

HOT 314: Chief Scientist Report

Chief Scientist: Tara M. Clemente

R/V *Kilo Moana*

August 1-5, 2019

Cruise ID: KM 19-15

Departed: August 1, 2019 at 08:39

Returned: August 5, 2019 at 14:18

Vessel: R/V *Kilo Moana*, University of Hawaii

Master of the Vessel: Captain David Martin

OTG Marine Technicians: Trevor Young and Julianna Diehl

1. SCIENTIFIC OBJECTIVES

The objective of the cruise is to maintain a collection of hydrographic and biogeochemical data at the Hawaii Ocean Time-series (HOT) stations. Five stations will be occupied and during the cruise and events will 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 will be occupied on August 1st for about 3-4 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 will be occupied August 2nd – August 4th.
- 3) Station 50, the site of WHOTS-15 Mooring (anchor position 22° 46.045'N 157° 53.888'W) will be occupied for about 3-4 hours on August 4th.
- 4) ROV *Lu'ukai*, (22°43.641'N, 157°54.180'W). An elevator will be deployed in the vicinity of ROV *Lu'ukai* on August 4th, once operations at Station 50 are completed.
- 5) Station 6, referred to as Station Kaena, is located off Kaena Point at 21° 50.8'N, 158° 21.8'W and will be occupied on August 5th 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 August 1st. 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, the WireWalker was to be deployed followed by the free-drifting sediment trap array. These two arrays were to stay in the water for about 54 hours. Following these deployments, a 200m CTD cast for preparation of the Primary Productivity Array was to be conducted followed by deployment of the Trace Metal pump. 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 August 3rd.

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 August 3rd.

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

The Hyperpro was to be deployed for a half-hour period near ~1400 on August 1st, 3rd and 4th.

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 August 4th.

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 Sediment Trap array and the WireWalker on the morning of August 4th.

After recovering the arrays, the ship was to transit to Station 50 to conduct a Hyperpro cast and 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 ADCP inter comparisons were complete the VPR was to be deployed followed by aerial drone operations. Once operations at Station 50 were complete, the ship was to re-position the ROV *Lu'ukai* site for the elevator deployment.

After the elevator deployment near the ROV *Lu'ukai*, the ship was to proceed to Station 6 (Kaena) and perform a near bottom CTD cast then transit back to Honolulu Harbor, Pier 35.

Four, one hour Video Plankton Recorder (VPR) deployments and four, one hour Acoustic Zooplankton Fish Profiler (AZFP) deployments were scheduled throughout the cruise.

Aerial drone operations were scheduled for each day.

The following instruments were to collect data throughout the cruise: shipboard ADCP, thermosalinograph, underway fluorometer, transmissometer, pCO₂ the meteorological package, SeaFlow, Inline C-Star Transmissometer and Imaging FlowCytobot (IFCB).

2. SCIENCE PERSONNEL

Participant	Title	Affiliation	Citizenship
Benedetto Barone	Scientist	UH	Italy
Brandon Brenes	Undergraduate Student	UH	USA
Karin Björkman	Scientist	UH	Sweden
Macarena Burgos	Scientist	UH	Spain
Tim Burrell	Research Associate	UH/SCOPE	New Zealand
Mathieu Caffin	Scientist	UH	France
Tara Clemente – Chief Scientist	Research Associate	UH/SCOPE	USA
Jacquelyn Corpus	Volunteer	UH	USA
Julianna Diehl	Marine Technician	OTG	USA
Dan Fitzgerald	Research Associate	UH	USA
Carolina Funkey	Research Associate	UH	USA
Eric Grabowski	Research Associate	UH	USA
Isaiah Kela-Pacheco	Volunteer	UH	USA

Rachel Kelly	Graduate Student	USC/SCOPE	USA
Kelsey Maloney	Student Assistant	UH	USA
Daniel Muratore	Graduate Student	GA Tech/SCOPE	USA
Tully Rohrer	Research Associate	UH/SCOPE	USA
Fernando Santiago-Mandujano	Research Associate	UH	USA
Eric Shimabukuro	Graduate Student	UH	USA
Ryan Tabata	Research Associate	UH/SCOPE	USA
Kristin Thompson	Graduate Student	UH	USA
Tracy Villareal	Scientist	UT Austin	USA
Blake Watkins	Marine Engineer	UH	USA
Trevor Young	Marine Technician	OTG	USA
Jinchun Yuan	Scientist	ECSU	USA
Lauren Yumol	Graduate Student	UH	USA

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, 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 at Station Kaena was not completed due to delays in the ROV *Lu'ukai* elevator deployment.

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.

Four, one hour Video Plankton Recorder (VPR) deployments and four, one hour Acoustic Zooplankton Fish Profiler (AZFP) deployments were conducted successfully throughout the cruise.

Aerial drone operations were conducted on three of the four days. Drone operations were cancelled on August 2nd, due to high winds (20-25kts).

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

The deployment of the elevator to assist with the future recovery of the ROV *Lu'ukai* was conducted using the 0.681 wire, however this attempt was unsuccessful after the weight broke free causing the elevator to return to the surface. The elevator was promptly recovered and then successfully re-deployed via free fall approximately about 200m to the ENE of the ROV *Lu'ukai*.

Winds at the beginning of the cruise were from the NE at 20-25kts and clocked around to the ESE lightening to 5-15kts throughout the cruise. Seas were 2-6 ft.

The Dynacon 0.322 winch exhibited level wind sensor problems during the first CTD casts. CTD operations were switched to the 0.681 wire for the remainder of the cruise. We were able to collect all water samples.

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 David Martin and the ship's crew showed flexibility, enthusiasm, concern, and dedication to our scientific mission. We especially commend the bridge for excellent ship handling during the array recoveries and deployments.

Technical support during this cruise was good. OTG personnel were available to assist in our work during the cruise. They were flexible and accommodating. We especially enjoyed the improved science safety drills.

5. DAILY REPORT OF ACTIVITIES (HST)

August 1st, 2019

0845 Cast off lines and departed UH Marine Center
0915 Safety Briefing, Lab Safety Tour, Fire and Abandon Ship drills
1050 Secure from drills
1100 Daily Meeting with Captain and Chief Engineer.
1130 Arrive Station Kahe. Begin Weight Cast
1135 Weight cast delayed due to level wind issues
1154 Begin weight cast
1235 End weight cast
1248 Begin Hyperpro. YoYo and 2 deep cast.
1328 End Hyperpro cast
1413 Begin S1C1 CTD cast to 1000m.
1528 End Cast
1540 Drone Operations
1630 End drone operations
16:39 Depart Station Kahe for transit to ALOHA.

August 2nd, 2019

0000 Arrive at southern edge of Station ALOHA
0025 Start Wire Walker deployment, 5nm South of center
0036 Wire Walker released: 22°39.171 N, 158°01.382 W
0053 Start Sediment Trap array deployment, 4nm South of center
0112 Sediment Trap array released: 22°40.762 N, 158°01.254 W
0200 Start S2C1- Winch stopped at 26db and had to pay out 10m, level wind sensor issue.
0241 S2C1 End
0315 Trace Metal Pump deployed
0414 Start Primary Production array deployment, 2nm north of center
0430 Primary Production array released: 22°42.20 N, 158°0.08 W
0430 Switching from 0.322 wire to 0.681 wire due to level wind sensor issues.
0432 End Trace Metal Pumping
0432 Transit to Station ALOHA, Center
0508 Arrive at Station ALOHA, Center
0508 S2C2 near bottom CTD

0732 S2C2 bottom depth, 6m off bottom
0923 Paused at 1200db on upcast for engineers to examine 0.681 winch
0928 Resume upcast, all clear from engineering
1000 S2C2 End, 22°44.992 N, 158°0.033 W
1134 S2C3 1000m CTD
1316 S2C3 End
1327 Start HyperPro
1405 End HyperPro
1418 S2C4 1000m CTD
1548 S2C4 End
1553 Transit to pump tanks
1717 S2C5 1000m CTD
1830 End S2C5
1839 Transit to recover PP array
1915 Begin PP array recovery: 22°47.38 N, 157°59.44 W
1948 PP array recovered
2011 S2C6 1000m CTD
2120 End S2C6
2144 Begin VPR towed camera deployment
2210 End VPR
2225 Net tow
2250 Net tow end
2255 Net tow
2326 Net tow end
2339 S2C7 1000m CTD

August 3, 2019

0043 End S2C7
0048 Transit to pump tanks
0132 Begin AZFP (acoustic zooplankton fish profiler) deployment
0200 End AZFP
0211 S2C8 1000m CTD
0307 End S2C8
0315 Transit to deploy Gas Array
0403 Start Gas Array deployment
0421 Gas Array released: 22°43.19 N, 158°02.39 W
0445 S2C9 1000m CTD
0608 End S2C9
0629 Begin VPR towed camera deployment
0658 End VPR
0713 Begin AZFP deployment
0758 End AZFP
0805 S2C10 1000m CTD
0912 End S2C10
0923 Transit to pump tanks
1012 Begin AZFP deployment
1047 End AZFP
1055 S2C11 1000m CTD
1153 End S2C11

1214 Net tow
1240 Net tow end
1246 Net tow
1313 Net tow end
1322 Begin Aerial Drone Ops
1335 Begin AZFP deployment
1407 End AZFP
1420 End Aerial Drone Ops
1423 S2C12 1000m CTD
1542 End S2C12
1558 Begin VPR towed camera deployment
1650 End VPR
1705 S2C13 1000m CTD
1818 End S2C13
1828 Transit to pump tanks
1942 Begin AZFP deployment
2015 End AZFP
2025 Begin ACO depth survey
2025 S2C14 1000m CTD
2128 End S2C14
2142 Begin AZFP deployment
2216 End AZFP
2226 Start Net tow
2232 End Net tow, line snagged on .322 wire on A-frame
2234 Start Net tow
2301 End Net tow
2318 S2C15 near bottom CTD

August 4, 2019

0113 S2C15 7m off bottom, 4808db; 22°44.98 N, 158°0.019 W
0300 End S2C15
0313 Deploy Optics package, three casts
0452 Optics package recovered
0456 Transit to recover Gas Array, ~8 miles
0613 Begin Gas Array Recover: 22°51.57 N, 158°5.65 W
0628 Gas Array Recovered
0630 Transit to the Sediment Trap Array
0738 Begin Sediment Trap Recovery: 22°58.29 N, 158°13.16 W
0753 Sediment Trap Array Recovered
0755 Transit to Wire Walker Array
0830 Begin Wire Walker Recovery
0841 Wire Walker Recovered: 22°57.43 N, 158°13.74 W
0842 Transit to Station 50, WHOTS buoy
1130 Arrive Station 50
1133 Begin HyperPro
1210 End HyperPro
1231 Begin Aerial Drone Ops
1301 S50C1 200m Yo-Yo, 1000m CTD
1330 End Ariel Drone Ops

1440 Begin hand held net tow
 1448 End hand held net tow
 1454 End S50C1, 5 cycles complete
 1512 Begin VPR towed camera deployment
 1602 End VPR
 1605 Transit to ROV Lu'ukai site
 1707 Begin ROV Elevator Deployment
 1900 Ship repositioned slightly to release elevator away from ROV
 2045 Release Command Sent
 2100 Upon release of elevator, elevator did not remain on bottom, but floated to the surface. Wire is being recovered, will take 1-1.5hr, then Elevator will need to be recovered as well. This will cause the cancellation of S2C6, Station Kaena.
 2217 Releases recovered
 2330 Begin Elevator Recovery attempt
 2340 Elevator recovered
 2345 Begin retrofit of elevator anchor system

August 5, 2019

0111 Begin redeployment (free fall) of elevator
 0120 Setting up for triangulation of elevator/anchor
 0239 Begin transit to Honolulu Harbor
 1418 Arrive Pier 35
 1430 Post-Cruise Meeting

HOT program sub-components:

Investigator	Project	Institution
Angelique White	Core Biogeochemistry	UH
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 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	UH

methane, sulfide and nitrous oxide.

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
Dan Repeta	SCOPE: DOM collection	WHOI
Angelique White	SCOPE: C-STAR, IFCB	UH
Virginia Ambrust	SCOPE: Seaflow	UW
Jinchun Yuan	Vertical Profiles of Trace Gases in Lower Troposphere	ECSU
Tracy Villareal	Diatom aggregate visualization	UT Austin
Benedetto Barone	Vertical profiles using Acoustic Zooplankton Fish Profiler (AZFP)	UH
Rachel Kelly	Trace Metal Surface Pump System Testing and Nickel Incubation	UCSC
Mathiew Caffin	Isotopic Constraints on the Contribution of N ₂ fixation to New and Export Production in the NPSG	UH
Morgan Linney	Characterizing cell-free DNA from Station ALOHA (Water Collection)	UH
Kyle Edwards	ALOHA surface sea water (Water Collection)	UH