Hawaii Ocean Time-series
HOT-256 Cruise Plan

Cruise ID: KM 13-19
Vessel: R/V *Kilo Moana*, University of Hawaii
Master of the Vessel: Captain Gray Drewry
Chief Scientist: Fernando Santiago-Mandujano, University of Hawaii
OTG Marine Technicians: Trevor Goodman, Trevor Young

Kilo Moana phone number: 842-9817, cell # 864-0065, satellite # 001-870-336-956510
Marine Center phone number: 842-9813

Loading: October 25, 2013@0900
Departure: October 26, 2013 @0900 (Science personnel on board by 0800).
Arrival: October 30, 2013 @ 0800

1.0 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 October 26th 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 will be occupied on October 27th to 29th.
3) Station 52, the site of WHOTS-10 Mooring (anchor position 22° 40.12'N 157° 57.01'W) will be occupied on October 29th 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 will be occupied on October 29th for about 2 hours.

1.1 SCIENTIFIC OPERATIONS

Station	Activities
Kahe (sta. 1)	Weight Cast, Hyperpro cast, CTD cast (1000 m)
ALOHA (sta. 2)	Sediment traps, gas array, net tows, CTD operations, primary productivity measurements, ACS/AC9/FRRf, misc. experiments.
WHOTS mooring station (Sta. 52)	One CTD cast (yo-yo to 200 m), surface instrument intercomparisons.
Kaena (sta. 6)	One CTD cast (near bottom)
Underway/continuous	ADCP, thermosalinograph, pCO2 system, fluorometry, and meteorology.

2.0. SCIENCE PERSONNEL

Participant	Title	Affiliation/HOT Group
Susan Curless	Research Associate	UH/BEACH
Dan Sadler	Research Associate	UH/BEACH
Brett Updyke	Research Associate	UH/BEACH
Adriana Harlan	Research Associate	UH/BEACH
Lance Fujieki	Research Associate	UH/BEACH
Blake Watkins	Marine Engineer	UH/BEACH
Stuart Goldberg	Postdoctoral Researcher	UH/BEACH
Christopher Schvarcz	Graduate Student	UH
Sara Thomas	Graduate Student	UH
Jefrey Snyder	Marine Technician	UH/PO
Fernando Santiago-Mandujano	Research Associate	UH/PO
Cameron Fumar	Research Associate	UH/PO
Daniel McCoy	Data Assistant	UH/PO
Eunjung Kim	Graduate Student	UH/PO
Kari Barber	Undergrad Student	UH/PO
Trevor Goodman	Marine Technician	OTG
Trevor Young	Marine Technician	OTG

3.0. SUMMARY SCHEDULE

21 October	Pre-cruise planning meeting 11030 hrs.
25 October	Ship loading at 0900 hrs.
26 October	Depart from Snug harbor at 0900 hrs. **Science personnel on board by 0800.**
26 October	Station 1 Kahe Pt. operations.
27-29 October	Station ALOHA operations. Station 52 CTD yo-yo cast, Station Kaena
30 October	Arrive back to Snug Harbor. Full offload

4.0. OPERATIONAL PLANS

4.1. Station Kahe (21°20.6'N, 158°16.4'W)

A 1000 lb. weight-test cast, one CTD cast to 1000 m, and a Hyperpro cast (Sect. 4.2.7) will be conducted at this location on October 26th. The A-frame, CTD crane and CTD winch will be required for these operations.

4.2. Station ALOHA (22°45'N, 158°W with 6 nm radius)

4.2.1. Upon arrival to Station ALOHA, the sediment traps will be deployed. After the sediment trap deployment is complete, one 1000-m CTD cast will be conducted before deploying the Primary Productivity array (Sect. 4.2.3). These operations will be followed by a near-bottom CTD cast.

4.2.2. Sediment trap array deployment

Upon arrival to Station ALOHA, the floating sediment traps will be deployed at a location within Station ALOHA circle determined by forecasted current conditions and real-time ADCP data (if available). The array will be deployed from the stern, using the A-frame and Sea-Mac winch. Power requirement for the winch is 440 VAC, three phase at 10 amps. After deployment we request that the Bridge verify that the radio transmitters are functioning and directionally correct.

The array will drift for about 53 hours before recovery. The array is equipped with 2 ARGOS satellite transmitters (platform #'s 01833, 60481), 2 strobe lights, and 2 radio transmitters (channel 68: 156.625 MHz, and 72: 156.425 MHz). Daily positions of the array shall be transmitted by email directly to the ship (argosfix@km.soest.hawaii.edu, password: argosfix), therefore the ship will **not** need to keep within site of the array until the time of the recovery. Assistance from the Bridge is requested in plotting the drift track of the array. We request the use of the ship's radio direction finder for locating the array before recovery.

After deployment of the sediment trap array, the ship shall continue with CTD cast operations to prepare water for the Primary Productivity Array and other experiments.

4.2.3 Primary Production experiment

Samples for the primary productivity experiment will be collected from the rosette. Before dawn (sunrise 0634 hrs on October 27th), a free drifting incubation array will be deployed from the stern. We request the use of the A-frame for this operation and will also use the Sea-Mac winch. The array is equipped with two ARGOS satellite transmitters (platform #'s 3028, 60482 emailing positions to argosfix@km.soest.hawaii.edu, password: argosfix), strobe lights and a radio transmitter (156.425 MHz). The **ship shall keep within site of the array** while performing CTD operations for the last 6 hours of the approximately 12-hour time the array will be in the water unless the array drifts outside of the ALOHA circle. If the array drifts out of the circle, the ship should return inside the circle to conduct CTD casts, and the monitoring of the array will be coordinated with the watch leader. The array will be recovered just at sunset (1757 hrs). CTD operations shall continue after recovery.

All radioactive waste generated by the experiment shall be returned to the University of Hawaii. Only qualified personnel shall handle radioactive material.

4.2.4. Water column measurements

Vertical profiles of temperature, conductivity and dissolved oxygen will be made with an instrument package consisting of a Sea-Bird CTD attached to a 24-place rosette with 12 liter Bullister sampling bottles. We will need the ship's A-frame and trawl winch system for these operations. Water samples for biogeochemical measurements will be collected on each CTD cast. The cast after the deployment of the Primary Productivity Array shall be made to the near bottom (approximately 4740 m). Following this cast, a series of 1000-m casts shall be made every 3 hours for a 36-hour period. It is highly desired that this burst sampling be done without interruption and we request the ship to maintain position within the study area for that period of time, and repositioning to the center of the Station before each cast whenever possible.

Whenever pumping of the ship's tanks is needed, it must be conducted outside the circle that defines station ALOHA (Sect. 1.0), down current, but not near drifting arrays. To avoid disruptions in the schedule, this operation should be coordinated with the chief scientist or the watch leaders **(Jefrey Snyder, Brett Updyke)**.

4.2.5. Gas Array deployment

A second free drifting incubation array will be deployed on October 28th at Station ALOHA. Samples for the gas array will be collected from Station 2 CTD cast 9. We request the use of the A-frame for this operation and will also use the Sea-Mac winch. The array is equipped with two ARGOS satellite transmitters (platform #'s 03028, 60482 emailing positions to argosfix@km.soest.hawaii.edu, password: argosfix), a strobe light and a radio transmitter (156.425 MHz). The ship will **not** need to keep within sight of the array until the time of the recovery, approximately 25 hours after its deployment. Assistance from the Bridge is requested in plotting the drift track of the array.

4.2.6. Zoo net tows

A plankton net will be deployed from the stern and shall be towed for half-hour periods. Half-hour periods are scheduled around noon and midnight on October 27th and 28th (see schedule) for a total

of six slots. The A-frame and capstan will be needed for this operation. B. Watkins will be in charge of these operations.

4.2.7. Hyperpro

The Hyperpro is a profiling unit with one up-looking and one down-looking hyperspectral radiometer, a WET Labs ECO-BB2F triplet (measuring Chlorophyll-a fluorescence and backscattering in the blue and red wavelengths), temperature and conductivity sensors. This instrument also incorporates a ship mounted surface radiometer. Around noon on October 26th, 27th, and 29th, the Hyperpro will be deployed from the stern through a small block hung from the A-frame. The instrument is hand-lowered and retrieved with assistance from the winch.

4.2.8. ACS/AC9/FRRf/LISST

An optical package including a Wet Labs AC9 that measures water column spectral absorption and attenuation at nine wavelengths, a Chelsea Fast Repetition Rate Fluorometer (FRRf), a SeaBird Seacat with temperature, conductivity, fluorometer, and pressure sensors, and a LISST particle size and distribution analyzer will be deployed two times on October 29th.

Each deployment will consist of two up and two down profiles to a target depth of 200 m at a constant speed of 10 m/min during both the downcast and upcast. An instrument soaking period at just below the surface will be required between the two profiles. The A-frame and capstan will be needed for this operation.

4.2.9. Automated Trace Element Sampler (ATE)

On the morning of October 28th, the ATE will be hand deployed off the back deck to a depth of 10 m to collect a trace-metal free sample. The ATE will be recovered after 30 minutes in the water. The ATE is approximately 1' tall and 4'' in diameter, weighting 5 lbs.

If the ship has been stationary at ALOHA for previous cruise activities, it is requested that the ship steams approximately 10-15 minutes up current from current position prior to the ATE deployment to limit contamination of the trace metal sample from the ship's hull.

4.3 Floating gas array and sediment trap recovery

In the early morning of October 29th, we shall transit for the recovery of the Gas Array. The A-frame and the Sea-Mac winch will be needed to retrieve the Gas Array. After the array is recovered, the ship shall transit to recover the floating sediment trap array. After the array is recovered, the ship shall transit to Station ALOHA to conduct an AC9/FRRF cast. After these operations are completed the ship shall transit to Station 52 and conduct one 200 m CTD yo-yo cast, followed by a Hyperpro cast inside the ALOHA circle.

4.4 Station 52 - WHOTS-10 Mooring

The anchor position of the WHOTS-10 mooring is 22° 40.12'N 157° 57.01'W. The watch circle of the buoy is about 2 nautical miles. Generally, the buoy stays on the edge of the watch circle. The buoy has a radar reflector that should be seen on radar. It should be detectable even in rough seas with some effort.

4.5.1 CTD yo-yo cast (subsurface instrument intercomparison)

One 200-m CTD yo-yo cast with at least 5 full cycles will be conducted near the WHOTS mooring on October 29th for subsurface instrument intercomparison. This cast should be conducted downwind/down current, and about 200 m from the mooring.

4.5.2 Surface instrument intercomparison

While on station, the ship's meteorological system shall be in operation for surface instrument intercomparisons with the WHOTS mooring. Once the yo-yo cast is completed, the ship shall transit to Station Kaena.

4.6 Station Kaena (21° 50.8'N, 158° 21.8'W)

A near-bottom CTD cast (~2500 m) will be conducted at this location in the evening of October 29th. Once the CTD cast is complete, the ship shall return to Snug Harbor.

4.7 Acoustic Doppler Current Profiler

The ship's acoustic Doppler current profiler (ADCP) will be in operation during the duration of the cruise. The OTG electronics technicians will be in charge of the ADCP system.

4.8 Thermosalinograph, pCO_2 system, Fluorometer, and meteorological system

The ship's thermosalinograph, pCO_2 system and fluorometer sampling the uncontaminated seawater supply system will be in operation during the duration of the cruise while the ship is outside of Snug Harbor. Salinity samples to calibrate the thermosalinograph will be taken from the intake hose at 4-hour intervals throughout the duration of the cruise by the science personnel. The ship's meteorological system shall be in operation throughout the cruise. Access to real-time underway data through the ship's network will be required. The OTG technicians will be in charge of the thermosalinograph, pCO_2 system, Fluorometer, and meteorological suite operations.

4.9 Seaglider Operations

One seaglider (sg512) is currently deployed at Station ALOHA. Throughout the cruise, it will be diving and profiling in the Station ALOHA area and at times transiting within the circle boundaries of Station ALOHA. The seaglider GPS fixes and alert info will be sent to the onboard email address seaglider@km.soest.hawaii.edu which is accessible both by the science party and Captain.

ARGOS message ref # - sg512 ARGOS - 90993

It is requested that when the KM is within the circle, the OTG (sisprog) initiated cronjob (running a script that forwards the ship's position) send out the message to poulos@soest.hawaii.edu once every two hour period.

5.0 EQUIPMENT

5.1 The HOT science party shall be bringing the following

1. Seabird CTD system, all sensors, deck boxes and computer CTD acquisition systems
2. Rosette and 24 12L Bullister sampling bottles, and all associated spare parts
3. One 20 ft. laboratory van with assorted equipment for radioisotope and general use (Van #23)
4. One 12 ft. equipment van ("Blue" Van)
5. Distilled, deionized water and all required chemicals and isotopes
6. Large vacuum waste container
7. Liquid nitrogen dewar
8. Drifting sediment trap array with strobe lights, satellite and radio transmitters, floats, weights
9. Kevlar line, polypropylene line
10. Sediment traps and crosses
11. Drifting primary production array and gas array with light and radio transmitter, floats, weights, polypro. line, spare buoy, etc.
12. Hyperpro and other optical measuring instruments.
13. Oxygen titration system
14. Plankton nets and towing lines
15. Desktop and laptop personal computers
16. Assorted tools
17. All required sampling bottles
18. Deck incubation system
19. Pertinent MSDS

20. Chest refrigerator incubator chamber (to be located in Staging Bay)

5.2 We will need the use of the following ship's equipment:

1. A-frame
2. A-frame block assembly
3. Trawl winch with conducting wire for CTD
4. Electric power for winches (440 VAC, 3 phase, 60 Amp breaker) and vans (208 VAC single phase at 60 amps for lab van, 110 VAC 10 amps for equipment van)
5. Radio direction finder
6. Space on the main deck for one equipment van
7. Space on upper deck for two laboratory vans
8. Space on upper deck for incubators
9. Hand-held VHF transceivers
10. Precision depth recorder
11. Shackles, sheaves, hooks and lines
12. Shipboard Acoustic Doppler Current Profiler
13. Thermosalinograph, *p*CO2 system, and Fluorometer
14. Meteorological suite
15. Copy machine
16. Grappling hooks and line
17. Laptop with Nobeltec charting software and GPS feed
18. Running fresh water and seawater hoses
19. Electronic mail system
20. GPS system
21. Uncontaminated seawater supply
22. Small capstan (~ 10 m/min)
23. Underway/on-station data acquisition system for meteorological instruments, ADCP, thermosalinograph, fluorometer, *p*CO2 and access to real-time data through the network.
24. OTG's 24-place rosette, and 24 12L water sampling bottles (to be used as spare)
25. 1300 lb weight.
26. Large Sea-Mac winch (Mod. 1025 EHS). 60 Amp Hubbel plug/connector (440 VAC, 3 phase, 60 Amp breaker)
27. WetLabs C-Star Transmissometer

Ship: R/V *KILO MOANA* **HOT 256 CTD CASTS** **Date: October 26 –30, 2013**

Cast		Samples	#Bottles
Kahe Pt.			
s1c1	1000 m	O_2, Temp, DIC/Alk, Nuts, Chl a, LLN, LLP, DOC, FCM, Salts	24
Station ALOHA			
s2c1	1000 m	Primary Production, Salts	22
s2c2	4740 m (PO-1)	O_2, Temp, DOC, DIC/Alk, Nuts, Salts	24
s2c3	1000 m (PO-2)	O_2, Temp, DOC, DIC/Alk, Nuts, Salts	24
s2c4	1000 m	PC/PN, ST(1@200,250,300,400,450,500,550,600), Salts	22
s2c5	1000 m	PPO4, ST(1@650,700,750,770,800,850,900,1000), Salts	22
s2c6	1000 m (BEACH)	O_2, Temp, DIC/Alk, Nuts, LLN, LLP, DOC, Keeling, Quay, Salts,	23
s2c7	1000 m	PUR, Salts	10
s2c8	1000 m	Gas Array(2@5,25,45,75,100,125), Salts	14
s2c9	1000 m	MB(6@300,4@1000), Salts	13
s2c10	1000 m	PSi, MC(1@5,25,45,75,100,125,150,175), Salts	18
s2c11	1000 m	CS(2@5,25,45,75,100,125,150,175), Salts	19
s2c12	1000 m	ATP, MC(1@200,300,500,770), Salts SW(1@1000,900,800,700,600,500,400,300,200)	23
s2c13	1000 m	MC(1@5,25,45,75,100,125,150,175), Salts SW(pb MC depths)	10
s2c14	1000 m	HPLC, Chl a, Slides, Salts	22
s2c15	4740 m (PO-3)	Oxygen, MC(1@1000,2000,3000,4000), BU(4@4000), Salts	16
WHOTS Mooring			
s52c1	200 m yo-yo	ST(12@200), SG(10@10), DS(1@5)	23
Kaena			
s6c1	2400 m	Chl, Salts	13

MC=Matt Church, **SW=**Sam Wilson, **MB**=Mark Brzezinski, **CS**=Chris Schvarcz, **ST**=Sara Thomas, **BU**=Brett Updyke, **SG**=Stuart Goldberg, **DS**=Dan Sadler

Ship: R/V *KILO MOANA* HOT 256 Dates: October 26 – 30, 2013

TIME	Saturday 10/26	Sunday 10/27	Monday 10/28	Tuesday 10/29	Wednesday 10/30
0000					
0100					
0200		S2C1 PP	S2C8 Gas		
0300				AC9/FRRF	
0400		Deploy PP Array	Deploy Gas Array		
0500		S2C2 PO-1	S2C9 Open	Transit gas array	
0600				Recover array Transit sed traps	
0700				Recover sed traps	
0800			S2C10 PSi	Transit ALOHA	Arrive Snug
0900	Depart Snug				
1000		Net Tow	Net Tow ATE	AC9/FRRF	
1100	Arrive Kahe Weight cast	S2C3 PO-2 (Begin 36 hr)	S2C11 Open	Transit Sta 52	
1200	S1C1 Kahe		Net Tow	S52C1 WHOTS	
1300		Hyperpro			
1400	Hyperpro	S2C4 PC/PN	S2C12 ATP	Hyperpro	
1500	Transit ALOHA			Transit St. Kaena	
1600					
1700		S2C5 PPO4	S2C13 Open		
1800		Recover PP array			
1900					
2000		S2C6 BEACH	S2C14 HPLC		
2100				S6C1 Kaena	
2200		Net Tow Net Tow	Net Tow		
2300	Arrive ALOHA Deploy sed traps	S2C7 PUR	S2C15 PO-3 (end 36 hours)	Transit Snug	

October 27th: Sunrise 0634, Sunset 1757

6.0 HOT-256 Watch Schedule

0300-1500

Adriana Harlan **–** *Water Boss*
Dan Sadler
Lance Fujieki *–Tag*
Jefrey Snyder*–* **–**Watch Leader - *Tag*
Cameron Fumar*– Console*
Kari Barber **–** *Alt Tag*

1500-0300

Susan Curless *–Water Boss*
Brett Updyke – Watch Leader – *Tag*
Fernando Santiago-Mandujano – Chief Scientist *–Tag*
Daniel McCoy *– Console*
Eunjung Kim *– Alt. Tag*

0900-2100

Stuart Goldberg

At Large

Blake Watkins
Sara Thomas
Christopher Schvarcz

OTG

Trevor Goodman
Trevor Young