

The ship was to proceed to Station 6 (Kaena) and perform a near bottom CTD cast then transit back to Honolulu Harbor, Pier 35.

An Argo float was to be deployed just before leaving station.

Aerial drone operations were scheduled for each day.

The following instruments were to collect data throughout the cruise: shipboard ADCP, thermosalinograph, underway fluorometer, transmissometer, the meteorological package.

2. SCIENCE PERSONNEL

Participant	Title	Affiliation	Citizenship
Kendra Babcock	Research Associate	UH	USA
Ryan Tabata	Research Associate	UH	USA
Tim Burrell	Research Associate	UH/SCOPE	New Zealand
Dan Fitzgerald	Research Associate	UH	USA
Carolina Funkey	Research Associate	UH	USA
Tully Rohrer	Research Associate	UH/SCOPE	USA
Dan Sadler– Chief Scientist	Research Associate	UH	USA
Fernando Santiago-Mandujano	Research Associate	UH	USA
Blake Watkins	Marine Engineer	UH	USA
Jeff Koch	Marine Technician	OTG	USA
Patrick A'Hearn	Marine Technician	OTG	USA
Karin Björkman	Scientist	UH	Sweden
Jinchun Yuan	Scientist	ECSU	USA
Kelsey Maloney	Student Assistant	UH	USA
Dylan Boeman	Undergraduate Student	UH	USA
Nathaniel Harmon	Graduate Student	UH	USA
Andres Salazar Estrada	Graduate Student	UH	Chile
Hayley Schiebel	Scientist	UH	USA
Wendell Waters	Scientist	Brown	USA
Mathieu Caffin	Scientist	UH	France
Erik Hakansson	Volunteer	UH	Sweden
Mary Parker	Journalist	M.L. Parker Media	USA
Peter Vissers	Engineer	Hawbolt Ind.	Canada

3. GENERAL SUMMARY

All operations were completed at Station Kahe. Upon arrival at Station ALOHA, the WireWalker, sediment traps and primary production array were deployed and drifted northwestward.

One 1000 m CTD cast was completed at Station Kahe. Two near bottom CTD casts, eleven 1000 m CTD casts, one 500m CTD cast, and one 200m CTD cast were conducted at Station ALOHA. One 5 cycle yoyo CTD cast to 200 m was completed near the WHOTS mooring (Station 50). A near bottom CTD cast was completed at Station Kaena.

Five net tows for the core HOT zooplankton collection were completed successfully; Two during the day and three during the night. The gas array was deployed and recovered.

Hyperpro casts were completed at Station Kahe and Station ALOHA. Casts with a new Hyperpro system were performed directly after the regular Hyperpro unit to compare the two systems.

The ADCP, underway fluorometer, thermosalinograph, transmissometer and the ship's meteorological suite ran without interruption during the cruise.

Aerial drone operations were conducted on all four days.

One ARGO float was deployed on July 3rd on departure from Station ALOHA.

Winds during the cruise were from the South at 5-15 kts. Seas were 2-6 ft.

The Dynacon 0.322 winch exhibited level wind problems during the first 2 CTD casts. Adjustments were made but the issue persisted on the S2C2 deep cast. The cast was aborted at 500m and CTD operations were switched to the 0.681 wire. To overcome the 3 hour delay, one open CTD cast was dropped from the schedule. We were able to collect the missed water samples on other cast so that all samples were collected.

A design engineer from Hawbolt Industries observed the current CTD operations and equipment to assist in designing the new CTD winch/crane deployment system.

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

The R/V *Kilo Moana* and crew provided excellent support for the cruise.

Technical support during this cruise was very good. OTG personnel were available to assist in our work during the cruise. They were flexible in accommodating the atmospheric sampling.

5. DAILY REPORT OF ACTIVITIES (HST)

June 30, 2019

0835 Cast off lines and departed UH Marine Center
0930 Safety Briefing, Lab Safety Tour, Fire and Abandon Ship drills,
1048 Secure from drills

1100 Daily Meeting with Captain, Chief Engineer and OTG.
1129 Arrive Station Kahe. Begin Weight Cast
1206 End cast
1220 Begin Hyperpro. YoYo and 2 deep cast at 21° 20.5673'N, 158° 16.4227'W
1300 End Hyperpro cast
1315 Begin S1C1 CTD cast to 1000m. Level wind issues on upcast. Resolved by engineering
1441 End cast
1510 Drone Operations
1525 End drone operations
1530 Depart Station Kahe for transit to ALOHA
2220 Arrive Station ALOHA
2228 Begin Wirewalker deployment
2238 Wirewalker deployed at 22° 39.7016'N. 158° 01.5756'W
2300 Begin Sediment Trap deployment
2318 Sediment Traps depoyed at 22° 40,3827'N. 158° 00,8441'W

July 1, 2019

0148 Begin S2C1 1000m CTD cast
2237 End cast
0405 Begin Primary Production array deployment
0424 PP array deployed at 22° 40,9447'N, 158° 00,0330'W
0430 Transit to center of circle
0508 Begin S2C2 near bottom CTD cast
0527 All stop at 500 db for level wind issues
0610 Engineering makeing adjustments to level wind
0616 Cast aborted - raising CTD using manual level wind
0746 End of cast
0824 Begin S2C3 near bottom CTD cast on 0.681 wire
1245 End of cast
1304 Begin net tow 22° 44.9897'N, 157° 59.8361'W
1335 End net tow
1343 Begin Hyperpro cast
1409 End cast
1427 Begin S2C4 1000 m CTD cast - start of 36 hour burst sampling
1608 End of cast
1615 Transit to pump tanks
1729 Begin S2C5 1000m CTD cast
1808 Start Drone Operations
1841 End cast
1846 End Drone operations
1932 Recovering PP array at 22° 47.5214'N, 158° 03.9468'W
1949 PP array on deck
2001 Begin S2C6 1000m CTD cast
2114 End of cast
2202 Start net tow
2232 End net tow
2238 Start net tow
2306 End net tow
2318 Begin S2C7 1000m CTD cast

July 2, 2019

0026 End of cast
0030 Transit to pump tanks
0157 Begin S2C8 1000m CTD cast
0308 End of cast
0400 Begin gas array deployment
0419 Gas array released at 22° 45.09’N, 158° 02.89’W
0510 Begin S2C9 1000m CTD cast
0625 End of cast
0751 Begin S2C10 1000m CTD cast
0905 End of cast
0920 Transit to pump tanks
1051 Begin S2C11 1000m CTD cast
1115 Daily meeting with Captain, Chief Engineer and OTG
1210 End of cast
1220 Begin net tow
1246 End of net tow
1250 Begin net tow
1318 End of net tow
1330 Begin drone ops
1406 End drone ops
1414 Begin S2C12 1000m CTD cast
1526 End cast
1538 Begin drone ops
1600 End drone ops
1603 Hand net tow
1614 End net tow
1650 Begin S2C13 1000m CTD cast
1808 End cast
1815 Transit to pump tanks
1953 Start S2C14 1000m CTD cast
2103 End cast
2200 Start net tow
2228 End net tow
2254 Begin S2C15 near bottom CTD cast

July 3, 2019

0240 End of cast
0300 Start optics cast
0436 End optics cast at 22° 45.1579’N, 157° 59.8956’W
0440 Transit to Gas Array
0557 Begin GA recovery at 22° 54.2942’N, 158° 07.9660’W
0640 GA on board at 22° 54.6535’N, 158° 07.9660’W
0642 Transit to Sediment Traps
0724 Begin ST recovery at 22° 58.0793’N, 158° 12.5482’W
0745 Sediment Traps on board
0831 Begin Wirewalker recovery at 22° 56.1576’N, 158° 15.9375’W
0842 Wirewalker on deck
0844 Transit to Station 50, WHOTS mooring

1100 Arrived Station 50
1210 Begin Hyperpro cast at 22° 47.8878'N, 157° 55.1678'W
1254 End Hyperpro cast
1259 Begin hand net tow
1306 End hand net tow
1354 Begin S50C1 YoYo CTD cast
1454 End of cast. Completed 5 cycles
1512 Begin drone ops
1604 End drone ops
1628 Deployed ARGO float at 22° 47.7261'N, 157° 54.9133'W
1635 Transit to Station Kaena
2230 Begin S6C1

July 4, 2019

0033 End cast
0035 Transit to Honolulu Harbor
0704 Arrive Pier 35

HOT program sub-components:

Investigator	**Project**	**Institution**
Dave Karl	Core Biogeochemistry	UH
Angelique White	Core Biogeochemistry	UH
John Dore	Biogeochemistry QA/QC	MSU
James Potemera	Hydrography	UH
Mike Landry	Zooplankton dynamics	SIO
Ricardo Letelier	Optical measurements	OSU
Ancillary programs:		
Andrew Dickson	CO_2 dynamics and intercalibration	SIO
Paul Quay	$DI^{13}C$	UW
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, Single cell genomic flow cytometry sample collection	UH
Dan Repeta	SCOPE: DOM collection	WHOI
Angelique White	SCOPE: C-STAR, IFCB, Seaflow	UH
Virginia Ambrose	SCOPE: Seaflow	UW
Grieg Steward	Three dimensional model system of mixotrophic Phytoplankton, its prey and a giant virus infecting them	UH
Karin Bjorkman & Sara Ferrón-Smith	Comparison of 14C-assimilation and gross O2 production, and effects on respiration at different light intensities.	UH
Jinchun Yuan	Vertical Profiles of Trace Gases in Lower Troposphere	ECSU
Hayley Schiebel	Characterization of Reactive Nitrogen in the North	Suffolk U.
Wendell Waters	Pacific Atmosphere	Brown