

Hawaii Ocean Time-series HOT-233 Operational Cruise Plan

Cruise ID: KM 11-20

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

Master of the Vessel: Captain Richard Meyer

Chief Scientist: Susan Curless, University of Hawaii

OTG Marine Technicians: Dan Fitzgerald and Ben Colello

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

Marine Center phone number: 842-9813

Loading: July 14, 2011, Blue Equipment Van

July 17, 2011 @ 0900, General Loading –#23 and #24 lab vans, incubators, hand carry gear

Departure: July 18, 2011 @ 0800, all science personnel on board by 0700.

Arrival: July 22, 2011 @ 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 the first day of the cruise 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 during the 2nd, 3rd, and 4th days of the cruise.
- 3) Station 52, the site of WHOTS-8 Mooring, approximate position 22°40.1572'N, 157°57.0225'W will be occupied on the 4th day of the cruise 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 the 4th day of the cruise for about 2 hours.

1.1 SCIENTIFIC OPERATIONS

<u>Station</u>	<u>Activities</u>
Kahe (sta. 1)	Weight Cast, Hyperpro cast, CTD cast (1000 m), 20 m Niskin cast.
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)	CTD cast (near bottom)
Underway/continuous	ADCP, thermosalinograph, pCO ₂ system, fluorometry, and meteorology.

2.0. SCIENCE PERSONNEL

Participant	Title	Affiliation/HOT Group
Daniela Böttjer	Postdoctoral Researcher	UH/CMORE
Susan Curless	Research Associate	UH/BEACH
Lance Fujieki	Computer Specialist	UH/BEACH
Scott Grant	Research Associate	UH/CMORE
Adriana Harlan	Research Associate	UH/BEACH
Aric Mine	Graduate Student	University of Chicago/BEACH
Shimi Rii	Graduate Student	UH/BEACH
Dan Sadler	Research Associate	UH/BEACH
Brett Updyke	Research Associate	UH/BEACH
Daniela del Valle	Postdoctoral Researcher	UH/CMORE
Donn Viviani	Graduate Student	UH/BEACH
Brenner Wai	Graduate Student	UH/CMORE
Blake Watkins	Marine Engineer	UH/BEACH
Sam Wilson	Postdoctoral Researcher	UH/CMORE
Cameron Fumar	Research Associate	UH/PO
Jefrey Snyder	Marine Technician	UH/PO
Craig Nosse	Research Associate	UH/PO
Alison Andrews	Undergraduate Intern	UH/PO
Reagan Grant	Volunteer	PO
Jim Foley	Marine Educator	UH/CMORE
Nick DeBoer	Teacher	Punahou School
Charlotte Godfrey-Romo	Teacher	Hilo High School
Shelia Folan	Teacher	Florin High School
Dan Fitzgerald	Marine Technician	OTG
Ben Colello	Marine Technician	OTG

3.0. SUMMARY SCHEDULE

7 July	Pre-cruise planning meeting 1100 hrs.
14 July	Blue Equipment Van loading.
17 July	Ship loading at 0900 hrs.
18 July	Depart from Snug harbor at 0800 hrs. Science personnel on-board by 0700.
18 July	Station 1 Kahe Pt. operations.
18 July – 22 July	Station ALOHA operations. Station 52 CTD yo-yo cast, Station Kaena
22 July	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, a Hyperpro cast (Sect. 4.2.7), and a 20 m Niskin cast will be conducted at this location on July 18th. The A-frame, Sea-Mac winch, CTD crane and CTD winch will be required for these operations. A line with a small weight (~10lbs) deployed through the A-frame shall be used to attach the Niskin bottle. The Niskin will be deployed to a depth of approximately 20 m and will be lowered and retrieved by hand.

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, four 200-m casts 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, to be determined enroute to ALOHA by local current conditions. 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 72, 156.625 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 0558 hrs on July 19th), 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 60484, 84857, emailing positions to argosfix@km.soest.hawaii.edu, password: argosfix), strobe lights and a radio transmitter (channel 74, 156.725 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 (1919 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 CTD crane and winch 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 continuously 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). 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 the third day of the cruise at Station ALOHA. Samples for the gas array will be collected from Station 2 CTD cast 11. 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 60484, 84857), emailing positions to argosfix@km.soest.hawaii.edu, password: argosfix), a strobe light and a radio transmitter (channel 74, 156.725 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 the second, third, and fourth days (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.

4.2.6.1 Surface hand net tow

Surface net tows are hand-deployed off the stern for about 15-20 minute periods. One hand net tow is scheduled for 13:30 on July 19th. We request that the ship remain stationary during this tow.

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 the first, third and fourth days, 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 to a target depth of 200 m at a constant speed of 10 m/min during the downcast and upcast. The A-frame and capstan will be needed for this operation.

4.2.9. Automated Trace Element Sampler (ATE)

On the 2nd day of the cruise, the ATE will be hand deployed off the back deck to a depth of 10 m. The ATE will be recovered after 30 minutes in the water. The ATE is approximately 1' tall and 4" in diameter, weighing 5 lbs.

4.3 Floating sediment trap recovery

In the early morning of July 21st, we shall transit for the recovery of the floating sediment trap array. The A-frame and the Sea-Mac winch will be needed to retrieve the sediment trap array. After the array is recovered, the ship shall transit to recover the Gas Array. After the array is recovered, the ship shall transit to Station 52 and conduct one 200 m yo-yo cast.

4.4 Station 52 - WHOTS-8 Mooring

(nominal position of mooring = 22°40.1572'N, 157°57.0225'W)

4.4.1 CTD yo-yo cast (subsurface instrument intercomparison)

One 200-m CTD yo-yo cast with at least 6 full cycles will be conducted near the WHOTS mooring on July 21st for subsurface instrument intercomparison. This cast should be conducted downwind, down current, and about 200 m from the mooring.

4.4.2 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 ALOHA to conduct one AC9/FRRf cast, one Hyperpro cast and one 200 m CTD cast. If the mooring is positioned such that it is within the Station ALOHA circle, these operations can be performed as close to the WHOTS mooring as safely possible to extend the surface instrument intercomparison.

After the operations are complete, the ship shall transit to Station Kaena.

4.5 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 July 21st. Once the CTD cast is complete, the ship shall return to Snug Harbor.

4.6 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.

4.7 Thermosalinograph, $p\text{CO}_2$ system, Fluorometer, and meteorological system

The ship's thermosalinograph, $p\text{CO}_2$ 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, $p\text{CO}_2$ system, Fluorometer, and meteorological suite operations.

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. Two 20 ft. laboratory vans with assorted equipment for radioisotope and general use (Van's 23 and 24)
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

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, $p\text{CO}_2$ 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, $p\text{CO}_2$ and access to real-time data through the network.
24. OTG's 24-place rosette, and 24 12-l water sampling bottles (to be used as spare)
25. 1000 lb weight.
26. Large Sea-Mac winch (Mod. 1025 EHS). 60 Amp Hubbel plug/connector (440 VAC, 3 phase, 60 Amp breaker)
27. Seapoint Fluorometer (to be used as spare)
28. Lifting basket to transport carboys from the main deck to the 02 deck

Cast	Depth	Samples	#Bottles
<u>Kahe Pt.</u>			
s1c1	1000 m	O ₂ , Temp, DIC/Alk, Nuts, Chl a, LLN, LLP, DOC, FCM, Salts JF(pb on 5,25,750,900,1000)	24
<u>Station ALOHA</u>			
s2c1	200 m	CMORE(5@25,5@45,5@75), DdV(1@25), SW(2@25)	18
s2c2	200 m	Primary Production, DV(pb PP depths), Salts	20
s2c3	200 m	DB, DV (24@5)	24
s2c4	200 m	DB, DV (24@5)	24
s2c5	4740 m (PO-1)	O ₂ , Temp, DOC, DIC/Alk, Nuts, Salts, AM(pb Nutrients)	24
s2c6	1000 m (PO-2)	O ₂ , Temp, DOC, DIC/Alk, Nuts, Salts	24
s2c7	1000 m	PC/PN, BW(1@150), JF(1@5,45,100,200,350,500,1000), Salts	22
s2c8	1000 m	PPO ₄ , BW(1@150), SR(1@5,25,45,75,100,125,150,175), Ddv(1@350), Salts	24
s2c9	1000 m (BEACH)	O ₂ , Temp, DIC/Alk, Nuts, LLN, LLP, DOC, Keeling, Quay, Salts BW(pb@150), DdV(1@25), AM(pb Nutrients)	24
s2c10	1000 m	PUR, CMORE(5@1000,5@770,5@500), Salts	24
s2c11	1000 m	Gas Array(6@5,25,45,1@75,100,125), Salts, BW(1@150)	24
s2c12	1000 m	CMORE(5@125,5@200), PO(6@1000), Salts, BW(1@150)	18
s2c13	1000 m	PSi, MC(1@5,25,45,75,100,125,150,175), Salts, BW(1@150), SW(pbMC@5,25,45)	19
s2c14	1000 m	JF(1@5,25,45,75,100,125,150,175,200), Salts, BW(1@150) SR(1@5,25,45,75,100,125,150,175)	20
s2c15	1000 m	ATP, MC(1@200,300,500,770), Salts, BW(1@150) SW(1@200,300,400,500, 600,700,800,900,1000)	24
s2c16	1000 m	PE, MC(5,25,45,75,100,125,150,175), SW(pb MC), Salts, BW(1@150)	23
s2c17	1000 m	HPLC, Chl a, Slides, Salts, BW(pb@150), DdV(2@25), SW(pbSlides@5,25,45)	24
s2c18	4740 m (PO-3)	Oxygen, MC(1@1000,2000,3000,4000), DV(1@4800,4750), Salts, O17(1@10,250,500,1000,1500,2500,3500,4500,bottom, pb@2000,3000,4000) BW(1@150)	24
s2c19	200 m	SR(18@25)	18
<u>WHOTS Mooring</u>			
S52c1	200 m yo-yo	SW(1@25), SR(1@5,25,45,75,100,125,150,175)	9

MC=Matt Church, SW=Sam Wilson, DV=Donn Viviani, DB=Daniela Böttjer, BW=Brenner Wai,
DdV=Daniela del Valle, SR=Shimi Rii, JF=Jim Foley, AM=Aric Mine

Ship: R/V KILO MOANA**HOT 233****Date: July 18-22, 2011**

TIME	Mon. 7/18	Tues. 7/19	Wed. 7/20	Thurs. 7/21	Fri. 7/22
0000		S2C2 PP			
0100		S2C3	Net Tow		
0200		S2C4	S2C11 Gas		
0300		Deploy PP Array		AC9/FRRF	
0400			Deploy Gas Array	Transit sed traps	
0500		S2C5 PO-1	S2C12 Open	Recover traps Transit gas array	
0600				Recover gas array	
0700				Transit St. 52	
0800	Depart Snug		S2C13 PSi	S52C1 WHOTS	Arrive Snug
0900				Transit St. ALOHA	
1000	Arrive Kahe (10:30) Weight cast	Net Tow	Net Tow		
1100	Hyperpro	S2C6 PO-2 (Begin 36 hr)	S2C14 Open	AC9/FRRF	
1200	S1C1 Kahe	Net Tow	Hyperpro AC9/FRRF	Hyperpro	
1300	Niskin Cast Transit ALOHA	ATE Hand Net Tow		S2C19	
1400		S2C7 PC/PN	S2C15 ATP	Transit St. Kaena	
1500					
1600					
1700		S2C8 PPO4	S2C16 PE		
1800					
1900		Recover PP array			
2000		S2C9 BEACH	S2C17 HPLC		
2100	Arrive ALOHA			S6C1 Kaena	
2200	Deploy sed traps	Net Tow	Net Tow		
2300	S2C1	S2C10 PUR	S2C18 Open (end 36 hours)	Transit Snug	

July 19th: Sunrise 0558, Sunset 1919

6.0 HOT-233 Watch Schedule

0300-1500

Adriana Harlan – *Water Boss*

Dan Sadler – *Tag*

Lance Fujieki – *Alt. Tag*

Cammy Fumar – *Console*

Jefrey Snyder – *Watch Leader – Tag*

1500-0300

Susan Curless – *Chief Scientist – Water Boss*

Brett Updyke – *Watch Leader – Tag*

Craig Nosse – *Console*

Alison Andrews – *Tag*

Aric Mine – *Alt. Tag*

0900-2100

Reagan Grant

At Large

Sam Wilson

Scott Grant

Daniela del Valle

Blake Watkins

Daniela Böttjer

Donn Viviani

Shimi Rii

Brenner Wai

Jim Foley

Nick DeBoer

Charlotte Godfrey-Romo

Sheila Folan

OTG

Dan Fitzgerald

Ben Colello