HOT 322: Chief Scientist Report
Chief Scientist: Dan Sadler
R/V *Kilo Moana*
August 28 - September 6, 2020

Cruise ID: KM 20-10
Vessel: R/V *Kilo Moana*, University of Hawaii
Master of the Vessel: Captain David Martin
Chief Scientist: Dan Sadler, 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.

- Sailed with a minimum science party, one scientist per stateroom. And exception was granted for this cruise to have two scientists share the chief scientist stateroom.
- All cruise participants self-isolated according to the HOT Risk Mitigation Plan before the cruise (August 12th – August 28th).
- All cruise participants were tested for COVID-19 two days before the cruise (August 26).

During the cruise all participants:

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

2.0 SCIENTIFIC OBJECTIVES

The cruise objective was to maintain a collection of hydrographic and biogeochemical data at the Hawaii Ocean Time-series (HOT) stations. This cruise also planned to investigate a high chlorophyl region northwest of Station ALOHA.

A copy of the detailed cruise plan is available at:

https://hahana.soest.hawaii.edu/hot/crsplan/HOT_322_KM_Cruise_Plan.pdf

Science operations were planned for 8 stations, in the following order:

1) Station 1, referred to as Station Kahe, is located at 21° 20.6'N, 158° 16.4'W.
2) Stations 20, 21, 22, 23 and 24 along a transect to a high chlorophyl region northwest of Kauai. The station locations were to be determined during the cruise based on current satellite imagery.
3) 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.
4) Station 52, the site of WHOTS-16 Mooring (anchor position 22° 40.01'N 157° 56.96'W).

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
Mathilde Dugenne	Post-Doc	UH	FRA
Dan Fitzgerald	Research Associate	UH	USA
Lance Frymire	Marine Technician	OTG	USA
Lucie Knor	Graduate Student	UH	DEU
Fernando Pacheco	Research Associate	UH	BRA
Tully Rohrer	Research Associate	UH/SCOPE	USA
Dan Sadler-Chief Sci	Research Associate	UH	USA
Ryan Tabata	Research Associate	UH/SCOPE	USA
Blake Watkins	Marine Engineer	UH	USA

4.0. GENERAL SUMMARY

HOT-322 differed from previous HOT cruises in that extra time was allotted to investigate a high chlorophyll region northwest of Kauai. The cruise was loaded and departed on the same day and proceeded to Station Kahe where the LARS system was weight tested and a 1000 m CTD cast completed.

The ship proceeded due west from Station Kahe and began the underway CTD survey approximately halfway between Oahu and Kauai (21° 20.96’ N, 159° 08.69’ W). The underway CTD was deployed approximately every 4 nm along the route. At 21° 20.66' N, 159° 42.02' W, course was altered to the NW to sail between Kauai and Niihau towards a high chlorophyl area. This leg extended to 22° 15.48 ‘N, 160° 01.37’ W. At this point the cruise plan was revised to avoid military training exercises. Based on satellite imagery, a new route to the east of Kauai was selected for the underway survey along with 5 stations for CTD casts, water sampling and a primary production experiment.

Stations occupied were:

- Station 20: 21° 20.66' N, 159° 42.02' W - 1000 m CTD cast
- Station 21: 21° 34' 12" N, 159° 26' 60" W – 1000 m CTD cast
- Station 22: 22° 14' 24" N, 158° 35' 24" W – 1000 m CTD cast
- Station 23: 22° 59' 24" N, 158° 29' 24" W – Optics cast, 2 x1000 m CTD cast, Primary Production Array deployed and recovered, Hyperpro cast, Hand Net Tow.
- Station 24: 23° 26' 24" N, 158° 11' 24" W – 1000 m CTD cast

After departing Station 24, the underway CTD survey was extended to Station ALOHA.

Upon arrival at Station ALOHA, the WireWalker, floating sediment traps, and IRS sediment traps were deployed just south of the station circle. They drifted northward and were recovered on the last day of the cruise just northeast of Station ALOHA. A primary production array and a gas array experiment were also completed at Station ALOHA.

At Station ALOHA, two near bottom CTD casts, eighteen 1000 m CTD casts, and one cast to 100 m were completed. One 5 cycle yoyo CTD cast to 200 m was completed near the WHOTS mooring (Station 52).

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.

Hyperpro operations were conducted twice at Station ALOHA. Once during the primary production experiment and once near the WHOTS mooring. Each operation consisted of 2 deep casts and a 5 cycle Yo-Yo cast to 20m.

The ADCP, underway fluorometer, transmissometer and the ship's meteorological suite ran without interruption during the cruise. The data from the thermosalinograph still had a few issues due to the pressure flow system causing the data to be segmented.

Weather during the cruise was generally fair with some overcast skies and rain near the end. The cruise started with winds from the west at 10-15 knots then swinging to the northeast, becoming 25-30 knots before backing off to 10-15 knots. The last day saw an increase back to 20-25 knots.

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

The R/V *Kilo Moana* continues to maintain very good ship support for our work. The LARS system worked well throughout the cruise giving very consistent CTD cast times that allowed us to stick to our schedule despite winds over 30 knots. We look forward to full implementation of the docking head which will allow for "hands-free" deployments and recoveries.

In the IMET lab the pressure flow system is still experiencing intermittent and reduced flow rates, which impacted the quality of the thermosalinograph data. This issue has been discussed with OTG and they believe they can get it fixed for the next HOT cruise.

Captain David Martin 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.

6.0. DAILY REPORT OF ACTIVITIES (HST)

August 28, 2020

- 0800 - Began crane operations
- 0900 - Began hand loading
- 1355 - Departed Pier 35
- 1430 - Captain's briefing followed by safety drill and small boat drill
- 1558 - Transiting to St. Kahe
- 1738 - Arrival at St. Kahe
- 1752 to 1869 - weight cast
- 1948 to 2042 - S1C1 Kahe CTD cast
- 2050 - begin transit westward to survey track
- 2135 - Brief ship wide power outage. Repaired.
- 2320 - Test cast of underway CTD with dummy probe.

August 29, 2020

- 0007 Began underway CTD survey at 21 20.963N, 159 08.694W
- 0709 Turned onto NW leg of survey after completing 17 casts
- 0830 Pumped tanks
- 0911 - 1400 Completed survey through cast 41
- 1444 - Area north closed for military operations. Changed study area to east side of Kauai
- 1700 Began new survey to Station 20
- 2210 - Arrived Station - 20
- 2230 to 2327 - S20C1 1000 m CTD cast

August 30, 2020

- 0000 - Begin underway CTD survey to Station 21
- 0220 - Arrive Station 21
- 0244 to 0328 - S21C1 1000 m CTD cast
- 0400 Begin underway CTD transit to Station 22
- 1146 - Arrive Station 22
- 1200 to 1300 - Hyperpro. 2 deep casts and 1 5x yoyo to 20 m
- 1355 to 1500 - S22C1 1000 m CTD cast
- 1527 - Begin underway CTD transit to Station 23
- 2146 - Arrive Station 23
- 2205 to 2251 - S23C1 1000 m CTD cast
- 2315 - Begin Optics cast

August 31, 2020

- 0058 - End of Optics cast
- 0100 - Pumped tanks
- 0215 to 0307 - S23C2 1000 m CTD cast to collect water for primary production array
- 0403 to 0503 - Primary Production array deployed at 22 59.475 N, 159 29.311 W.
- 0510 - Begin underway CTD transit to Station 24

- 1058 to 1153 - S24C1 1000 m CTD cast
- 1248 to 1313 - Hyperpro cast
- 1338 to 1401 - Hand net tow 3
- 1418 Transit back to PP array
- 1902 to 1917 - Recovered the primary production array at 23 03.604 N, 158 34.338 W
- 1945 - Transiting to St ALOHA with underway CTD ops
- 2224 to 2258 - Hand net tow at 22 55.557 N, 158 21.352 W
- 2300 - resumed transit to St. ALOHA conducting underway CTD cast

September 1, 2020

- 0325 - Arrived Station ALOHA continued outside the circle to pump tanks
- 0727 - Wirewalker deployed at 22 39.00 N, 158 01.00 W
- 0847 - Sediment Traps deployed at 22 38.91 N, 157 89 W
- 0919 - IRS Sediment Traps deployed at 22 38.90 N, 157 58. 07 W
- 1233 to 1300 - Hand net tow
- 1305 - relocated 1.5 nm north of WHOTS mooring
- 1331 to 1448 - S2C1 1000 m CTD cast for high density DCM sampling
- 1455 - Transit to pump tanks
- 1814 to 1911 - S2C2 1000 m CTD cast for high density DCM sampling
- 2232 to 2307 - hand net tow

September 2, 2020

- 0212 to 0309 - S2C3 1000 m CTD cast for primary production
- 0456 - primary production array deployed at 22 45.00 N, 157 58.91 W
- 0515 to 0617 - S2C4 1000 m CTD cast for particulate study
- 0629 - Transit to pump tanks
- 0838 to 0940 - S2C5 1000 m CTD cast for SCOPE DNA
- 1127 - Seaglider deployed at 22 44.998 N, 158 04.026 W.
- 1206 to 1237 - net tow
- 1244 to 1314 - hand net tow
- 1325 to 1415 - Hyperpro cast
- 1437 - Transit to pump tanks
- 1900 to 1916 - Primary Production Array recovered at 22 47.66 N, 157 58.36 W.
- 2205 to 2304 - 2 net tows completed
- 2309 to 2343 - hand net tow
- 2356 to 0133 - Optics cast

September 3, 2020

- 0134 - transit to pump tanks
- 0309 to 0658 - S2C6, first PO deep CTD cast
- 1050 to 1229 - S2C7, PO shallow cast
- 1244 to 1337 - 2 net tows completed
- 1358 to 1512 - S2C8 1000 m CTD cast for PC/PN
- 1709 to 1803 - S2C9 1000 m CTD cast for PPO4

- 1810 - Transit to pump tanks
- 2018 to 2120 - S2C10 1000 m CTD cast for BEACH
- 2208 to 2236 - Net Tow
- 2310 to 0001 - S2C11 1000 m CTD cast

September 4, 2020

- 0209 to 0301 - S2C12 1000 m CTD cast for Gas Array
- 0435 to 0501 - Deployed Gas Array at 22 46.95 N, 157 58.72 W.
- 0522 to 0625 - S2C13 1000 m CTD cast for DNA
- 0758 to 0855 - S2C14 1000 m CTD cast for PSi
- 1054 to 1151 - S2C15 1000 m CTD cast
- 1227 to 1259 - Hand net tow
- 1357 to 1402 - S2C16 1000 m CTD cast for ATP
- 1717 to 1805 - S2C17 1000 m CTD cast
- 2008 to 2100 - S2C18 1000 m CTD cast
- 2203 to 2235 - Hand net tow
- 2315 - Begin S2C19 near bottom CTD cast, 2nd deep cast

September 5, 2020

- 0234 - End of deep cast
- 0415 to 1500 - Sediment traps recovered at 22 51.496 N, 157 53.322 W
- 0506 - Raining on deck
- 0520 to 0542 - Gas Array recovered at 22 50.355 N, 157 54.569 W
- 0614 to 0635 - IRS traps recovered at 22 54.304 N, 157 57.418 W
- 0655 to 0715 - Wirewalker recovered at 22 51.995 N, 157 55.755 W
- 0720 - Transit to WHOTS mooring
- 1037 to 1143- S52C1 250 m CTD yo yo cast
- 2300 to 2332 - Hyperpro cast
- 1337 to 1354 - S2C20 CTD cast to 100 m
- 2005 to 2046 - S2C21 1000 m CTD cast
- 2120 - Transit back to port

September 5, 2020

- 0753 - Arrive Pier 35, Unloaded Ship

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
Paul Quay	$DI^{13}C$	UW
Dan Repeta	SCOPE: DOM collection	WHOI
Angelicque White	SCOPE: C-STAR, IFCB, UVP, IRS Traps	UH
John Zehr	Samples for unicellular cyanobacterium	UCSC
Mathilde Dugenne	Mixotrophic Grazing Experiments	UH
Matthieu Caffin	N2 fixation at sea based on Ar induced H2 production	UH
Jacob Waldbauer	Tracking marine diazotrophy with isotope-labeling proteomics	UChicago
Allison Coe	Prochlorococcus on particles and dark survival	MIT
Sonya Dyhrman	Physiological ecology of diatom diazotroph associations using metatranscriptome samples.	LDEO
Danielle Hull	SOEST Laboratory of Analytical Biogeochemistry Nutrient Reference Materials	UH