Hawaii Ocean Time-series
HOT-288 Cruise Plan

Cruise ID: SKQ201615S
Vessel: R/V *Sikuliaq*, University of Alaska
Master of the Vessel: Captain Diego Mello
Chief Scientist: Fernando Santiago-Mandujano, University of Hawaii
Marine Technicians: Bern McKiernan and Steven Hartz

UH Marine Center phone number: 956-0686
Sikuliaq phone number: UAF/Seward Marine Center/907-224-5261
Sikuliaq Cell number: 907 491 1793
Sikuliaq Satellite Phone Numbers: ***Call the ship via Fleet Broad Band***

- *Dial 001 wait for AT&T prompt*
- *Dial "01 870773150710"*

Phone rings in the Pilot House if unanswered after 20 seconds it will ring in the Computer lab if unanswered after 20 seconds it will ring in the Mess Deck

Loading: November 23, 2016 @0900
Departure: November 25, 2016 @0900 (Science personnel on board by 0800).
Arrival: November 29, 2016 @ 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 November 25th 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 November 26-28th.
3) Station 50, the site of WHOTS-13 Mooring (anchor position 22° 47.24' N, 157° 54.45' W) will be occupied for about one hour on November 28th.
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 November 28th 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, optics casts, misc. experiments.
WHOTS mooring station (Sta. 50)	One CTD cast (yo-yo to 200 m), surface instrument intercomparisons.
Underway/continuous	ADCP, thermosalinograph, fluorometry, meteorology

2.0. SCIENCE PERSONNEL

University of Hawaii at Manoa

Participant	Title	Affiliation
Susan Curless	Research Associate	UH
Dan Sadler	Research Associate	UH
Brenner Wai	Research Associate	UH
Alexa Nelson	Research Associate	UH
Timothy Burrell	Research Associate	UH
Blake Watkins	Marine Engineer	UH
Thomas Lankiewicz	Scientist	University of Maryland
Anne Thompson	Scientist	Portland State University
Kathleen Kouba	Research Assistant	Portland State University
Tara Clemente	Research Associate	UH/SCOPE
Greyson Adams	Research Associate	UH/SCOPE
Eric Shimabukuro	Research Associate	UH /SCOPE
Ryan Tabata	Research Associate	UH/SCOPE
Jefrey Snyder	Marine Technician	UH
Fernando Santiago-Mandujano	Research Associate	UH
Kellen Rosburg	Research Associate	UH
Robert (Walt) Deppe	Research Associate	UH
Angelicque White	Scientist	OSU
Katie Watkins-Brandt	Scientist	OSU
Mark Haught	Scientist	UW
Sara Ferron-Smith	Scientist	UH
Gerianne Terlouw	Graduate Student	UH
Stephanie Matthews	Volunteer	
TBA	Volunteer	
Bern McKiernan	Marine Technician	Sikuliaq
Steven Hartz	Marine Technician	Sikuliaq

3.0. SUMMARY SCHEDULE

18 November	Pre-cruise planning meeting 1430 hrs, Moore Conference room.
23 November	Ship loading at 0900 hrs.
25 November	Depart from Pier 35 at 0900 hrs. **Science personnel on-board by 0800.**
25 November	Station 1 Kahe Pt. operations.
26-28 November	Station ALOHA operations. Station 50 CTD yo-yo cast, Station Kaena
29 November	Arrive back to Pier 35. Full offload.

4.0. OPERATIONAL PLANS

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

A 1000 lb. 1000 m weight-test cast, one CTD cast to 1000 m and a Hyperpro cast (Sect. 4.2.7) will be conducted at this location on November 25th. The CTD and the CTD Load Handling System will be required for these operations. 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 the edge of the circle that defines Station ALOHA (see Sect 1.0), a Seaglider will be deployed (Sect. 4.2.11). After this operation is completed, the ship shall proceed to the center of the Station, where the sediment traps will be deployed (Sect. 4.2.2). 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, to be determined enroute to ALOHA by local current conditions. The array will be deployed from the stern, using the A-frame and the Sea-Mac 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 456190, 60484), 2 strobe lights, and 2 radio transmitters (channel 74: 156.725 MHz). Daily positions of the array shall be transmitted by email to the science party and provided to the ship, 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.

4.2.3 Primary production experiment

Samples for the primary productivity experiment will be collected from the rosette. Before dawn (Sunrise 0653 hrs on November 26th), 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 SeaMac winch. The array is equipped with two ARGOS satellite transmitters, (platform #'s 60482, 3028) strobe lights and a radio transmitter (channel 68:156.425 MHz). Positions of the array will be emailed to the science party and provided to the ship. 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 (1746 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.

After deployment of the primary production array, an optical profiling float (Sect. 4.2.10) will be deployed to compare float based productivity to that measured by the array.

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 the Sikuliaq's 24-place rosette with 12 liter sampling bottles. We will need the ship's CTD Load Handling System for these operations. Water samples for biogeochemical measurements will 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 **(Susan Curless, Jefrey Snyder)**.

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 CTD cast 8. The gas array will be deployed from the stern. We request the use of the A-frame for this operation and will also use the SeaMac winch. The array is equipped with two ARGOS satellite transmitters (platform #'s 60482, 3028), emailing positions to the science party, 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 25 hours after its deployment. Assistance from the Bridge is requested in plotting the drift track of the array. CTD operations shall continue after the recovery.

4.2.6. Zooplankton 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 small 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 the first, and 1400 on the second and fourth days, the Hyperpro will be deployed from the stern through a small block hung from the A-frame. The instrument is lowered and retrieved by hand. Each deployment will consist of three profiles before the instrument is retrieved.

4.2.8. Optics

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 during the cruise on November 28th.

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 November 27th, the ATE will be hand deployed off the back deck to a depth of 10 m to collect at 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 each ATE deployment to limit contamination of the trace metal sample from the ship's hull.

4.2.10. Optical Profiling Float

On the morning of November 26th, an optical profiling float (bio-argo style) will be deployed after the primary productivity array deployment, to compare float based productivity to that measured by the array. The float will be hand-deployed from the back deck. Angelicque White will be in charge of this operation.

4.2.11. Seaglider Deployment

Upon arrival to the edge of the circle that defines Station ALOHA (see Sect 1.0), Seaglider #626 (ARGOS ID 162399) will be deployed from the back deck. The A-frame and the Sea-Mac winch will be used for this deployment. Blake Watkins will be in charge of this operation which will take one hour.

During deployment, Blake will be in communication via Iridium phone with the Seaglider pilot (Steve Poulos) on land. After deployment Steve will be monitoring the ship's positions to keep the glider steering clear of ship's operations.

4.3. Gas Array and floating Sediment trap recovery

In the morning of November 28th, after the optics cast has been completed, the ship shall transit for the recovery of the Gas Array. The A-frame and the Sea-Mac winch will be needed to retrieve the sediment trap array. After the Gas Array is recovered, the ship shall transit to recover the floating sediment trap array. After the sediment traps are recovered, the ship shall transit to Station ALOHA for an AC9/FRRf cast. Once the optics work is complete, the ship shall transit to Station 50 and conduct one 200 m CTD yo-yo cast.

4.4 Station 50 - WHOTS-13 Mooring

The anchor position of the WHOTS-13 mooring is 22° 47.24' N, 157° 54.45' 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 can be detected via radar in good weather conditions but is harder to detect with larger sea states.

4.4.1 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 November 28th 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, a Hyperpro cast will be conducted within the circle that defines Station ALOHA. Once the Hyperpro cast is completed, the ship will transit to Station Kaena, unless the time and weather conditions allow for a small boat operation to repair one of the WHOTS buoy's anemometers (Sect. 4.9).

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 November 28th. Once the CTD cast is complete, the ship shall return to Pier 35.

4.6. Acoustic Doppler Current Profiler

The ship's acoustic Doppler current profiler (150 kHz ADCP) will be in operation during the duration of the cruise. The Sikuliaq's technicians 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 Honolulu 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 Sikuliaq's technicians will be in charge of the thermosalinograph and fluorometer operations.

4.8. Underway surface seawater filtration system

Surface seawater will be obtained from the underway system, filtered through a high-capacity 0.2 micron filter into 2x 55-gallon barrels (1-2 hours of underway sampling). This water will be circulated through an ultra-filtration system (1x1x3.5 ft) using a peristaltic pump (1 day). As the water circulates through the filter the sample permeates out and is drained overboard. The system collects only material greater than the nominal pore size of the filter. The underway water will be sampled upon reaching St. ALOHA. The barrels will be re-filled 2 more times for a total of 12,000 liters of water

sampled over the course of the cruise while in St. ALOHA. Sample collection is not time-dependent. This system will be run by Sara Ferron-Smith and Gerianne Terlouw.

4.9. Small boat operation to repair WHOTS buoy's anemometer

If the weather conditions are favorable and if time allows, a small boat shall be deployed near the WHOTS buoy (anchor position 22° 47.24' N, 157° 54.45' W) on November 28th to repair one of the failing buoy's anemometers. We request the use of the Sikuliaq's small boat and crew for this activity. Jefrey Snyder will be in charge of this operation, he will board the boat with the anemometer's replacement parts, and the boat should move to the buoy where the repairs will be conducted.

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. Small capstan (~ 10 m/min)
3. Two 20 ft. laboratory vans (#23, OTG rad van) with assorted equipment for radioisotope and general use.
4. Distilled, deionized water and all required chemicals and isotopes
5. Large vacuum waste containers
6. Liquid nitrogen dewar
7. Drifting sediment trap array with strobe lights, satellite and radio transmitters, floats, weights
8. Polypropylene line
9. Sediment traps and crosses
10. Drifting primary production array and gas array with light and radio transmitter, floats, weights, polypropylene line, spare buoy, etc.
11. Hyperpro and other optical measuring instruments.
12. Oxygen titration system
13. Plankton nets and towing lines
14. Desktop and laptop personal computers
15. Assorted tools
16. All required sampling bottles
17. Deck incubation system
18. Pertinent MSDS
19. Chest Freezer (22 cubic inch)
20. ~ 1300 lb test weight
21. Deck Incubator on 4'x4' containment pallet with hoses and fittings.
22. One 12 ft. Blue Equipment Van
23. SeaMac winch

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
4. Electric power for Sea-Mac winch and capstan (480 VAC, 3 phase, 60 Amp breaker) and vans (208 VAC single phase at 60 amps for #23 lab van [could run on 110 VAC with extension cords if necessary], 110 VAC 10 amps for equipment van, 480 VAC 3 phase 60 amps for OTG rad van)
5. Radio direction finder
6. Space in the main deck for one 20 ft laboratory van **(#23)**
7. Space on main deck for two vans **(OTG rad van** 20 ft**, and blue equipment van,** 12 ft**)**

8. Hand-held VHF transceivers
9. Precision depth recorder
10. Shackles, sheaves, hooks and lines
11. Shipboard Acoustic Doppler Current Profiler
12. Thermosalinograph and Fluorometer
13. Copy machine
14. Grappling hooks and line
15. Navlink2 PC or equivalent
16. Running fresh water and seawater, hoses
17. Electronic internet/mail system
18. GPS system
19. Uncontaminated seawater supply
20. Underway/on-station data acquisition system for meteorological instruments, ADCP, thermosalinograph, fluorometer
21. Sikuliaq's 24-place rosette, and 24 10-l water sampling bottles (to be used as spare)
22. Remote CTD dbar pressure display in the winch operator area.
23. Monitor in CTD Lab displaying ship coordinates, GMT, bottom depth, and 12 kHz pinger signal.
24. -80 ℃ Freezer
25. -20 ℃ Freezer
26. Refrigerator
27. Sikuliaq's 24-place rosette, and 24 12-l water sampling bottles (to be used with our CTD and sensors)

Ship: R/V *Sikuliaq* HOT 288 CTD CASTS Date: November 25-29, 2016

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, SF-S(pb on PP bottles), AW(1@5), Salts	23
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, AT(pb@5,25,45,75,100,125,150,175 [*]), Salts	24
s2c4	1000 m	PC/PN, DNA(1@5,25,45,75), AW(1@5,25,45,75,100,125), Salts	24
s2c5	1000 m	PPO4, SF-S(1@5,25), AT(pb@5,25,45,75,100,125,150,175), Salts	16
s2c6	1000 m (BEACH)	O_2, Temp, DIC/Alk, Nuts, LLN, LLP, DOC, Keeling, Quay, AT(pb@5,25,45,75,100,125,150,175), SF-S(1@5,pb@25), Salts	24
s2c7	1000 m	PUR, SF-S(1@5,25), DNA(1@,100,125,150,175), AT(3@40), AT(pb@5,25,45,75,100,125,150,175), TL(5@300), Salts	24
s2c8	1000 m	Gas Array(3@5,25,45,75,100,125), SF-S(1@5,25), Salts	22
s2c9	1000 m	DNA(1@200,225,250,275), SF-S(3@25, 1@5,45,75,100,125, 2@200), AW(2@5), Salts	18
, s2c10	1000 m	PSi, SF-S(1@5,25,2@100), KW-B(1@5,25,45), TL(5@200,2@300), Salts	23
s2c11	1000 m	SF-S(1@5,25,2@300,2@400), AT(pb@5,25,75,100,150; 1@45,125,175)), AW(1@5,25,50,75,100,150,200,300,400,750,1000,2@500), Salts	24
s2c12	1000 m	ATP, DNA(2@300,400,500,770), SF-S(1@5,25), Salts	21
s2c13	1000 m	MC(1@5,25,45,75,100,125,150,175), SW(pb MC), SF-S(1@5,25), AT(pb@5,25,45,75,100,125,150,175), SW(1@200,300,400,500, 600,700,800,900,1000), Salts	21
s2c14	1000 m	HPLC, Chl a, AT(pb@5,25,45,75,100,125,150,175), Salts TL(10@200)	24
s2c15	4740 m (PO-3)	Oxygen, DNA(1@1000,2000,3000,4000), AT(3@DCM), AT(1@5,25,45,75, 100,125,150,175), Salts	23
WHOTS Mooring			
s50c1	200 m yo-yo	DIC/TA(1@5), KW-B(1@5,25,45), TB(2@25) , AW(1@5,25,45,75,100,125 [**]), SF-S(8@25), ES(1@15,DCM)	22
Kaena			
s6c1	2400 m	Chl, Salts	13

MC=Matt Church, **SW**=Sam Wilson, **SF-S=**Sara Ferrón-Smith, **AT**=Anne Thompson, **KW-B**=Kate Watkins-Brandt, **AW**=Angelicque White, **TL**=Tom Lankiewicz, **TB**=Timothy Burrell, **BB**=Benedetto Barone, **ES**=Eric Shimabukuro

[*] This cast does not have standard depths, bottles are closed at selected isopycnal depths
(**) This cast may be slightly outside the ALOHA circle

Ship: R/V *Sikuliaq* HOT 288 Date: November 25-29, 2016

TIME	Friday 11/25	Saturday 11/26	Sunday 11/27	Monday 11/28	Tuesday 11/29
0000					
0100					
0200		S2C1 PP	S2C8 Gas		
0300				Optics	
0400		Deploy PP Array Deploy Optical float	Deploy Gas Array		
0500		S2C2 PO-1	S2C9 Open	Transit gas array	
0600				Recover gas array Transit sed traps	
0700				Recover traps	
0800			S2C10 PSi	Transit ALOHA	Arrive Pier 35
0900	Depart Pier 35				
1000			Net Tow ATE	Optics	
1100	Arrive Kahe (11:30) Weight cast	S2C3 PO-2 (Begin 36 hr)	S2C11 Open		
1200	Hyperpro	Net Tow	Net Tow	Transit St. 50 S50C1 WHOTS	
1300	S1C1 Kahe	Hyperpro		Hyperpro	
1400		S2C4 PC/PN	S2C12 ATP		
1500	Transit ALOHA			Transit St. Kaena	
1600		S2C5 PPO4			
1700			S2C13 Open		
1800		Recover PP array (17:46)			
1900					
2000		S2C6 BEACH	S2C14 HPLC	S6C1 Kaena	
2100					
2200	Arrive ALOHA edge Deploy Seaglider	Net Tow Net Tow	Net Tow		
2300	Arrive ALOHA Deploy Sed Traps	S2C7 PUR	S2C15 PO-3 (end 36 hours)	Transit Pier 35	

November 26th: Sunrise 0653, Sunset 1746

6.0 HOT-288 Watch Schedule

0300-1500

Tara Clemente **–** *Water Boss*
Dan Sadler – *Tag*
Eric Shimabukuro
Timothy Burrell– *Alt. Tag*
Alex Nelson **–** *Alt. Water Boss*
Walt Deppe **-***Console*
Jefrey Snyder – Watch Leader – *Tag*

1500-0300

Susan Curless – Watch Leader – *Water Boss*
Brenner Wai – *Tag*
Ryan Tabata – *Alt. Tag*
Kellen Rosburg **–** *Console*
Fernando Santiago-Mandujano **-** Chief Scientist - *Tag*
Greyson Adams – *Alt. Tag*

0900-2100

Stephanie Matthews

At Large

Blake Watkins
Thomas Lankiewicz
Angelicque White
Katie Watkins-Brandt
Mark Haught
Sara Ferron-Smith
Gerianne Terlouw
Anne Thompson
Kathleen Kouba

Marine Tech

Bern McKiernan
Steven Hartz