# Hawaii Ocean Time-series
# HOT-273 Operational Cruise Plan

Cruise ID: KM15-10
Vessel: R/V *Kilo Moana*, University of Hawaii
Master of the Vessel: Captain Jay Chavez
Chief Scientist: Susan Curless, University of Hawaii
Marine Technicians: Trevor Young and Steve Tottori

*Marine Center phone number: 842-9813*
*KM Phone number: 842-9817*
*KM Cell number: 864-0065*
*KM Satellite Phone Number: 011-870-773-234249*

Loading: June 17, 2015@1100
**Departure: June 18, 2015@0900 (Science personnel on board by 0800).**
Arrival: June 22, 2015@ 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 June 18 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 June 18-21.
3) Station 50, the site of WHOTS-11 Mooring (anchor position 45.981'N 157° 53.964'W) will be occupied on for about one hour on June 21.
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 June 21 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. 50) | One CTD cast (yo-yo to 200 m), surface instrument intercomparisons. |
| Kaena (sta. 6) | One CTD cast (near bottom) |
| Underway/continuous | ADCP, thermosalinograph, fluorometry, and meteorology. |

## 2.0. SCIENCE PERSONNEL

| Participant | Title | Affiliation |
|---|---|---|
| Susan Curless | Research Associate | UH |
| Dan Sadler | Research Associate | UH |
| Lance Fujieki | Research Associate | UH |
| Alexa Nelson | Research Associate | UH |
| Brenner Wai | Research Associate | UH |
| Eric Shimabukuro | Research Associate | UH/SCOPE |
| Tara Clemente | Research Associate | UH/SCOPE |
| Blake Watkins | Marine Engineer | UH |
| Natalie Dornan | Undergraduate Student | UH |
| Chris Schvarcz | Graduate Student | UH |
| Brie Maillot | Technician | UH |
| Roman Battisti | Technician | UH |
| Victoria Campbell | Research Technician | USC/SCOPE |
| Sarah Hu | Graduate Student | USC/SCOPE |
| Minda Monteagudo | Graduate Student | UCSB |
| Jefrey Snyder | Marine Technician | UH |
| Adela Dumitrascu | Student Assistant | UH |
| Daniel McCoy | Research Associate | UH |
| Robert (Walt) Deppe | Research Associate | UH |
| Chris Jury | Graduate Student | UH |
| Casey Moss | Undergraduate Student | UH |
| Greyson Adams | Research Associate | UH/SCOPE |
| Jim Burkitt | Research Associate | UH/SCOPE |
| Steve Tottori | Marine Technician | OTG |
| Trevor Young | Marine Technician | OTG |
| Scott Reed | Marine Technician | OTG |

## 3.0. SUMMARY SCHEDULE

| | |
|---|---|
| 10 June | Pre-cruise planning meeting 1430 hrs, Moore Conference Center, CMH. |
| 17 June | Ship loading at 1100 hrs. |
| 18 June | Depart from Snug harbor at 0900 hrs. **Science personnel on-board by 0800.** |
| 18 June | Station 1 Kahe Pt. operations. |
| 18-21 June | Station ALOHA operations. Station 50 CTD yo-yo cast, Station Kaena |
| 22 June | 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 June 18. The A-frame, and CTD winch will be needed 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 (Sect. 4.2.2). Then one 200-m and 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 and weather conditions. The array will be deployed from the stern, using the A-frame and SeaMac 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 3028, 60482), 2 strobe lights, and 2 radio transmitters (channel 68: 156.425 MHz). Daily positions of the array shall be transmitted by email directly to the ship (Shipboard e-mail account argosfix@km.soest.hawaii.edu and 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 0547 hrs on June 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 SeaMac 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 **(Walt Deppe, Danny McCoy)**.

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 9. 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 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 and third 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.

4.2.6.1 MM net tow

A plankton net will be deployed from the stern and shall be towed for half-hour periods with the net close to the surface throughout the duration of the tow. The A-frame and small capstan will be needed for this operation.

4.2.6.2 Surface hand net tow

Surface net tows are hand-deployed off the stern for about 15-20 minute periods. Hand tows are scheduled for 0900 on June 19rd and 20th. We request that the ship remain stationary during these tows.

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 1400 on the first, 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. Optical Package

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.

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 June 20th, 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 ATE deployment to limit contamination of the trace metal sample from the ship’s hull.**

4.2.10. Sea Glider #146 Deployment (sg146 ARGOS – 90990)

One hour of time is scheduled for deploying the sea glider. Approximately 30 minutes will be needed to deploy the glider using the winch and ship’s A-frame. Once the glider is in the water, it will conduct a shallow test dive (~30 min) and call its operational status into the command center.

It is requested that during the test dive, the ship stays close to the deployment site until the status of the glider has been confirmed to be operational. Should the glider malfunction, recovery of the glider via small boat or by wire noose may become necessary. Recovery operations will be performed at the Captain's discretion.

4.3 Gas Array and floating Sediment Trap recovery

In the early morning of June 21st, the ship shall transit for the recovery of the Gas Array. The A-frame and SeaMac winch will be needed to retrieve the arrays. 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-11 Mooring

The anchor position of the WHOTS-11 mooring is 22° 45.981'N, 157° 53.964'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 June 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, 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.

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 June 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 shipboard technicians will be in charge of the ADCP system.

4.7 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.

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. Liquid nitrogen dewar
7. Drifting sediment trap array with strobe lights, satellite and radio transmitters, floats, weights sediment traps and crosses
8. Drifting primary production array and gas array with light and radio transmitter, floats, weights, polypro. line, spare buoy, etc.
9. Hyperpro and other optical measuring instruments.
10. Oxygen titration system
11. Plankton nets and towing lines
12. Desktop and laptop personal computers
13. Assorted tools
14. All required sampling bottles
15. Deck incubation system
16. Pertinent MSDS

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

1. A-frame
2. A-frame block assembly
3. CTD winch
4. Space on upper deck for one 20ft laboratory van and on the main deck for one equipment van
5. Electric power for two vans
   -208 VAC single phase at 60 amps for #23 lab van,
   -120 VAC 10 amps for blue equipment van
6. Radio direction finder
7. Space on deck and power for small capstan = 4700lbs, and the power requirements are 440/480 VAC, 3 phase 60Hz, 60amp
8. Space on upper deck for sea water incubators
9. Space on deck for ~4 deck baskets of array gear
10. Precision depth recorder
11. Shackles, sheaves, hooks and lines
12. Shipboard Acoustic Doppler Current Profiler
13. Thermosalinograph, $pCO_2$ system, and Fluorometer
14. Meteorological suite
15. Grappling hooks and line
16. Display in the lab of ship's position (charting software/GPS feed)
17. Running fresh water and seawater hoses
18. Electronic mail system
19. GPS system
20. Underway/on-station data acquisition system for meteorological instruments, ADCP, thermosalinograph, fluorometer, and access to real-time data through the network.
21. OTG's 24-place rosette, and 24 12L water sampling bottles (to be used as spare)
22. ~1300 lb test weight
23. OTG's transmissometer

**Ship: R/V *Kilo Moana*** **HOT 273 CTD CASTS** **Date: June 18-22, 2015**

| 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 | 200m | DC(24@20) | 24 |
| s2c2 | 1000 m | Primary Production, Salts | 22 |
| s2c3 | 4740 m (PO-1) | $O_2$, Temp, DOC, DIC/Alk, Nuts, Salts | 24 |
| s2c4 | 1000 m (PO-2) | $O_2$, Temp, DOC, DIC/Alk, Nuts, Salts | 24 |
| s2c5 | 1000 m | PC/PN, DNA(1@5,25,45,75), Salts | 18 |
| s2c6 | 1000 m | PPO4, SF-S(1@5,25), Salts | 16 |
| s2c7 | 1000 m (BEACH) | $O_2$, Temp, DIC/Alk, Nuts, LLN, LLP, DOC, Keeling, Quay, Salts SF-S(1@5, pb@25) | 24 |
| s2c8 | 1000 m | PUR, SF-S(1@5,25), DNA(1@,100,125,150,175), Salts | 16 |
| s2c9 | 1000 m | Gas Array(3@5,25,45,75,100,125), SF-S(1@5,25), Salts | 22 |
| s2c10 | 1000 m | DNA(1@200,225,250,275), SF-S(1@5,25),DC(16@20), Salts | 24 |
| s2c11 | 1000 m | PSi, SF-S(1@5,25), KW-B(1@5,25,45) Salts | 15 |
| s2c12 | 1000 m | CS(2@5,25,45,75,100,125,150,175), SF-S(1@5,25), Salts | 20 |
| s2c13 | 1000 m | ATP, DNA(2@300,400,500,770), SF-S(1@5,25), Salts | 21 |
| s2c14 | 1000 m | MC(1@5,25,45,75,100,125,150,175) SW(1@700, pbMC) SF-S(1@5,25), Salts | 13 |
| s2c15 | 1000 m | HPLC, Chl a, Slides, Salts | 22 |
| s2c16 | 4740 m (PO-3) | Oxygen, DNA(1@1000,2000,3000,4000), KW-B(1@5,25,45), AN(2@4000), Salts | 17 |
| **WHOTS Mooring** | | | |
| s50c1 | 200 m yo-yo | DIC/TA(1@5) | 1 |
| **Kaena** | | | |
| s6c1 | 2400 m | Chl, Salts | 13 |

**MC=** Matt Church, **SW**=Sam Wilson, **CS=**Chris Schvarcz, **SF-S=**Sara Ferrón-Smith,
**KW-B**=Katie Watkins-Brandt, **DC**=David Caron, **AN=**Alex Nelson

**Ship: R/V *Kilo Moana*  HOT 273  Date: June 18-22, 2015**

| TIME | Thurs. 6/18 | Fri. 6/19 | Sat. 6/20 | Sun. 6/21 | Mon. 6/22 |
|---|---|---|---|---|---|
| 0000 | | S2C1 Open | | | Transit Snug |
| 0100 | | | | | |
| 0200 | | S2C2 PP | S2C9 Gas | | |
| 0300 | | | | Optics | |
| 0400 | | Deploy PP Array | Deploy Gas Array | | |
| 0500 | | S2C3 PO-1 | S2C10 Open | Transit gas array | |
| 0600 | | | | | |
| 0700 | | | MM Net Tow | Recover gas array<br>Transit sed traps | |
| 0800 | | | S2C11 PSi | Recover traps | Arrive Snug |
| 0900 | Depart Snug | DC Net Tow | DC Net Tow | Transit ALOHA | |
| 1000 | | Transit to pump tanks | Net Tow<br>ATE | Optics | |
| 1100 | Arrive Kahe (11:30)<br>Weight cast | S2C4 PO-2<br>(Begin 36 hr) | S2C12 Open | | |
| 1200 | Hyperpro | Net Tow | Net Tow | Transit St. 50<br>S50C1 WHOTS | |
| 1300 | S1C1 Kahe | Hyperpro | Deploy Sea Glider | Transit ALOHA | |
| 1400 | | S2C5 PC/PN | S2C13 ATP | Hyperpro | |
| 1500 | Transit ALOHA | | MM Net Tow | Transit St. Kaena | |
| 1600 | | MM Net Tow | | | |
| 1700 | | S2C6 PPO4 | S2C14 OPEN | | |
| 1800 | | | MM Net Tow | | |
| 1900 | | Recover PP array | | | |
| 2000 | | S2C7 BEACH | S2C15 HPLC | S6C1 Kaena | |
| 2100 | | Transit to pump tanks | Transit to pump tanks | | |
| 2200 | | Net Tow<br>Net Tow | Net Tow | | |
| 2300 | Arrive ALOHA<br>Deploy sed traps | S2C8 PUR | S2C16 PO-3<br>(end 36 hours) | | |

**June 19th: Sunrise 0547, Sunset 1919**

## 6.0 HOT-273 Watch Schedule

**0300-1500**

Dan Sadler – *Tag*
Lance Fujieki **–** *Alt. Tag*
Alex Nelson – *Water Boss*
Natalie Dornan
Tara Clemente
Jim Burkitt **–** *Alt. Tag*
Walt Deppe – Watch Leader **-** *Console*
Jefrey Snyder –*Tag*
Casey Moss

**1500-0300**

Susan Curless – Chief Scientist - *Water Boss*
Brenner Wai – *Tag*
Brie Maillot
Eric Shimabukuro –*Tag*
Greyson Adams **–** *Alt. Tag*
Danny McCoy – Watch Leader **-** *Console*
Adela Dumitrascu
Christopher Jury **–** *Alt. Tag*

**0900-2100**

Roman Battisti

**At Large**

Blake Watkins
Chris Schvarcz
Victoria Campbell
Sarah Hu
Minda Monteagudo

**OTG**

Trevor Young
Steve Tottori
Scott Reed