

**Cruise ID: KOK-1806**  
**The LAVA expedition**

Vessel: R/V *Ka'Imikai-O-Kanaloa*, University of Hawaii  
Master of the Vessel: Captain Ron Short  
Chief Scientist: Sam Wilson, University of Hawaii  
OTG Marine Technicians: Jeff Koch and Austin

*Marine Center phone number: (808) 956-0688, Ross Barnes (808) 956-0689*  
*KOK phone number: (808) 587-8562 or (808) 587-8563*  
*KOK Cell number: (808) 690-5393*

*Sam Wilson Cell Number: (808) 688 6141*

Loading: July 5 2018 (in Honolulu)

Departure: July 13, 2018 @0800 from Hilo  
Pier 2, Hilo Port, 99 Kuhio St, Hilo, HI 96720

The pier may be TWIC-restricted and scientists may need to be escorted to the ship. Most of the UH scientists will catch the 0615 am flight landing at 0709am and go straight to the Pier in a cab. Its 3 miles from the airport to the pier, and the cab ride is approx. \$13. Once the previous science party has disembarked, and all KOK1806 scientists are onboard, we will leave the port.

Arrival: July 17, 2018 @ 0800 in Honolulu

**1. Cruise participants**

<b>Name (male/female)</b>	<b>Position</b>	<b>Nationality</b>	<b>Institute</b>	<b>Lab Group</b>
Tim Burrell (M)	Research Scientist	NZ	U Hawaii	(SCOPE Ops)
Angie Boysen (F)	Graduate student	USA	U Washington	(Ingalls lab)
Karin Björkman (F)	Research Scientist	Sweden	U Hawaii	(Karl lab)
Macarena Burgos (F)	Postdoctoral scholar	Spain	U Hawaii	(Karl Lab)
John Casey (M)	Postdoctoral scholar	USA	U Hawaii	(Karl Lab)
Mathilde Dugenne (F)	Postdoctoral scholar	France	U Hawaii	(White lab)
Sara Ferron (F)	Assistant Researcher	USA	U Hawaii	(Karl lab)
Rhea Foreman (F)	Assistant Researcher	USA	U Hawaii	(Karl lab)
Carolina Funkey (F)	Research Scientist	USA	U Hawaii	(Karl lab)
Nick Hawco (M)	Postdoctoral scholar	USA	USC	(John lab)
Rachel Kelly(F)	Postdoctoral scholar	USA	USC	(John lab)
Gabe Foreman (M)	Engineer	USA	U Hawaii	(SCOPE Ops)
Eric Shimabukuro (M)	Research Scientist	USA	U Hawaii	(SCOPE Ops)
Oscar Sosa (M)	Postdoctoral scholar	USA	U Hawaii	(Karl Lab)
Ryan Tabata (M)	Research Scientist	USA	U Hawaii	(SCOPE Ops)
Alice Vislova (F)	Graduate student	USA	U Hawaii	(DeLong lab)
Blake Watkins (M)	Engineer	USA	U Hawaii	(HOT program)
Sam Wilson (M)	Chief Scientist	UK	U Hawaii	(SCOPE Ops)

## 2. Timetable of activity

Friday 13 July

0800: All science personnel onboard

0830: Ship leaves port and steams 25 miles south-east to Cape Kumukahi @ 5 knots

1500: The ship conducts a small coastal transect from Cape Kumukahi to the lava entry point

Saturday 14 July

Ship conducts transect to map the plume trailing off Cape Kumukahi (shown in the figure below).

Sunday 15 July

Ship completes the transect and any remaining sampling. Begin transit to Honolulu

Monday 16 July: Transit to Honolulu

Tuesday 17 July: Return to port @0900

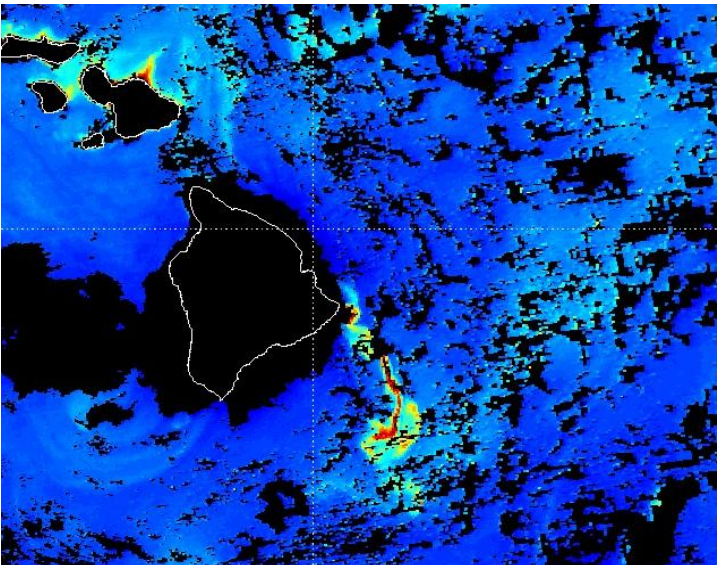
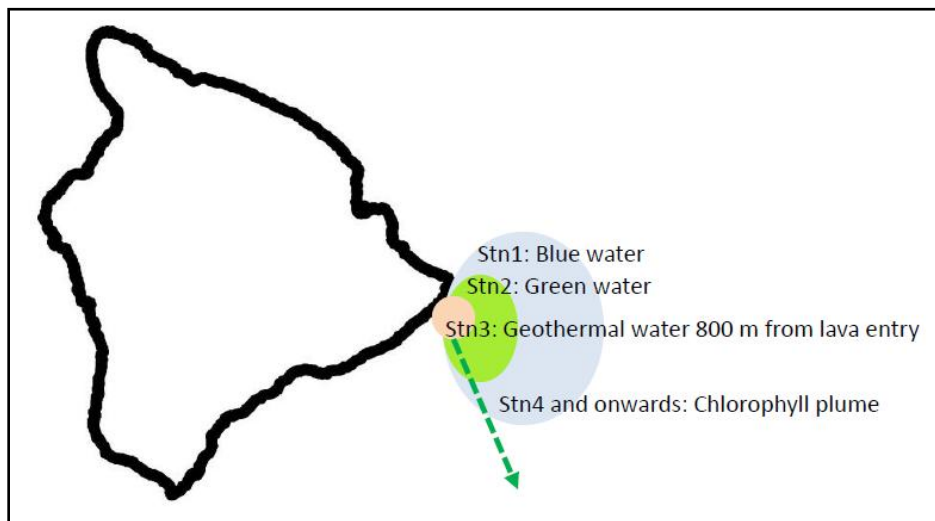


Figure of satellite-derived chlorophyll fluorescence from single day image on 10 July 2018. The KOK1806 expedition will conduct a transect along the chlorophyll plume and then depart for Honolulu.

### 3. Draft Cruise Track

Station	Latitude	Longitude
Blue Water (Stn #1)		
Green Water (Stn #2)		
Geothermal station (Stn #3)	19 28' 92"	154 47' 52"
Approx 1 mile east (Stn #4) beginning of plume transect		
Head SE		
Waypoint (Pin5)	19 05' 43"	154 43' 39"
Waypoint (Pin4)	18 46' 12"	154 24' 50"
Waypoint (Pin6) if time permits	18 35' 08"	154 12' 45"
Waypoint (Pin1)	18 22' 11"	154 21' 22"
Waypoint (Pin2)	18 25' 31"	154 49' 24"
Control		
Kona shelf	19 5' 15"	156 5' 72"
Honolulu		

### 3. Science activity

#### Backdeck and over-the-side activity

- **CTD profiles** 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 crane for these operations. Water samples for biogeochemical measurements will be collected on each cast. There will be no near-seafloor sampling.
- **Surface towfish sampler:** A custom built PVC towfish will be used to sample trace metal free water close to the sea surface. The towfish will be deployed from the ship using the CTD boom to distance the sampler from the ship.
- **Waveglider:** A Waveglider (Liquid Robotics) will sit at the surface, equipped with sensors to conduct its own operations.
- **Seaglider:** We anticipate deploying one Seaglider during the cruise to survey the region of interest.
- **Plankton net tows:** A hand-held 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.
- **Hyperpro:** The Hyperpro is a profiling unit with one up-looking and one down-looking hyperspectral radiometer, a WET Labs ECO-BB2F triplet, temperature and conductivity sensors. This instrument also incorporates a ship mounted surface radiometer. 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.

- **Discrete Niskin or Go-Flo bottles.** It is possible that we will collect surface seawater using a single Niskin bottle (ranging in size from 2.5 to 10 L). The bottle will be deployed on a line and tripped using a messenger.

#### **Within-ship sampling**

- **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.
- **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 at sea. The OTG technicians will be in charge of the thermosalinograph and fluorometer operations.
- **Flow cytometer 'SeaFlow' (Armbrust/SCOPE)** This instrument provides continuous measurements of cell abundance and cell size distributions will be used to generate hourly estimates of Prochlorococcus and other picophytoplankton growth and loss rates.
- **Transmissometer and Flow Cytobot (Matilde)** This instrument is configured to auto-sample whole water for 50 mins and 0.2 um filtered seawater for 10 mins at hourly intervals from the ship's underway system.

#### **4.0. Science equipment**

The science party shall be bringing the following

1. Two 20 ft. laboratory vans (#HOT and TM van)
2. Distilled, deionized water and all required chemicals and isotopes
3. Large vacuum waste containers
4. Liquid nitrogen dewars
5. Oxygen titration system
6. Plankton nets and towing lines
7. Desktop and laptop personal computers
8. On-deck incubation systems (1- dark incubator and 4 light incubators)
9. Pertinent MSDS
10. 2 x chest Freezer (22 cubic inch)

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

1. A-frame
2. A-frame block assembly
3. CTD rosette, bottles, CTD winch
4. Electric power (440/480 VAC, 3 phase 60Hz, 60amp for winches and 208 VAC single phase at 60 amps for lab vans)
5. Space on upper deck for two vans (HOT and TM van)
6. Space on upper deck for sea water incubators
7. Small capstan (~ 10 m/min)
8. Radio direction finder
9. Hand-held VHF transceivers
10. Shackles, sheaves, hooks and lines
11. Precision depth recorder
12. Shipboard Acoustic Doppler Current Profiler
13. Thermosalinograph and Fluorometer
14. Meteorological suite

15. Navlink2 PC or equivalent
16. Running fresh water and seawater, hoses
17. Uncontaminated seawater supply

### 5.0 Measurements being made on Lava expedition

Parameter	Person sampling	Lab group with the samples
<b>Elements, Nutrients, Other</b>		
Trace metals: Fe, Ni, Cu, Zn, Cd, Pb, Mn, Co	Nick/Rachel	Seth John
Trace metal isotopes: Pb, Fe, Zn, Cd, Cu	Nick/Rachel	Seth John
Nutrients: NO <sub>2</sub> +NO <sub>3</sub> , PO <sub>4</sub> , Si, NH <sub>4</sub> , DON	Rhea/Carolina/Karin	Dave Karl
Metabolites: (10 L sunrise/sunset, TM underway)	Angie	Anitra Ingalls
Lipids: (2 L alongside metabolites)	Angie	Ben Van Mooy
<b>Rates &amp; Processes</b>		
Productivity: O <sub>2</sub> /Ar, 18O-GPP	Sara/Macarena	Dave Karl
Productivity: 14C assimilation, 32-P uptake	Karin	Dave Karl
N <sub>2</sub> fixation: 15N assimilation	Sam	SCOPE
Phosphorus cycling C-P lyase measurements	Oscar	Dave Karl/Dan Repeta
<b>Microbial cells</b>		
Whole seawater onto a 0.2 um (2 L) nifH analysis	Tim (and SCOPE)	Jon Zehr
Whole seawater onto a 5 um (3 x 20 L) euk RNA	Tim (and SCOPE)	Sonya Dyhrman
Prefilter of 100 um mesh onto 0.2 um (3 x 6 L)	Tim (and SCOPE)	Ginger Armbrust
Whole seawater on 25 mm 0.2 um (2 x 2 L)	Alice/John	Ed DeLong
Subsample from Ed	Alice/John	DeLong/Dave Caron
Size fraction 0.03 - 0.2 (tbd)	Alice/John	DeLong/Debbie Lindell
<b>Net tows</b>		
Tricho	Blake Watkins	Sonya Dyhrman
Preservation for microscopy	Blake Watkins	SCOPE
Biomass, elemental, energy	Blake Watkins	Karl Lab
<b>Shipboard underway measurements</b>		
Cell imaging: Cytobot	Mathilde Dugenne	Angel White
SeaFlow	Eric Shimabukuro	Ginger Armbrust
Transmissometer	Mathilde Dugenne	Angel White
HPLC pigments	Eric/Ryan/Tim	Ricardo Letelier
<b>Biogeochemistry</b>		

Chlorophyll a	Eric/Ryan/Tim	SCOPE-UH
PC/PN/PP	Eric/Ryan/Tim	SCOPE-UH
Flow cytometry	Eric/Ryan/Tim	SCOPE-UH
DIC/pH	Eric/Ryan/Tim	SCOPE-UH
HPLC pigments	Eric/Ryan/Tim	Ricardo Letelier
Microscope slides	SCOPE/Sam	SCOPE-UH
O2, CH4, N2O, H2	SCOPE/Sam	Karl Lab
Proteins (30 L in duplicate at central stns)	Angie	Anitra Ingalls
Tricho clades (5,25,45,75,100)	Eric/Ryan/Tim	Sonya Dyhrman
Additional		
Seaglider/WaveGlider	Gabe Foreman	Steve Poulos
HyperPro	Blake/Mathilde	Angel White

**Ship: R/V KOK****Date: 13 - 17 July****Sunrise: 0600****Sunset: 1930**

TIME	Friday 7/13	Saturday 7/14	Sunday 7/15	Monday 7/16	Tuesday 7/17
0000		Stn 4 CTD cast #1	Stn 8 CTD cast #1		
0100		Stn 4 CTD cast #2	Stn 8 CTD cast #2		
0200					
0300					
0400					
0500					
0600		Stn 5 CTD cast #1	Stn 9 CTD cast #1	Stn 12 CTD cast #1	
0700		Net tow	Net tow	Stn 12 CTD cast #2	Arrive at Honolulu
0800	All scientists onboard			Stn 12 CTD cast #3	
0900	Ship departs port & transits to Cape Kumukai				
1000					
1100		Stn 6 CTD cast #1	Stn 10 CTD cast #1		
1200		Stn 6 CTD cast #2	Stn 10 CTD cast #2		
1300	Deploy SeaGlider	HyperPro	HyperPro		
1400	Stn 1 CTD cast #1	Net tow	Net tow		
1500					
1600	Stn 2 CTD cast #1				
1700					
1800		Stn 7 CTD cast #1	Stn 11 CTD cast #1		
1900	Stn 3 CTD cast #1		Transit to Honolulu with a fly-by of the shelf off Kona		
2000	Stn 3 CTD cast #2				
2100	Net tow				
2200					
2300					

**\*Station 12 is the 'out of plume' station with a deep cast for O2 calibration**

**Coastal stations SCOPE KOK1806 Sample Data Sheet**

Station/Cast #: Stn 1 Cast 1

Date: \_\_\_\_\_ (HST)

Target Depth (db): 400

CTD Start Time: \_\_\_\_\_ (HST)

Rosette Position	Depth (m)	PC/PN PPO4	DIC/pH, Chla, FCM, Nuts	Cells (Mathu)	HPLC (Ryan-Ricardo)	Diss. H2 (Sam)	AFDW (Rhea)	DNA/RNA (Alice)	nifH (Tim-Jon)
1	125							X	
2	125					X	X		
3	125	X	X	X	X				
4	125								
5	100							X	
6	100					X	X		
7	100		X	X	X				
8	100	X							
9	75							X	X
10	75					X	X		
11	75		X	X	X				
12	75	X							
13	45							X	X
14	45					X	X		
15	45		X	X	X				
16	45	X							
17	25							X	X
18	25					X	X		
19	25		X	X	X				
20	25	X							
21	5							X	X
22	5					X	X		
23	5		X	X	X				
24	5	X							



**Coastal stations SCOPE KOK1806 Sample Data Sheet**

Station/Cast #: Stn 2 Cast 1

Date: \_\_\_\_\_ (HST)

Target Depth (db): 400

CTD Start Time: \_\_\_\_\_ (HST)

Rosette Position	Depth (m)	PC/PN PPO4	DIC/pH , Chla, FCM, Nuts	Cells (Mathu)	HPLC (Ryan-Ricardo)	Diss. H2 (Sam)	AFDW (Rhea)	DNA/RNA (Alice)	nifH (Tim-Jon)
1	125							X	
2	125					X	X		
3	125	X	X	X	X				
4	125								
5	100							X	
6	100					X	X		
7	100		X	X	X				
8	100	X							
9	75							X	X
10	75					X	X		
11	75		X	X	X				
12	75	X							
13	45							X	X
14	45					X	X		
15	45		X	X	X				
16	45	X							
17	25							X	X
18	25					X	X		
19	25		X	X	X				
20	25	X							
21	5							X	X
22	5					X	X		
23	5		X	X	X				
24	5	X							

## Coastal stations: SCOPE KOK1806 SAMPLE Data Sheet

Station/Cast #: Stn 3 Cast 1

Date: \_\_\_\_\_ (HST)

Target Depth (db): 400

CTD Start Time: \_\_\_\_\_ (HST)

Rosette Position	Depth (m)	PC/PN PPO4	DIC/pH, Chla, FCM, Nuts	Cells (Mathu)	HPLC (Ryan-Ricardo)	AFDW (Rhea)	Diss. H2, CH4, C2H4 (SamSara)	DNA/RNA (Alice)	nifH (Sam-Jon)
1	125							X	X
2	125					X	X		
3	125		X	X	X				
4	125	X							
5	100							X	X
6	100					X	X		
7	100		X	X	X				
8	100	X							
9	75							X	X
10	75					X	X		
11	75		X	X	X				
12	75	X							
13	45							X	X
14	45					X	X		
15	45		X	X	X				
16	45	X							
17	25							X	X
18	25					X	X		
19	25		X	X	X				
20	25	X							
21	5							X	X
22	5					X	X		
23	5		X	X	X				
24	5	X							

## Coastal Stations: SCOPE KOK1806 SAMPLE Data Sheet

 Station/Cast #: Stn 3 Cast 2

Date: \_\_\_\_\_ (HST)

 Target Depth (db): 400

CTD Start Time: \_\_\_\_\_ (HST)

Rosette Position	Depth (m)	Proteins (Angie)	Euk RNA (Tim-Sonya)	Euk RNA (Sam-Ginger)	Rates N2 fix (Sam) O2 (Sara)	Tricho clades (Tim-Sonya)	Microscope	C-P lyase (Oscar)
1	100					X		
2	75					X		
3	45					X		
4	25					X		
5	5				X			
6	5				X			
7	5				X			
8	5			X				
9	5			X				
10	5		X					
11	5		X					
12	5		X					
13	5		X					
14	5		X					
15	5		X					
16	5	X						
17	5	X						
18	5	X						
19	5	X						
20	5	X						
21	5	X						
22	5					X		
23	5						X	
24	5							X

**Notes:**

### Chl plume stations: SCOPE KOK1806 Midnight-Midday casts

Station/Cast #: Stn 4 Cast 1

Date: \_\_\_\_\_ (HST)

Target Depth (db): 400

CTD Start Time: \_\_\_\_\_ (HST)

Rosette Position	Depth (m)	PC/PN PPO4	DIC/pH, Chla, FCM, Nuts	Cells (Mathilde)	HPLC (Ryan-Ricardo)	AFDW (Rhea)	DNA/RNA (Alice)	nifH (Tim-Jon)
1	125						X	X
2	125					X		
3	125		X	X	X			
4	125	X						
5	100						X	X
6	100					X		
7	100		X	X	X			
8	100	X						
9	75						X	X
10	75					X		
11	75		X	X	X			
12	75	X						
13	45						X	X
14	45					X		
15	45		X	X	X			
16	45	X						
17	25						X	X
18	25					X		
19	25		X	X	X			
20	25	X						
21	5						X	X
22	5					X		
23	5		X	X	X			
24	5	X						

## Chl plume stations: SCOPE KOK1806 SAMPLE Data Sheet

Station/Cast #: Stn 4 Cast 2 Date: \_\_\_\_\_ (HST)

Target Depth (db): 400 CTD Start Time: \_\_\_\_\_ (HST)

Rosette Position	Depth (m)	Proteins (Angie)	Euk RNA (Tim-Sonya)	Euk RNA (Sam-Ginger)	N2 fix (Sam)	Tricho clades (Tim-Sonya)	Microscope	C-P lyase (Oscar)
1	100					X		
2	75					X		
3	45					X		
4	25					X		
5	5				X			
6	5				X			
7	5				X			
8	5			X				
9	5			X				
10	5		X					
11	5		X					
12	5		X					
13	5		X					
14	5		X					
15	5		X					
16	5	X						
17	5	X						
18	5	X						
19	5	X						
20	5	X						
21	5	X						
22	5					X		
23	5						X	
24	5							X

**Notes:**

## Chl plume stations: SCOPE KOK1806 Sunrise/sunset casts

Station/Cast #:                     Stn 5 Cast 1                     Date:    (HST)  
 Target Depth (db):                     400                     CTD Start Time:    (HST)

Rosette Position	Depth (m)	Rates N2fix, O2-prod	PC/PN PPO4	DIC/pH, Chla, FCM, Nuts	Cells (Mathu)	HPLC (Ryan-Ricardo)	Diss. H2 (Sam)	AFDW (Rhea)	DNA/RNA (Alice)	nifH (Tim-Jon)
1	125								X	X
2	125						X	X		
3	125			X	X	X				
4	125		X							
5	100								X	X
6	100						X	X		
7	100			X	X	X				
8	100		X							
9	75								X	X
10	75						X	X		
11	75			X	X	X				
12	75		X							
13	45								X	X
14	45						X	X		
15	45			X	X	X				
16	25								X	X
17	25						X	X		
18	25			X	X	X				
19	5	X								
20	5	X								
21	5	X								
22	5								X	X
23	5						X	X		
24	5			X	X	X				

**Notes:**

**Deep cast 1000 m : SCOPE KOK1806 O2 sensor calibration**

Station/Cast #: Deep cast Date: \_\_\_\_\_ (HST)

Target Depth (db): 1000 CTD Start Time: \_\_\_\_\_ (HST)

Rosette Position	Depth (m)	O2 temp	O2					
1	<b>1000</b>		X					
2	<b>770</b>		X					
3	<b>700</b>		X					
4	<b>600</b>		X					
5	<b>500</b>		X					
6	<b>400</b>		X					
7	<b>300</b>		X					
8	<b>200</b>		X					
9	<b>175</b>		X					
10	<b>150</b>		X					
11	<b>125</b>		X					
12	<b>100</b>		X					
13	<b>75</b>		X					
14	<b>45</b>		X					
15	<b>25</b>		X					
16	<b>5</b>		X					
17								
18								
19								
20								
21								
22								
23								
24								

**Notes:**

Organization of CTD rosette sampling: Blake/Gabe to operate the consol, everyone else to prepare the CTD (SCOPE Ops to check it)

Midday/midnight Core Station Cast #1

Niskin bottle	Parameter	Person sampling	Person processing
4	PC/PN, PPO4	Ryan/Karin	Ryan
3	Chla	Rhea/Carolina	Ryan
3	Nutrients	Rhea/Carolina	Rhea/Carolina
3	DIC	Eric	Macarena/Sara fixing
3	pH	Eric	?
3	FCM	Eric	Eric
3	Cells	Mathilde	Mathilde
3	HPLC	Mathilde	Ryan – for Ricardo
2	Gases – H2	Sam	Sam
2	Gases – C2H4, CH4	Sara	Sara/Oscar
2	AFDW	Rhea	Rhea
1	DNA/RNA	Alice/John	Alice/John
1	nifH	Tim	Tim for Jon

Midday/midnight Core Station Cast #2

Niskin bottle	Parameter	Person sampling	Person processing
#	Proteins	Angie	Angie
#	Euk RNA	Tim	Tim for Sonya
#	Euk RNA	Eric	Eric for Ginger
#	N2 fixation	Sam	Sam
#	O2 production	Sara/Macarena/Karin	Sara/Macarena/Karin
#	Tricho clades	Tim/Oscar	Tim for Sonya
#	Microscope slides	Oscar	Oscar for Dave C
#	C-P lyase	Oscar	Oscar
#	Gases – C2H4, CH4	Sara	Sara/Oscar

Sunrise/sunset Stations Cast #1

Niskin bottle	Parameter	Person sampling	Person processing
4	PC/PN, PPO4	Ryan/Karin	Ryan
3	Chla	Rhea/Carolina	Ryan
3	Nutrients	Rhea/Carolina	Rhea/Carolina
3	DIC	Eric	Macarena/Sara fixing
3	pH	Eric	
3	FCM	Eric	Eric
3	Cells	Mathilde	Mathilde
3	HPLC	Mathilde	Ryan – for Ricardo
2	Gases – H2	Sam	Sam
2	AFDW	Rhea	Rhea
1	DNA/RNA	Alice/John	Alice/John
1	nifH	Tim	Tim for Jon