Hawaii Ocean Time-series
HOT-210 General Cruise Plan
KN 195-07

Vessel: R/V *Knorr*, Woods Hole Oceanographic Institution
Master of the Vessel: Captain Adam Seamans
Chief Scientist: Eric Grabowski, University of Hawaii
SSSG Marine Technicians: Robbie Laird and Catie Graver

Marine Center phone number: 842-9813

Loading: April 26, 2009 @ 0800
Departure: April 27, 2009 @ 0800
Arrival: May 1, 2009 @ 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 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 will be occupied during the 2nd, 3rd, and 4th days of the cruise.
3) Station 50, is the site of the WHOTS Mooring, located at 22° 46'N, 157° 53.83'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 will be occupied on the 4th day of the cruise for about 2 hours.

1.1 SCIENTIFIC OPERATIONS

Station	Activities
Kahe (sta. 1)	Weight Cast, PRR and Hyperpro casts, CTD cast (1000 m)
ALOHA (sta. 2)	Sediment traps, gas array, net tows, CTD operations, primary productivity measurements, AC9, misc. experiments
WHOTS mooring station (Sta. 50)	One CTD cast (yo-yo to 200 m).
Kaena (sta. 6)	CTD cast (2400 m)
Underway/continuous	ADCP, thermosalinograph, fluorometry, meteorology

2.0. SCIENCE PERSONNEL HOT-210 (- indicates personnel form submitted)

Participant	Title	Affiliation/Group
-Eric Grabowski	Chief Scientist	UH/BEACH
-Karin Björkman	Research Specialist	UH/BEACH
-Susan Curless	Research Associate	UH/BEACH
-Lance Fujieki	Computer Specialist	UH/BEACH
-Adriana Harlan	Research Associate	UH/BEACH
-Binglin Li	Graduate Student	UH/BEACH
-Dan Sadler	Research Associate	UH/BEACH
-Brett Updyke	Technician	UH/BEACH
-Sam Wilson	Scientist	UH/BEACH
-Ken Doggett	Research Associate	UH/BEACH
-Tara Clemente	Research Associate	UH/BEACH
-Blake Watkins	Marine Engineer	UH/BEACH
-Jay Wheeler	Research Associate	UH/BEACH
-Richard Allen Shema	Volunteer	BEACH
-Amanda Whitmire	Scientist	OSU/BEACH
-Michael Beman	Scientist	UH
-Kate Achilles	CMORE Educator	UH/CMORE
-Christine Glazer	Teacher	CMORE
-Robert Bevacqua	Teacher	CMORE
-Lily Edmon	Teacher	CMORE
-Alon Amrani	Researcher	CalTech
-Jefrey Snyder	Marine Technician	UH/PO
-Paul Lethaby	Research Associate	UH/PO
-Fernando Santiago-Mandujano	Research Associate	UH/PO
-Justin Smith	Undergrad Student	UH/PO
Robbie Laird	Marine Technician	WHOI
Catie Graver	Marine Technician	WHOI

3.0. SUMMARY SCHEDULE

17 April	Pre-cruise meeting, MSB 307, 1030 hrs.
23 April	Loading of vans
26 April	Ship loading starting at 0800 hrs.
27 April	Depart from Snug harbor at 0800 hrs. Science personnel on-board by 0700.
27 April	Station 1 Kahe Pt. operations.
27-30 April	Station ALOHA operations. Station 50 and Kaena Pt.
1 May	Arrive back to Snug Harbor. ETA 0800 hrs, 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 PRR and Hyperpro casts (Sect. 4.2.8) will be conducted at this location in the afternoon of April 27th. The CTD winch and crane will be required for these operations. The PRR and Hyperpro casts will also require the use of the capstan and A-frame.After the operations are satisfactorily completed, the ship shall proceed to Station ALOHA.

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 200-m and one 1000-m CTD 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 the TSE winch. 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 (**sci2@knorr.whoi.edu**), 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 Production Array.

4.2.3 Primary production experiment

Samples for the primary productivity experiment will be collected from the rosette,CTD cast 2. Before dawn (sunrise 0602 hrs on April 28), 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 TSE winch. The array is equipped with two ARGOS satellite transmitters (platform #'s 03028, 60482), strobe lights and a radio transmitter (channel 68, 156.425 MHz). Position fixes of the array will be e-mailed to the ship (**sci2@knorr.whoi.edu**). 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 leaders (**Fernando Santiago-Mandujano and Dan Sadler**) . The array will be recovered just at sunset (1856 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 sampling bottles. We will need the ship's CTD winch and crane for these operations. Water samples for biogeochemical measurements will also be collected on each 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, ending with a second near-bottom cast. 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.

4.2.5. Gas Array deployment

A second free drifting incubation array will be deployed the third day of the cruise at ALOHA station. Samples for the gas array will be collected from CTD cast 9. We request the use of the A-frame for the gas array deployment, and will also use the TSE winch. The array is equipped with two ARGOS satellite transmitters (platform #'s 03028, 60482, emailing positions to (**sci2@knorr.whoi.edu**), a strobe light and a radio transmitter (channel 68, 156.425 MHz). The ship will **not** need to keep within sight of the array until the time of the recovery, approximately 24 hours after its deployment. CTD operations shall continue after the recovery.

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 at around noon and two consecutive half-hour periods at midnight on the second, third, and fourth days (see schedule) with a total of eight available slots to accommodate cancellations due to sea state or other unforeseen problems. The A-frame and capstan will be needed for this operation. B. Watkins will be in charge of these operations.

4.2.6.1 KA net tow

The hand held surface net tow will be deployed off the stern for about 15-20 minutes. The ships deck equipment is not needed for this operation. We request that the ship remain stationary during these tows. Kate Achilles will be in charge of these tows.

4.2.7. Automated Trace Element Sampler (ATE)

On the 3rd 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, weighting 5 lbs.

4.2.8. Profiling Reflectance Radiometer (PRR) and Hyperpro

Around noon on each day a profiling reflectance radiometer will be deployed from the main deck using the A-frame. The instrument is hand-lowered and retrieved with assistance from the winch or capstan. After the PRR cast a Hyperpro will be deployed in the same manner as the PRR.

4.2.9. AC9

The Wet Labs AC9 is an optical instrument that measures water column spectral absorption and attenuation at nine wavelengths. The AC9 package also includes a Sea-Bird Seacat with temperature, conductivity, fluorometer, and pressure sensors. The package will be deployed to a target depth of 250 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.

4.3 Floating sediment trap recovery

In the morning of April 30, after the second deep CTD cast has been completed, we shall transit for the recovery of the floating sediment trap array. The A-frame and the TSE 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 that array is recovered, the ship shall transit to Station 50 to conducrt one yo-yo CTD cast. After which time the ship shall transit to ALOHA to conduct one PRR cast, one Hyperpro cast, and two AC9 casts.

4.4 WHOTS Mooring (Station 50)

One 200-m CTD yo-yo cast with at least 6 full cycles (one hour) will be conducted near the WHOTS mooring on April 30. This cast should be conducted downwind, downcurrent, and at about 200 m from the mooring. The watch leader will determine the position of the buoy from the WHOTS web site (`http://ocelot.whoi.edu/projects/WHOTS/data/whots4_pos.txt`) and will give this information to the bridge. The nominal position of the mooring's anchor is 22° 46'N, 157° 53.83'W.

After these operations are completed, the ship will transit back inside the St. ALOHA circle to complete optical casts. Once those operations are complete, the ship will 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 April 30, after which 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 SSSG technician will be in charge of the ADCP system.

4.7 Thermosalinograph and Fluorometer

The ship's thermosalinograph 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

SSSG electronics technician will be in charge of the thermosalinograph and fluorometer operations.

5.0 EQUIPMENT

5.1 The HOT science party will bring the following:

1. Seabird CTD system, all sensors, deck boxes and computer CTD acquisition systems
2. Rosette and 24 12-l water sampling bottles, all spare parts
3. Two laboratory vans with assorted equipment for radioisotope and general use (main deck and O1 deck)
4. Distilled, deionized water and all required chemicals and isotopes
5. Storage van with assorted equipment (O1 deck)
6. Large vacuum waste container
7. Liquid nitrogen dewer
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. PRR, 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. Crane and winch with conducting wire for CTD
5. Radio direction finder
6. Space on the main deck for one lab (rad) van
7. Space on O1 deck for two lab vans starboard side
8. Space on upper deck for incubators
9. Hand-held VHF transceivers
10. Precision depth recorder
11. Shackles, sheaves, hooks, lines and grappling hooks
12. Shipboard Acoustic Doppler Current Profiler
13. Thermosalinograph and Fluorometer (underway system)
14. Copy machine
15. Grappling hooks and line
16. Navlink2 PC or equivalent

17. Running fresh water and seawater, hoses
18. Electronic mail system
19. GPS system
20. Uncontaminated seawater supply (underway water)
22. Underway/on-station data acquisition system for meteorological instruments, ADCP, thermosalinograph and fluorometer
23. WHOI's 24-place rosette, 24 12-l water sampling bottles (to be used as spare)
24. Pinger (to be used as spare)
25. 1000 lb weight (for weight cast Kahe)
26. Remote CTD decibar pressure display in the winch operator cabin.
27. TSE winch
28. Ship's location email broadcast
29. DI water
30. Freezers, refrigerators, and -80
31) Small capstan (~ 10 m/min) (borrowed from UH, OTG)

Ship: R/V *Knorr* HOT 210 CTD CASTS April27-May1, 2009

Cast		Samples	#Bottles
Kahe Pt.			
s1c1	1000 m	O_2, Temp, DIC/Alk, Nuts, Chl a, LLN, $LLPO_4$, DOC, FCM, KA(sample remaining water), Salts	24
Station ALOHA			
s2c1	200 m	CMORE(5@25, 5@45, 5@75), MikeB(4@chlmax)	19
s2c2	1000 m	Primary Production, Salts, SW (1@25, 1@125), MB(pb on all depths)	24
s2c3	4740 m (PO-1)	O_2, Temp, DOC, DIC/Alk, Nuts, KA(pb oxygen), Salts	24
s2c4	1000 m (PO-2)	O_2, Temp, Nuts, DIC/Alk, DOC, Salts	24
s2c5	1000 m	PC/PN, SW(1@5,25,45,75,100,125,150,175), BL(1@25,45), Salts	24
s2c6	1000 m	PPO4, AA(6 btls tbd), Salts	22
s2c7	1000 m (BEACH)	O_2, Temp, DIC/Alk, Nuts, LLN, LLP,DOC, Keeling, Quay, Salts	23
s2c8	1000 m	PUR, CMORE(5@1000,5@770,5@500), Salts	24
s2c9	1000 m	Gas Array (2@125,100) (3@5,25,45,75) MB(1@175,150,125,100,75,45,25,5)	24
s2c10	1000 m	CMORE(5@125,5@200), AA(6 btls tbd), Salts	18
s2c11	1000 m	PSi, MC(5,25,45,75,100,125,150,175), KA(pbMC), Salts SW(1@5,25,45,75,100,125),SW(pbMC@150,175)	24
s2c12	1000 m	MIT, BL(1@75,DCM)(3@150)(3@175),Salts	24
s2c13	1000 m	ATP, MC(200,300,500,770), SW (1@200,300,400,500, 600,700,800,900,1000), SD(1@1000,pbATP-125,100, 75,45,25,5), Salts	24
s2c14	1000 m	PE, MC(5,25,45,75,100,125,150,175), SW(pb MC), Salts	22
s2c15	1000 m	HPLC, Chl a, Slides, Salts	22
s2c16	4740 m (PO-3)	Oxygen, MC(1000,2000,3000,4000), AA(6 btls tbd), Salts	18
WHOTS Mooring			
S50c1	200 m yo-yo	BC (1@DCM,70,40,15), BL(3@ 5,25,45,75,100,125)	22
Kaena			
S6c1	2400 m	Chl, Salts	13

(AA)- Alon Amrani, (MikeB)- Michael Beman, (SW)-Sam Wilson, (MB)-Mark Brz, (BL)-Binglin Li, (BC)-Brandon Carter, (MC)-Matt Church, (KA)-Kate Achilles, (SD)-Solange

SHIP R/V *Knorr* HOT 210 Date: April 27 – May 1, 2009

TIME	Mon.. 4/27	Tue.. 4/28	Wed. 4/29	Thurs. 4/30	Fri. 5/1
0000		S2C1			
0100		S2C2 PP	Net Tow		
0200			S2C9 Gas		
0300				Transit sed traps	
0400		Deploy PP Array	Deploy Gas Array		
0500		S2C3 PO-1	S2C10 Open	Recover sed traps	
0600				Transit gas array	
0700			ATE	Recover gas array	
0800	Depart Snug		S2C11 PSi	Transit St. 50	Arrive Snug
0900					
1000	Arrive Kahe (10:30) Weight cast	Net Tow	Net Tow	S50C1	
1100	PRR	S2C4 PO-2 (Begin 36 hr)	S2C12 MIT	PRR	
1200	Hyperpro	Net Tow	PRR Hyperpro	Hyperpro	
1300	S1C1	KA hand net tow	AC9 Net Tow	AC9	
1400		S2C5 PC/PN	S2C13 ATP	AC9	
1500	Transit ALOHA			Transit St. Kaena	
1600					
1700		S2C6 PPO4	S2C14 PE		
1800					
1900		Recover PP array			
2000		S2C7 BEACH	S2C15 HPLC		
2100				S6C1	
2200		Net Tow	Net Tow		
2300	Arrive ALOHA Deploy sed traps	S2C8 PUR	S2C16 PO-3 (end 36 hours)	Transit Snug	

April 28: Sunrise 0602 Sunset 1856

6.0 HOT-210 Watch Schedule

0300-1500

Adriana Harlan **-** *Water Boss*
Lance Fujieki –*Tag*
Eric Grabowski - Chief Scientist
Tara Clemente- *Alt Tag*
Amanda Whitmire – *Alt Tag*
Fernando Santiago-Mandujano **-** Watch Leader- *Console*
Jefrey Snyder- *Tag*

1500-0300

Karin Björkman
Dan Sadler – Watch Leader- *Tag*
Susan Curless- *Water Boss*
Jay Wheeler - *Alt Tag*
Paul Lethaby - *Console*
Justin Smith **-** *Tag*

0900-2100

Richard Allen Shema

At Large

Blake Watkins
Ken Doggett
Brett Updyke - *Alt Tag*
Binglin Li
Sam Wilson - *Alt Tag*
Kate Achilles
Christine Glazer
Robert Bevacqua
Lily Edmon
Alon Amrani
Michael Beman

SSSG

Robbie Laird
Catie Graver