

## CMORE-SCOPE cruise 24 July-6 August 2015 R/V *Kilo Moana*

### 1. Cruise information

Cruise ID: KM1513

Vessel: R/V *Kilo Moana*, University of Hawaii

Master of the Vessel: Captain Jay Chavez

Chief Scientist: Sam Wilson, University of Hawaii

OTG Marine Technicians: Trevor Young and Steve Tottori

*Kilo Moana* phone number: 842-9817, cell # 864-0065, satellite # 011-870-773234249

Marine Center phone number: 842-9813

Loading: July 22, 2015 @1300

Departure: July 24, 2015 @0900 (Science personnel on board by 0700)

Arrival: August 6, 2015 @ 0800

### Shipping address

Blake Watkins

CMORE CRUISE 24 July – 6 Aug, KM

C/O UH Marine Center, #1 Sand Island Access Road, Honolulu, HI 96819

### 2. Berthing

Below is the list of participating personnel, the male to female ratio, research institute and citizenship to satisfy the newly-adopted 'University of Hawaii Site-Specific Technology Control Plan'.

<b>Participant</b>	<b>Title</b>	<b>Citizenship</b>	<b>Affiliation</b>
Frank Aylward (M)	Postdoctoral scholar	USA	University of Hawaii
Abby Bate (F)	Research Assistant	New Zealand	University of Hawaii
Angie Boysen (F)	Graduate student	USA	UW
Laura Carlson (F)	Research Assistant	USA	UW
Dave Caron (M)	Scientist	USA	USC
John Casey (M)	Graduate student	USA	University of Hawaii
Paige Connell (F)	Graduate student	USA	USA
Bryndan Durham (F)	Postdoctoral scholar	USA	UW
Sonya Dyhrman (F)	Scientist	USA	Columbia University
Sara Ferron (F)	Postdoctoral Scholar	USA	University of Hawaii
Kyle Frischkorn (M)	Graduate student	USA	Columbia University
Sheean Haley (F)	Scientist	USA	Columbia University
Chris Hayes (M)	Postdoctoral scholar	USA	MIT
Debbie Lindell (F)	Scientist	Israel	Technion
Morgan Linney (F)	Graduate student	USA	University of Hawaii
Craig McLean (M)	Scientist	USA	WHOI
Dan Repeta (M)	Scientist	USA	WHOI
Francois Ribalet (M)	Scientist	France	UW
Sarah Searson (F)	Research Assistant	UK	University of Hawaii
Eric Shimabukuro (M)	Research Assistant	USA	University of Hawaii
Dror Shitrit (M)	Graduate student	Israel	Technion
Alice Vislova (F)	Graduate student	USA	University of Hawaii
Katie Watkins-Brandt (F)	Research Assistant	USA	OSU

Sam Wilson (M)	Research Scientist	UK	University of Hawaii
Marnie Jo Zirbel (F)	Research Assistant	USA	OSU
Steve Tottori (M)	Marine Technician	USA	OTG
Trevor Young (M)	Marine Technician	USA	OTG

(27 science party: 13 male, 14 female)

### 3. OVERALL SCIENCE OBJECTIVES

The objective of the cruise is deploy free-drifting surface drifters (see Section 4.1) in the vicinity of the Hawaii Ocean Time-series (HOT) station (Station ALOHA), which is defined as a circle with a 6 nautical mile radius centered at 22° 45'N, 158°W. The surface drifters will be monitored for the duration of the cruise and the Kilo Moana will conduct water-column sampling using the CTD-rosette alongside one of the drifters for the duration of the cruise.

The SVP drifter locations are transmitted every 30 mins. The positions are recorded at PacificGyre.com (username C-MORE, login microstar) and are also transmitted via email to sdrifter@soest.hawaii.edu. They can also be forwarded to any email account that the UH Marine Center or the ships would like to receive them at.

The summary schedule is as follows:

- 22 July: Loading of the ship for hand-carry on items in the pm
- 23 July: Loading of items needing to be craned onboard
- 24 July: Depart from Snug harbor at 0900 hrs.  
Science personnel on-board by 0800
- 24 July CTD Test cast on route to deployment of SVP drifters
- 24 July-5 August: Operations in the vicinity of Station ALOHA
- 6 August Arrive back to Snug Harbor. Offload ship.

Whenever pumping of the ship's tanks is needed, it must be conducted 0.5 miles from existing operations. To avoid disruptions in the schedule, this operation should be coordinated with the chief scientists and we will allocate two times a day when this operation can occur.

### 4. SHIPBOARD OPERATIONS

#### 4.1 SVP Drifters (*Karl Lab: Wilson*)

The Surface Velocity Program (SVP) Drifters comprise of a spherical surface float (equipped with a solar LED) and a "holey-sock" drogue centered at 15 m below the surface. They transmit their position using iridium. They are design to drift along with the surface currents and therefore provide a means to track the same water parcel. We will deploy four SVP drifters in the vicinity of Stn ALOHA in close proximity with the intention of tracking and sampling from the ship alongside them.

#### 4.2 CTD operations (*SCOPE: Searson*)

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 CTD channels will be for the

following sensors: dual temperature (2) , dual salinity (2), oxygen SBE43 sensor and optode (2), fluorometers triplet and Fls (2) , transmissometer (1).

#### 4.3 Automated Trace Element Sampler (ATE) (*Boyle Lab: Hayes*)

Each day that the ship is occupying Station ALOHA, the ATE will be hand deployed off the back deck to a depth of 10 m to collect a 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 prior to each ATE deployment to limit contamination of the trace metal sample from the ship's hull.

#### 4.4 VANE sampling (*Boyle Lab: Hayes*)

Trace-metal clean samples will be collected using VANE samplers attached to the Kevlar covered wire (MVP wire, 0.33"). Two VANE casts will be conducted with target depths of 250 m and 1500 m respectively. Each cast will have 5 VANES attached to the wire. The deep cast (Depths: 250, 500, 700, 1000, 1200, and 1400m) and a shallow cast (Depths: 25, bottom of mixed layer ~50, 75, 100, chl-max~130, and 175m) will be conducted on consecutive days. In conjunction to the VANES deployments, CTD water collection targeting the same depths as the VANES will be conducted. Complimentary measurements to the Fe studies will also be taken for Nd isotopes (5 L) in order to identify the source of the dust-derived Fe: Asia or Hawaii (Katharina Pahnke). The VANES will also be deployed through the A-frame on the back deck.

#### 4.5 Optical package: transmissometer (*SCOPE: Shimabukuro*)

An optical package including a CSTAR transmissometer that measures beam attenuation and a LISST particle size and distribution analyzer will be deployed two times daily. 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. The A-frame and capstan will be needed for this operation.

#### 4.6 Hyperpro (*White Lab: White*)

Daily deployment of Atlantic radiometer to characterize irradiance and radiance. 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. The Hyperpro will be deployed from the stern through a small block hung from the A-frame. The instrument is hand-lowered and retrieved with assistance from the winch.

#### 4.7 Surface hand net tow (*Dyhrman Lab: Dyhrman*)

Surface net tows are hand-deployed off the stern for on 3 occasions at night, and 4-6 occasions during the day (1 hour total per session, Sonya Dyhrman). We request that the ship remain stationary during these tows.

#### 4.8 Go-Flo bottles (*Karl Lab: Ferron*)

Single Go-Flo bottles will be deployed at a depth of 25 m on repeated occasions during the cruise. Due to the shallow deployment, we will attach the Go-Flo bottle to a line and deploy the bottle using the A-Frame on the backdeck.

#### 4.9 Primary production array (*Karl: Ferron*)

#### 4.10 Thermosalinograph, pCO<sub>2</sub> system, Fluorometer, and meteorological system

The ship's thermosalinograph, pCO<sub>2</sub> system and fluorometer sampling the uncontaminated seawater supply system will be in operation during the duration of the cruise while the ship is outside of Snug Harbor. The ship's meteorological system shall be in operation throughout the cruise. Access to real-time underway data through the ship's network will be required. The OTG technicians will be in charge of the thermosalinograph, pCO<sub>2</sub> system, Fluorometer, and meteorological suite operations.

### 5.0 SHIPBOARD COMMUNICATIONS

We request that OTG group initiate the shell script to automatically send the ships coordinates approximately hourly by email to poulos@soest.hawaii.edu and lfujieki@soest.hawaii.edu. This will be important to cross-calibrate the instrumentation in the water (sea-gliders and floats).

### 6.0 EQUIPMENT

6.1 The science party shall be bringing the following

1. One 20 ft. OTG rad van
2. All required chemicals and isotopes
3. Large vacuum waste containers
4. Liquid nitrogen dewar
5. Drifting primary production array and gas array with light and radio transmitter, floats, weights,
6. polypropylene line, spare buoy, etc.
7. Hyperpro and other optical measuring instruments.
8. Oxygen titration system
9. Plankton nets and towing lines
10. Desktop and laptop personal computers
11. Assorted tools
12. All required sampling bottles
13. Deck incubation system
14. Pertinent MSDS

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

1. OTG's 24-place rosette, and 24 12-l water sampling bottles
2. CTD Instrument package
3. A-frame
4. A-frame block assembly
5. Caley winch and crane with conducting wire for CTD
6. Electric power for winches (440 VAC, 3 phase, 60 Amp breaker) and vans (208 VAC single phase at 60 amps for lab van, 110 VAC 10 amps for equipment van)
7. Radio direction finder
8. Space on the O1 deck for OTG laboratory van
9. Space on upper deck for incubators
10. Hand-held VHF transceivers
11. Precision depth recorder
12. Shackles, sheaves, hooks and lines
13. Shipboard Acoustic Doppler Current Profiler
14. Thermosalinograph, pCO<sub>2</sub> system, and Fluorometer
15. Meteorological suite

16. Copy machine
17. Grappling hooks and line
18. Laptop with Nobeltec charting software and GPS feed
19. Running fresh water and seawater, hoses
20. Electronic mail system
21. GPS system
22. Uncontaminated seawater supply
23. Small capstan (~ 10 m/min)
24. Underway/on-station data acquisition system for meteorological instruments, ADCP,
25. thermosalinograph, fluorometer, pCO<sub>2</sub> and access to real-time data through the network
26. OTG's 24-place rosette, and 24 12-l water sampling bottles (to be used as spare)
27. 1000 lb weight
28. Large Sea-Mac winch (Mod. 1025 EHS). 60 Amp Hubbel plug/connector (440 VAC, 3 phase, 60 Amp breaker)

**Ship: R/V KILO MOANA      KM      Date: 24 July – 6 August      Sunrise: 0602 Sunset: 1914**

TIME	Wednesday 7/22	Thursday 7/23	Friday 7/24	Saturday 7/25	Sunday 7/26
0000				CTD cast S2C1	
0100					net tow (30 min)
0200					CTD cast S2C9
0300				CTD cast S2C2	
0400					Optics package
0500				Deploy PP array	net tow (30 min)
0600				CTD cast S2C3	CTD cast S2C10
0700				ATE sample (30 min)	ATE (30 min)
0800	HOT #2274 returns	Loading crane ops	Scientists onboard	Ship pump tanks	Ship pump tanks
0900			Depart Snug		net tow (30 min)
1000				CTD cast S2C4	CTD cast S2C11
1100					
1200			CTD cast Test	HyperPro	HyperPro
1300	Loading crane ops			CTD cast S2C5	net tow (30 min)
1400				CTD cast S2C6	CTD cast S2C12
1500					
1600					
1700					net tow (30 min)
1800				CTD cast S2C7	CTD cast S2C13
1900				Recover PP array	ATE (30 mins) Optics package
2000					
2100					net tow (30 min)
2200			Deploy drifters	CTD cast S2C8	CTD cast S2C14
2300				Ship pump tanks	Ship pump tanks

**Ship: R/V KILO MOANA      KM      Date: 24 July – 6 August      Sunrise: 0602 Sunset: 1914**

TIME	Monday 7/27	Tuesday 7/28	Wednesday 7/29	Thursday 7/30	Friday 7/31
0000					
0100	net tow (30 min)	net tow (30 min)	net tow (30 min)		
0200	CTD cast S2C15	CTD cast S2C21	CTD cast S2C29	CTD cast S2C235	CTD cast S2C240
0300		CTD cast S2C22			CTD cast S2C241
0400	Optics package	Optics package	Optics package	Optics package	Optics package
0500	net tow (30 min)	Deploy PP array net tow (30 min)	net tow (30 min)		Deploy PP array
0600	CTD cast S2C16	CTD cast S2C23	CTD cast S2C30	CTD cast S2C236	CTD cast S2C242
0700	ATE (30 min)	ATE (30 min)	ATE (30 min)	VANES (5 h)	ATE sample (30 min)
0800	<i>Ship pump tanks</i>	<i>Ship pump tanks</i>	<i>Ship pump tanks</i>		
0900	net tow (30 min)	net tow (30 min)	net tow (30 min)		
1000	CTD cast S2C17	CTD cast S2C24	CTD cast S2C31		CTD cast S2C243
1100					
1200	HyperPro	HyperPro	HyperPro	HyperPro	HyperPro
1300	net tow (30 min)	net tow (30 min)	net tow (30 min)	net tow (30 min)	
1400	CTD cast S2C18	CTD cast S2C25	CTD cast S2C32	CTD cast S2C237	CTD cast S2C244
1500					
1600					
1700	net tow (30 min)	net tow (30 min)	net tow (30 min)		
1800	CTD cast S2C19	CTD cast S2C26	CTD cast S2C33	CTD cast S2C238	CTD cast S2C245
1900	ATE (30 mins) Optics package	Recover PP array Optics package	ATE (30 mins) Optics package	ATE (30 mins) Optics package	Recov PP array Optics package
2000					
2100	net tow (30 min)	net tow (30 mins) CTD cast S2C27	net tow (30 min)		CTD cast S2C246
2200	CTD cast S2C20	CTD cast S2C28	CTD cast S2C34	CTD cast S2C239	CTD cast S2C247
2300	<i>Ship pump tanks</i>	<i>Ship pump tanks</i>	<i>Ship pump tanks</i>		

Ship: R/V **KILO MOANA**      KM      Date: **24 July – 6 August**      Sunrise: **0602** Sunset: **1914**

TIME	Saturday 8/01	Sunday 8/02	Monday 8/03	Tuesday 8/04	Wednesday 8/05
0000					
0100	net tow (30 min)	net tow (30 min)	net tow (30 min)	net tow (30 min)	CTD cast S2C74
0200	CTD cast S2C48	CTD cast S2C54	CTD cast S2C60	CTD cast S2C68	
0300			CTD cast S2C61		
0400	Optics package	Optics package	Optics package	Optics package	CTD cast S2C75
0500	net tow (30 min)	net tow (30 min)	Deploy PP array net tow (30 min)	net tow (30 min)	
0600	CTD cast S2C49	CTD cast S2C55	CTD cast S2C62	CTD cast S2C69	VANES (4 h)
0700	ATE (30 min)	ATE (30 min)	ATE (30 min)	ATE (30 min)	
0800	Ship pump tanks	Ship pump tanks	Ship pump tanks	Ship pump tanks	
0900	net tow (30 min)	net tow (30 min)	net tow (30 min)	net tow (30 min)	
1000	CTD cast S2C50	CTD cast S2C56	CTD cast S2C63	CTD cast S2C70	
1100					
1200	HyperPro	HyperPro	HyperPro	HyperPro	Depart station for Honolulu
1300	net tow (30 min)	net tow (30 min)	net tow (30 min)	net tow (30 min)	
1400	CTD cast S2C51	CTD cast S2C57	CTD cast S2C64	CTD cast S2C71	
1500					
1600					
1700	net tow (30 min)	net tow (30 min)	net tow (30 min)	net tow (30 min)	
1800	CTD cast S2C52	CTD cast S2C58	CTD cast S2C65	CTD cast S2C72	
1900	ATE (30 mins) Optics package	ATE (30 mins) Optics package	Recov PP array Optics package	ATE (30 mins) Optics package	
2000					
2100	net tow (30 min)	net tow (30 min)	net tow (30 min) CTD cast S2C66	net tow (30 min)	
2200	CTD cast S2C53	CTD cast S2C59	CTD cast S2C67	CTD cast S2C73	
2300	Ship pump tanks	Ship pump tanks	Ship pump tanks	Ship pump tanks	



**CTD Casts**

<b>Cast</b>	<b>Depth</b>	<b>Sample</b>	<b>Bottles</b>
<i>24 July</i>			
S1C1	545 m	SWAC3: DO, temp, DIC/Alk, nuts, Chl a, N2O/CH4, FCM (2@5, 25, 45, 75, 100, 150, 300, 500 m)	24
S1C2	175 m	SWAC2: DO, temp, DIC/Alk, nuts, Chl a, N2O/CH4, FCM (2@5, 25, 45, 75, 100, 150 m)	24
S1C3	105 m	SWAC1: DO, temp, DIC/Alk, nuts, Chl a, N2O/CH4, FCM (2@5, 25, 45, 75, 100 m)	24
S2C1	500 m	1@5,25,45,75,100, 125 (Lindell)	5
<i>25 July</i>			
S2C2	500 m	1@5,25,45,75,100,125 (Ferron)	6
S2C3	500 m	4@15 (Lindell) 1@5,15,25,45,75,125, 175 (DeLong/Caron)	11
S2C4	1000 m	O2 (750,500,300,200,100,25,5), PC/PN, Chl a, HPLC, Nuts, FCM, 1@5,25,45,75,100, 150 (Dyhrman)	20
S2C5	500 m	24@25 m (Dyhrman)	24
S2C6	100 m	24@25 m (Dyhrman)	24
S2C7	500 m	12@25 m (Aylward) 1@5,25,45,75,100 (Dyhrman)	17
S2C8	500 m	20@15 m (Caron)	20
<i>26 July</i>			
S2C9	500 m	24 @ 15 m (diel)	24
S2C10	500 m	24 @ 15 m (diel)	24
S2C11	500 m	24 @ 15 m (diel)	24
S2C12	500 m	24 @ 15 m (diel)	24
S2C13	500 m	24 @ 15 m (diel)	24
S2C14	500 m	24 @ 15 m (diel)	24

**CTD Casts**

<b>Cast</b>	<b>Depth</b>	<b>Sample</b>	<b>Bottles</b>
<i>27 July</i>			
S2C15	500 m	24 @ 15 m (diel)	24
S2C16	500 m	24 @ 15 m (diel)	24
S2C17	500 m	24 @ 15 m (diel)	24
S2C18	500 m	24 @ 15 m (diel)	24
S2C19	500 m	24 @ 15 m (diel)	24
S2C20	500 m	24 @ 15 m (diel)	24
<i>28 July</i>			
S2C21	500 m	24 @ 15 m (diel)	24
S2C22	500 m	1@5,25,45,75,100,125 (Ferron)	6
S2C23	500 m	24 @ 15 m (diel)	24
S2C24	500 m	24 @ 15 m (diel)	24
S2C25	500 m	24 @ 15 m (diel)	24
S2C26	500 m	24 @ 15 m (diel)	24
S2C27	100 m	20 @ 15 m (Caron)	24
S2C28	500 m	24 @ 15 m (diel)	24
<i>29 July</i>			
S2C29	500 m	24 @ 15 m (diel)	24
S2C30	500 m	24 @ 15 m (diel)	24
S2C31	500 m	24 @ 15 m (diel)	24
S2C32	500 m	24 @ 15 m (diel)	24
S2C33	500 m	24 @ 15 m (diel)	24
S2C34	500 m	24 @ 15 m (diel)	24

**CTD Casts**

<b>Cast</b>	<b>Depth</b>	<b>Sample</b>	<b>Bottles</b>
<i>30 July</i>			
S2C35	500 m	8@25 m (Ribalet/Watkins)	8
S2C36	500 m		0
S2C37	1000 m	O2 (750,500,300,200,100,25,5), PC/PN, Chl a, HPLC, Nuts, FCM,	20
S2C38	500 m	1@5,25,45,75,100 (Dyhrman)	5
		1@5,25,45,75,100, 125 (Lindell)	5
S2C39	500 m		0
<i>31 July</i>			
S2C40	500 m		0
S2C41	500 m	1@5,25,45,75,100,125 (Ferron)	6
S2C42	500 m		0
S2C43	500 m	15@25 m (Aylward), 1@5,25,45,75,100,150 (Dyhrman)	21
S2C44	500 m	1@5,15,25,45,75,125, 175 (DeLong/Caron)	7
S2C45	500 m		0
S2C46	500 m	20@15 m (Caron)	20
S2C47	500 m		0
<i>1 August</i>			
S2C48	500 m	24 @ 15 m (diel)	24
S2C49	500 m	24 @ 15 m (diel)	24
S2C50	500 m	24 @ 15 m (diel)	24
S2C51	500 m	24 @ 15 m (diel)	24
S2C52	500 m	24 @ 15 m (diel)	24
S2C53	500 m	24 @ 15 m (diel)	24

## CTD Casts

Cast	Depth	Sample	Bottles
<i>2 August</i>			
S2C54	500 m	24 @ 15 m (diel)	24
S2C55	500 m	24 @ 15 m (diel)	24
S2C56	500 m	24 @ 15 m (diel)	24
S2C57	500 m	24 @ 15 m (diel)	24
S2C58	500 m	24 @ 15 m (diel)	24
S2C59	500 m	24 @ 15 m (diel)	24
<i>3 August</i>			
S2C60	500 m	24 @ 15 m (diel)	24
S2C61	500 m	1@5,25,45,75,100,125 (Ferron)	6
S2C62	500 m	24 @ 15 m (diel)	24
S2C63	500 m	24 @ 15 m (diel)	24
S2C64	500 m	24 @ 15 m (diel)	24
S2C65	500 m	24 @ 15 m (diel)	24
S2C66	100 m	20 @ 15 m (Caron)	24
S2C67	500 m	24 @ 15 m (diel)	24
<i>4 August</i>			
S2C68	500 m	24 @ 15 m (diel)	24
S2C69	500 m	24 @ 15 m (diel)	24
S2C70	500 m	24 @ 15 m (diel)	24
S2C71	500 m	24 @ 15 m (diel)	24
S2C72	500 m	24 @ 15 m (diel)	24
S2C73	500 m	24 @ 15 m (diel)	24

**CTD Casts**

<b>Cast</b>	<b>Depth</b>	<b>Sample</b>	<b>Bottles</b>
<i>5 August</i>			
S2C74	1000 m	O2 and Chl samples 1@5,15,25,45,75,125, 175 (DeLong/Caron)	24
S2C75	PC/PN,	Chl a, HPLC, Nuts, FCM, 1@5,25,45,75,100, 125 (Lindell)	16 5