

# Hawaii Ocean Time-series HOT-298 Draft Cruise Plan

Cruise ID: KOK-1718

Vessel: R/V *Ka'imikai-O-Kanaloa*, University of Hawaii

Master of the Vessel: Captain Ross Barnes

Chief Scientist: Andrew King, University of Hawaii

OTG Marine Technicians: Jeff Koch and Julianna Diehl

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*Andrew King Cell Number: (210) 701 6727*

Loading: December 8, 2017 @0900

**Departure: December 11, 2017 @0800 (Science personnel on board by 0700).**

Arrival: December 15, 2017 @ 0800

Debrief: December 15, 2017 @ 1000 in the KOK Conference Room

## 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. Three 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 December 11<sup>th</sup> 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 December 11<sup>th</sup> – 13<sup>th</sup>
- 3) Station 52, the site of WHOTS-14 Mooring (anchor position 22 40.01'N 157 57.09'W) will be occupied on for about one hour on December 14<sup>th</sup>.

**Note: No operations at Station 6, Kaena, due to time requirements for the recovery of the deep sediment trap.**

## 1.1 SCIENTIFIC OPERATIONS

| <u>Station</u>                  | <u>Activities</u>  |
|---------------------------------|--|
| 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. 52) | One CTD cast (yo-yo to 200 m), surface instrument intercomparisons.  |
| Underway/continuous             | ADCP, thermosalinograph, fluorometry, meteorology  |

## 2.0. SCIENCE PERSONNEL

| <b>Participant</b>            | <b>Title</b>          | <b>Affiliation</b> | <b>Citizenship</b> |
|-------------------------------|-----------------------|--------------------|--------------------|
| Karin Bjorkman                | Scientist             | UH                 | Sweden             |
| Dan Sadler                    | Research Associate    | UH                 | USA                |
| Brenner Wai                   | Research Associate    | UH                 | USA                |
| Blake Watkins                 | Marine Engineer       | UH                 | USA                |
| Tim Burrell                   | Research Associate    | UH/SCOPE           | New Zealand        |
| Tara Clemente                 | Research Associate    | UH/SCOPE           | USA                |
| Eric Shimabukuro              | Research Associate    | UH/SCOPE           | USA                |
| Fernando Santiago-Mandujano   | Research Associate    | UH                 | USA                |
| Andrew King – Chief Scientist | Research Associate    | UH                 | USA                |
| Gerarda Terlouw               | Post Graduate Trainee | UH                 | The Netherlands    |
| Carolina Funkey               | Research Associate    | UH                 | USA                |
| Ryan Tabata                   | Research Associate    | UH                 | USA                |
| Svetlana Natarov              | Research Assistant    | UH                 | USA                |
| Jefrey Snyder                 | Marine Technician     | UH                 | USA                |
| Morgan Linney                 | Graduate Student      | UH                 | USA                |
| Erica Goetze                  | Professor             | UH                 | USA                |
| Kara Nichols                  | Volunteer             | High School        | USA                |
| Kaylee Scidmore-Rossing       | Volunteer             | HPU                | USA                |
| Julianna Diehl                | Marine Technician     | OTG                | USA                |
| Jeff Koch                     | Marine Technician     | OTG                | USA                |

## 3.0. SUMMARY SCHEDULE

|                |   |
|----------------|---|
| 5 December     | Pre-cruise planning meeting 1330 hrs, MSB-315                               |
| 8 December     | Ship loading at 0900 hrs.   |
| 11 December    | Depart from Pier 35 at 0800 hrs. <b>Science personnel on-board by 0700.</b> |
| 11 December    | Station 1 Kahe Pt. operations.  |
| 12-14 December | Station ALOHA operations. Station 52 CTD yo-yo cast                         |
| 15 December    | Arrive back to Pier 35. Full offload.                                       |

## 4.0. OPERATIONAL PLANS

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

A 500 lb. 1000 m weight-test cast, one CTD cast to 1000 m (Sect. 4.2.7) will be conducted at this location on December 11<sup>th</sup>. The CTD winch and starboard squirt boom 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. On arrival at Station ALOHA, the sediment traps will be deployed (Sect. 4.2.2). Once the sediment trap is deployed, the Wirewalker will be deployed (Sect. 4.2.2.1). After these operations are completed, one 1000-m CTD cast will be conducted. Following this, the Primary Production array will be deployed (4.2.3); These operations will be followed by a near-bottom CTD cast and the start of the 36-hour water column observations at Station ALOHA.

**Note: Array tracking is facilitated through the SOEST Cruise and Drifter Tracks tool found at <http://hahana.soest.hawaii.edu/nowcast/loctable.html>**

#### 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 by local current conditions. The array will be deployed from the starboard stern rail using the small crane 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 56 hours before recovery. The array is equipped with 1 ARGOS satellite transmitter (platform #: 60484), 1 Novatech Iridium beacon (platform #: 200), strobe lights, a radio transmitter (channel 74: 156.725 MHz). Daily positions of the array shall be transmitted by email directly to the ship ([argosfix@kok.soest.hawaii.edu](mailto:argosfix@kok.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 prepare to deploy the wirewalker.

##### 4.2.2.1 Wirewalker deployment

A Wirewalker (Del Mar Oceanographic) will be deployed at Station ALOHA to take hydrographic and optical observations in the upper 400 m of the water column. The instrument is about 1.5 m long and 0.6 m wide and about 30 Kg, with a 40 Kg bottom weight, and attached to a surface buoy with strobe light and Pacific Gyre positioning system (ID: DMO-GLBCN-0003 or DMO-GLBCN-0004), Xeos 56010, Iridium (platform #: 704320), and one Rockblock Beacon.

The Wirewalker will be deployed and recovered close to the sediment traps deployment and recovery, so that the two should drift in the same direction to reduce the transit time to recover them. The instrument will stay in the water for about 2 days. Deployment and recovery will be conducted from the back deck through the A-frame and using the SeaMac winch, each operation will take 30 to 60 min. Blake Watkins will be in charge of this operation with 2 or 3 members of the science party. Two ABs will be required to operate the A-frame and winch respectively.

After deployment of the primary production array, the ship shall transit to the center of the station circle to conduct a near bottom CTD cast (approximately 4740 m).

#### 4.2.3 Primary production experiment

Samples for the primary productivity experiment will be collected from the rosette. Before dawn (Sunrise 0700 hrs on December 12<sup>th</sup>), a free drifting incubation array will be deployed from the starboard stern rail using the small crane and the Sea-Mac winch. The array is equipped with two ARGOS satellite transmitters (platform # 84857), Novatech Iridium beacon (platform #: 100), strobe lights and a radio transmitter (channel 73: 156.675 MHz). Positions of the array will be emailed to [argosfix@kok.soest.hawaii.edu](mailto:argosfix@kok.soest.hawaii.edu) , password: argosfix. 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 at 1600, before sunset (1751 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 winch and crane 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 (**Tara Clemente, Fernando Santiago-Mandujano**).

#### 4.2.5. Gas Array deployment

A 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 8. The gas array will be deployed from the starboard stern rail using the small crane and the Sea-Mac winch. The array is equipped with two ARGOS satellite transmitters (platform # 84857), Novatech Iridium beacon (platform #: 100), strobe lights and a radio transmitter (channel 73: 156.675 MHz). Positions of the array will be emailed to [argosfix@kok.soest.hawaii.edu](mailto:argosfix@kok.soest.hawaii.edu), password: argosfix. 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. 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. 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.

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.

#### 4.2.8. Automated Trace Element Sampler (ATE)

On the morning of December 13<sup>th</sup>, 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.**

#### 4.3. Gas Array and floating Sediment sediment trap recovery

In the morning of December 14<sup>th</sup>, after the optics cast has been completed, the ship shall transit for the recovery of the Gas Array. The small crane 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. On completion of sediment trap array recovery, the ship shall transit to recover the Wirewalker. 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 52 and conduct one 200 m CTD yo-yo cast.

#### 4.4 Station 52 - WHOTS-14 Mooring

The anchor position of the WHOTS-14 mooring is 22° 40.0154' N, 157° 57.0915' 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 December 14<sup>th</sup> 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, ADCP intercomparisons will be run between the shipboard ADCP system and the moored instruments on the WHOTS-14 mooring line. These comparisons should also be conducted downwind, down current, and about 200 m from the mooring.

#### 4.5 Deep Sediment Trap Recovery

Following the completion of ADCP comparisons, the ship shall transit to the location of the deep sediment trap anchor at 22°51.971' N, 157°53.167' W. Recovery of the sediment trap is expected to take approximately 3 hours, with return to the surface expected to take an hour. The array is equipped with a radio transmitter for location (156.625MHz)

Blake Watkins will be in charge of this operation with 2 or 3 members of the science party. Two ABs will be required to operate the A-frame and winch respectively.

#### 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 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 Pier 35. 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 OTG technicians will be in charge of the thermosalinograph and fluorometer 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 (#23, and SCOPE) with assorted equipment for radioisotope and general use. One 10 ft. blue storage van (PO) for equipment and spare storage.
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, line, sediment traps and crosses.
8. Drifting primary production array with strobe lights, satellite and radio transmitters, floats, weights, line primary production bottles and spreader bars.

9. Drifting diazotrophy growth rate array with strobe lights, satellite and radio transmitters, floats, weights, line, 4 L bottles and long mounting bars.
10. Drifting gas array with strobe lights, satellite and radio transmitters, floats, weights, line, 4 L bottles and short mounting bars.
11. Oxygen titration system
12. Plankton nets and towing lines
13. Desktop and laptop personal computers
14. Assorted tools
15. All required sampling bottles
16. Deck incubation system (1- dark incubator)
17. Pertinent MSDS
18. Chest Freezer (22 cubic inch)
19. Wirewalker

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. Electric power
  - 440/480 VAC, 3 phase 60Hz, 60amp for winches
  - 208 VAC single phase at 60 amps for lab vans
5. Space on the back deck for one laboratory van (**#23**)
6. Space on upper deck for two vans (**SCOPE and Blue Equipment van**)
7. Space on deck for ~6 deck baskets of array gear
8. Space on back deck for sea water incubators
9. Small capstan (~ 10 m/min)
10. SeaMac Winch
11. Radio direction finder
12. Hand-held VHF transceivers
13. Shackles, sheaves, hooks and lines
14. Precision depth recorder
15. Shipboard Acoustic Doppler Current Profiler
16. Thermosalinograph and Fluorometer
17. Meteorological suite
18. Grappling hooks and line
19. Navlink2 PC or equivalent
20. Running fresh water and seawater, hoses
21. Uncontaminated seawater supply
22. -80°C Freezer
23. 4°C Refrigerator and -20°C Freezer
24. Distilled, deionized water system
25. Electronic mail system
26. GPS system
27. Underway/on-station data acquisition system for meteorological instruments, ADCP, thermosalinograph, fluorometer, and access to real-time data through the network.
28. OTG's 24-place rosette, and 24 12-l water sampling bottles (to be used as spare)
29. ~1300 lb weight
30. Remote CTD dbar pressure display in the winch operator area.
31. Monitor in CTD Lab displaying ship coordinates, bottom depth and GMT.
32. OTG's transmissometer

| Cast                        | Samples        | #Bottles   |    |
|-----------------------------|----------------|--|----|
| <b><u>Kahe Pt.</u></b>      |                |  |    |
| s1c1                        | 1000 m         | O <sub>2</sub> , Temp, DIC/Alk, Nuts, Chl a, LLN, LLP, DOC, FCM, Salts                               | 24 |
| <b><u>Station ALOHA</u></b> |                |  |    |
| s2c1                        | 1000 m         | Primary Production, SF-S(pb 3@ 5, 25, 45, 75, 100, 125 ), Salts                                      | 22 |
| s2c2                        | 4740 m (PO-1)  | O <sub>2</sub> , Temp, DOC, DIC/Alk, Nuts, Salts   | 24 |
| s2c3                        | 1000 m (PO-2)  | O <sub>2</sub> , Temp, DOC, DIC/Alk, Nuts, Salts   | 24 |
| s2c4                        | 1000 m         | PC/PN, DNA(1@5,25,45,75), Salts  | 18 |
| s2c5                        | 1000 m         | PPO4, SF-S(1@25), Salts  | 15 |
| s2c6                        | 1000 m (BEACH) | O <sub>2</sub> , Temp, DIC/Alk, Nuts, LLN, LLP, DOC, Keeling, Quay, Salts, SF-S(1@5,pb@25)           | 24 |
| s2c7                        | 1000 m         | PUR, SF-S(1@5, 25), DNA(1@,100,125,150,175), Salts   | 16 |
| 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(1@5, 25), MC (1@5, 25, 45, 75, 100, 125, 150, 175), Salts               | 16 |
| s2c10                       | 1000 m         | PSi, SF-S(1@5, 25), KW-B(1@5,25,45), Salts   | 17 |
| s2c11                       | 1000 m         | SF-S(1@5, 25), ML(4@25), GT (1@5,25,45,75,100,125, 150,200,300,400, MLD-5, MLD+5), Salts             | 21 |
| s2c12                       | 1000 m         | ATP, DNA(2@300,400,500,770), SF-S(1@5, 25), Salts  | 21 |
| s2c13                       | 1000 m         | SW(1@5,25,45,75,100,125,150,175, 200, 300, 400, 800), SF-S(pb SW 1@5, 25), Salts                     | 14 |
| s2c14                       | 1000 m         | HPLC, Chl a, Salts   | 14 |
| s2c15                       | 4740 m (PO-3)  | Oxygen, DNA(1@1000,2000,3000,4000), EG(2@5,DCM,500,1000,2000,3000,4000,4500), KW-B(1@5,25,45), Salts | 23 |
| <b><u>WHOTS Mooring</u></b> |                |  |    |
| s52c1                       | 200 m yo-yo    | DIC/TA(1@5), KW-B(1@5,25,45),KB(1@5),GT(2@25)  | 7  |

MC=Matt Church, SW=Sam Wilson, SF-S=Sara Ferrón-Smith, KW-B=Kate Watkins-Brandt, EG=Erika Goetze, KB=Karin Bjorkman, ML=Morgan Linney, GT=Gerianne Terlouw

**Ship: R/V Ka'Imikai-O-Kanaloa    HOT 298    Date: December 11-15, 2016**

| TIME | Mon 12/11              | Tue. 12/12                 | Wed. 12/13                   | Thur. 12/14                            | Fri. 12/15     |
|------|------------------------|----------------------------|------------------------------|--|----------------|
| 0000 |                        | Deploy WireWalker          |                              |  |                |
| 0100 |                        | Deploy Sed Traps           |                              |  |                |
| 0200 |                        | S2C1 PP                    | S2C8 Gas                     |  |                |
| 0300 |                        |                            |                              | Optics                                 |                |
| 0400 |                        | Deploy PP Array            | Deploy Gas Array             |  |                |
| 0500 |                        |                            | S2C9 Open                    | Transit gas array                      |                |
| 0600 |                        | S2C2 PO-1                  |                              | Recover gas array<br>Transit sed traps |                |
| 0700 | All Sci. Aboard        |                            |                              | Recover sed traps                      |                |
| 0800 | Depart Pier 35         |                            | S2C10 PSi                    | Transit WireWalker                     | Arrive Pier 35 |
| 0900 | Arrive Kahe (10:00)    |                            |                              | Recover WireWalker                     |                |
| 1000 | Weight cast            |                            | ATE                          | Transit St. 52                         |                |
| 1100 | S1C1 Kahe              | S2C3 PO-2<br>(Begin 36 hr) | S2C11 Open                   |  |                |
| 1200 | Transit ALOHA          | Net Tow                    | Net Tow<br>Net Tow           |  |                |
| 1300 |                        |                            |                              | S52C1 WHOTS                            |                |
| 1400 |                        | S2C4 PC/PN                 | S2C12 ATP                    | ADCP Inter-comp                        |                |
| 1500 |                        |                            |                              | Transit deep trap                      |                |
| 1600 |                        | S2C5 PPO4                  |                              | Deep trap recovery                     |                |
| 1700 |                        | Recover PP array           | S2C13 Open                   |  |                |
| 1800 |                        |                            |                              |  |                |
| 1900 |                        |                            |                              | Transit Pier 35                        |                |
| 2000 |                        | S2C6 BEACH                 | S2C14 HPLC                   |  |                |
| 2100 |                        | Goetze Tow                 |                              |  |                |
| 2200 |                        | Net Tow<br>Net Tow         | Net Tow                      |  |                |
| 2300 | Arrive ALOHA<br>(0000) | S2C7 PUR                   | S2C15 PO-3<br>(end 36 hours) |  |                |

**December 12th: Sunrise 0700, Sunset 1751**



## 6.0 HOT-298 Watch Schedule

### **0300-1500**

Dan Sadler - *Water Boss*

Brenner Wai – *Tag*

Jefrey Snyder – *Tag*

Tara Clemente – *Watch Leader, Alt. Tag*

Gerianne Terlouw – *Alt. Tag*

Eric Shimabukuro

Svetlana Natarov – *Console*

Kaylee Rossing

### **1500-0300**

Karin Bjorkman – *Water Boss*

Carolina Funkey

Ryan Tabata - *Tag*

Tim Burrell – *Tag*

Morgan Linney – *Alt Tag*

Fernando Santiago-Mandujano – *Watch Leader, Alt Tag*

Andrew King – *Chief Scientist, Console*

Kara Nichols

### **At Large**

Blake Watkins

Erica Goetze

### **OTG**

Jeff Koch

Julianna Diehl