Regional Operations Centre
Canadian Coast Guard – Pacific

PACIFIC REGION CCG VESSEL - POST CRUISE REPORT
Line P Program – Fisheries and Oceans Canada

NAME OF SHIP/PLATFORM: John P Tully

DATE: **FROM:** 8 February 2016 **TO:** 22 February 2016

SCIENCE CRUISE NUMBER: 2016-01 **SHIP'S PATROL NUMBER:** 15-11

CHIEF SCIENTIST[S]: Marie Robert

SCIENTIFIC PERSONNEL:

Female	Male
Alysia Herr (UBC)	Michael Arychuk (IOS)
Marie Robert (IOS)	Mark Belton (IOS)
Jade Shiller (UBC)	Glenn Cooper (IOS)
Theresa Venello (UVic)	John Dower (UVic)
	Robert Izett (UBC)
	Richard Nelson (BIO)
	Philippe Tortell (UBC)
	Doug Yelland (IOS)

AREAS OF OPERATION: North East Pacific, Line P, Station P.

INTRODUCTION/PROGRAM BACKGROUND: Line P is a long standing program which surveys a 1400 km long section 3 times annually. Data has been collected along this line since 1956 and shows evidence of the impact of climate variability on ocean productivity. It is the only Canadian long time-series that allows scientists to monitor climate changes in the Pacific Ocean. It is also the best opportunity for other programs (e.g. Universities) to do research in the Pacific since the Line P data give them background as well as current water properties.

CRUISE OBJECTIVE/OBJECTIVES: Repeat hydrography section (physics, chemistry, zooplankton), repeat cesium sampling, deploy one weather data drifting buoy for Environment Canada, four Argo floats for IOS and one Argo float for University of Washington.

CRUISE DESCRIPTION: This cruise (2016-01) went really well. Despite having only 2 weeks to do the cruise we managed to do everything we were planning to do, and more. It really, really helped that the crew of the Tully was ready for us to start loading the morning of February 8th, before the official start of the cruise. This allowed us to leave on the first evening of the allocated ship time. Starting to load in the morning also helped in that groups loaded their gear one after the other, instead of everything coming on board at once. The weather

was a big factor too in the success of this cruise. We had to cancel a few casts on the outbound leg, but we were able to revisit those stations on the way back, and all in all the weather was really decent for a February cruise. Another factor for success was the smaller demands on wire time than usual. No trace metal or primary productivity samples were collected so less time had to be spent at each station. Because of this factor we were able to recover a malfunctioning Glider for WHOI. And finally, as usual, the Tully red crew made everything work like a charm!

DAYS ALLOCATED: 14 **DAYS OF OPERATION:** 13

DAYS LOST DUE TO WEATHER: Only a few hours, mainly going from P24 to P26. Also some stations or casts were cancelled on the way out but done on the way back.

SAMPLING:

- The Line P survey was 100% successful. Only one 250m bongo at P12 had to be cancelled.
- One weather data drifting buoy was deployed for Environment Canada, 4 Argo floats were deployed for IOS, and one Argo float was deployed for the University of Washington. One Glider was recovered about 75 miles north of P35 for Woods Hole.
- Trace Metal samples were not collected on this cruise.
- We collected some extra "Deep Conductivity Sensor" data for Clark Richards at RBR Ltd as well as some "Back Scattering Sensor" data for Toby Westberry at Oregon State University – Corvallis.
- We collected some extra Dissolved Oxygen, Salinity, and Chlorophyll samples from the loop system while closing the 5-m Niskin at specific stations along Line P, as well as samples from the loop roughly 10 minutes after leaving the station, i.e. while underway, to study the quality of the loop water and the effect of ship's movement on the loop system. The dissolved oxygen samples will be compared to the values from a Gas Tension Device setup in the wet lab continually measuring dissolved oxygen, while the salinity and chlorophyll samples will be compared to the data from the thermosalinograph and the fluorometer set up in the main lab. See Tortell's report in the science section for the dissolved oxygen preliminary analysis.
- The samples collected include:
    1) Underway: **IOS**: Thermosalinograph (Temperature, Salinity, Fluorescence), acoustic sounder, ADCP, pCO_2 – **UBC (Tortell, Izett, Herr):** DMS, DMSP, DMSO, dissolved nitrogen (N_2), oxygen (O_2), CO_2, argon (Ar), DMS, DMSP.
    2) "E-data" from CTD: Pressure, Temperature, Conductivity, Dissolved Oxygen, Transmissivity, Irradiance, Fluorescence.
    3) From the Rosette: **DFO-IOS:** dissolved oxygen, salinity, nutrients, DMS, DMSP, chlorophyll, pigments (HPLC), dissolved inorganic carbon (DIC), alkalinity, pH – **DFO-BIO (Nelson)**: Cesium, ^{129}Iodine – **UBC (Shiller):** high-resolution bacterial DNA sequencing, number of cells per millilitre, single cell DNA analysis, virus analysis, viral counts – **UBC (Tortell, Izett, Herr):** methane (CH_4) and nitrous oxide (N_2O) – **UVic (Dower, Venello):** secondary productivity.
    4) **DFO-IOS and UVic (Yelland, Dower, Venello):** Zooplankton using vertical net hauls (Bongos to 250 m and 1200 m).

RADIOISOTOPE USE:

No radioisotopes were used during this cruise. The Rad-van was not on board.

PROBLEMS [SCIENTIFIC GEAR AND OPERATIONS]:

The thermosalinograph (TSG) was not functioning properly. It seems that too many bubbles got trapped in the lines which periodically affected the conductivity. The bubbles appeared to be siphoning back up the drain tube due to lack of back pressure in TSG. There were also many leaks all through the system. We had a meeting with the people using the loop system and setting up instruments in that corner. Hopefully some drawings can be done soon in order to clean up the area during self-refit in April.

The Y-cable used on the CTD to connect the back scattering sensor wasn't working properly. We lost our transmissivity data on the first two casts, and had to eventually take the sensor off since its signal was obviously faulty.

The label laptop didn't have Office installed on it so the watch leaders were not able to modify the rosette logs when necessary; we had to use PDF files. Also the screen is too small, the software windows don't all fit on the screen or monitor. The Line P program will get its own label laptop from now on .

We tested some new O-rings and springs on 8 of the 24 Niskins on the rosette. A few of the Niskins were leaking very badly. The springs inside the bottles seem to be too long. One of the modified bottles had a piece of line inside it; we thing that these bottles never got tested before being sent on the ship. One Niskin that had not been modified was also badly leaking from the bottom cap.

Lots of bubbles were accumulating in the chemical dispensers for dissolved oxygen analysis, both in the moving part of the dispenser as well as in the long skinny tube.

The ship departure got delayed because the configuration file was not ready in the CTD computer. This should have been done before the computer even got on board.

We lost 16 DMSP samples and three dissolved oxygen samples with the rolling motion of the ship. The samples were simply not secured properly. No dangerous good spill occurred with these breaks.

The UBC incubator in the main lab leaked quite heavily at the beginning of the rougher weather. It got looked after in the timely manner by the UBC crew and the deck got cleaned up.

SUCCESSES [SCIENTIFIC]:

There was a heavy demand on the manifold in the lab and on the sinks but we managed to make it work. It was a good thing that no incubators were needed on the heli-deck as this would have brought the pump to its limit.

The pCO_2 system ran well this cruise. The previous problem with the LICOR analyzer was fixed and it did not give the same problems as experienced on previous cruises. The AVOS weather station data string was very stable this cruise and did not glitch or fail a single time. There still is a problem with the temperature data coming from the "Inlet" as it was still giving inaccurate numbers. This is a particularly difficult problem to identify and diagnose due to the location of the temperature probe but some additional information was obtained this cruise to hopefully solve the problem for future cruises. In the meantime the "Inlet" temperature data will have to be taken from the TSG data file and merged with the PCO2 data file.
A prototype of the new PCO2 system was tested out on this cruise and it ran for about 8 days. It was useful to have both new and old systems running side by side as it helped identify areas of the design where adjustments will need to be made. The comparison of data between systems will be done back in the lab as it will require pulling data strings from multiple areas and merging them together to get a full and accurate picture.
Michael Arychuk

We used a new compressed gas tanks holder on this cruise. It was extremely stable and proved to be a great improvement on the old one used previously. It took a very long time to assemble at the beginning of the cruise but that was to be expected as it was the first time it was being used. Some improvement on the design still needs to be explored but it is definitely a much better system to use.

PROBLEMS [SHIP'S EQUIPMENT/OPERATIONS/PLATFORM SUITABILITY]:

There was a delay of about 30 minutes because of technical difficulties with the CTD winch.

There was an electrical problem with the shaft generator as we were going to revisit station P4, cancelling the station.

The Web App we have to use to receive our ship email does not allow the saving of those emails. If this situation is permanent (that the science computers won't have access to Outlook anymore) a different Email App would be preferable.

SUCCESSES [SHIP]:

Shortly before sailing, the Coast Guard IT group completed an overhaul of the shipboard network. The consequences for Science were better than anticipated. Science areas on the Tully have been isolated from the rest of the ship's network. The science subnet does have access to the Internet (when the ship does) but not to the ship's subnet. Science was allocated several static IP addresses so permanently situated computers are now set (the ADCP, the sounders, and the science server at this point).
Coast Guard also installed two new computers for the operation of the EA600 (12 kHz) and EK60 (multifrequency) sounders. They are now operating well; it's great to have new monitors that are stable. Thank you Lawrence Kuromi! The ADCP computer appears to have failed late in the cruise; it will be assessed but will likely need replacing due to the nature of the failure.
Email on board is in transition. The future configuration for all shipboard email is unknown at this time. Brian Wong helped make it workable for this cruise, thanks! In moving forward, it should be stated that email access for Science has become imperative. Our programs are often designed with email access assumed. Receipt of buoy transmissions in near-real-time, weather and satellite data, and instructions due to changing priorities and conditions are all important reasons for maintaining consistent access to email for science personnel aboard the ship.
Access to the Internet was generally good, depending on the ship's orientation. Blockage of the antenna seems to be a problem on certain headings. But when connected it's fast enough to be useful most of the time.

Doug Yelland.

The recovery of the malfunctioning Woods Hole glider went like a charm. It was spotted very rapidly (thanks to Arran Eagle Eyes ☺) and the crew in the 753 did a fantastic job of seizing the Glider and getting it on board the Tully while taking extremely good care of it.

The two Officers of the Watch did an amazing job on very, very rarely using the bow thrusters. Thanks! ☺

DELAYS [OTHER THAN WEATHER]:

About 30 minutes for problems with CTD winch.

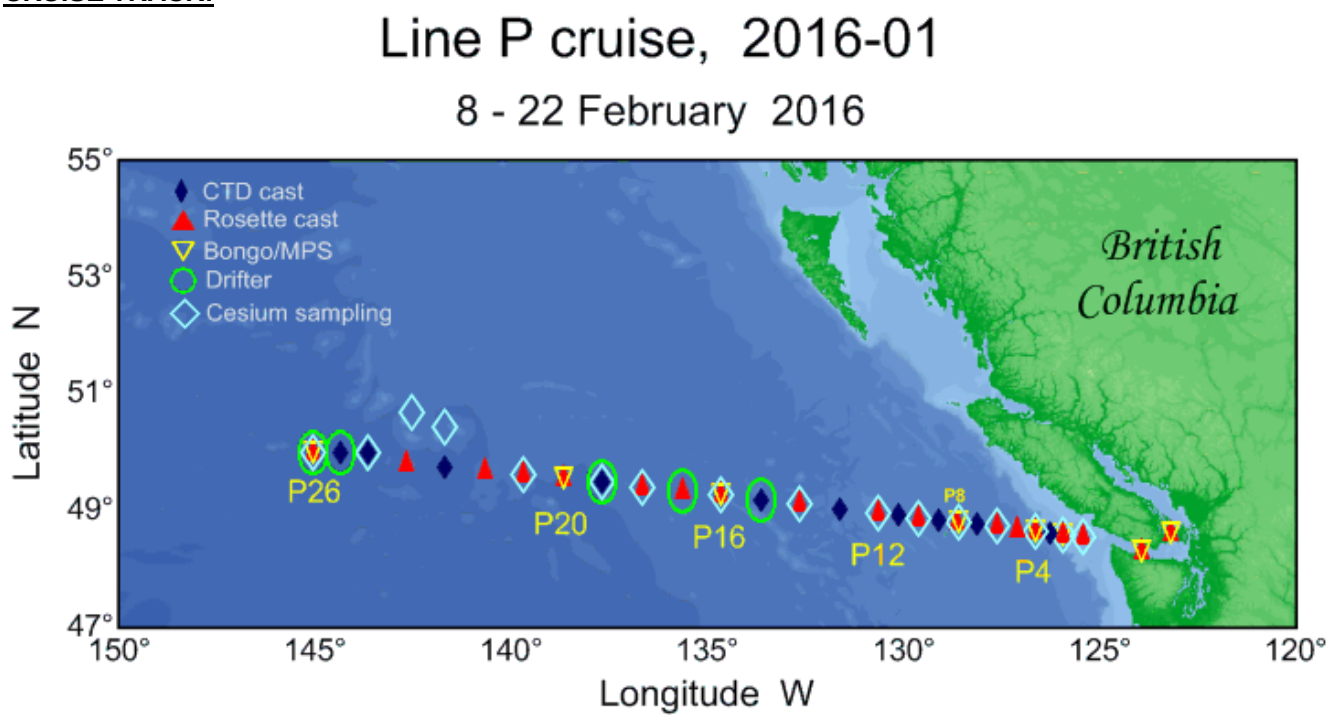
HAZARDOUS OCCURRENCES:

None involving scientific personnel.

EVENT LOG:

Monday 8 February:	Loading of the container and winches first thing in the morning. Start loading scientific gear around 0830. Safety meeting at 1500. Science meeting at 1800. Leave Pat Bay at 2100. Station Haro59.
Tuesday 9 February:	Stations JF2 to P4. Fire and boat drill at 1300.
Wed 10 February:	Stations P4 to P9
Thursday 11 February:	Stations P10 to P13. Cancel the bongos at P12 due to strong winds.
Friday 12 February:	Stations P14 to P16.
Saturday 13 February:	Stations P16 to P19.
Sunday 14 February:	Deep cast at P20, 2 bongos and DMS cast cancelled due to strong winds. Stations P21 and P22.
Monday 15 February:	Stations P23 and P24. Cancel P25 and P35 and follow weather course.
Tuesday 16 February:	Station P26 (5 rosette casts and a 250m bongo). Burial at sea ceremony. Deploy UW Argo float and EC weather drifter. Stations P25 and P35. Then head towards the Glider.
Wed 17 February:	Recover WHOI Glider.
Thursday 18 February:	P20, DMS cast, 250 and 1200 m bongos.
Friday 19 February:	Sailing east.
Saturday 20 February:	Stop at P4 to re-sample. Station cancelled because of troubles with shaft generator. Keep sailing east.
Sunday 21 February:	Arrive at IOS and offload the UBC gear.
Monday 22 February:	Offload IOS and UVic gear in the morning.

CRUISE TRACK:



SUMMARY/FINAL COMMENTS:

- Many thanks to everyone at IOS who have helped make this cruise a success: Kenny, Nina, Kelly, Moira, Hugh … your help is always greatly appreciated! Thanks for the extra hand (and backs!) while loading and offloading ...

- Many thanks to Lawrence Kuromi and Brian Wong for getting me access to the Chief Scientist's email account, and for helping with the setup of computers in the lab.

- Thanks to Captain McCullagh and the Officers for sending the weather reports, and for all their help making the best plans according to the latest forecast!

- Special thanks to the Captain and crew of the *Tanu* for relieving the *Tully* as early as possible from SAR duties, and to Johnny and the whole deck crew for starting to load our gear before the official beginning of the cruise.

- Thanks to Doug Yelland for spending so much time dealing with network issues, and to Mark Belton for downloading the RBR data every day.

- And thanks to everyone on board for such a successful and enjoyable cruise! Once again the galley crew did an amazing job feeding us and looking after us, and the deck crew and engine room crew were always so very helpful whenever we needed them. Everyone was a joy to work with. See you all again in June!

Marie Robert

- I'd like to thank the captain and crew of the *Tully* for their assistance and excellent work throughout the cruise. They kept us safe and allowed us to successfully sample even in inclement weather. Thanks to Kara and the rest of the galley team for their delicious meals. Thanks to the IOS team and the scientists onboard for their help and their humour on deck and in the lab. And finally, a great big thank-you to Marie for flawlessly organizing the entire cruise.

Jade Shiller

- We'd like to thank the Captain and crew of the *Tully* for all their assistance and hard work throughout the cruise. Thanks to Marie Robert and the science crew for having us on board to do this work.

  Theresa Venello and John Dower

- We would like to thank all of those who assisted in the collection of DIC/Alkalinity samples. Your help was greatly appreciated.

  Glenn Cooper

- As always, it was a pleasure to work with our colleagues at IOS. Their support and professionalism is greatly appreciated. We particularly appreciated the additional efforts to collect Winkler O_2 calibration samples.

  Philippe Tortell, Robert Izett and Alysia Herr

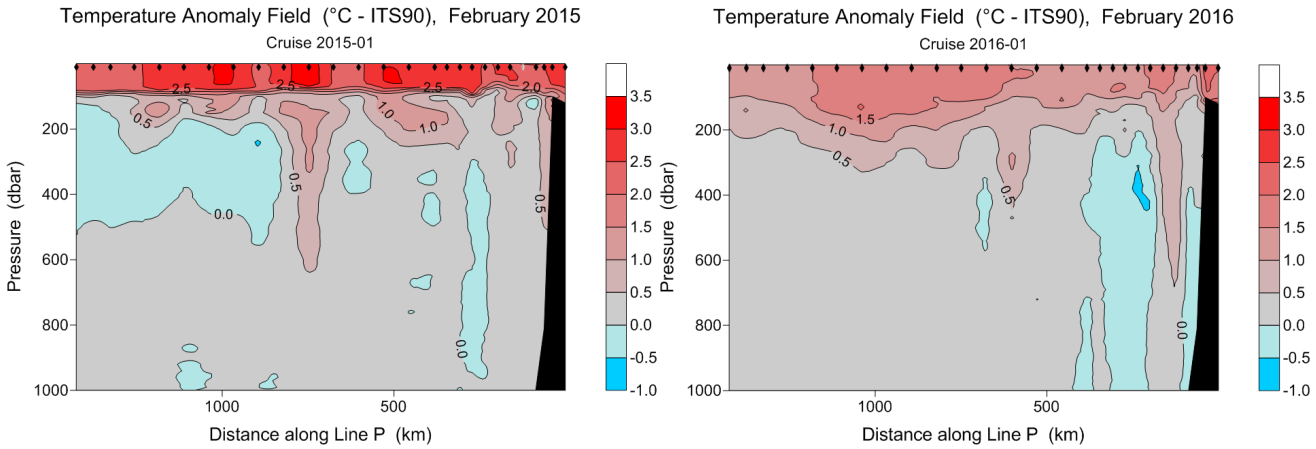
- Thanks to the officers and crew of the CCGS John P. Tully for the work to make this a successful cruise. Special thanks to Marie Robert for all of the wire time and all those who helped carry the 24 ℓ carbouys.

  Rick Nelson

PROJECTS AND RESULTS:

Water masses – Marie Robert, DFO/IOS.

The main story of the past few years is the now famous “Blob”, the very large mass of warmer-than-usual water situated in the top 100 metres or so of the North Pacific Ocean covering most of the Gulf of Alaska. Is it still present? When looking at the anomaly of temperature with respect to the 1956-1991 averages, it seems that it is still there, but is much weaker than a year ago at the same time. The temperature anomaly is not as important, on the other side it seems to be more distributed in the water column, as can be seen in the figure below.



Temperature anomaly field with respect to the 1956 – 1991 averages for February 2015 (left panel) and February 2016 (right panel).

Line P - February 2016 – Theresa Venello and John Dower, UVIC

Objectives: Quantifying secondary (crustacean zooplankton) production along Line P using the chitobiase-method. Comparison of loop sample production and rosette sample production.

Sampling:
500mL of seawater was taken from 6 depths (5,10,20,50150,250m) at all 7 major stations that have a bongo net cast (P2,P4,P8,P12,P16,P20,P26). P20 sampling occurred on the way back. Loop seawater samples (500 mL) were also taken at each of these stations.

In addition, loop seawater samples were taken at P6, P10, P14, P19, P22, P24 to increase the spatial resolution of our production estimates.

Water samples were ‘spiked’ with a homogenate made from ground amphipods, krill or copepods (depending on what was in the bongo sample); filtered over a 12 hr period to create a decay of the moulting enzyme chitobiase. Samples were assayed and read using a fluorometer while on board.

Comments:
All of our sampling goals for this cruise were met.

We’d like to thank the Captain and crew of the *Tully* for all their assistance and hard work throughout the cruise. Thanks to Marie Robert and the science crew for having us on board to do this work.

Line P February 2016 – Jade Shiller, UBC.

Objectives:
Describe the taxonomic and metabolic diversity of the bacterial and viral communities in the cycling of major nutrients along Line P, focusing on the communities in the oxygen minimum zone.

Sampling summary:
At 5 stations (P4, P12, P16, P20, and P26)

1) 2 L seawater samples (at 16 depths) for high-resolution (HR) bacterial DNA sequencing were filtered.
2) 50 mL seawater samples were taken per depth to count the number of cells per milliliter using flow cytometry and single cell DNA analysis. Samples were aliquoted and preserved using glutaraldehyde and glycerol+TE, respectively.

Additionally, at 3 major stations (P4, P12, and P26), the following were sampled at four depths: 10, 500, 1000, and 2000 (bottom+10 at P4) across the oxygen minimum zone.

1) Large volumes (20 L; LV) at each depth were filtered to create genomic libraries of the bacterial communities.
2) After adding of iron chloride to the filtered water, the samples were filtered again for later virus analysis.
3) For viral counts, samples were taken and preserved using glutaraldehyde and betaine.
4) 50 mL seawater samples were taken per depth to count the number of cells per milliliter using flow cytometry and single cell DNA analysis. Samples were aliquoted and preserved using glutaraldehyde and glycerol+TE, respectively.

Comments:

All my lab objectives for this cruise were successfully fulfilled. The work area distribution was convenient for my sampling needs. Closer proximity to a sink/drain would be even better in the future. Weather permitting, it is also preferable to have at least 3 hours between collecting HR samples from the deep cast and LV samples from the "UBC" cast to allow adequate time for processing samples.

I'd like to thank the captain and crew of the *Tully* for their assistance and excellent work throughout the cruise. They kept us safe and allowed us to successfully sample even in inclement weather. Thanks to Kara and the rest of the galley team for their delicious meals. Thanks to the IOS team and the scientists onboard for their help and their humour on deck and in the lab. And finally, a great big thank-you to Marie for flawlessly organizing the entire cruise.

Cruise Report - Line P – Philippe Tortell, Robert Izett and Alysia Herr; Earth, Ocean & Atmospheric Science, UBC

Objectives:
Our work on this cruise was focused on quantifying the distribution of biogenic gases and optical properties in surface and subsurface waters along the Line P transect. We deployed a number of automated ship-board instruments for real time analysis, and collected discrete depth profile samples for subsequent laboratory analysis at UBC. Several of our instruments are still under development, so the cruise was used as an opportunity to test and trouble-shoot methods. We were also interested in evaluating potential offsets in O_2 concentrations in the seawater sampling loop relative to surface Niskin bottles.

Sampling plan:
At stations P4, P8, P12, P16, P20 and P26, we collected duplicate depth profile samples for analysis of methane (CH_4) and nitrous oxide (N_2O) concentrations. Samples will be run at UBC using an automated purge and trap gas choromatography - mass spectrometry system. We have been measuring these gases along the Line P transect since 2008 (with some gaps), and are thus approaching a 10 year time-series. Additional surface water (5 m) samples were collected for N_2O analysis at a number of stations along the transect. Data obtained from these samples will be used to constrain vertical mixing of sub-surface waters into the mixed layer, using excess N_2O as a proxy for the entrainment of low O_2 waters.

Much of our work was accomplished using automated instruments. We used membrane inlet mass spectrometry (MIMS) to continuously measure surface water concentrations of dissolved nitrogen (N_2), oxygen (O_2), CO_2, argon (Ar) and DMS. We experienced a number of technical problems with this instrument, including repeated computer crashes, electrical noise, and plumbing issues with an equilibrator water tank (see below). We were able to repair and/or mitigate these problems to obtain a reasonable amount of data for the cruise. Observations of particular interest include $\Delta O_2/Ar$ as a proxy for net community production, pCO_2 and dimethylsulfide (DMS). During this cruise, DMS concentrations were low ~ 1 nM or less, and thus undetectable by our method.

Additional DMS (and DMSP) measurements were made using our recently developed Organic Sulfur Sequential Chemical Analysis Robot (OSSCAR). The instrument uses a Pulsed Flame Photometric Detector interfaced with a custom built and fully automated GC and purge and trap gas extraction system. We spent a fair bit of time trouble shooting the instrument during the first week of the cruise, and we were able to address a number of hardware and software issues. On the return trip from Station Papa, we obtained high quality measurements of DMS and DMSP (see Fig. 1 below) and the system worked extremely well in a fully automated mode. We made substantial improvements to the software, including the development of a new automated data processing and real-time display module.

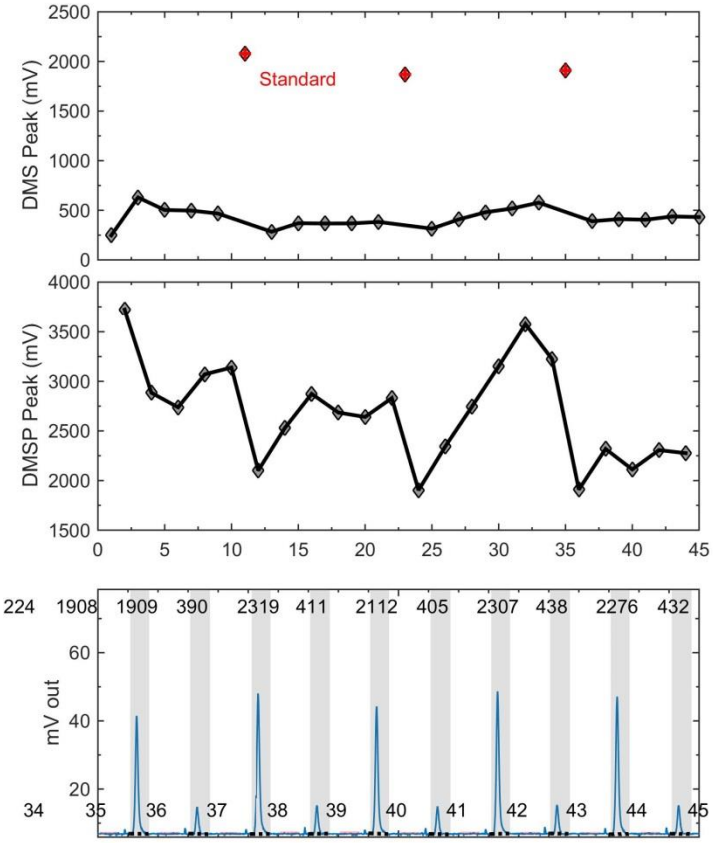


Fig.1. Sample data obtained for underway analysis of DMSP and DMS using the OSSCAR system. The bottom panel shows peaks eluting from the GC column. Numbers at the top are the peak integrals computed in real-time using a matlab script. The top two panels show the peak areas for DMS and DMSP over the sequence of a 45 sample run.

Continuous surface water measurements of O_2 concentrations and total gas pressure were made using an Optode and Gas Tension Device (GTD), respectively. Concentrations (and saturation state) of N_2 can be derived from the GTD and Optode data, with some assumptions / corrections for CO_2 and Argon saturation states. These newly acquired instruments were deployed for a first test run. We set up the instruments in the wet lab and they appear to have functioned well. Our plan is to create a more permanent installation for the sensors, near the ship's hull intake in the transducer compartment. This installation will minimize warming of seawater in transit to the laboratory, and also other the potential for biological consumption of oxygen or entrainment of bubbles in the sampling lines. We had extensive discussions with the Chief Engineer, and with a

representative from Pro Oceanus Systems (who met the ship prior to departure), with the aim of developing an optimal installation plan. We were able to come up with a very good option for mounting the sensors, and we will follow this up after the cruise. Our intention is to have a system ready for installation during the April re-fit period.

As part of the GTD / Optode deployment, we conducted a calibration exercise to examine potential offsets in O_2 concentrations in the ship's seawater supply lines. At all of the major stations, surface loop samples were collected at the same time as 5m Niskin bottles were closed. Additional samples were also collected 10 minutes after leaving station. Results of this exercise are shown in the figure below. As shown in the figure, there is a significant offset in the O_2 concentrations measured in the underway lines as compared to the Niskin bottles. In all cases, the sampling loop samples have higher concentrations of oxygen then the Niskin bottles, suggesting significant entrainment of air/bubbles into the water.

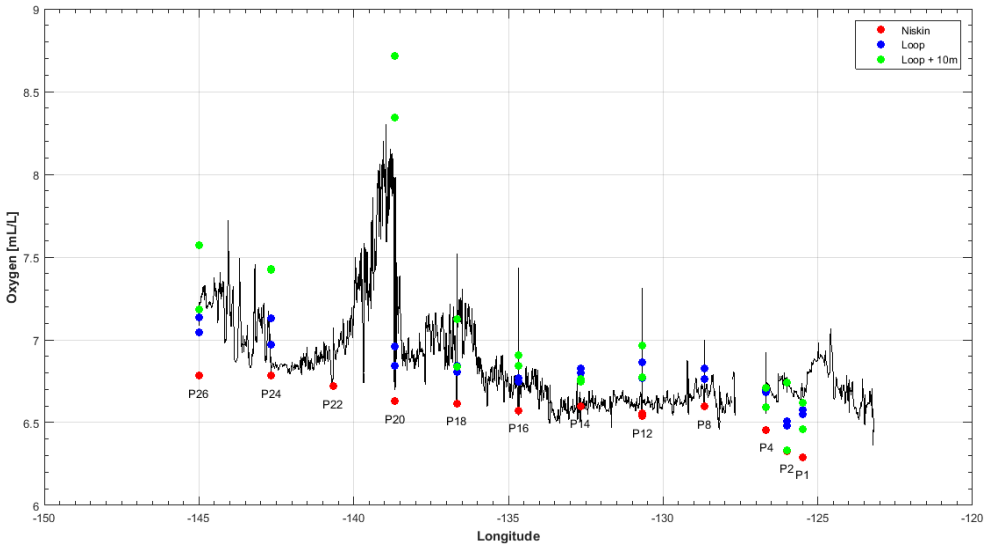


Fig. 2. Comparison of oxygen concentrations measured in the seawater loop (by discrete Winkler titration and continuous Optode measurements) as compared to 5 m Niskin bottle samples. As shown in the figure, the loop samples are consistently higher than 5m Niskin bottle measurements. This indicates significant entrainment of air into the seawater sampling lines.

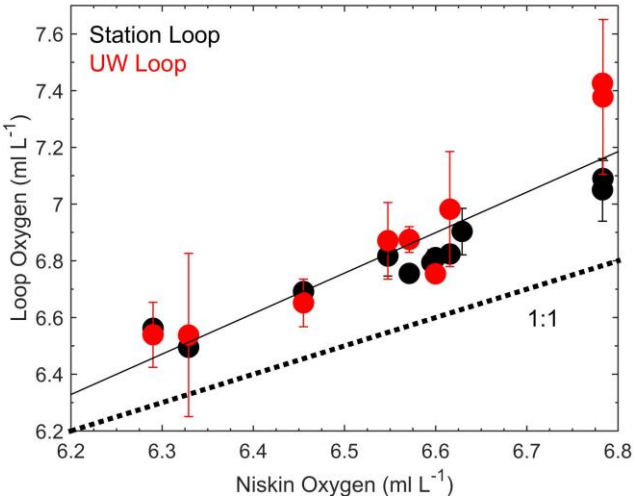


Fig. 3. Direct comparison of Niskin and loop oxygen samples. The offset in the seawater loop samples is clearly shown.

We also made continuous underway measurements of several surface water optical properties, including particulate back-scatter and spectrally-resolved absorption spectra. These measurements will be used to derive an algorithm for predicting particular carbon concentrations in surface waters and the relatively abundance of different pigment classes (which can be used to indicate phytoplankton taxonomic abundances). The sensors were loaned to us by Michael Behrenfelds' group at Oregon State University, and Toby Westberry met the ship to install the sensors in the wet lab. The instruments appear to have produced good data, but we need to wait for more advanced data processing to confirm this. UBC has purchased identical sensors, and they will be installed on future Line P / LaPerouse cruises.

Finally, we used a Fast Repetition Rate Fluorometer (FRRF) to continuously measure active chlorophyll a fluoresence along the ship's track. These data can be used to infer rates of photosynthetic electron transport around Photosystem II (as a proxy for gross primary productivity), and they also provide information on a number of phytoplankton photo-physiological properties (e.g. photosynthetic efficiency, F_v/F_m, and functional absorption cross section □). Data quality appears to be good from these sensors.

Comments:

As always, it was a pleasure to work with our colleagues at IOS. Their support and professionalism is greatly appreciated. We particularly appreciated the additional efforts to collect Winkler O_2 calibration samples.

On this trip, there appeared to be an acute space crunch for seawater lines on the TSG sink in the main lab. We had to use multiple splits to supply our various instruments, and we also needed to use a seawater line in the wet lab. In discussions with the chief engineer, we have suggested that additional branch points be installed on the seawater loop system. We also discussed ways to maximize the efficiency of space use on the wall where the TSG is mounted. Apparently, there will be some changes made during the re-fit in April. There is significant scope to improve the use of this highly coveted space.

We also experienced some problems with the draining of our water bath (used to keep standard bottles close to SST). During rough seas the drains would back up, allowing some water to run onto the floor of the main lab. Part of the problem was due to a clog of the starboard side scuppers (apparently from a dead bird….). For future deployments, we will look into getting a pump to facilitate drainage of our tank into the sinks.

We have developed a new CO_2 / DMS calibration system. This system allows us to significantly reduce the number of gas tanks needed (from 3 to just 1 CO_2 mix). This helps minimize clutter in the main lab. The new gas tank holding system worked very well.

Finally, we still suffer from a 'time-crunch' during the loading period. We recognize the tight time-lines for departure (particularly for the February cruises). However, given the high degree of complexity of our instruments, it would be helpful to have more time for set up. During this particular cruise, we had two people from out of town working with us to set up new instruments (Toby Westberry from OSU, and Bryan Schofield from ProOceanus in Halifax). There was not enough time for them to provide full training on the respective instruments (particularly for the optics) and this created some difficulties during the cruise. As a point of comparison, we normally have a minimum of two full days for initial set up on other research vessels. This amount of time is not likely feasible for Line P trips, but perhaps there is a way to get an 'early start' on the installation of equipment.

pH analysis and DIC/Alkalinity sampling – Glenn Cooper, DFO/IOS

1) Seawater pH analysis:

Seawater pH was determined using the spectrophotometric method developed by Clayton and Byrne (Deep Sea Research, 1993). Seawater was collected directly from the rosette Niskins into 10cm path length glass cuvettes. Meta-cresol purple was used as the indicator dye and was validated prior to the cruise at IOS. The following major stations were sampled: P01, P02, P04, P12, P16, P20, and P26. One set of triplicate samples was taken at stations P01 and P02, whereas all other casts had two sets of triplicates sampled. Replicates will be used to determine precision for the entire cruise. A calibration cast was performed at P24 where triplicates were taken from 5 Niskins which were closed at all the same depth of 2000m.

2) DIC/alkalinity sampling:

DIC/alkalinity samples were collected in 500ml glass bottles and preserved with 100µl of saturated $HgCl_2$ at the following stations: Haro59, JF02, P1, P2, P4, P12, P16, P20, P26. A calibration cast was performed at P24 where triplicates were taken from 5 Niskins, all of which were closed at same depth of 2000m. Stoppers were greased with Apeizon grease and taped closed with electrical tape and placed into a walk in cooler until unloaded at IOS for onshore analysis. At P26, a complete extra set of samples was collected for archiving. We would like to thank all of those who assisted in the collection of these samples. Your help was greatly appreciated.

pCO_2 systems – Michael Arychuk, DFO/IOS.

The pCO_2 system ran well this cruise. The previous problem with the LICOR analyzer was fixed and it did not give the same problems as experienced on previous cruises. The AVOS weather station data string was very stable this cruise and did not glitch or fail a single time. There still is a problem with the temperature data coming from the "Inlet" as it was still giving inaccurate numbers. This is a particularly difficult problem to identify and diagnose due to the location of the temperature probe but some additional information was obtained this cruise to hopefully solve the problem for future cruises. In the meantime the "Inlet" temperature data will have to be taken from the TSG data file and merged with the PCO2 data file.

A prototype of the new pCO_2 system was tested out on this cruise and it ran for about 8 days. It was useful to have both new and old systems running side by side as it helped identify areas of the design where adjustments will need to be made. The comparison of data between systems will be done back in the lab as it will require pulling data strings from multiple areas and merging them together to get a full and accurate picture.

Cs-137 and I -129 Sampling – Rick Nelson, DFO/BIO

An earthquake triggered tsunami on March 11, 2011 caused extensive damage to the nuclear generating station at Fukushima Japan resulting in the discharge of large amounts of Cs-137 and other radionuclides directly to the Western North Pacific ocean during the months following the accident. The radioactivity plume was transported northeastward under the influence of the Kuroshio current and was expected to approach the Canadian coastline several years after the accident. A Canadian monitoring program was established to detect the arrival of Fukashima radioactivity in the water columns of the eastern North Pacific and the Arctic oceans.

Water samples were collected at stations occupied on the "Line P" missions on the CCGS J P Tully in June of 2011, 2012 and this year 2013. The program was expanded in 2014 to include both the Feb and Aug Line p missions.

Sampling 2016-01:

Five depth profiles were collected at stations P4, P10, P16, P21 and P26. Depths 500, 400, 300, 200, 150, 100, 50 and 5 meters for P4, P16 and P26 and 6 depths at P10 and P21: 300,200,150, 100, 50 and 5 meters. Sixty liter samples were collected at all depths.

In addition 60 liter surface samples were collected from the underway loop system after the ship was on station at P1, P2 P6, P8, P12, P14, P18, P19, P23, P24, P25. A total of 46 samples were collected.

In addition 500 milliliter samples were collected for 129 analysis from the rosette at Station P4, P10, P16, P21 and P26. A total of 36 samples were collected.

The samples for Cs were extracted onto KCFC (potassim cobalt ferrocyanide) ion exchange resin at flow rates of approximately 300 ml's per minute, then sealed for return to the Bedford Institute of Oceanography.

The resin samples were then dried, placed in appropriate counting geometries and the Cs-137 and Cs-134 radionuclides were determined by Gamma ray Spectroscopy using HPGE (high purity Germanium) detectors.

Thanks to the officers and crew of the CCGS John P. Tully for the work to make this a successful cruise. Special thanks to Marie Robert for all of the wire time and all those who helped carry the 24 ℓ carbouys.