HOT 320: Chief Scientist Report
Chief Scientist: Carolina Funkey
R/V *Kilo Moana*
July 13-19, 2020

Cruise ID: KM 20-07
Vessel: R/V *Kilo Moana*, University of Hawaii
Master of the Vessel: Captain Joey Daigle
Chief Scientist: Carolina Funkey, University of Hawaii
Marine Technicians: Julianna Diehl, Lance Frymire

1.0 COVID-19 PREVENTION

Due to the current COVID-19 pandemic extra precautions were set in place before and during the cruise to prevent the spread of COVID-19 onboard. UNOLS has provided guidelines which were followed on this cruise. A few of the guidelines are found below. The extensive list can be found in the Pandemic Response Plan.

- Sailing with a minimum science party, one scientist per stateroom (11 scientist).
- All cruise participants sheltered in place for 16 days (June 26th - July 12th) before the cruise.
- All cruise participants were tested for COVID-19 before and during the shelter in place (June 26th and July 10th).

During the cruise all participants:

- wore face masks
- maintained a distance of 6 ft. when possible
- properly disinfected of all workspaces often
- remain in their staterooms as much as possible during non-work hours

2.0 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. Four stations will 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 will be occupied on July 13th 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 July 14th – July 18th.
3) Station 52, the site of WHOTS-16 Mooring (anchor position 22° 40.01'N 157° 56.96'W) will be occupied for about 3-4 hours on July 17th.
4) Deep sediment trap anchor at 22°50.719’ N, 157°55.068’ W will be recovered on July 17th which will take about 3-4 hours.
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 July 18th 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 July 13th. 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. The HyperPro was to be deployed for one yo-yo and two profiles.

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 out at sea for about 96 hours, which is two days longer than a normal cruise. This was to be followed by a 1000 m CTD cast for the preparation of the Primary Productivity Array. The deployment of the free-drifting Primary Productivity Array was to be incubated in situ from dawn to dusk. A 1000 m CTD cast was to be conducted afterwards for a sinking particle experiment.

Plankton net were to be towed between 1000-1400, and 2200-0200 for 30-minute intervals on July 14th,15th and 16th at Station ALOHA. Handheld plankton net (50 µm mesh) were to be towed for 15-20 minutes, moving at ~0.5 knots. These tows were done around noon and midnight on July 15th, July 16th and July 17th.

The HyperPro was to be deployed around noon time on July 14th and 18th. 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 July 15th and late at night on July 17th.

A full-depth (~4740 m) CTD cast was to be conducted after the Optics Cast, 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 16th.

The Gas Array was to be deployed for 24 hours for incubation experiments on July 16th, which was to be recovered on July 17th.

At Station 52 (WHOTS-16 mooring) a one-hour 200 m CTD yo-yo cast was to be conducted.

The deep moored sediment traps, anchored at 22°50.719’ N, 157°55.068’ W, were to be recovered. After the release, the mooring should successfully reach the surface in an hour. The recovery of all three deep sediment traps and the acoustic release should take about 3-4 hours, on July 17th.

An additional 1000 m CTD cast was to be deployed for ancillary science work.

On the morning of the last day at Station ALOHA, July 18th, the WireWalker and the free-floating sediment trap were to be recovered. An additional 1000 m CTD cast was to be deployed for a nutrient enrichment (mixing) experiment.

A trace metal rosette was to be deployed three times during the cruise on July 14th and twice on July 18th to a depth of 350 meters.

Once the above operations were to be completed, the ship was to transit to Station Kaena to conduct a near-bottom CTD cast. After all operations were to be completed, the ship was to transit back to Honolulu Harbor, Pier 35.

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

The following instruments was to be collected data throughout the cruise: shipboard ADCP, thermosalinograph, LISST, transmissometer, pCO2 the meteorological package, Inline C-Star Transmissometer and Imaging FlowCytobot (IFCB).

In addition, two McLane pumps were to be tested for large volume collection of particulate material on different pore size filters and were to be assessed for total mass collected and the evenness of particle distribution on the filters. The two pumps were connected to the underway system and run for about six hours before the experiment was terminated.

3.0. SCIENCE PERSONNEL

Participant	Title	Affiliation	Citizenship
Karin Björkman	Scientist	UH	SWE
Brandon Brenes	Research Assistant	UH	USA
Tim Burrell	Research Associate	UH/SCOPE	NZL
Mathieu Caffin	Post Doc	UH	FRA
Julianna Diehl	Marine Technician	OTG	USA
Dan Fitzgerald	Research Associate	UH	USA
Lance Frymire	Marine Technician	OTG	USA
Carolina Funkey-Chief Sci	Research Associate	UH	USA
Eric Grabowski	Research Associate	UH	USA
Fernando Pacheco	Research Associate	UH	BRA
Tully Rohrer	Research Associate	UH/SCOPE	USA
Blake Watkins	Marine Engineer	UH	USA
Angelicque White	PI	UH	USA

4.0. GENERAL SUMMARY

All operations were completed at Station Kahe. Upon arrival at Station ALOHA, the WireWalker, sediment traps were deployed and drifted Northeast and were recovered on the last day. The primary production array was deployed at dawn and recovered at dusk on the 15th.

One 1000 m CTD cast was completed at Station Kahe. At Station ALOHA, two near bottom CTD casts, nineteen 1000 m CTD casts, and three Trace Metal CTD casts were done at 350 meters. One 5 cycle yoyo CTD cast to 200 m was completed near the WHOTS mooring (Station 52). A near bottom CTD cast was completed at Station Kaena.

Six net tows for the core HOT zooplankton collection were completed successfully; three during the day and three during the night. An additional six handheld net tows were completed three at noon and three at midnight.

The gas array was deployed and drifted Northeast and recovered successfully.

HyperPro casts were completed at Station Kahe and Station ALOHA.

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

The Seaflow did not run on this cruise because it need maintenance, it has now been maintained and ready for the next cruise.

Winds at the beginning of the cruise were from the Northeast at 15-18 kts and which shifted to the East strengthening to 12-15 kts near the end of the cruise. The Seas were 3-6 ft.

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

The R/V *Kilo Moana* recently came back from the shipyard with the newly installed LARS system and a newly renovated Wetlab and IMET lab. The LARS system had a few minor issues that still need to be resolved including docking head mounting over the bridle to alleviate the use of taggers, a few minor alarms going off during the cast, there is a payout meter discrepancy, and there is excessive cable lube that was collecting on the sheaves and rollers which dripped onto the rosette throughout the cruise.

The biggest improvement was the newly renovated Wetlab which now includes a sled system to safely bring in the CTD, new red lights were installed for dark sampling. This set up made sampling and filtering more convenient.

The IMET lab was also updated with a panel system to allow for multiple quick-connect ports to attach to various instruments. Unfortunately, intermittent and reduced flow rates were observed, which impacted the quality of the thermosalinograph data; these data cannot be corrected in post-processing. Efforts to regulate this flow during the cruise were unsuccessful and the problem was immediately communicated to OTG in hopes this issue can be remedied prior to the next HOT cruise.

Captain Joey Daigle and the ship's crew showed flexibility, concern, and dedication to our scientific mission.

Technical support during this cruise was great. OTG personnel were available to assist in our work during the cruise. They were flexible and accommodating. They were well trained on the LARS system and navigated the new system well.

6.0. DAILY REPORT OF ACTIVITIES (HST)

July 13, 2020

- 0635: Departure from the Marine Center
- 0815-0845: Safety Drills
- 0910: Arrive to Station Kahe
- 0925-1015: Weight Cast
- 1103-1132: HyperPro (2 profiles and 1 yoyo)
- 1232-1400: Kahe Station Cast (S1C1)
- 1407: Depart to Station ALOHA
- 2042: Arrive to Station ALOHA
- 2124: Deployed the WireWalker (22º 44.4200'N, 158º 00.033'W)
- 2338: Deployed the Sediment Traps (2 crosses) (22º 45.0710'N, 157º 59.1696'W)

July 14, 2020

- 2405-0120: CTD casts (x2) to test the UVP
- 0200-0258: Primary Production Cast (S2C1)
- 0446: Deployed the Primary Production Array (22º 44.9210'N, 157º 56.3461'W)
- 0831- 0937: Sinking Particles experiment Cast (S2C2)
- 1204-1244: Net Tow (x1)
- 1308-1343: HyperPro (1 yoyo, 2 profiles)
- 1633-1656: CTD to test UVP
- 1800: Transit to Primary Production Array
- 1927: Recovery of the Primary Production Array (22º 47.375'N, 157º 55.7703'W)
- 2013-2030: Trace Metal CTD Cast (to fill bottles for cleaning)
- 2212-2318: Net Tow (x3)
- 2352-0134: Optics Cast

July 15, 2020

- 0301-0705: Deep Cast (PO-1) (S2C3)
- 1050-1224: Shallow Cast (PO-2) (S2C4)
- 1235-1304: Net Tow (x1)
- 1317-1333: Hand Net Tow (x1)
- 1349-1508: PC/PN Cast (S2C5)
- 1700-1805: PPO4 Cast (S2C6)
- 2001-2111: Beach Cast (S2C7)
- 2250-2309: Hand Net Tow (x1)
- 2323-2418: SCOPE DNA Cast (S2C8)

July 16, 2020

- 0158- 0256: Gas Array Cast (S2C9)
- 0408-0429: Deployment of the Gas Array (22º 44.3920'N, 158º 00.1547'W)
- 0503-0612: SCOPE DNA & MC DNA Cast (S2C10)
- 0758-0859: PSi Cast (S2C11)
- 1059-1206: SCOPE Gases Cast (S2C12)
- 1218-1240: Net Tow (x1)

- 1249-1315: Hand Net Tow (x1)
- 1400-1500: ATP Cast (S2C13)
- 1659-1753: PPO4 and ATP comparisons Cast (S2C14)
- 2003- 2103: HPLC Cast (S2C15)
- 2108-2228: Net Tow (x1)
- 2237-2259: Hand Net Tow (x1)
- 2222-0241: Deep Cast #2 (S2C16)

July 17, 2020

- 0415-0442: Recovery of the Gas Array (22º 47.4374'N, 157º 48.4451'W)
- 0730-0810: PIC Cast (S2C17)
- 0916-1016: WHOTS Cast (S52C1)
- 1227-1254: Hand Net Tow (x1)
- 1509: Released the transducer out of the water for the Deep Sediment Trap
- 1556: Mooring reached the surface
- 1602-1727: Recovery of the Deep Sediment Trap (22º 50.76'N, 157º 55.24'W)
- 1802: Open Cast for Ancillary Science (S2C18)
- 2200-2236: Optics Cast #2
- 2239-2317: Hand Net Tow (x1)
- 2323-0100: Optics Cast #3

July 18, 2020

- 0510-0527: Recovery of the WireWalker (22º 57.1996'N, 157º 45.9229'W)
- 0609-0629: Recovery of the Sediment Traps (23º 00.6340'N, 157º 51.9241'W)
- 1000-1044: Water for Mix Experiment Cast (S2C19)
- 1053-1132: Trace Metal Cast for filtering
- 1218-1312: HyperPro (1 yoyo, 2 profiles)
- 1402-1426: Trace Metal Cast for filling
- 1430: Transit to Kaena
- 2200: Arrive to Kaena
- 2213-0010: Kaena Station Cast (S6C1)

July 19, 2020

- 0020: Transit to Honolulu
- 0755: Arrive to Pier 35

HOT program sub-components:

Investigator	Project	Institution
Angelicque White	Core Biogeochemistry	UH
Dave Karl	SCOPE-biogeochemistry and particle flux	UH
John Dore	Biogeochemistry QA/QC	MSU
James Potemra	Hydrography	UH
Mike Landry	Zooplankton dynamics	SIO
Ricardo Letelier	Optical measurements	OSU
Ancillary programs:		
Virginia Ambrust	SCOPE: Seaflow	UW
Karin Björkman (Karl)	Deep sea ATP sampling	UH
Matt Church	Diversity and activities of nitrogen-fixing microorganisms	UM/FLBS
Ed DeLong	SCOPE: DNA and Viral DNA collection	UH
Andrew Dickson	CO_2 dynamics and intercalibration	SIO
Sara Ferrón-Smith	Determination of gross primary production from the euphotic zone in situ, using the drifting primary production array	UH
Eric Grabowski (Karl)	Particulate matter collection	UH
Nick Hawco	Trace Metal water collection/filtration	UH
Robert Letcher	Transparent exopolymer and phytoplankton vertical migration as sources for preformed nitrate anomalies in the subtropical N. Pacific Ocean	UNH
Paul Quay	$DI^{13}C$	UW
Dan Repeta	SCOPE: DOM collection	WHOI
Angelicque White	SCOPE: C-STAR, IFCB, UVP	UH
Sam Wilson	Reduced gases in the upper ocean: The cycling of methane, sulfide and nitrous oxide.	UH
John Zehr	Samples for unicellular cyanobacterium	UCSC