Cruise Report - Preliminary

California Current LTER Program
UC-Ship Funds Student Cruise
CCE-P0904
R/V New Horizon: Apr. 22 – May 3rd

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Cruise ID: CCE-P0904
Depart: 22 Apr. 2009 at 0800 (PST)
Return: 3 May. 2009 at 0900 (PST)
Vessel: R/V New Horizon
Operator: SIO
Master: Captain John Manion
Chief Scientist: Michael Stukel
SIO Resident Technicians: Gus Aprans, Meghan Donohue

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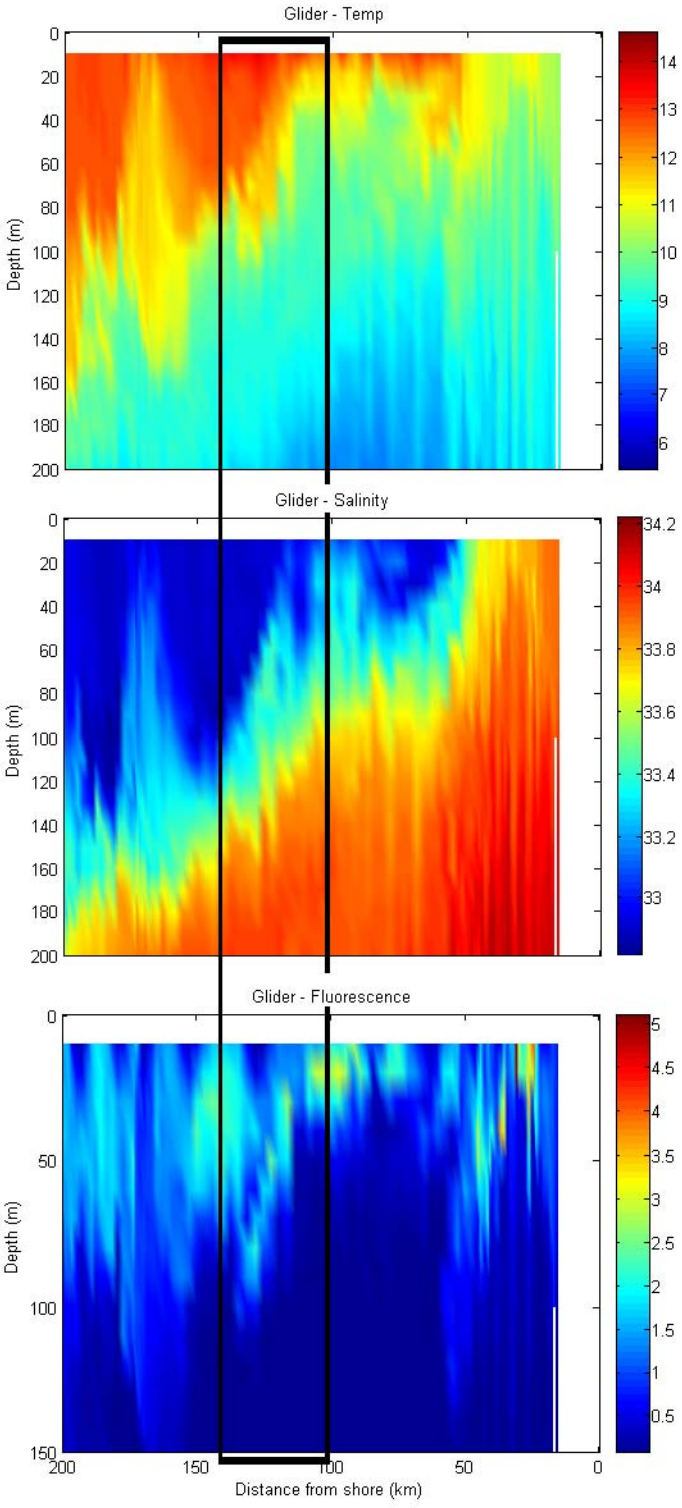
SCIENTIFIC OBJECTIVES

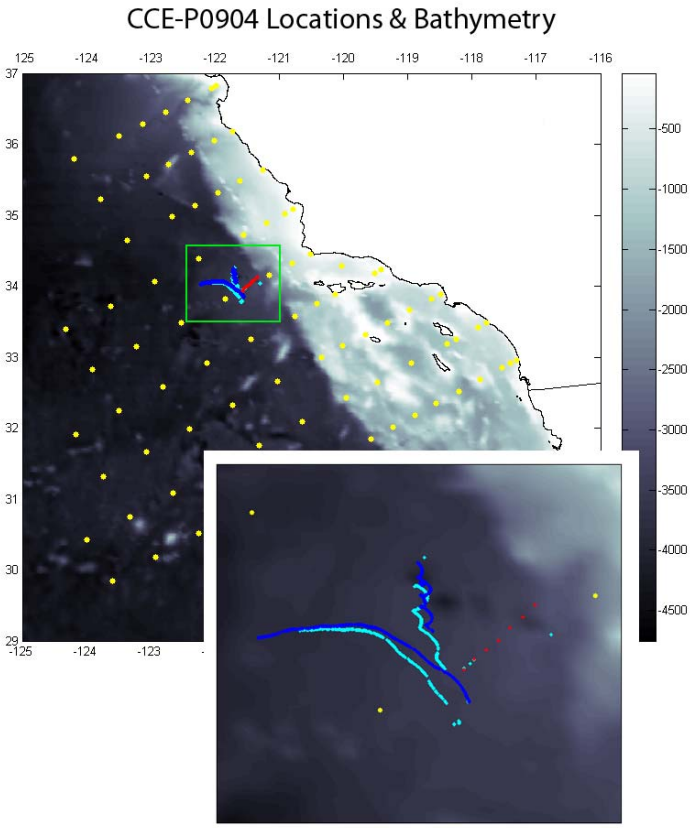
This cruise was conceived as an opportunity for older graduate students to test hypotheses arising from studies on earlier CCE Process cruises while allowing younger students to conduct exploratory work for their theses. The overall scientific objective was to characterize trophic and production processes within and surrounding a frontal region that often forms in the spring and separates the core of the California Current from the more productive water inshore.

GENERAL OVERVIEW OF THE SCIENCE PLAN

The edge of the California Current Proper is often identifiable as a strong salinity gradient in CCE Glider transects along CalCOFI line 80. A recent glider section, along with satellite support and shipboard flow-through sea surface temperature (SST) and fluorescence was used for initial site selection. We planned two short experimental cycles on either side of the frontal region, followed by a two day sampling period dedicated to the front itself.

Two day experimental cycles on the inshore (productive) side of the front and offshore (oligotrophic) side of the front (cycles 1 & 2, respectively) were designed to allow measurement of key productivity rates. Measurements included phytoplankton net and gross growth rates and primary productivity, new production, micro- and mesozooplankton grazing, and bacterial production. The extended period of time spent within each water parcel also allowed for repeat measurements of standing stocks from bacteria and nutrients to mesopelagic fish using multiple complementary methods. Lagrangian sampling of these water parcels allowed us to compare rates measured on our *in situ* drift array to net community changes in the water column.





Sampling across the front attempted to characterize both the physical and biological nature of the front. After an initial day spent locating the front using surface feature profiles made with the ship's flow-through measurements and the Advanced Laser Fluoremeter (ALF) system, we chose seven stations that spanned the length of the front. An initial night-time transect across the front measured profiles of chlorophyll, HPLC pigments, dissolved organic carbon (DOC), particulate organic carbon (POC), flow cytometry, epifluorescence microscopy of the nano- and microplankton community, and nutrient concentrations, as well as primary productivity at the 30% light level, and PRPOOS net-sampled mesozooplankton biomass and grazing. The following day two cross-frontal transects (one five km upstream and the other five km downstream of our night-time stations) with seven CTD stations each were taken to further characterize the physical structure of the front. The final night-time crossing featured three stations (stations 2, 4, and 6 from the previous night) with more detailed rate measurements as well as along-front oblique tows for mesozooplankton and mesopelagic fish.

Ship and Technical Support

We set out with ambitious goals including several operations that are typically performed on larger vessels. For the most part, these challenging operations were successful, thanks to the skill and willingness of the captain and crew of the R/V New Horizon. We owe particular thanks to the restechs, Gus Aprans and Meghan Donohue, who were always available, helpful, and capable in assisting us with our operations. Their continual effort and helpful advice went a long way in translating our plans into reality.

However, there were some distinct problems encountered during the cruise. We lost our first day of ship-time because the CTD failed after reaching a depth of 200-m. Luckily, only a day was lost due to the suggestion of the captain and restechs that we conduct a test station as soon as we reached deep enough water, rather than waiting until we had arrived on site. Another significant issue was the inaccuracy of the winch readout. This particular problem was not noticed until the end of the cruise, and will cause us significant difficulties when trying to interpret the results from our zooplankton net tows, because the depth of the tows is not known.

Science Operations and Issues

Our ambitious schedule was designed to maximize the 12 days' of ship-time allotted to us by conducting two mini-cycles of 2-3 day on either side of a front that commonly forms along the inner edge of the California Current Proper (CCP) as well as sampling the front itself for two days. Our goal was made more difficult from the start as the moving vessel profiler (MVP) we had planned to use was deemed inoperable before the cruise, forcing us to use the ship's flow-through system in combination with the ALF system to identify both the front and homogeneous water parcels in which to conduct our cycles. The troubles with the CTD further confounded our schedule, setting us a day behind when we began our science.

From that point, however, things started to run more smoothly. We conducted two two-day cycles while successfully tracking an *in situ* drifter. Although we lost communication with the drifter on four different occasions, constant monitoring of the drifter tracking computer combined with a new method of predicting its location and the able assistance of the crew allowed us to locate it each time. Each cycle successfully included daily measurements of C-14 primary productivity, phytoplankton growth and microzooplankton grazing, mesozooplankton net tows, sediment trap and Th-234 measurements of export, IKMT tows for mesopelagic fish, and bacterial incubations. While weather caused us to scrub some IKMT tows, the vast majority of our scientific activities were successfully completed on schedule.

Our plan for front sampling involved sampling biomass at 7 locations across the front on the first night. Between the hours of 9pm and 5am PST we conducted 7 CTD casts and vertical PRPOOS net deployments at stations located 5km apart. The stations were chosen roughly perpendicular to shore and spanning a strong frontal feature noticed in a salinity profile from the ship's flow-through data as we surveyed the area. Due to the lack of an MVP we chose to survey the physical structure of the feature by conducting repeated CTD casts during the day. A total of 14 CTD (7 upstream and 7 downstream of the night transect line) casts were conducted at 5km spacing. The following night we conducted more thorough sampling at 3 sites across the front. At these stations CTD casts were utilized both for biomass and rate measurements, and oblique bongo and IKMT tows were conducted along the axis of the front.

CCE-P0904 Activity Schedule

Cycle 1

Day 0 – April 24th				
	Noon	1200	ALF Profile Across-shore	Hafez
	2pm	1400	Deploy Sediment Trap	Stukel
	3pm	1500	CTD Bowtie (Yo-yo)	Stukel
	9pm	2100	CTD Cast – Thorium	Stukel
Day 1 - Apr. 25th				
	1am or ASAP	0100	Bongo Tow	Powell
	2am	0200	CTD, Production	Stukel
	4am	0400	Array Deployment	Stukel
	6am	0600	IKMT Deep Tow	Davison
	10am	1000	Bongo Tow & Size Frac	Powell
	Noon	1200	CTD	Emy
	1pm	1300	IKMT Shallow Tow	Davison
	6pm	1800	McLane Pump	Stukel
	7pm	1900	CTD, full dilution	Pasulka
	8pm	2000	Bongo Tow	Powell
	9pm	2100	Bongo Tow & Size Frac	Powell
Day 2 - Apr. 26th				
	2am	0200	CTD, production	Stukel
	4am	0400	Array Recovery & Redeployment	Stukel
	10am	1000	Bongo Tow & Size Frac	Powell
	Noon	1200	CTD	Emy
	2pm	1400	Bongo Tow	Powell
	3pm	1500	Bongo Tow	Powell
	4pm	1600	Bongo Tow	Powell
	5pm	1700	Bongo Tow	Powell
	6pm	1800	Bongo Tow	Powell
	7pm	1900	McLane Pump	Stukel
	10pm	2200	Bongo Tow & Size Frac	Powell
	11pm	2300	Bongo Tow	Powell
Day 3 - Apr. 27th				
	Midnight	0000	Bongo Tow	Powell
	1am	0100	Bongo Tow	Powell
	2am	0200	CTD, finals	Stukel
	4am	0400	Array recovery & deploy	Stukel
	6am or ASAP	0600	Recover Sediment Trap	Stukel
	7am	0700	Transit Offshore	

Cycle 2

Day 0 – April 27th				
	3pm	1500	ALF Profile Across-shore	Hafez
	5pm	1700	CTD	Stukel
	6pm	1800	Sed Trap Deployment	Stukel
	8pm	2000	Bongo Tow	Powell
	9pm	2100	Bongo Tow	Powell
	10pm	2200	Bongo Tow & Size Frac	Powell
	11pm	2300	IKMT Shallow Tow	Davison
Day 1 - Apr. 28th				
	1am or ASAP	0100	Bongo Tow	Powell
	2am	0200	CTD, Production	Stukel
	4am	0400	Array Deployment	Stukel
	6am	0600	IKMT Deep Tow	Davison
	10am	1000	Bongo Tow & Size Frac	Powell
	11am	1100	McLane Pump	Stukel
	Noon	1200	CTD	Emy
	1pm	1300	IKMT Deep Tow	Davison
	6pm	1800	Deep CTD (1000m), dil & Th	Stukel & Pasulka
	*	Concurrent	Fill bottles for Dickson Lab	
	8pm	2000	Repeated Bongo Tows	Powell
	9pm	2100	Bongo Tow	Powell
	10pm	2200	Bongo Tow & Size Frac	Powell
	11pm	2300	Bongo	Powell
Day 2 - Apr. 29th				
	2am	0200	CTD, production	Stukel
	4am	0400	Array Recovery & Redeployment	Stukel
	7am	0700	McLane Pump	Stukel
	10am	1000	Bongo Tow & Size Frac	Powell
	Noon	1200	CTD	Emy
	1pm	1300	IKMT Deep tow	Davison
	7pm	1900	McLane Pump	Stukel
	8:30pm	2030	IKMT shallow tow	Davison
	10pm	2200	Bongo Tow & Size Frac	Powell
	11pm	2300	Bongo Tow	Powell
Day 3 - Apr. 27th				
	2am	0200	CTD, finals	Stukel
	4am	0400	Array recovery & deploy	Stukel
	6am or ASAP	0600	Recover Sediment Trap	Stukel
	7am	0700	Transit to front	

Front

Day 0 – Apr. 30th				Day 1 - May 1st		
	0800	Survey to locate front			0800	CTD
	1200	PRPOOS Net			0845	CTD
	1215	CTD with sampling			0930	CTD
	1230	Continue Survey			1015	CTD
Night 1 - Apr. 30 - May 1					1100	CTD
	2100	PRPOOS			1145	CTD
	2115	CTD with sampling			1215	CTD
	2200	PRPOOS			1315	CTD
	2215	CTD with sampling			1400	CTD
	2300	PRPOOS			1445	CTD
	2315	CTD with sampling			1515	CTD
	0000	PRPOOS			1600	CTD
	0045	CTD with sampling			1645	CTD
	0130	PRPOOS			1730	CTD
	0145	CTD with sampling		**Night 2 - May 1-2**		
	0245	PRPOOS			2100	CTD with sampling
	0300	CTD with sampling			2130	Bongo
	0345	PRPOOS			2200	IKMT
	0415	CTD with sampling			0015	CTD with sampling
					0100	Bongo
					0130	IKMT
					0330	CTD with sampling
					0415	Bongo
					0500	IKMT
					0600	Brief Front Survey
					0645	CTD
					0715	CTD
					0730	Head Home

Cruise Personnel

Name	Position
Mike Stukel	Grad Student / Chief Sci.
Pete Davison	Grad Student
Jesse Powell	Grad Student
Darcy Taniguchi	Grad Student
Ally Pasulka	Grad Student
Byron Pedler	Grad Student
Andrew Taylor	Grad Student
Jian Liu	Technician
Ana Lara Lopez	Technician
Mark Hafez	Technician (Columbia U. / NASA)
Emy Daniels	Undergrad
Marco Hatch	Volunteer (Grad Student)
Mary MacCormick	Volunteer
Lars Thoresen	Volunteer
Melissa Miller	Volunteer
Heather Crellin-Greer	Volunteer
Lauren Franco	Volunteer
Gus Aprans	ResTech
Meghan Donohue	ResTech