SCOPE-PARAGON II (Aug 4-18, 2022) cruise plan and schedule

Cruise ID: KM 22-??
Vessel: R/V *Kilo Moana*, University of Hawaii
Master of the Vessel: ??
Chief Scientist: Matthew Church, University of Montana
Marine Technicians: Trevor Young (lead), Lance Frymire, Nick Matthews

Marine Center phone number: (808) 956-0688
KM phone numbers (in port): 808-587-8566 / 67
KM cell phone: 808-864-0065
KM sat phone (voice): 011-870-773-234249
KM sat phone (fax): 011-870-783-207825
Matthew Church Cell Number: (831)-359-3574

Pre-Cruise Meeting: July 7, 2022 at 0900 (Hawaii):
https://umontana.zoom.us/j/98760640581?pwd=OVZ1YWxsNmxDd3EyVkJCc0hWdTFoUT09

COVID testing and quarantine timeline:
July 24- scientists must take a COVID antigen test and begin masking (N-95 or equivalent) and social distancing
July 30 - Conduct another pre-travel antigen test
July 31 - Travel to HNL, Arrive and check into hotel. You should wear a mask on the airplane.
Aug 1 - PCR Test - Same Day Results (achieve negative)
Aug 2 (noon) - Proceed to ship for partial load; science party to stay in hotels this evening
Aug 3, 2022 at 0800, science party proceed to Pier 35 for full load
Aug 3, 2022 Off island cruise participants move aboard the vessel
Aug 4, 2022 at 0800 Depart Honolulu Harbor (**Science personnel at UHMC by 0700**)
Aug 18, 2022 at 1700 arrival Honolulu Harbor (science party stays aboard vessel this evening)
Aug 19, 2022 at 0800 offload
Science party departs the vessel: Aug 19, 2022

For access to BEACH lab for cruise staging please use: 73853 for the door code.

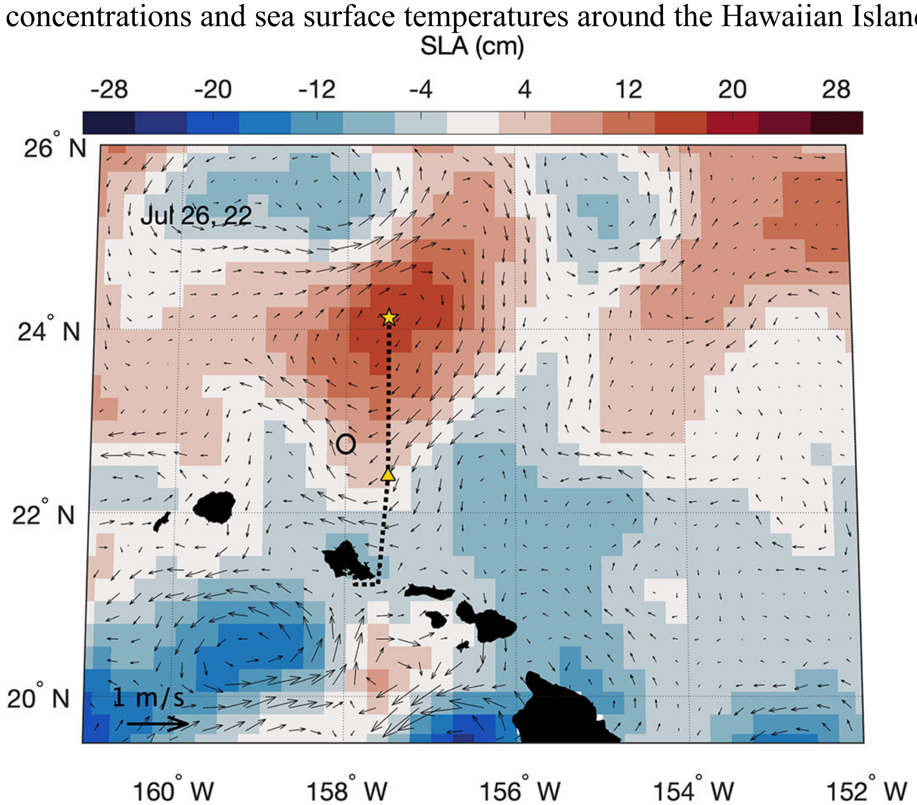
SCIENTIFIC OBJECTIVES

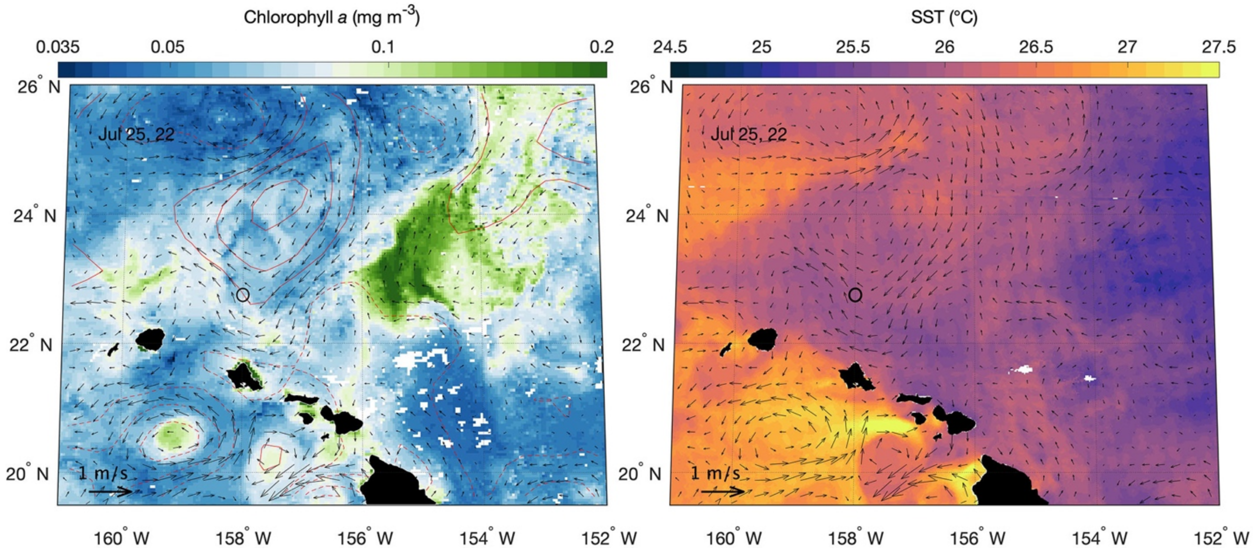
The 2022 SCOPE-PARAGON II research cruise is focused on characterization of particle export, particle composition and characteristics (elemental content, biochemical content, size, sinking speeds, etc.), and particle remineralization in the upper 500 m of the North Pacific Subtropical Gyre. Despite the importance of particles as key sites of biological activity in an otherwise dilute seawater medium, there remain major gaps in our understanding of the specific processes and organisms controlling particle transformations. The 2022 SCOPE-PARAGON II cruise seeks to better understand processes and rates of biological particulate matter transformations (e.g., production, decomposition, sinking) as well as the ecological interactions that occur in association with suspended and sinking particles. We will conduct targeted studies on particle dynamics that leverage ongoing ecological and biogeochemical modeling efforts in SCOPE.

Work during this cruise will occur primarily within a mesoscale eddy. The specific location of sampling sites will be determined several days prior to the cruise based on satellite maps of sea surface altimetry and chlorophyll. The aim is to identify a relatively strong, closed circulation eddy to the north of the Hawaiian islands. Beginning at or near Station ALOHA (22°45´N, 158° W), we will begin underway CTD mapping of the eddy feature. This initial mapping of the hydrographic characteristics of the eddy will start along the southern boundary of the eddy and transit northward to ~24°45´N, 158°W, crossing the eddy center. The goal of this mapping is to identify a region near the presumed center of the eddy where sea surface currents are weak and generally circular. The mapping will rely on the shipboard ADCPs, shipboard underway CTD and fluorometric sensors, and an underway, profiling CTD provided by the science party. During the underway mapping phase of the cruise the ship will transit at 8 knots.

We plan to transit the eddy, from south to north, identifying the region where currents shift directionality; once identified, we would deploy the first of two Wirewalkers. After this deployment, we will resume underway CTD mapping, transiting back to the south to identify a region close of the center of the eddy. When the approximate location of the eddy center is identified, we will deploy the 2nd Wirewalker and begin on station science operations.

The map below depicts recent (July 26, 2022) satellite-based sea-level anomalies around the Hawaiian islands. We have identified an anticyclonic eddy that has been moving to the west over the past 1.5 months. At the time of the PARAGON II cruise, we expect the feature to be approximately due north of Station ALOHA. A potential cruise track is depicted by the dashed black line. The yellow triangle indicates the approximate edge of the eddy (note that we plan to begin the underway CTD survey near the center of the Station ALOHA circle (black circle) and transit north. In addition, the second set of panels depicts recent satellite-based chlorophyll concentrations and sea surface temperatures around the Hawaiian Islands.





2.0 OPERATIONAL PLANS

2.1 Test station (Location to be determined after departure from Honolulu, but to be located in the lee of Oahu).

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 Trace Metal cast (TM) and a CTD cast (both to 500 m) will be conducted at this location. The ship's A-frame, CTD winch, and trace metal winch will be needed for these operations. After these operations are satisfactorily completed, the ship shall proceed to the first underway CTD eddy transect site.

At the test station, the weight cast will 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 operators 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 is 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 operators 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 is 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.

2.2 Pumping Tanks and incinerating trash

Whenever pumping of the ship's tanks is needed or burning of trash, these activities must be conducted up current of operations, ideally more than 3 miles away from science activities. To avoid disruptions in the schedule, any pumping or burining operations outside of those on the cruise schedule should be coordinated with the chief scientist or co-chief scientist **(Matthew Church or Angel White)**.

3.0 EDDY SAMPLING AND DEPLOYMENTS/RECOVERIES

3.1 Underway CTD mapping

Upon arrival at the edge of the eddy we will begin deployments of the underway CTD mapping system. The underway CTD consists of a Rinko profiler (JFE Advantech) that is deployed from the stern of the ship using a winch (Teledyne) designed for underway profiling. The Rinko profiler measures temperature, conductivity, pressure, chlorophyll fluorescence, turbidity, and dissolved oxygen. The measurements are obtained when the probe is free-falling while tethered to the ship by a line, which is loaded on a tail spool before every cast. The probe is recovered after every cast using the winch. **The deployment requires a ship speed ≤ 8 kts to avoid overheating**. After recovery, the line is re-spooled on the tail of the probe and the deployment can be repeated. Depth and frequency of deployment can be modified based on the specific needs. The profiler will collect data down to 400 m. Ship speed and deployment frequency determine the horizontal resolution: A deployment every 30 minutes while sailing at 8 kts permits a resolution of 7.5 km, which would be adequate to resolve the mesoscale variability. However, sampling frequency could be increased near the eddy center predicted from the altimetry to obtain a more accurate estimate of the position of the eddy center where the ship will be sampling.

Upon completion of the underway CTD mapping, the ship will position at the identified eddy center and begin a series of deployments beginning with the WireWalker.

3.2 Wirewalker deployment

Two separate Wirewalkers (Del Mar Oceanographic) will be deployed to take hydrographic and optical observations in the upper 400 m of the water column. These instruments are approximately 1.5 m long and 0.6 m wide and weighs approximately 30 Kg. The instruments will be deployed on a wire with a 40 Kg bottom weight and a surface buoy with strobe light and Pacific Gyre positioning system (**See section X.X for transmitter IDs**).

One of the Wirewalkers will be deployed approximately 5 nmiles to the north-east of the identified eddy center. The second WireWalker will be deployed at the eddy center, near the deployment site for the Long-term sediment trap array, enabling both arrays to drift in a similar direction. Both instruments will stay in the water for approximately 13 days. Deployment and recovery of the WireWalkers will be conducted from the back deck through the A-frame and using the SeaMac winch. Two ABs will be required to operate the A-frame and winch, respectively. **The SCOPE Ops team will direct this deployment**.

3.3 Long term (LT) sediment trap array deployment

The long-term (LT) floating sediment traps will be deployed from the back of the deck through the A-frame and using the SeaMac winch. This array will include 12 crosses deployed at different depths (see below) with each cross holding between 4 and 12 individual sediment traps.

Specific depths and numbers of traps on each of the crosses are:
130 m (John lab, all 4 traps)
140 m (Repeta lab, all 12 traps)
150 m (SCOPE, 12 traps)
160 m (DeLong and Caron labs, all 12 traps)
175 m (SCOPE, 12 traps)
200 m (SCOPE, 12 traps)
225 m (John lab, all 4 traps)
250 m (SCOPE, 12 traps)
300 m (DeLong and Caron labs, all 12 traps)
350 m (SCOPE, 12 traps)
400 m (John lab, all 4 traps)
500 m (SCOPE, 12 traps)
SCOPE traps are as follows= Van Mooy (2), John (1), White (1), Church (1- KCl), Karl (7)

After deployment we request that the bridge verify that the radio transmitters are functioning and directionally correct. The array will drift for approximately 13 days before recovery. The array is equipped with 1 ARGOS satellite transmitter, 1 Novatech Iridium beacon, strobe lights, and a radio transmitter (**see section X.X 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. **The SCOPE Ops team will direct this deployment.**

3.4 SeaGlider deployment

One SeaGlider (sg513, Hydroid) will be deployed following deployment of the Wirewalkers and LT sediment traps. The SeaGlider will be recovered near the end of the cruise. The SeaGlider will be diving and profiling in the proximity of the vessel, at a safe distance from ship operations. The objective of this deployment is to operate a microstructure sensor

(MicroPod, Rockland Scientific) mounted on the autonomous vehicle. The MicroPod measures shear and temperature changes on a very fine scale that are used to estimate turbulent mixing. The probes mounted on the microstructure sensor are very delicate and require careful operations during both deployment and recovery. The deployment requires a procedure to minimize impact on the sensors, and involves lowering the instrument into the water using the ship's crane or winch combined with the ship's A-frame. Once in the water, the vehicle needs to be observed floating prior to complete release. After release, the glider will perform a series of test dives to make sure that the vehicle is communicating through Iridium and that the sensors are working correctly. The vessel can conduct other operations within the area while waiting for this initial feedback. The total deployment time will take approximately 60 minutes. Should the glider malfunction, the vehicle will need to be recovered.

During deployment, the SCOPE Ops team will be communicating via Iridium phone with the Seaglider pilot, Steve Poulos, on land. The recovery of the Seaglider will take approximately 60 minutes. Recovery can occur either from the small boat or from the ship deck by using a wire noose and by lifting it through the A-frame. To track the Seaglider position, its coordinates will be emailed automatically from "sdrifter@soest.hawaii.edu" to "seaglider@km.soest.hawaii.edu", or can be found on the Seaglider website:
http://hahana.soest.hawaii.edu/hot/trackmap/TrackMap.html

3.5 IRSC Sediment trap array deployment

The IRSC sediment traps will be deployed approximately 1 mile away from the deployment site of the LT sediment trap array. The IRSC array will be deployed from the back of the deck 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 IRSC array will consist of three indented rotating sphere traps on a custom frame. The array will drift for about 12 days before recovery. The array is equipped with a satellite position transmitter, strobe lights, and a radio transmitter (**See section X.X for transmitter IDs**). Daily positions of the array shall be transmitted by email directly to the ship (argosfix@km.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. **The SCOPE Ops team will direct this deployment.**

3.6 CTD casts

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. The rosette will need to be equipped with dual CTDs, dual O2 sensors, a fluorometer, and a transmissometer. We will need the ship's CTD winch and crane for these operations. Water samples for subsequent analyses of ecological and biogeochemical properties will be collected on each cast. All CTD casts will be deployed to at least 500 m. **The OTG marine technicians will oversee CTD deployments and recoveries.**

3.7 Trace metal rosette casts

Vertical profiles between 0-500 m 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 this 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. Matthew Church, Lauren Manck, and Phil Kong will oversee these operations. **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**.

3.8 Large volume pump casts

The goal of this activity is to concentrate particles from ~1200 L of seawater to allow us to perform solid state NMR analysis on the samples. We plan to collect water from two depths: 1) 15 m for a mixed layer sample and 2) at the deep chlorophyll maximum (~130 m) to look for an increase in the cellular phosphonate concentrations in suspended particles.

Pumping operations: To efficiently collect 1200 L of seawater, we will deploy a 3/4" polyethylene hose to depth by attaching it to an Amsteel line, affixed to the SeaMac winch, deployed through the A-frame. We will require use of the metered trace metal block to have a wire out measurement. The hose never goes through the block, but rather is attached to the line as it comes down from the A-frame. A 100 lbs weight will be attached to the bottom of the line (in the past we have used two very large shackles as weights). The bottom of the hose is attached to the line using two custom PVC clamps that grip the line with rubber sleeves. This protects the line and provides ample clamping to keep the hose in position. We will also affix a depth sensor to the clamp. As the line is deployed, the hose is secured to the line. To secure the line, we will use either black electrical tape or reusable twist ties, depending on which option seems to work best.

Deployment of the hose down to the deep chlorophyll maximum takes approximately 60 minutes. The end of the hose is then hooked up to an air driven diaphragm pump. The pump has no power requirements but, during operation, **the ship should turn on a second compressor to supply the necessary air**. Pumping 1200 L from the deeper depth (~130 m) takes ~3 hours, assuming a flow of ~8 L/min.

Once pumping is complete, the hose is recovered. A knife can be used to cut tape along the hose to remove it from the line, or the twist ties will need to be undone. Recovery of the hose is quick and should only take 25 minutes. Total operation time should be 3 hours for the 15 m sample and 4-5 hours for the deep chlorophyll maximum depth. **Jay Li will oversee deployment and recovery of the tubing and pumping operations; he will be assisted by a member of the SCOPE Ops team.** It is critical that the spools of hose be held and unrolled as the hose is deployed to prevent kinks. We will also require assistance from one of the OTG Techs to attach the hose, and assistance from the ship's crew to operate the winch and A-frame. Jay can stand below the A-frame to attach the tubing to the line while the OTG tech holds the hose to the line and the SCOPE Ops team member feeds the hose out. This made the process efficient and safe.

POM concentration: To concentrate the POM we will bring our custom concentrator, along with 6x 200 L blue barrels. The concentrator and barrels need to be staged in close proximity. These have previously been staged on the starboard-side back deck, aft of the Wet Lab. Power is required for the concentrator and we will supply water-tight extension cords; we plan to use an outlet in the CTD bay. All the barrels will be strapped to the starboard railing.

3.9 Surface net tows (EG)

A small handheld plankton net will be deployed from the stern and shall be towed for about 15-30 minutes while the ship is moving very slowly (<1 knot). **Eric Grabowski will oversee these operations.**

3.10 SnowCatcher Operations

Two Snowcatcher instruments (one small, one large) will be deployed using the Sea-Mac winch and the A-frame. These are self-contained cylinders that will be deployed in similar fashion to the HOT optics cage, and a handheld messenger will be sent down the line to trip the sampling mechanism. The instrument will then be recovered. Deployment is 30 minutes or less, and will be **overseen by the SCOPE Ops team**.

3.11 Surface net drifts and surface net tows (DC)

A small handheld plankton net will be deployed from the stern. NO ship movement, i.e., propellers in IDLE (this is essential- any ship movement, even facing into the wind, could blow out the nets). Nets will be drifted for 30 minutes and recovered. **Jennifer Beatty will oversee the deployment of this instrument**.

3.12 Opening/Closing net tows (DC)

A plankton net will be deployed from the stern using the A-frame. The net will be gently towed (<1 knot). The net will be profiled to 200 m for 60 minutes and recovered. **Jennifer Beatty will oversee the deployment of this net**.

3.13 SPC deployments

A Scripps Plankton Camera (SPC) will be deployed on several occasions during the cruise. This instrument provides optical images of plankton. This instrument is a submersible camera that collects plankton images in the water column. The camera is 120 cm x 18 cm and requires 30W max at 9-36VDC. It will be deployed in profiling mode on a separate cage lowered with the small capstan. The instrument will be deployed using the same line used for deployment of the HOT Optics package. The SPC will be vertically profiled (once) at 10 m/min, and then recovered. The camera is deployed to 200-300 m, and deployments are typically around 30 minutes in the water. **Jennifer Beatty will oversee the deployment of this instrument**.

3.14 Primary production array

Samples for the primary productivity experiment will be collected from pre-dawn CTD casts three times during the cruise. The samples will be inoculated with 14C (radioisotope) in SCOPE van 23. Samples will then be deployed on a free drifting incubation array. The array will be deployed from the backdeck through the A-frame and using the SeaMac winch. The primary production incubation array will be deployed for the daylight period (dawn to dusk). Positions of the array will be emailed to argosfix@km.soest.hawaii.edu, password: argosfix.

The array will be recovered at sunset (~1900 hrs). All radioactive waste generated by the experiment shall be returned to the University of Hawaii. Only qualified personnel shall handle radioactive material. **The SCOPE Ops team will direct the array deployment and recovery operations**.

3.15 PIT-a-Day array

The PIT-a-Day floating sediment trap will be deployed for a 24 hr period, partially recovered, then re-deployed on a near-daily basis. This array will be deployed from the backdeck through the A-frame and using the SeaMac winch. This array will include a single cross deployed at 150 m; the cross will hold 12 individual sediment traps. After deployment we request that the bridge verify that the radio transmitters are functioning and directionally correct. The array will drift for approximately 24 hrs before recovery. The array is equipped with 1 ARGOS satellite transmitter, 1 Novatech Iridium beacon, strobe lights, and a radio transmitter (**see section X.X 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. **The SCOPE Ops team will direct this deployment.**

3.16 PIT-an-Hour array

The PIT-an-Hour floating sediment trap will be deployed for a 24 hr period on three separate occasions during the cruise. This array will be deployed from the backdeck through the A-frame and using the SeaMac winch. This array will include a single conical, sequencing sediment trap deployed at 150 m. The trap will include 24 discrete cups, each programed to collect sinking particles for 1 hr over the 24 hr period. After deployment we request that the bridge verify that the radio transmitters are functioning and directionally correct. The array is equipped with 1 ARGOS satellite transmitter, 1 Novatech Iridium beacon, strobe lights, and a radio transmitter (**see section X.X 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. **The SCOPE Ops team will direct this deployment.**

3.17 Optics package

An optical package including a SeaBird Seacat with temperature, conductivity, and pressure sensors, a Wetlabs ECO triplet measuring backscatter, chlorophyll fluorescence, and CDOM fluorescence, a LISST particle size and distribution analyzer, and an ac-s will be deployed on several occasions at night 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. **Angel White will oversee this operation.**

3.18 Gas Array deployment

A free drifting incubation array will be deployed 3 times over the course of the cruise. Samples for the gas array will be collected from a pre-dawn CTD and prepared for deployment. The gas array will be deployed from the backdeck using the A-frame and the SeaMac winch. The array is equipped with GPS transmitters, strobe lights and a radio transmitter (See Section 6.0 for transmitter IDs). Positions of the array will be emailed to argosfix@km.soest.hawaii.edu, password: argosfix. The ship will **not** need to keep within sight of the array until the time of the recovery, approximately 24 hours after its deployment. Assistance from the bridge is requested in plotting the drift track of the array. **Angel White will oversee this deployment**.

3.19 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. Between noon and 1400 on several days throughout the cruise, 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 20m) before the instrument is retrieved. **Angel White will oversee this deployment**.

3.20 Net traps

Net traps will be deployed to capture sinking particles. These are nets on either a 150-m, 175-m or 300-m lines which are pre-rigged and ready to deploy. The time for deployment and recovery is estimated to be similar to the PIT-a-Day. Upon recovery, the ship will need to pause before actual approach in order to trigger the release (15 min) before recovery. Two net traps and releases will be used during the cruise; for most net traps the deployment period will be 24 hrs; upon recovery the cod ends will be removed, emptied (or swapped) and the traps will be redeployed. This recovery/deployment procedure is expected to take ~1 hour per net trap operation. **The SCOPE Ops team will oversee net trap operations.**

3.21 Array recoveries

Recoveries of the Gas Array, PIT-a-Day, LT sediment trap, PIT-an-Hour, Net Traps, and WireWalker will require the A-frame and the Sea-Mac winch. **<u>The port screw propeller should be secured during all recoveries to avoid entanglements!</u>**

4.0 SEAWATER FLOW-THROUGH SYSTEMS AND UNDERWAY INSTRUMENTATION

4.1 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.

4.2 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.

4.3 SeaFlow, Inline C-Star Transmissometer, Hyperspectral Absorption and Attenuation (AC-S) and Imaging FlowCytobot (IFCB)

In addition to the continuous thermosalinograph and fluorometer sampling, the SeaFlow, an inline C-Star Transmissometer, AC-S, and the IFCB will sample continuously from the uncontaminated seawater supply system throughout the duration of the cruise while the ship is outside of Honolulu Harbor. Access to real-time underway data through the ship's network is required. The SCOPE Ops technicians and UH personnel will be in charge of these instruments and operations.

4.4 Several scientists will be collecting samples from the shipboard seawater intake system located the labs.

5.0 EQUIPMENT

5.1. The Science party shall be bringing the following

1. 3 20 ft laboratory vans: van (#23) with assorted equipment for radioisotopes (inboard port side); the OTG van for radioisotope use (outboard portside), and one trace metal 20 ft van (5-0; starboard side).
2. All required chemicals and isotopes
3. Large vacuum waste containers
4. Liquid nitrogen dewars (x3)
5. Drifting sediment trap array with strobe lights, satellite and radio transmitters, floats, weights, line, sediment traps and crosses.
6. Drifting primary production array with strobe lights, satellite and radio transmitters, floats, weights, line primary production bottles and spreader bars.
7. Drifting gas array with strobe lights, satellite and radio transmitters, floats, weights, line, 4 L bottles and short mounting bars.
8. Drifting Wirewalker™ array with surface buoy, strobe lights, satellite transmitters, floats, weights, 400m and cable.
9. Drifting IRSC Sediment Trap array with surface buoy, strobe lights, satellite transmitters, floats, weights, line, and instrument cage.
10. Desktop and laptop personal computers
11. Assorted tools
12. All required sampling bottles
13. SeaFlow
14. Inline C-Star Transmissometer and AC-S
15. Imaging FlowCytobot (IFCB)
16. Trace metal clean rosette with 8L Niskin bottles and programmable CTD
17. Temperature controlled Caron incubators (n=3) - to be loaded in the science hold
18. Flow-through, shaded deckboard incubators with necessary plumbing (n=3, 2 Big Blue and 2 Baby Blues)
19. Temperature controlled "Armbrust" incubators (n=4)
20. Bench-top incubator for D. Caron lab (n=1)

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

1. A-frame
2. A-frame block assembly
3. OTG Seabird CTD system, all sensors, deck boxes and computer CTD acquisition systems
4. Rosette and 24x12L Niskin sampling bottles, and all associated spare parts
5. CTD winch
6. Electric power
7. -440/480 VAC, 3 phase 60Hz, 60amp for winches
8. -208 VAC single phase at 60 amps for lab vans
9. Space on upper 01 deck port side for one 20 ft van **(OTG van)**

10. Space on upper 01 deck port side for one 20 ft van **(#23)**
11. Space on upper 01 deck starboard side for trace metal 20 ft van (**#5-0**)
12. Space on 02 deck for incubators
13. Space on deck for ~5 deck baskets of array gear
14. Small capstan (~ 10 m/min)
15. SeaMac Winch
16. Radio direction finder
17. Hand-held VHF transceivers
18. Shackles, sheaves, hooks and lines
19. Precision depth recorder
20. Shipboard Acoustic Doppler Current Profiler
21. Thermosalinograph, pCO_2 system, and Fluorometer
22. Meteorological suite
23. Grappling hooks and line
24. Navlink2 PC or equivalent
25. Running fresh water and seawater, hoses
26. Uncontaminated seawater supply
27. Source of compressed air for Trace Metal pump
28. -80°C Freezer
29. 4°C Refrigerator and -20°C Freezer
30. Distilled, deionized water system (MiiliQ)
31. Electronic mail system
32. GPS system
33. Underway/on-station data acquisition system for meteorological instruments, ADCP, thermosalinograph, fluorometer, SeaFlow, inline C-Star transmissometer and IFCB and access to real-time data through the network.
34. ~1300 lb weight
35. Remote CTD dbar pressure display in the winch operator area.
36. Monitor in CTD Lab displaying ship coordinates, bottom depth and GMT.
37. Trace metal free block
38. Amsteel Line (1/4”) for trace metal clean work

6.0 Cruise Participants

Participant	email address	Affiliations
Matthew Church	matt.church@flbs.umt.edu	Univ. Montana
Cathy Garcia	cathy.garcia@hawaii.edu	Univ. Hawaii
Karin Bjorkman	bjorkman@hawaii.edu	Univ. Hawaii
Shavonna Bent	sbent@mit.edu	WHOI
Jennifer Beatty	jlbeatty@usc.edu	Univ. South. Calif.
Lauren Manck	lauren.manck@flbs.umt.edu	Univ. Montana
Samantha Gleich	gleich@usc.edu	Univ. South. Calif.
Angel White	aewhite@hawaii.edu	Univ. Hawaii
Esther Mak	wimak@ucsc.edu	UC Santa Cruz
Fernanda Henderikx Freitas	fhenderi@hawaii.edu	Univ. Hawaii
Miranda Seixas	miranda.seixas@flbs.umt.edu	Univ. Montana
Joan De Vera	joan.devera@mail.utoronto.ca	Univ. South. Calif.
Jingxuan (Jay) Li	jingxuan@mit.edu	WHOI
Daniel Muratore	dmuratore3@gatech.edu	Georgia Tech
Eric Grabowski	grabowsk@hawaii.edu	Univ. Hawaii
Paul Berube	pmberube@mit.edu	MIT
Brandon Brenes	brenesb@hawaii.edu	Univ. Hawaii
Tim Burrell	burrellt@hawaii.edu	Univ. Hawaii
Ryan Tabata	rtabata@hawaii.edu	Univ. Hawaii
Phil Kong	kyeongpi@usc.edu	Univ. South. Calif.
Andy Burger	aburger@hawaii.edu	Univ. Hawaii
Kurt Castro	kgcastro@mit.edu	MIT
Lance Frymire	frymirel@hawaii.edu	Univ. Hawaii (OTG)
Trevor Young	tnyoung@hawaii.edu	Univ. Hawaii (OTG)
Nick Matthew		Univ. Hawaii (OTG)

Ship: R/V *Kilo Moana* PARAGON II Date: Aug 4-18, 2022

TIME	**Thursday 8/4**	**Friday 8/5**	**Saturday 8/6**	**Sunday 8/7**	**Monday 8/8**
0000			SPC Deployment #1 (DC)	Snow catcher #1	CTD7 (500 m)
0100			Optics Cast #1		
0200				CTD4 (PP#1, 500 m)	CTD8 (N2 fix#1, 500 m)
0300			CTD2 (1000 m)	TM4 (500 m)	
0400			TM2 (500 m)	Deploy PP array	Deploy N2 fix array #1
0500			Deploy PIT-a-Day #1	Recover PIT-a-Day #1; deploy PIT-a-Day #2	TM5 (500 m)
0600			Pump tanks	Deploy Net traps #1-2 (1 @150 m, 1@150 m)	CTD9 (500 m)
0700	All Sci. Aboard		Pump tanks	Pump tanks	Pump tanks
0800	Depart Pier 35		Deploy long-term ST array	Pump tanks	Net trap #1-2 recovery
0900	Fire and abandon ship drills		Deploy IRSC trap	CTD5 (500 m)	Net trap #3-4 (1@150 m, 1@150 m) deploy
1000			Deploy Seaglider 513		Recover PIT-a-Day #2
1100			Surface net tow (EG)	Surface net tow (DC)	Deploy PIT-a-Day #3
1200	Arrive test station weight cast (500 m)		CTD3 (500 m) - core cast #1	Hyperpro	Hyperpro
1300	TM1 (300 m)				Snow Catcher #2 surface net tow (EG)
1400	CTD1 cast (500 m)		TM3 (500 m)	CTD6 (500 m)	CTD10 (500 m)
1500	Transit		Drift net (DC)		Transit to Seaglider 513
1600					CTD11 High-res #1 (300 m)
1700		Pause UW CTD survey; deploy WW1 (eddy center)	Pump tanks and incinerate	Pump tanks and incinerate	Surface net tow (DC)
1800		Resume UW CTD survey	Pump tanks and incinerate	Pump tanks and incinerate	Open/closing net tow (DC)
1900			Pump cast #1 (surface - DR)	Recover PP array #1	Pump tanks and incinerate
2000		Complete UW CTD survey (eddy center); deploy WW2			Pump tanks and incinerate
2100					
2200	Begin underway CTD survey	Surface net tow (DC)			surface net tow (EG)
2300		Opening/closing net tow (DC)	Surface net tow (EG)		SPC Deployment #2 (DC)

Aug 6th: Sunrise 0607, Sunset 1907

TIME	**Tuesday 8/9**	**Wednesday 8/10**	**Thursday 8/11**	**Friday 8/12**	**Saturday 8/13**
0000	Optics Cast #2	Optics Cast #3	Surface net tow (EG)	Optics Cast #4	Open/closing net tow (DC)
0100					Surface net tow (DC)
0200	Open/Closing net (DC)	CTD13 (PP#2, 500 m)	CTD16 (N2 fix #2, 500 m)	Deploy PIT-an-Hour #2	CTD22 (PP#3, 500 m)
0300	Surface net tow (DC)			TM10 (500 m)	
0400	Recover N2 fix array #1	Deploy PP Array #2	Deploy N2 fix array #2	Recover N2 fix array #2	Deploy PP Array #3
0500	CTD12 cast (500 m)	Surface net drift (DC)		TM11 (500 m)	Pump tanks
0600	Pump tanks	Pump tanks	CTD17 (500 m)	Snow Catcher #6	Pump tanks
0700	Pump tanks	Pump tanks	Pump tanks	Pump tanks	CTD23 (500 m)
0800	Recover PIT-a-Day #3	Recover PIT-a-Day #4	Pump tanks	Pump tanks	Recover PIT-an-Hour #2
0900	Deploy PIT-a-Day #4	Deploy PIT-a-Day #5	TM9 (500 m)	TM12 (500 m)	TM13 (500 m)
1000	Deploy PIT-an-Hour #1	TM8 (500 m)	CTD18 (500 m)		Surface net tow (EG)
1100	TM6 Cast (500 m)	Net trap #5-6 recovery	Surface net tow (EG)	CTD21 (500 m)	Net trap #11-12 recovery
1200	Net trap #3-4 recovery	Net trap #7-8 deployment (1@150 m, 1@200 m)	Hyperpro	Net trap #9-10 recovery	Net trap #13-14 deployment (1@150 m, 1@200m)
1300	Net trap #5-6 deployment (1@150 m, 1@175 m)	Hyperpro	Net trap #7-8 recovery	Net trap #11-12 deployment (1@150 m, 1@175 m)	Hyperpro
1400		CTD14 (500 m)	Net trap #9-10 deployment 1@150 m, 1@300 m		CTD24 (500 m)
1500	Snow Catcher #3	Recover PIT-an-Hour #1	Recover PIT-a-Day #4	Recover PIT-a-Day #5	Recover PIT-a-Day #6
1600			Deploy PIT-a-Day #5	Deploy PIT-a-Day #6	Deploy PIT-a-Day #7
1700		Snow Catcher #4	Snow Catcher #5	Surface net drift (DC)	
1800	TM7 (500 m)		CTD19 (500 m)	Pump tanks and incinerate	Snow Catcher #7
1900	Pump tanks and incinerate	Recover PP Array #2		Pump tanks and incinerate	Recover PP Array #3
2000	Pump tanks and incinerate	Pump tanks and incinerate	CTD20 Core #2 (500 m)	Pump cast #2 (DCM, DR)	Pump tanks and incinerate
2100		Pump tanks and incinerate	Pump tanks and incinerate		Pump tanks and incinerate
2200			Pump tanks and incinerate		CTD25 (500 m)
2300	SPC Deployment #3 (DC)	CTD15 (500 m)	SPC Deployment #4 (DC)		Surface net tow (EG)

TIME	**Sunday 8/14**	**Monday 8/15**	**Tuesday 8/16**	**Wednesday 8/17**	**Thursday 8/18**
0000	CTD26 (500 m)	**CTD (200 m - AW?)**	CTD31 (500 m)	CTD35 (500 m)	TM15 (500 m)
0100		Surface net tow (DC)	Surface net drift (DC)	Snow Catcher #11	Transit Pier 35
0200	CTD27 (N2 fix #3, 500 m)	Open/closing net tow - 150 m	Pump tanks	CTD36 (500 m)	
0300		Pump tanks	Pump tanks	Pump tanks	
0400	Deploy N2 fix array #3	Pump tanks		Pump tanks	
0500		Recover N2 fix array #3	CTD32 (500 m)	CTD37 (500 m)	
0600	CTD28 (500 m)		Snow Catcher #10	Transit net trap #18	
0700	Deploy PIT-an-Hour #3	Surface net drift (DC)	Transit to wire walker 1	Recover Net trap #18	
0800	Snow Catcher #8	TM14 (500 m)		Transit to Seaglider 513	
0900	Pump tanks	Recover PIT-an-Hour #3	Recover Wire Walker 1	CTD38 High-res #3 (500 m)	
1000	Pump tanks	Net trap #15-16 recovery		Recover Seaglider 513	
1100	Net trap #13-14 recovery	Net trap #17-18 deployment (1@150 m, 1@300 m - note 2 day deployment)	Transit to Wire Walker #2	Transit to IRSC traps	
1200	Net trap #15-16 deployment (1@150 m, 1@300 m)	Hyperpro			
1300	Hyperpro	Surface net tow (EG)	Recover Wire Walker #2	Recover IRSC traps	
1400	Recover PIT-a-Day #7		CTD33 (500 m)	CTD39 (500 m)	
1500	Deploy PIT-a-Day #8	Recover PIT-a-Day #8	Transit to PIT-a-Day #9	Transit LT PIT array	
1600	Transit to Seaglider 513	Deploy PIT-a-Day #9	Recover PIT-a-Day #9	Recover LT PIT array	
1700	CTD29 high res #2 (300 m)		Transit to net traps #17		Arrive Pier 35
1800	Pump tanks and incinerate	Snow Catcher #9	Net traps #17 recovery	Pump tanks and incinerate	
1900	Pump tanks and incinerate		CTD34 (500 m)	Pump tanks and incinerate	
2000	Pump Cast #3 - TBD (DR)	CTD30 Core cast #3 (500 m)		CTD40 (500 m)	
2100		Pump tanks and incinerate	Pump tanks and incinerate	SnowCatcher #9 – XL	
2200		Pump tanks and incinerate	Pump tanks and incinerate	Snowcatcher #10 - S	
2300		Surface net tow (EG)		CTD41 (500 m)	

PARAGON II Snowcatcher Deployment Schedule

Activity	Date / Time	Depth	PI
Snowcatcher #1	Aug 7, 00:00	??	Karl
Snowcatcher #2	Aug 8, 13:00	??	Van Mooy
Snowcatcher #3	Aug 9, 15:00	150 m	DeLong
Snowcatcher #4	Aug 10, 16:00	150 m	John
Snowcatcher #5	Aug 11, 19:00	25 m	Zehr
Snowcatcher #6	Aug 12, 06:00	??	Van Mooy
Snowcatcher #7	Aug 13, 18:00	300 m	John
Snowcatcher #8	Aug 14, 08:00	25 m	Zehr
Snowcatcher #9	Aug 15, 18:00	200 m	John
Snowcatcher #10	Aug 16, 06:00	??	Karl
Snowcatcher #11	Aug 17, 01:00	175 m	John