# Hawaii Ocean Time-series
# HOT-334 Cruise Plan - Operational

Cruise ID: KM 21-18
Vessel: R/V *Kilo Moana*, University of Hawaii
Master of the Vessel: Captain Peter Aguinaldo
Chief Scientist: Karin Björkman, University of Hawaii
Marine Technicians: Jeff Koch, Nick Mathews

*Marine Center phone number: (808) 956-0688*
*KM phone numbers (in port): 808-587-8566 / 67*
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***Karin Björkman Cell Number: (808)-738-6421***

Pre-Cruise Meeting: Nov 23rd, 2021 at 1330 via Zoom
Loading: Dec 1st, 2021 at 0900, Pier 35.
Departure: Dec 2nd, 2021 at 0900. (**Science personnel at UHMC by 0800).**
Arrival: Dec 7th, 2021 at 0800
Post-Cruise Meeting: Dec 8th, 2021 at 1330 via Zoom

## 1.0 COVID-19 PREVENTION

Please note that COVID-19 restrictions are still in place to prevent the spread of the virus onboard. UNOLS has provided guidelines which were followed on this cruise. A few of the guidelines are found below. The extensive list can be found in the Pandemic Response Plan.

All science personnel are to have proof of vaccination and have received a negative RT-PCR test result prior to cruise. Social distancing and mask wearing apply as per previous cruises.

## 2.0 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 December 2nd for about 3-4 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 2-6.
3) Station 50, the site of WHOTS-17 Mooring (anchor position 22° 46.002'N 157° 53.958'W) will be occupied for about 3-4 hours on December 6th.
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 for about 2 hours on December 6th.

1.1 SCIENTIFIC OPERATIONS

| Station | Activities |
|---|---|
| Kahe (Sta. 1) | Weight Cast, Hyperpro cast, CTD cast (1000 m), Trace Metal Go-Flo cast |
| ALOHA (Sta. 2) | Sediment traps, Primary productivity array, Gas array, Hyperpro, Net tows, CTD operations, Optics casts, Trace Metal Go-Flo casts |
| WHOTS mooring station (Sta. 50) | One CTD cast (yo-yo to 200 m), Hyperpro, Trace Metal Go-Flo cast, surface instrument intercomparisons. |
| Kaena (Sta. 6) | One near bottom CTD-cast (~2400 m) |
| Underway/continuous | ADCP, thermosalinograph, fluorometry, meteorology |

2.0. SCIENCE PERSONNEL

| **Participant** | **Title** | **Affiliation** | **Citizenship** |
|---|---|---|---|
| Eleanor Bates | Graduate student | UH | USA |
| Andy Burger | Scientist | UH | USA |
| Karin Björkman | Scientist | UH | SWE |
| Jia Cashon | Undergraduate student | UH | USA |
| Dan Fitzgerald | Research Associate | UH | USA |
| Lance Fujieki | Research Associate | UH | USA |
| Caroline Jackson | Graduate student | UH | USA |
| Reece James | Graduate student | UH | USA |
| Lucie Knor | Graduate student | UH | DEU |
| Jeff Koch | Marine Technician | OTG | USA |
| Fuyan Li | Post-doc | UH | CHI |
| Nick Mathews | Marine Technician | OTG/UNOLS | USA |
| Nicole Mathews | Undergraduate student | UH | USA |
| James Harris III | Undergraduate student | UH | USA |
| Dan Sadler | Research Associate | UH | USA |
| Fernando Santiago-Mandujano | Research Associate | UH | USA |
| Eric Shimabukuro | Graduate student | UH | USA |
| Blake Watkins | Marine Engineer | UH | USA |

| | |
|---|---|
| 23 Nov | Pre-cruise planning meeting 1330 hrs, via Zoom. |
| 1 Dec | Loading at 0900 hrs, Pier 35. |
| 2 Dec | Depart from Pier 35 at 0900 hrs. **Science personnel to UHMC by 0800.** |
| 2 Dec | Station 1 Kahe Pt. operations. |
| 2-6 Dec | Station 2 ALOHA operations, Station 50 CTD yo-yo cast, Station 6 deep CTD cast |
| 7 Dec | Arrive back to Pier 35. |
| 8 Dec | Post-cruise meeting at 1330 hrs, via Zoom |

4.0. OPERATIONAL PLANS

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

A 1300 lb. weight-test cast to 500 m will be conducted, **including testing of the emergency systems on the docking head of the Hawboldt LARS system.** A Hyperpro cast (Sect. 4.2.9), one CTD cast to 1000 m (4.2.6), and a Trace Metal Go-Flo cast (4.8) will be conducted at this location on Dec 2nd. The ship's A-frame,

CTD winch, and SeaMac winch will be needed for these operations. After the operations are satisfactorily completed, the ship shall proceed to Station ALOHA.

Following the incident on HOT-328, this and all future weight casts are to include the following tests of the Hawboldt system:

**A. Manual Anti-2 Block Test**

This test will verify that the control system will successfully prevent excessive tension spikes in the event that the operator were to accidentally pull the package into the docking head at full speed.

- Start the hydraulics and enable control from the belly pack.
- Position the test weight and the LARS docking head over the main deck, approximately in the landing area normally used for the rosette.
- Position the docking head approximately 10' from the deck, and manually lower the test weight such that it is barely lifted off the deck
- Ensure the winch is in manual mode
- Ensure all personnel are clear of the area.
- Haul in with the CTD winch at full speed until the test weight compresses the springs completely. The test weight should immediately lower approximately 1.5' and stop as the winch brakes apply.
- The tension can be viewed on the monitor in Lab 1, ensure the spike is below 5,000 lbs.
- Reset all alarms on the Local Console.

**B. Auto with LARS Anti-2 Block Test**

This test will verify that the control system will successfully prevent excessive tension spikes in the event that the operator were to forget to put the winch into Auto with LARS mode prior to moving the LARS.

- Start the hydraulics and enable control from the belly pack.
- Pick up the test weight with the LARS and position the LARS in the 'Casting' slew position with the knuckle pointing straight down, and the extension boom retracted.
- Ensure all personnel are clear of the area.
- If it isn't already, pull the test weight up into the docking head, just so the springs start to compress.
- Turn the winch to manual mode.
- Knuckle out at full speed. The weight will get pulled into the docking head as the winch will not respond to LARS movement.
- Once the test weight is 2-blocked, the LARS will stop moving and the weight will remain fully 2 blocked.
- The tension can be viewed on the monitor in Lab 1, ensure the spike is below 5,000 lbs.
- Reset all alarms on the Local Console.

**C. Auto with LARS Switch Malfunction Test**

This test will verify that the control system will successfully prevent excessive tension spikes in the event that the docking head anti-2 block sensor malfunctions during a deployment or recovery.

- Start the hydraulics and enable control from the belly pack.
- Pick up the test weight with the LARS and position the LARS in the 'Casting' slew position with the knuckle pointing straight down, and the extension boom retracted.
- Ensure all personnel are clear of the area.
- If it isn't already, pull the test weight up into the docking head, just so the springs start to compress.
- Turn the winch to Auto with LARS mode
- Knuckle out at a reduced speed.
- As the LARS is moving, temporarily remove fuse F10161 from the Local Console.
- The LARS and winch will immediately stop, the winch will lower the weight about 1.5' and then apply its brake.

- Once this behavior is confirmed, the test is considered successful.
- Reset all alarms on the Local Console

4.2. Station ALOHA (22°45'N, 158°W with 6 nm radius)

4.2.1. Upon arrival to Station ALOHA, a cast to1000 m for 1000 m seawater collection will be conducted. At 0200 a 1000 m cast for the Primary Production experiment will be conducted followed by the Primary Production array deployment (4.2.3) (*). The recovery of the PP-array will be around dusk the same day. After these operations are completed we will continue with CTD casts, TM-Go-Flo cast, HyperPro (4.2.6) and net tows.

On December 4th the Sediment Trap Array will be deployed (Sect 4.2.2).

These operations will be followed by 1000 m CTD cast, and at 0400 a near-bottom CTD cast and a 1000 m cast as the start of the 36-hour water column observations at Station ALOHA.

**(*) NOTE: The deployment of all drifting array must be determined by observed local and forecasted currents to avoid possible entanglement with the WHOTS mooring.**
**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

The floating sediment traps will be from the back of the deck through the A-frame and using the SeaMac winch. After deployment we request that the bridge verify that the radio transmitters are functioning and directionally correct. The Sediment Trap array, to be deployed on the Dec 4th and recovered on Dec 6th, will consist of two crosses, one with 12 particle interceptor traps (PIT) placed at 150 m, and one cross above it with 4 traps.

The array is equipped with 1 Novatech Iridium beacon, strobe lights, and a radio transmitter (see section 6.0 for transmitter IDs). 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. Blake Watkins will direct this deployment.

4.2.3. Primary production experiment

Samples for the primary productivity experiment will be collected from the rosette. Before dawn (Sunrise 0657 hrs on December 3rd), a free drifting incubation array will be deployed from the back of the deck thru the A-frame and using the SeaMac winch. The primary production incubation array will be deployed at a location within Station ALOHA to be determined by observed local and forecasted currents to avoid possible entanglement with the WHOTS mooring. Positions of the array will be monitored (See section 6.0 for Transmitter IDs).

The array will be recovered at sunset (1747 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. Blake Watkins will direct this deployment.

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 A-frame for these operations. Water samples for biogeochemical measurements will be collected on each cast. Around 0400 on the 4th a near bottom (approximately 4740 m) cast shall be made. Following this cast, a series of 1000-m casts shall be made continuously every three 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 **(Dan Sadler and 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 13. The gas array will be deployed from the back of the deck thru the A-frame and using the SeaMac winch. The gas array will be deployed at a location within Station ALOHA to be determined by observed local and forecasted currents to avoid possible entanglement with the WHOTS mooring. The array is equipped with GPS transmitters, strobe lights and a radio transmitter (See Section 6.0 for transmitter IDs). 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. Blake Watkins will be in charge of this deployment.

4.2.6. 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 two profiles and one yo-yo (5 x 20 m) before the instrument is retrieved.

4.2.7. Optics

An optical package including a SeaBird Seacat with temperature, conductivity, and pressure sensors, a Wetlabs ECO triplet measuring backscatter, chlorophyll fluorescence, and CDOM fluorescence, and a LISST particle size and distribution analyzer will be deployed during the cruise. Each deployment will consist of three 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. 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. Blake Watkins will direct these operations.

4.3 Gas Array, Sediment Trap Array recovery

In the morning of December 6$^{th}$, 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 array. After the Gas Array is recovered, the ship shall transit to recover the floating sediment trap array. Blake Watkins will be in charge of these operations. After the completion of these operations the ship shall transit to Station 50.

4.4 Station 50 - WHOTS-17 Mooring

The anchor position of the WHOTS-17 mooring is 22° 46.002'N 157° 53.958'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. Upon arrival at

Station 50 on December 6th, one 200 m CTD yo-yo cast (Sect. 4.4.1), a Hyperpro cast, and ADCP intercomparisons will be conducted.

4.4.1 CTD yo-yo cast (subsurface instrument intercomparison)

One yo-yo cast with at least 5 full cycles will be conducted near the WHOTS buoy on December 6th for subsurface instrument intercomparison. The cast should be conducted downwind, down current, and about 200 m from the mooring.

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 December 6th. Once the CTD cast is complete, the ship shall return to Pier 35.

4.7. Acoustic Doppler Current Profiler

The ship's acoustic Doppler current profilers (ADCP) will be in operation during the duration of the cruise. The OTG technicians will be in charge of the ADCP system.

4.8. Thermosalinograph, Fluorometer and $pCO_2$

The ship's thermosalinograph, fluorometer and $pCO_2$ 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 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, fluorometer, and meteorological suite operations.

4.9. Trace Metal Clean Rosette

THIS WILL BE CONDUCTED USING GO-FLO BOTTLES ON THIS CRUISE

Vertical profiles between 0-600m will be conducted for trace metal analysis using a rosette package with autonomous Auto Fire Module. This mini-CTD rosette consists of a SeaBird CTD attached to a 12-place rosette with 8 liter Niskin sampling bottles. The rosette is approximately 5 ft x 5ft x 4 ft and weighs 355/565 lbs in air empty/full. We will deploy the CTD rosette using the W2 winch, delrin block and 1/4" Amsteel line using trace metal clean procedures from the stern of the vessel using the A-Frame. Eleanor Bates will be in charge of this operation. **We request the ship's personnel to contact us before doing any trash burning or any cooking that would disseminate smoke to the labs or working area**.

## 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. One 20 ft. laboratory van (#23) with assorted equipment for radioisotope and general use, one 10x8 ft. equipment van (PO) for equipment and spare storage, and one trace metal 20 ft van (#24).
3. Distilled, deionized water and all required chemicals and isotopes
4. Large vacuum waste containers
5. Liquid nitrogen dewars
6. Drifting sediment trap array with strobe lights, satellite and radio transmitters, floats, weights, line, sediment traps and crosses.
7. Drifting primary production array with strobe lights, satellite and radio transmitters, floats, weights, line primary production bottles and spreader bars.

8. Drifting gas array with strobe lights, satellite and radio transmitters, floats, weights, line, 4 L bottles and short mounting bars.
9. Oxygen titration system
10. Plankton nets and towing lines
11. Desktop and laptop personal computers
12. Assorted tools
13. All required sampling bottles
14. Pertinent MSDS
15. Incubator, blue, stored on 02 Deck

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 upper 01 deck port side for one 10 ft van **(Equipment van)**
6. Space on upper 01 deck port side for one 20 ft van **(#23)**
7. Space on upper 01 deck starboard side for trace metal 20 ft van (**#24**)
8. Space on 02 deck for one incubator
9. Space on deck for ~4 deck baskets of array gear.
10. Small capstan (~ 10 m/min)
11. SeaMac Winch
12. W2 winch
13. Radio direction finder
14. Hand-held VHF transceivers
15. Shackles, sheaves, hooks and lines
16. Precision depth recorder
17. Shipboard Acoustic Doppler Current Profiler
18. Thermosalinograph, $pCO_2$ system, and Fluorometer
19. Meteorological suite
20. Grappling hooks and line
21. Navlink2 PC or equivalent
22. Running fresh water and seawater, hoses
23. Uncontaminated seawater supply
24. Source of compressed air for Trace Metal pump
25. -80°C Freezer
26. 4°C Refrigerator and -20°C Freezer
27. Distilled, deionized water system
28. Electronic mail system
29. GPS system
30. Underway/on-station data acquisition system for meteorological instruments, ADCP, thermosalinograph, fluorometer, access to real-time data through the network.
31. OTG's 24-place rosette, and 24 12-l water sampling bottles (**to be used as primary**)
32. OTG's CTD (back-up to HOT's)
33. ~1300 lb weight
34. Remote CTD dbar pressure display in the winch operator area.
35. Monitor in CTD Lab displaying ship coordinates, bottom depth and GMT.
36. OTG's transmissometer

37. Trace metal free block
38. Amsteel Line (1/4") for trace metal clean work

## 6.0 Satellite Position Transmitters Summary

| Array Name | RockBlock ID | XEOS ID | Argos ID | Radio Frequency |
|---|---|---|---|---|
| Sediment Trap | 05 | 267 | | 156.675 MHz |
| Primary Production (PP) | 08 | 266 | | 156.475 MHz |
| Gas Array (GA) | 08 | 266 | | 156.475 MHz |

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

**Ship: R/V *Kilo Moana*** **HOT 334 CTD CASTS** **Date: Dec 2-7, 2021**

| Cast | | Samples | #Bottles |
|---|---|---|---|
| **Kahe Pt.** | | | |
| s1c1 | 1000 m | $O_2$, Temp, DIC/Alk, pH, Nuts, LLN, LLP, Chl a, Salts | 15 |
| **Station ALOHA** | | | |
| s2c1 | 1000 m | **AB** (24@1000 m) | 24 |
| s2c2 | 1000 m | Primary Production (3@ 5, 25, 45, 75, 100, 125, 150, 175)<br>Chl a, FCM, DIC, Salts | 24 |
| s2c3 | 1000 m | SCOPE DNA (1@5, 25, 45, 75) | 4 |
| s2c4 | 1000 m | **AB** (24@1000 m) | 24 |
| s2c5 | 1000 m | SCOPE DNA(1@200, 225, 250, 275) | 6 |
| s2c6 | 1000 m | **RF**(1@5,25,45, 75,100, DCM), **AB** (18@1000m) | 24 |
| s2c7 | 4740 m (PO-1) | $O_2$, Temp, DOC, DIC/Alk, pH, Ref Si, Nuts, Salts | 24 |
| s2c8 | 1000 m (PO-2) | $O_2$, Temp, DOC, DIC/Alk, pH, Nuts, Ref Si, Salts<br>PQ (DIC [A,B] pb@300,400,500,600,800,1000) | 24 |
| s2c9 | 1000 m | PC/PN, **DL**(pb@5,25,45,75,100,125,150,175), Salts | 19 |
| s2c10 | 1000 m | PPO4, salts, SCOPE DNA (1@300,400,500,770) | 18 |
| s2c11 | 1000 m (BEACH) | $O_2$, Temp, DIC/Alk, pH, Nuts, LLN, LLP, DOC, Keeling, Quay, salts<br>PQ (DIC [A,B] 1@50m pb@5,25,75,100,150,200) | 24 |
| s2c12 | 1000 m | SCOPE DNA(1@ 100,125,150,175) | 6 |
| s2c13 | 1000 m | Gas Array(3@5,25,45,75,100,125), Salts | 20 |
| s2c14 | 1000 m | **MC** (1@5, 25, 45, 75, 100, 125, 150, 175), Salts | 10 |
| s2c15 | 1000 m | PSi, Salts | 10 |
| s2c16 | 1000 m | **RF**(1@5,25,45, 75,100, DCM), **SD** (6@ML) | 14 |
| s2c17 | 1000 m | ATP, Salts | 11 |
| s2c18 | 1000 m | **AB** (22@1000 m) | 24 |
| s2c19 | 1000 m | HPLC, Chl a, Salts | 14 |
| s2c20 | 4740 m (PO-3) | Oxygen, SCOPE DNA(1@ 1000,2000,3000,4000), Salts<br>**AB** (10@1000 m) | 22 |
| **WHOTS Mooring** | | | |
| s50c1 | 200 m yo-yo | DIC/TA(1@5) | 9 |

**Station Kaena**

| | | | |
|---|---|---|---|
| s6c1 | 2400 m | Chl a, salts | 13 |

**AB=**Andy Burger**, MC**=Matt Church**, SD=**Sonya Dyhrman**, RF**=Rachel Foster, **DL**=Debbie Lindell, **PQ**=Paul Quay

**Ship: R/V *Kilo Moana* HOT 334 Date: December 2 – Dec 7, 2021**

| TIME | Thursday 12/2 | Friday 12/3 | Saturday 12/4 | Sunday 12/5 | Monday 12/6 |
|---|---|---|---|---|---|
| 0000 | | S2C1 | Deploy Sed Traps | | |
| 0100 | | | | | |
| 0200 | | S2C2 - PP | S2C6 | S2C13 Gas Array | |
| 0300 | | | | | Optics |
| 0400 | | Deploy PP array | S2C7 PO-1 (Deep) | Deploy Gas Array | |
| 0500 | | | | S2C14 Open | Transit Gas Array |
| 0600 | | | | Transit to pump tanks, Incinerator | Recover Gas Array<br>Transit Sed Trap |
| 0700 | | | | | Recover ST |
| 0800 | On Board | S2C3 | | S2C15 PSi | |
| 0900 | Depart Pier 35 | TM Go-Flo 2 | TM Go-Flo cast 4 | TM Go-Flo cast 6 | |
| 1000 | | | S2C8 PO-2<br>(begin 36 hours) | | Transit Station 50 |
| 1100 | Arrive Kahe<br>Weight Cast | | | S2C16 | S50C1 WHOTS |
| 1200 | HyperPro | Net tow<br>Net tow | Net tow | Net Tow<br>Net Tow | HyperPro |
| 1300 | S1C1 Kahe | HyperPro | | | |
| 1400 | TM Go-Flo cast 1 | S2C4 | S2C9 PC/PN | S2C17 ATP | TM Go-Flo 8 |
| 1500 | Transit to ALOHA | | Transit to pump tanks | Transit to pump tanks | Transit to Kaena |
| 1600 | | | | | |
| 1700 | | Transit to PP-array<br>Recover PP-array | S2C10 PPO4 | S2C18 Open | |
| 1800 | | TM Go-Flo 3 | TM Go-Flo 5 | TM Go-Flo 7 | |
| 1900 | | | | | |
| 2000 | | S2C5 | S2C11 BEACH | S2C19 HPLC | S6C1 Kaena |
| 2100 | | | | | |
| 2200 | | Net Tow<br>Net Tow | Net Tow<br>Net Tow | Net Tow | |
| 2300 | Arrive Stn ALOHA | | S2C12 | S2C20 PO-3<br>(Deep end 36 h) | Transit to Pier 35 |

**December 3: Sunrise 0657, Sunset 1747**

**Ship: R/V *Kilo Moana*  HOT 334  Date: December 2-7, 2021**

| TIME | Tuesday 12/7 |
|---|---|
| 0000 | |
| 0100 | |
| 0200 | |
| 0300 | |
| 0400 | |
| 0500 | |
| 0600 | |
| 0700 | |
| 0800 | Arrive at Pier 35 |
| 0900 | |
| 1000 | |
| 1100 | |
| 1200 | |
| 1300 | |
| 1400 | |
| 1500 | |
| 1600 | |
| 1700 | |
| 1800 | |
| 1900 | |
| 2000 | |
| 2100 | |
| 2200 | |
| 2300 | |

# 6.0 HOT-334 Watch Schedule

**0300-1500**

Dan Fitzgerald– Watch leader
Lucie Knor– Console
Dan Sadler – Water Boss
Lance Fujieki
Nicole Mathews
Reece James

**1500-0300**

Karin Björkman – Water Boss – Chief Scientist
Fernando Santiago-Mandujano – Console – Watch leader
Eric Shimabukuro
Caroline Jackson
James Harris III

**0900-2100**

Jia Cashon

**At Large**

Eleanor Bates
Andrew Burger
Fuyan Li
Blake Watkins

**OTG**

Jeff Koch (lead)
Nick Mathews