HOT 291: Chief Scientist Report

Chief Scientist: Tara M. Clemente
R/V *Ka'Imikai-O-Kanaloa*
March 27-31, 2017

Cruise ID: **KOK17-05**
Departed: March 27, 2017 at 0705 (HST)
Returned: March 31, 2017 at 0926 (HST)
Vessel: **R/V *Ka'Imikai-O-Kanaloa***
Master of the Vessel: Mike Hoshlyk
OTG Marine Technicians: Sonia Brugger and 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. 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 March 27th for about 3 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 March 28th , 29th , and 30th.
3) Station 50, the site of WHOTS-13 Mooring (anchor position 22° 47.24' N, 157° 54.45' W) was to be occupied on March 30th 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 March 30th for approximately 3 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 March 27th. 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 these operations were satisfactorily completed, the ship was to proceed to Station ALOHA.

Upon arrival to Station ALOHA, two CTD casts; one 200 m cast to collect water for the Primary Productivity array and one 100m cast to collect water for the Diazotrophy Growth Rate array were to be conducted followed by the deployment of the free-drifting sediment trap array. The Sediment Trap array was to stay in the water for about 56 hours. This was to be followed by the deployment of the free-drifting Primary Productivity array to incubate in situ for 12 hours and the Diazotrophy Growth Rate array to incubate in situ for 48hrs. A full-depth (~4740 m) CTD cast was to be conducted after the deployment of the Diazotrophy Growth Rate array, and 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 March 29th.

Two additional free-drifting arrays (Net Trap array and Gas array) were to be deployed for 24 hours for incubation experiments on March 29th.

An Automated Trace Element (ATE) sampler was to be deployed to a depth of 10 m on March 29th.

A plankton net was to be towed three times between 1000-1400, and three times between 2200-0200 for 30 minute intervals on March 28th and 29th at Station ALOHA.

The Hyperpro was to be deployed for a half-hour period near ~1400 on March 27th, 28th, and 30th.

An optics package including 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 March 30th.

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 floating Net Trap array, Gas array, Diazotrophy Growth Rate array and the Sediment Trap array on the morning of March 30th.

After recovering the arrays, , the ship was to transit to Station 50 to conduct a one-hour 200 m CTD yo-yo cast. Once operations at Station 50 were complete, the ship was to re-position within Station ALOHA to conduct a Hyperpro cast.

Once operations at Station ALOHA were complete, the ship was to transit to Station 6, referred to as Station Kaena where a near-bottom CTD cast (~2500 m) was to be conducted to collect salinity and chlorophyll samples for calibration. After Station Kaena operations were complete, the ship was to transit back to Pier 35.

The following instruments were to collect data throughout the cruise: shipboard ADCP, thermosalinograph, the underway fluorometer, and the ship's anemometers.

2. SCIENCE PERSONNEL

Participant	Title	Affiliation	Citizenship
Susan Curless	Research Associate	UH	USA
Alexa Nelson	Research Associate	UH	USA
Dan Sadler	Research Associate	UH	USA
Eric Grabowski	Research Associate	UH	USA
Blake Watkins	Marine Engineer	UH	USA
Tim Burrell	Research Associate	UH	New Zealand
Tara Clemente	Research Associate	UH	USA
Eric Shimabukuro	Research Associate	UH	USA
Ryan Tabata	Research Associate	UH	USA
Andrew King	Research Associate	UH	USA
Svetlana Naratov	Graduate Student	UH	USA
Kellen Rosburg	Research Associate	UH	USA
Jefrey Snyder	Marine Technician	UH	USA
Kelsey Maloney	Undergraduate Student	UH	USA
Eint Kyi	Graduate Student	UH	Myanmar
Gerarda Terlouw	Post Graduate Trainee	UH	The Netherlands
Kendra Turk	Research Scientist	UCSC	USA
Mary Hogan	Research Scientist	UCSC	USA
Sonia Brugger	Marine Technician	OTG	USA
Patrick A'Hearn	Marine Technician	OTG	USA

3. GENERAL SUMMARY

Operations during the cruise were conducted as planned with modifications to the schedule. Departure from Pier 35 was on time and operations at Station Kahe were completed successfully. Winds from the ESE at 20-22 kts and 6-8 ft seas were present during transit to Station ALOHA after passing Kaena Point. We arrived at Station ALOHA 1.5 hours earlier than scheduled (0028 on March 28th).

Upon arriving at Station ALOHA on the morning of March 28th, we conducted two CTD casts for in situ incubation arrays; one 200 m cast to collect water for the Primary Productivity array and one 100m cast to collect water for the Diazotrophy Growth Rate array. Between CTD casts we successfully deployed the Sediment Trap Array (despite 20-30 minutes of propulsion failure on the port screw, causing a delay). Following the second CTD cast to 100m we successfully deployed the Primary Production array and Diazotrophy Growth Rate array. The deep cast was conducted successfully and the 36-hour CTD period began on schedule.

The daytime net tow and Hyperpro on March 28th were conducted successfully. A twisted wire was discovered just before deployment of S2C7. I was decided to delay deployment for cable inspection. 37.5 m of cable was paid out and inspected. After the cable was inspected and determined in good condition for use it was spooled back onto the winch. However, during the re-deployment of S2C7 the cable jumped the sheave and got pinched by the squirt boom. To undo the hang up, the CTD was lowered back on deck; the cable was cut and then re-terminated. 7737m of cable remains on the winch.

To utilize time during re-termination the Net Trap array was deployed three hours ahead of schedule on the early morning of March 29th. After re-termination and deployment of the Net Trap array we continued with S2C7. Following S2C7 the Gas Array was deployed successfully. In order to get back on schedule The PUR CTD cast was cancelled. The remaining CTD casts were deployed successfully.

On March 30th following the 36hr burst period and optics cast, we headed to recover 4 arrays (3 arrays headed south, 1 array headed east). First we headed south towards the Gas array, Sediment trap array and Net Trap array. We experienced a few challenges during two of the four array recoveries (the Gas array and Net Trap array). The first array scheduled for recovery was the Gas array. However, during approach, the gas array was run over and the floats were wrapped around the starboard screw/shaft. The surface buoy was mangled and trapped under the fantail where it repeatedly bashed against the hull. The flag was lost and the lights were broken off (but still attached). After much discussion and analyzing GoPro footage of the screw/shaft, the surface buoy was recovered. The array line was made off between the 5m and 25m samples and a decision was made to cut the line and recover the samples from 25 m and below. The floats remained attached to the screw during recovery of samples. The samples from 25m-125m were recovered and the buoys were unwrapped from screw after several hours of deliberation, GoPro footage and manually turning the screw. Unfortunately, the 5m samples were lost.

The second array scheduled for recovery was the Sediment trap array which was recovered successfully.

The third array scheduled for recovery was the Net Trap array. However, during the approach, the Net Trap array got hung up on the transducer guard under the bow. The GoPro was again utilized; however we did not get usable footage. The Net trap float line was hung up on the hull and the array line was trailing off to starboard. After much discussion and deliberation on how to proceed we decided to use a weight to try and free the buoys. To do this we grappled the Net Trap line trailing off to the starboard side and tie it off to the rail. Pulled in the slack and tied a knot in the line to attach a 140lb weight. We then lowered the weight and net trap line off the starboard side with the Pitman crane. This freed the buoys from the hull and allowed the array to be recovered successfully with minimal damage.

The fourth array schedule for recover was the Diazotrophy Growth Rate array, which headed off to the east in direction. It took 3 hours to steam towards the array and it was recovered successfully. After the recovery was complete we then steam towards the WHOTS mooring, (Station 50) to conduct the final CTD cast of the cruise. Due to the delays experienced during array recoveries, Station Kaena was cancelled.

One 1000 m CTD cast was completed at Station Kahe. One 200 m CTD, one 100m CTD, two near bottom CTD casts and eleven 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.

The Primary Production, Sediment Trap, and Diazotrophy Growth Rate arrays were deployed and recovered successfully.

The Net Trap array was recovered with minimal damage, however the Gas Array surface buoy and floats were damaged, the array line was cut and the samples from 5m were lost during the recovery.

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

Two Hyperpro casts (three cycles each) were successfully conducted two times around the scheduled 1330-1430 time slot on March 27th and 28th.

The ATE was conducted successfully on March 29th.

The optical package (Sea Bird Seacat/ Fluorometer /LISST), was deployed once in the early morning on March 30th. The cast was conducted successfully.

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

Winds during the cruise were mostly from the ESE with speeds of ~15-20 kts. The seas were 3-5ft from the ESE with a 6-8ft swell from the WNW.

We arrived at Pier 35 for off-loading on March 31st, at 0926 (HST).

The following operations were cancelled or delayed due problems with equipment:

1. One 1000m CTD casts for PUR was cancelled due to delays caused by twists in the CTD cable and the need to re-terminate the Markey .322 wire after the cable jumped the sheave and got pinched by the squirt boom.

The following operations were cancelled or delayed due problems with ship and/or maneuvering:

1. Sediment trap deployment was delayed by approximately 30 mins due to propulsion failure on the port screw.
2. Gas array recovery was delayed (~2hr) due to floats getting wrapped in the starboard screw.
3. Net trap array recovery was delayed (~2hr) due to floats getting caught on the transducer guard on the bow.
4. One out of three Hyperpo casts (three cycles each) were cancelled due to delays experienced during array recoveries.
5. One 2500m CTD cast at Station Kaena was cancelled due to delays experienced during array recoveries.

The following were problems experienced with ships equipment:

1. The safety alarm located on the bow of the KOK was not working.
2. Markey .322 wire had to be re-terminated on 28-29 of March due to CTD package rotational torque.

4. R/V *Ka'Imikai-O-Kanaloa* OFFICERS AND CREW, TECHNICAL SUPPORT

The R/V *Ka'Imikai-O-Kanaloa* continues to provide good ship support for our work. Despite some ship maneuvering issues during array recoveries, Captain Mike Hoshlyk and the entire ship's crew showed enthusiasm, concern, and dedication to our scientific mission. Three items that can be bettered include: 1) a defined protocol for missing persons during safety drills, 2) The bridge phone was not answered numerous

times when trying to contact the watch officer on duty and 3) More so than in the past, the ship has a hard time holding station when a CTD cast is in the water.

Technical support during this cruise was good. The OTG personnel were available at any time to assist in our work during the cruise.

5. DAILY REPORT OF ACTIVITIES (HST)

March 27, 2017
0705 Depart Pier 35
0745 Fire and Abandon Ship Drills
0807 Secured from Drills
0811 Safety Briefing
1018 Arrive Station Kahe
1034 Weight cast to 500m
1056 End of weight cast
1108 Start HyperPro
1156 End of HyperPro
1230 S1C1 1000m CTD cast
1326 S1C1 End
1330 Transit to Station ALOHA

March 28, 2017
0028 Arrive at Station ALOHA
0030 S2C1 200m CTD cast
0103 S2C1 End
0115 Start Sediment Trap array deployment,
0130 Sediment Trap array deployment delay due to propulsion failure on port screw.
0247 Sediment Trap array released: 22°42.28 N, 157°59.72 W
0321 S2C2 100m CTD cast
0341 S2C2 End
0417 Start Primary Production array deployment
0445 Primary Production array released: 22°44.19 N, 157°57.75 W
0525 Start Diazotrophy Growth Rate array deployment
0540 Diazotrophy Growth Rate array released: 22°44.97 N, 157°58.73 W
0600 Arrive at Station ALOHA, Center.
0610 S2C3 near bottom CTD
0811 S2C3 bottom depth 4795db
1006 S2C3 End
1140 S2C4 1000m CTD
1259 S2C4 End
1309 Hand Net Tow Start
1345 Hand Net Tow End
1348 Start HyperPro
1420 End of HyperPro
1423 S2C5 1000m CTD
1538 End S2C5
1658 S2C6 1000m CTD
1815 End S2C6
1820 Transit to recover PP array
1912 Begin PP array recovery: 22°43.03 N, 157°53.60 W
1937 PP array recovered

2008 S2C7 1000m CTD – went to deploy noticed something wrong with cable.
2029 S2C7 delayed due to twists in the cable, payed out 37.5 m of cable to check cable, determined it was recoverable, spooled cable back on winch. No re-termination at this time.
2114 S2C7 1000m CTD Re-deploy
2123 S2C7 Stopped before deployment due to cable hung up on squirt boom. CTD lowered on deck, cable cut and re-terminated. 7737m of cable remaining.
2355 Start Net Trap deployment

March 29, 2017
0011 Net Trap released: 22°42.62 N, 157°57.86 W
0025 S2C7 1000m CTD Re-deploy
0146 End S2C7
0303 S2C8 1000m CTD
0358 End S2C8
0500 Start Gas Array deployment
0525 Gas Array released: 22°45.78 N, 158°00.05 W
0551 S2C9 1000m CTD
0657 End S2C9
0845 S2C10 1000m CTD
0940 End S2C10
1040 Start ATE: 22°46.39 N, 157°54.97 W
1105 End ATE
1120 S2C11 1000m CTD
1213 End S2C11
1245 Net tow
1312 Net tow end
1320 Net tow
1354 Net tow end
1400 S2C12 1000m CTD
1511 End S2C12
1701 S2C13 1000m CTD
1811 End S2C13
1957 S2C14 1000m CTD
2104 End S2C14
2130 Start Net tow
2157 End Net tow
2205 Start Net tow
2232 End Net tow
2256 S2C15 near bottom CTD

March 30, 2017
0058 S2C15 8m off bottom; 22°45.044 N, 157°58.422 W
0252 End S2C15
0310 Deploy Optics package, three casts
0454 Optics package recovered
0456 Transit to recover Gas array
0635 Start Gas array recovery. During approach, array was run over and floats were wrapped around the starboard screw/shaft. The surface buoy was mangled and trapped under the fantail where it repeatedly bashed against the hull. The flag was lost and lights were broken off (but still attached).
0700 After discussing and taking GoPro footage of the screw/shaft, the surface buoy was recovered.
0715 The line was made off between the 5m and 25m sample and a decision was made to cut the line and recover samples from 25 m and below. The floats remained attached to the screw during recovery of samples.

0734 Samples from 25m-125m were recovered.
0925 Buoys were unwrapped from screw after several hours of deliberation, GoPro footage and manually turning the screw.
0949 All buoys recovered and onboard. 5m samples were lost.
0951 Transit to the Sediment Trap array
1045 Begin Sediment Trap recovery: 22°32.128 N, 157°56.133 W
1107 Sediment Trap array recovered
1108 Transit to recover Net Trap array
1130 Net Trap array hung up on the bow, used GoPro to assess.
1145 Net Trap float line hung up potentially on the transducer guard, but could not get good footage with the GoPro. Floats hung up on hull and array line trailing off to starboard. Discussions and deliberations on how to proceed occurred.
1245 Decided to use weight to try and free the buoys. To do this we grapple the Net Trap line trailing off to the starboard side and tie it off to the rail. Pulled in the slack and tied a knot in the line to attach a 140lb weight. We then lowered the weight and net trap line off the starboard side with the Pitman crane.
1311 Buoys freed from the hull… Extra weight worked!!!
1325 Net Trap array recovered: 22°30.887 N, 157°59.311 W
1327 Transit to recover Diazotrophy Growth Rate array
1653 Diazotrophy Growth Rate array recovered: 22°47.882 N, 157°43.879 W
1707 Transit to WHOTS-13 Buoy
1831 Arrive at Station 50
1833 S50C1 200m Yo-Yo
1951 End S50C1, 5 cycles complete
1955 Transit to Pier 35

March 31, 2017
0926 Arrive Pier 35

HOT program sub-components:

Investigator	Project	Institution
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_2 dynamics and intercalibration	SIO
Paul Quay	$DI^{13}C$	UW
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	USC
Ed DeLong	SCOPE: DNA and Viral DNA collection	UH
Dan Repeta	SCOPE: DOM collection	WHOI
Angelique White	SCOPE: Diazotroph Microscopy, Underway C-STAR	OSU
Rhea Forman	Total Nitrogen and Dissolved Organic Nitrogen	UH
Eint Kyi	Investigating the microbial activity and diversity involved with sinking particles at Station ALOHA, Net Trap array deployment	UH
Kendra Turk Mary Hogan	SCOPE: Water collected for diazotrophy growth rate experiments on array and flow cytometry population sorts to enrich UCYN-A using FACS.	UCSC