

HOT 312: Chief Scientist Report

Chief Scientist: Dan Sadler

R/V *Kilo Moana*

Cruise ID: **KM 19-09**

Departed: June 10, 2019 at 0854 (HST)

Returned: June 14, 2019 at 0742 (HST)

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

Master of the Vessel: Captain Joey Daigle

OTG Marine Technicians: Julianna Diehl, 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 10th 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 11th – 13th.
- 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 June 17th.
- 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 June 13th 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 10th. 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 June 12th.

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 June 12th.

A plankton net was to be towed three times between 1000-1400, and three times between 2200-0200 for 30 minute intervals on June 11th and 12th at Station ALOHA.

The Hyperpro was to be deployed for a half-hour period near ~1400 on June 10th, 11th, and 13th.

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 June 13th.

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 June 13th.

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
Tara Clemente	Research Associate	UH/SCOPE	USA
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
Julianna Diehl	Marine Technician	OTG	USA
Patrick A’Hearn	Marine Technician	OTG	USA
Morgan Linney	Graduate Student	UH	USA
Jinchun Yuan	Scientist	ECSU	USA
Elaine Luo	Graduate Student	UH	Canada
Courtney Morgan	Undergraduate Student	UH	USA
Brandon Brenes	Undergraduate Student	UH	USA
Richard Chen	Undergraduate Student	UH	USA
Andres Salazar Estrada	Graduate Student	UH	Chile
Karen Selph	Scientist	UH	USA
Mathieu Caffin	Scientist	UH	France

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 southward.

One 1000 m CTD cast was completed at Station Kahe. Two near bottom CTD casts, twelve 1000 m CTD casts, 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 June 13th on departure from Station ALOHA.

Winds during the cruise were mostly light from the South 5-10 kts. Seas were 2-6 ft.

Operations were slowed during the S2C1 CTD cast when a strand of the 0.322 wire broke and created a "birdcage" in the winch tensioning device. Once cleared, about 200 m were removed and the cable was re-terminated. The wire was visually inspected below 3000 m and rinsed during the upcast. The wire was deemed suitable to continue deep ctd casts. The wire condition was discussed in the post-cruise meeting and it was agreed that it would be lubricated on the next KM cruise.

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 10, 2019

0854 Cast off lines and departed UH Marine Center
0945 Safety Briefing
1030 Lab Safety Tour, Fire and Abandon Ship drills
1100 Meeting with Captain, and OTG to discuss Drone operations and CTD Wire examination.
1140 Arrive Station Kahe
1208 Begin Weight Cast
1232 End cast
1250 Begin Hyperpro. YoYo and 2 deep casts.
1335 End Hyperpro cast
1351 Begin S1C1 CTD cast to 1000m

1455 End cast
1515 Drone Operations
1400 Depart Station Kahe for transit to ALOHA

June 11, 2019

0025 Arrive ALOHA
0042 Deploy Wirewalker 22° 48.047' N 158° 00.602' W
0116 Deploying Sediment Traps
0141 Sediment Traps released at 22° 47.973' N 158° 1.645' W
0121 Begin S1C1 200m CTD cast
0225 Winch stopped for bad noise at 168m
One strand of CTD wire broken and started accumulating on the winch. Wire "birdcaged" and bunched up against a sheave. Required extensive efforts to repair enough to recover ctd. 0410
Repair complete, continued with upcast
0426 End S2C1
0527 Begin PP array deployment
0547 PP array released at 22° 48.688' N 158° 02.428' W
0550 Transit to center of station while reterminating wire. Removed approx. 200 m of ctd wire.
0657 Begin S2C2 near bottom CTD cast
Wire inspected below 3000 m by engineer, otg and HOT. Reported to have surface corrosion and salt build up. Strands were intact and deemed servicable to continue ctd operations and second deep cast.
1056 End of cast
1100 Daily meeting with captain and otg to review operations.
1108 Began aerial drone operations
1150 End of drone operations
1218 Begin S2C3 1000m ctd cast
1330 End of cast
1340 Begin Hyperpro
1423 End Hyperpro
1443 Begin S2C4 1000m CTD cast
1619 End of cast
1620 Pump tanks
1805 Start S2C5 1000m CTD cast
Secondary fluorescence max at 250 dbar
1913 End of cast
Transit to recover PP array
1930 Recover PP array at 22° 42.023' N, 158° 3.444' W
2019 Begin S2C6 1000m CTD cast - 2 secondary fluorescence maximum at 240 dbar and 190 dbar
2133 End of cast
2204 Start net tow
2232 End net tow
2240 Start net tow
2305 End net tow
2318 Begin S2C7 1000m CTD cast

June 12, 2019

0037 End of cast
0048 Pump tanks
0211 Begin S2C8 1000m CTD cast - Secondary fluorescence peak at 240 dbar

0316 End of cast
0320 Transit NE to gas array deployment site
0411 Begin gas array deployment
0429 Gas array deployed at 22° 47.190' N, 22° 57.990' W
0455 Begin S2C9 1000m CTD cast
0612 End of cast
0800 Begin S2C10 1000m CTD cast - Fluorescence peaks at 175 and 214 dbar in addition t DCM at 125 dbar.
0858 End of cast
0910 Pump tanks
1058 Begin S2C11 1000m CTD cast
1158 End cast
1214 Begin net tow 22° 47.213' N, 158° 01.423' W
1244 End net tow
1249 Begin net tow at 22° 48.026' N, 158° 00.917' W
1320 End net tow
1332 Begin drone operations
1410 End drone operations
1420 Begin S2C2 1000m CTD
1528 End of cast
1647 Begin S2C13 1000m CTD cast
1812 End of cast
1820 Pump tanks
2000 Begin S2C14 1000m CTD cast
2105 End of cast
2205 Start net tow
2230 End net tow
2254 Begin S2C15 near bottom CTD cast

June 13, 2019

0226 End of cast
0240 Deployed optics cage at 22° 44.992' N, 158° 00.0128' W. 3 profiles to 200 m
0415 End of optics cast
0418 Transit to gas array
0535 Begin GA recovery at 22° 34.2098' N, 158° 04.5081' W
0550 GA recovery complete at 22 34.1877 N, 158' 04.4998' W
0551 Transit to sediment traps
0711 Begin ST recovery at 22° 24.915' N, 158° 14.7684' W
0729 End ST recovery at 22° 24.9166' N, 158° 14.7784' W
0730 Transit to Wirewalker array
0808 Begin Wirewalker recovery at 22° 24.9696' N, 158° 12.9025' W
0820 End Wirewalker recovery at 22° 24.8616' N, 158° 12.8458' W
0822 Transit to WHOTS mooring
1140 Begin Hyperpro cast
1220 End Hyperpro cast
1226 Raining on station
1253 Begin S52C1 200m yoyo CTD cast. 5 cycles completed. Winch level wind issue on last cycle.
1356 End of cast
1418 Begin aerial drone operations
1515 Drone ops complete
1559 ARGO float deployed at 22° 44.118' N, 157° 54.7925' W

1600 Begin transit to St. Kaena
2110 Begin S6C1 near bottom CTD cast
2304 End of cast
2310 Transit to Honolulu Harbor

June 14, 2019

0742 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: Seafloor	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 ¹⁴ C-assimilation and gross O ₂ production, and effects on respiration at different light intensities.	UH
Jinchun Yuan	Vertical Profiles of Trace Gases in Lower Troposphere	ECSU
Karen Selph	Flow cytometry inter-comparison and mixotrophy assessments	UH