Regional Operations Centre, Canadian Coast Guard Western

Science Cruise Report: PAC 2022-022

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https://www.waterproperties.ca/requests/cruiseplanview.php?cruiseid=2022-022

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Department/Group:	Fisheries and Oceans Canada, OSD
Other Participating Groups:	
Science Cruise Number:	PAC 2022-022
Alternative Cruise Number:	
Ship's Patrol Number:	
Name of Vessel/Platform:	J.P. Tully
Dates:	**From:** Thursday 25-Aug-2022 **To:** Tuesday 06-Sep-2022
Chief Scientist:	**John Nelson**, 250-363-6584, john.nelson@dfo-mpo.gc.ca
Master:	Captain Lettau
Fishing Master:	n/a
Appropriateness of Vessel:	Excellent

Time Allocations

Originally Allocated Days **12.00**
Accounting below is given in days and should match the originally allocated days above.

Weather	+ 0.00	
SAR	+ 0.00	
CCG Refueling	+ 1.00	
CCG Ship Repair & Maintenance	+ 0.75	sewage plant maintenance
CCG Crew Changes	+ 0.00	
CCG Other	+ 0.00	
Science Operations	+ 9.75	
Science Equipment Loading/Unloading	+ 0.50	
Science Other	+ 0.00	
Days Gained	+ 0.00	
Days Grand Total	**= 12.00**	

Time Allocation Comments:

The ship time allocation was from Aug 25 to Sept 6- this spans 13 calendar days, but I assume is considered 12 actual days of ship time as the day starts on noon on Aug 25 and would have ended on noon on Sept 6th. We came in a bit before noon on the 4th (and then unloaded til around 1500). This spans 11 calendar days and thus 10.25 days of ship time for science of which about 0.5 days spent loading/unloading and testing equip. The reasons for arriving back at IOS earlier than originally planned were a need to fuel the ship and service the sewage plant prior to the next patrol. Regardless of the reduced

number of days, due to efficient science-ship operations and planning of the work to avoid any potentially activity reducing-weather, we occupied a very useful set of science stations, including the CS line which was not occupied in the spring 2022 cruise or the fall 2022 cruise. With the originally allocated time we would have been able to occupy additional stations west and north of VI as well as in the inside.

Cruise Events

Areas of Operations

Juan de Fuca, Strait of Georgia, Johnstone Strait, West Coast Vancouver Island, Northwest Coast Vancouver Island

Scientific Personnel

Name	Affiliation	Cabin	Watch	Notes
Mark Belton	DFO	G	00-12	
Rowan Fox	DFO	G	12-00	
Julian Smith	DFO	H	00-12	
John Nelson	DFO	A	06-18	
Liam Hubbert	UVic	F	00-12	
John Dower	Uvic	F	12-00	
Brandon McNabb	UBC	D	12-00	
Kenny Scozzafava	DFO	H	12-00	
Rebecca Crawford	UVic	C	00-12	
Kelly Young	DFO	E	12-00	
Moira Galbraith	DFO	E	00-12	
Nicole Link	UBC	D	00-12	
Makenzie Mueller	DFO	C	12-00	gluten and dairy intolerant

Event Log

Aug 25 - covid testing starting at ~ 1200, loading, depart for station SI05 arrive at SI05 at 1700, proceed to Haro59, JF2 and the LB line.

Aug 26 - arrive at LB01 at 0943, at coming onto station at LB08 ship rolled with seas on the beam while setting up for the station, resulting in table with UBC equipment falling over.; Mass spec was heavily damaged.

Aug 26 - LB line

Aug 27 - complete LB line, start LC line

Aug 28 - complete LC line, transit and work LD line

Aug 29 - complete LD, transit and start LG line

Aug 30 - complete LG line, transit to and start LBP line (LJ line was skipped completely due to time limitation)

Aug 31 - complete LBP line, visit copra zooplankton stations enroute to offshore CS stations, commence CS line

Sept 1 - CS line, release drifters

Sept 2 - complete CS line, SS 05, 06 and 07, CPE 1, release drifters, JS01

Sept 3 - Seymour Narrows, Salish Sea stations

Sept 4 - arrive IOS before lunch, unload ship.

Scientific Equipment Report

Overall the the core scientific program and equipment operated very smoothly.; It was however unclear how to configure the TSG system such that new data files could be started everyday, this necessitated carving out by day, the data from a very large TSG data file.; It was also unclear where or even if the weather station was online and where that data was being stored.; Also, the science network was unstable (would drop previously visable components) which necessitated some work arounds to back up and work with the data.;;

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The new computer in the CS's cabin worked well and was very useful!;;

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As mentioned above in the event log, a table with UBC's mass spec fell over serously damaging equipment and presenting a safety hazard.; An CG incident report was created that well captured the event as follows:

Immediate cause:;The table was not adequately secured to the deck - when the ship rolled, it was able to tip and fall - the direct cause of the incident. Also of note, the table is narrow, placed longitudinally, and had heavy equipment on top (improper loading) and had a large cylinder attached to one leg - also likely contributing direct causes of the incident.

Root cause: The incident occurred in the lab which can be a vulnerable space given the number of users with wide ranging experience, and the unfamiliarity of the ship's crew with the equipment in the lab. In this incident - a previous science group had used this table - with no incident. Ship's crew and oncoming science made the assumption alike that this table had been, and was secured in position. The congested work area made it difficult to see that the table wasn't actually secured without a thorough inspection. This faulty assumption,; allowed for the table to remain inadequately secured, unnoticed, until it ultimately fell over in the conditions described above.

Radioisotope Report

n/a;

Scientific Successes and Concerns

Taken together the ship/science parnership performed quite well.

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Platform Successes and Concerns

Ships operations were excellent and communication betweent the ship and sciene worked well.;

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I suggest that hard anchor points be installed on the deck in the lab where the tables typically go to avoid them tipping over such as happened in this cruise.

Safety Concerns

none other that the table in the lab was not properly secured and fell over, with attached gas cylinder when the ship rolled.;;

Hazardous Occurrences

[Not Entered]

Other Comments

Overall, thanks to Captain Lettau, officers and crew for their positive attitude to the program. A solid working relationship and excellent communications between the ship and science, made possible a safe and efficient cruise;

Also, many thanks to the galley team for amazing meals and tasty baked goods!

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Below are individual science reports from groups outside DFO.

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Dower lab report (Hubbert):The purpose of my involvement on the La Perouse cruise was to collect samples to be used to make secondary production estimates in the coastal and offshore waters around Vancouver Island. Water samples were collected from various depths to be used for chitobiase assays, a biochemical method of measuring crustacean zooplankton production rates. Zooplankton samples were also collected from BONGO nets to be analyzed via the AARS enzyme assay to also measure secondary production of different size classes. Samples were collected from LB08, LC09, LC04, LG09, LG02, LBP03, LBP08, CS02, CS09, 12, and GEO1. Performing both assays with samples from the same stations is interesting in the efficacy of the AARS technique on mixed zooplankton samples and provides a more thorough understanding of how zooplankton communities are spatially distributed.

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Varela Lab report (Crawford):In recent years, shifts in environmental conditions in arctic and subarctic oceans have brought increased attention to the biodiversity of these regions. Better predictions about how these oceanic regions may respond to climate change require that we fully understand the biodiversity and community structure of eukaryotic phytoplankton, given that they are the major primary producers in marine environments. In our efforts to assess phytoplankton biodiversity, water samples for DNA analysis were collected from coastal and offshore sites during the Fall La Perouse plankton monitoring program along Vancouver Island. These water samples serve as part of the subarctic component of our investigation of phytoplankton community composition in arctic and subarctic oceans.

Samples were collected from five coastal and six offshore stations during the fall La Perouse program. This included water sampling from Niskin bottles collected at 5, 10, 30 and 50 metre depths to assess the spatial distribution of phytoplankton community composition at each site. These water samples will be used for molecular and microscopic analysis to determine relative abundance and composition of phytoplankton taxa. At each station, water samples were also collected for environmental metadata and phytoplankton biomass estimates. This included sampling for dissolved and particulate nutrients, total chlorophyll, biogenic silica, and particulate organic carbon and nitrogen. These measurements will be paired with molecular data to characterize how community composition of phytoplankton varies with the environment.

Additional samples were collected for PhD candidate Michael Livingston to aid in his research on phytoplankton productivity and their production of exo-polymer carbon gels. Water samples were collected from five coastal and six offshore stations that were preserved in buffered formaldehyde. These samples will be used for later analysis of exo-polymer gels produced by phytoplankton. Carbon and nitrogen uptake experiments were performed at two coastal and two offshore stations to investigate phytoplankton productivity. These experiments included 24 hour incubations of water samples collected at 5m and 10m that were spiked with carbon and nitrogen isotopes. After their incubation period, water samples were filtered onto glass fiber filters to be used for analysis of total phytoplankton productivity and were then size fractionated to be used for analysis of productivity by pico-phytoplankton. These data will be used to enhance our understanding on the role that phytoplankton play in the oceanrsquo;s biological carbon pump.

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Tortell Lab report (McNabb):;esearch Summary
Dimethyl sulfide (DMS) is a biologically produced trace gas that is significant as both the dominant source of marine sulfur emissions to the atmosphere, and for its hypothesized role in stimulating cloud formation which can regulate climate at regional scales. DMS forms a complex part of the marine sulfur cycle together with its related compounds dimethyl sulfoniopropionate (DMSP) and dimethyl sulfoxide (DMSO, together referred to as DMS/O/P). The northeast Subarctic Pacific is a hotspot for DMS/O/P cycling, but the oceanographic drivers and physiological mechanisms this cycling is poorly understood, despite the climatic significance of these compounds.
To address this, we collected underway samples to map the on-shelf and off-shelf spatial variability in these compounds. Underway samples for DMS/O/P were collected with OSSCAR, a custom-built purge and trap system attached to a capillary inlet mass spectrometer (PT-CIMS) as a detector. Due to equipment failure, OSSCAR was later interfaced to with an atmospheric pressure chemical ionization mass spectrometer (PT-APCI-MS/MS), which provides high selectivity and extremely low detection limits for the tracer experiments described below.
We also conducted a series of 5 incubation experiments designed to test the hypothesis that photoacclimative stress may stimulate DMS/O/P turnover. For these experiments, water was collected from Niskin bottles at or near the chlorophyll-a max from both on-shelf and off-shelf stations. The water samples were transferred into triplicate gas tight bags which were spiked with stable isotope tracers of each compound of interest (D3-DMS, D6-DMSP, and D6,13C2-DMSO), allowing the turnover rates between these compounds to be quantified. These bags were then incubated for 8 hours on deck and were subsampled at 2-hour intervals for DMS/O/P concentrations, chromophoric dissolved organic matter (CDOM), and bacterial abundance (preserved with hexamine-formaldehyde for flow cytometry analysis). The concentration of each isotopic DMS/O/P tracer was measured using a similar custom-built purge and trap system to OSSCAR, but interfaced with the PT-APCI-MS/MS described above.
An additional experiment was conducted to test a hypothesized link between the DMSO reduction pathway and photosynthetic electron transport rates. Water was collected, incubated and subsampled as described above, but three replicates were amended with 10 nM addition of the photosynthetic inhibitor DCMU. Total chlorophyll-a was additionally collected at the last time point.
Acknowledgements
We would like to sincerely thank the captain and coast guard crew aboard the John P. Tully, IOS scientists, watch leaders, and our chief scientist John Nelson for helping facilitate the completion of this work.

Images

[No Alternative Image Provided]
Image notes:

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