Regional Operations Centre
Canadian Coast Guard – Pacific

PACIFIC REGION CCG VESSEL - POST CRUISE REPORT

NAME OF SHIP/PLATFORM: John P Tully

DATE: **FROM:** 27 January 2009 **TO:** 10 February 2009

SCIENCE CRUISE NUMBER: 2009-03 **SHIP'S PATROL NUMBER:** 08-12

CHIEF SCIENTIST[S]: Marie Robert

SCIENTIFIC PERSONNEL:

Female	Male
Janet Barwell-Clarke (IOS)	Michael Arychuk (IOS)
Karina Giesbrecht (UVic)	Bart de Baere (UBC)
Tara Lamothe (IOS)	Michael Bentley (CWS)
Anissa Merzouk (UBC)	Damian Grundle (UVic)
Kendra Mitchell (UBC)	Joe Jennings Jr. (OSU)
Marie Robert (IOS)	Keith Johnson (IOS)
Maureen Soon (UBC)	Yiming Luo (UBC)
Marnie Jo Zirbel (OSU)	Hugh Maclean (IOS)
	Doug Moore (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. In addition, it is the best occasion for other projects (e.g. CWS) to access offshore waters.

This cruise (2009-03) was somewhat compromised by the weather, but mainly compromised by lack of time. Twelve days of operation at sea would only be enough in perfect weather conditions. We had to cancel many stations, and lots of important work could not be accomplished. Fortunately we were not planning to do any work out of Line P.

CRUISE OBJECTIVE/OBJECTIVES: Repeat hydrography section.

DAYS ALLOCATED: 14 **DAYS OF OPERATION:** 12

DAYS LOST DUE TO WEATHER: ~ 1 day, 1 station cancelled.

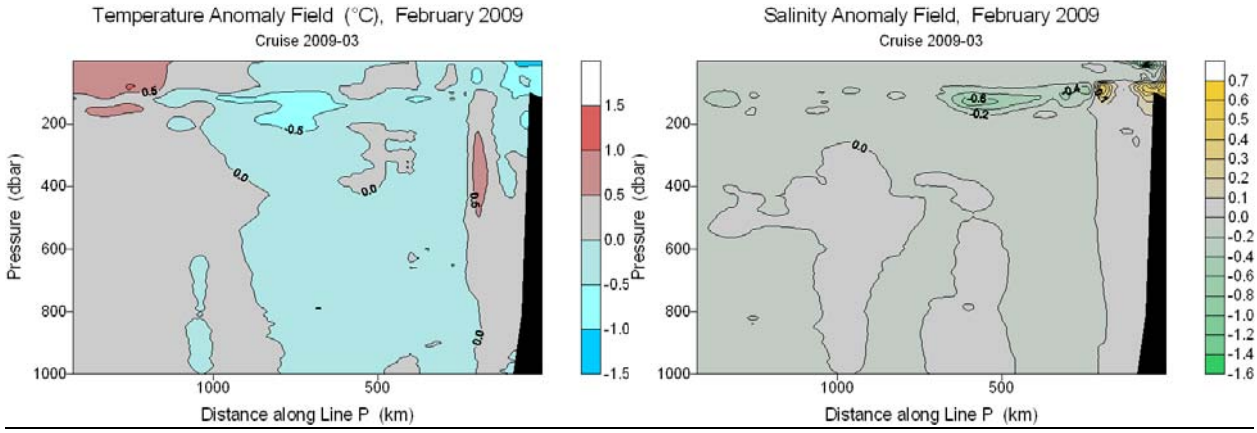
SAMPLING:

- The Line P survey was ~90% successful. 4 stations were missed and 6 casts were cancelled due to weather or lack of time.
- The samples collected include:
  - Underway: **IOS:** T, S, fluorescence, pCO_2, acoustic sounder. – **OSU:** pCO_2, pigment analysis (HPLC and extracted chlorophyll), pad absorption (to quantify functional absorbance and within-cell packaging effects) particulate carbon/nitrogen, pulse-amplitude modulated (PAM) fluorometry (to quantify the electron transport rate and approximate photosynthesis), ^{14}C productivity experiments, continuous measurements of beam attenuation (Wetlabs AC-S), variable fluorescence (Chelsea fast repetition rate fluorometer- FRrF), and photosynthetically active radiation (gimbled Biospherical PAR sensor on monkey's island). – **UBC (Merzouk/Mitchell):** N_2, O_2, CO_2, Argon, DMS.
  - Discrete (casts): T, S, fluorescence, oxygen, transmissivity, irradiance.
  - Water: **IOS:** dissolved oxygen, salinity, nutrients, chlorophyll, HPLC, DIC, Alk, DMS, DMSP-p, DMSP-t, pH – **UVic (Giesbrecht):** ONAr (Oxygen, Nitrogen, ARgon), Oxygen, nutrients, Chlorophyll, DIC, NH4, 13C and 15N productivity experiments. – **UVic (Grundle):** onboard incubation experiments to estimate daily rates of nitrification. Water samples were also collected to measure dissolved NH_4^+, NO_3^-, NO_2^-, PO_4^{3-} and $Si(OH)_4$ concentrations, total bacterial biomass (through the use of DAPI staining) and nitrifying bacterial biomass using FISH (fluorescent *in situ* hybridization). N_2O concentrations were also measured at 150, 300 and 600 metres in addition to the previously stated depths. At each of these additional depths the previously mentioned dissolved nutrient concentrations were also measured. – **OSU:** HPLC and extracted chlorophyll, pad absorption, particulate carbon/nitrogen, PAM fluorometry, ^{14}C productivity experiments. – **UBC (Merzouk/Mitchell):** Bacterial genomic, CO_2, CH_4, N_2O.
  - Zooplankton using vertical net hauls.

PROJECTS AND RESULTS:

WATER MASSES: Marie Robert, IOS

2008 was a year especially cold and somewhat fresh compared to long-term averages as well as compared to more recent data (2001 to present). The year 2009 starts in a much more moderate way. The waters are still somewhat cool and fresh, but the anomalies are not as important as during 2008. The offshore waters a warming up, and the coastal surface waters (P1 to P12) have lost their salinity anomaly.



Temperature and Salinity anomalies along Line P with respect to the 1956 – 1991 averages.

CARBONATE STUDIES - JP Tully 2009-03, January 27th to February 9th - W. K. Johnson and Mike Arychuk:

We are now routinely monitoring four aspects of the carbonate system on expeditions to OSP. As well as the normal underway continuous automated pCO2 and the sampling for DIC and TA we have added discrete pH analysis as a routine parameter.

1) pCO2

pCO2 was run using the seawater loop system for the entire expedition up until Juan de Fuca straits (~0800 on Feb. 8th). A new improved software edition that had just been completed was tested and from a preliminary evaluation seemed to work very well.
The atmospheric intake that was modified in February 2007 so that only the forward air intake line was connected was revisited. Previously the aft air intake had normally been shut off at all times so it was thought we should disconnect the "T" to prevent accidental mixing of air intakes. Due to following winds on the return trip we had to switch to the aft air intake. This seemed to be working well so we re-hooked up the "T" for easy switching. However when the "T" was connected the atmospheric signal seemed unstable (the value was drifting upward above expected values.
Throughout the cruise air and seawater pCO2 remained fairly stable with air around 390 ppm and seawater approximately 370ppm.
There was numerous times when the AVOS weather data collection seemed to crash but was easily restored. However this is a problem that should be looked into on the ship.

2) DIC/alkalinity sampling

DIC/alkalinity samples were collected in 500ml bottles at all major stations on line P. One duplicate was collected at each station between 1000 and 3000m. A calibration cast was conducted at P25 with 5 bottles tripped at 2000m and each sampled in triplicate. Station P26 was sampled in duplicate so that C13 could be measured as well or duplicate DIC/TA if required. We may want to decide if this is necessary to continue in the future. All sampling was done by Marie Robert and preserved by Janet Barwell-Clarke.

3) pH

pH was conducted at major line P stations using the new Agilent (HP) spectrophotometer and the m-cresol purple technique of Clayton and Byrne. Cells (100mm cylindrical glass) were filled directly from Niskins. They were stabilized at 25° C using a constant temperature bath and the IOS aluminium block. Profiles were collected from all major line P stations as well as a calibration cast at P25 where 5 Niskins were each sampled in triplicate.

The pH system was set up in the new Temperature control room for Salinity. This was thought to be a good location for pH but turned out to be fraught with temperature stability problems due to alcove location, high heat source from water bath and sporadic high cooling from air conditioner. The first water bath also had temperature stability problems but fortunately we had a spare. Although the air temperature was fluctuating the data seems to indicate that the samples were more thermally consistent in the Aluminium block.

Calculations were time consuming but hopefully with new templates made will be simplified in the future.

Damian Grundle (PhD Student, University of Victoria, Canada)

Data collected during this cruise was part of an ongoing study of nitrification (i.e. the biological oxidation of NH_4^+ to NO_3^-) along Line P in the NE Pacific Ocean. During the previous Line P cruise in August 2008 we discovered significant rates of nitrification occurring in the euphotic zone of the NE Pacific. Traditionally, nitrification was thought to be limited to depths below the euphotic zone indicating that any NO_3^- present in the euphotic zone was a direct result of upwelling and consequently any NO_3^- based primary productivity was considered to be "new primary production". A number of studies of "new primary production" have been conducted along Line P and these rates have been used to estimate *f*-ratios and potential carbon export rates in the NE Pacific ocean. However, our finding that nitrification occurs within the euphotic zone suggests that previously calculated rates of "new primary production" and potential carbon export have been overestimated. In order to revaluated previously calculated rates of "new primary production" and carbon export from the euphotic zone a much better understanding of the spatial and temporal variability of euphotic zone nitrification along Line P is required. To this end, the primary objective of this cruise (and future Line P cruises) was to measure nitrification rates throughout the euphotic zone at each of the major sampling stations (i.e. P4, P12, P16, P20 and P26) along Line P, and to assess how varying chemical, physical and biological factors affect these rates.

At P4, P12, P16, P20 and P26 samples were collected from 0, 10, 20, 30, 40 and 75 metres for the purpose of conducting onboard incubation experiments to estimate daily rates of nitrification at each station. At each of these depths water samples were also collected to measure dissolved NH_4^+, NO_3^-, NO_2^-, PO_4^{3-} and $Si(OH)_4$ concentrations, total bacterial biomass (through the use of DAPI staining) and nitrifying bacterial biomass using FISH (fluorescent *in situ* hybridization). N_2O concentrations were also measured at 150, 300 and 600 metres in addition to the previously stated depths. At each of these additional depths the previously mentioned dissolved nutrient concentrations were also measured. CTD instrumentation was used to obtain vertical profiles of temperature, salinity, PAR, *in situ* fluorescence (chlorophyll *a* + phaeopigments), and oxygen concentrations.

Consistent with the August 2008 Line P cruise, nitrification was found to occur throughout the euphotic zone during the present cruise. Furthermore, the spatial pattern of depth integrated nitrification rates were similar to those measured during August 2008. The highest rates of depth integrated nitrification rates were observed at P4, after which rates decreased from P12 to P20 and then increased again at P26. A cursory overview of the nitrification rate results indicated that rates were largely controlled by substrate (i.e. NH_4^+) concentration. Results from this cruise combined with data from subsequent cruises will significantly increase our understanding of nitrogen cycling in the NE Pacific Ocean, and will enable us to revaluate estimates of "new primary production" and potential carbon export.

I am extremely grateful to Marie Robert and the rest of the IOS science party for allowing me to participate in this cruise and for accommodating my sampling requirements. Sampling requirements and sampling schedules were organized in a very efficient manner, and was key to enabling me to ensure that samples were collected at each of my planned sampling stations and that onboard experiments were run immediately following sample collection. Thanks also to Janet Barwell-Clarke for allowing me to use the IOS TD-700 fluorometer to measure dissolved NH_4^+ concentrations. I would also like to thank the Captain and crew of the CCGS John P. Tully for all their help in the collection of samples and for ensuring that the needs of the scientists onboard were met.

Yiming Luo, Bart De Baere, and Maureen Soon. Department of Earth of Ocean Sciences, UBC.

Objectives:
1. Establish POC and other particle flux and remineralization profiles from the surface ocean to 3000m.
2. To collect foraminifera using the Bongo nets and Large volume pumps (LVP) at the top 300m.

Sampling plan:
1. Samples are taken from station papa only. Shallow depth samples include 20L sea water from 12 depths(25m, 50m, 75m, 100m, 125m, 150m, 175m, 200m, 225m, 250m, 275m and 300m). 2L is used for total 234Th determination. 8~10L is used for particulate 234Th measurements. The rest is used to determine Ba, 232Th and other elements of interests.
Deep ocean samples include particulate samples from the LVP and water samples collected by rosette. Water samples are collected from 12 different depths (400m, 600m, 800m, 1000m, 1200m, 1400m, 1600m, 1800m, 2000m, 2200m, 2600m and 3000m). LVPs are deployed at 6 depths (400m, 800m, 1200m, 1600m, 2000m and 3000m) twice for two different kinds of filters (SUPOR and GFF).

2. Bongo nets were deployed at P4, P8 and P26. One LVP was deployed at P8 only. No foraminifera were found in any of these stations.

Comments:
The sampling went smoothly except a pump was lost at one of the casts at Station P. 6 LVPs were deployed on the line and all but one was recovered. Other than that, we can say that all water sampling and the lab process went smoothly.
We would like to thank all the crew on the CCG JP Tully for all their help with deploying and retrieving our pumps efficiently. And many thanks go to Marie Robert and the IOS gang for helping out and making this another great Line P trip.

Anissa Merzouk and Kendra Mitchell, UBC, Line P – February 2009

Objectives:
Establish underway surface and depth distributions of the climate active gases nitrous oxide (N_2O), methane (CH_4), carbon dioxide (CO_2) and dimethylsulfide (DMS), measure underway surface O_2/Ar gas distributions to infer Net Community Production, and describe the taxonomic and metabolic diversity of the bacterial communities involved in the cycling of these gases along Line P.

Sampling plan:
Measure dissolved nitrogen (N_2), oxygen (O_2), carbon dioxide (CO_2), argon (Ar) and DMS continuously at the surface using a membrane inlet mass spectrometer (MIMS).

At 11 surface stations along Line P, filter large volumes (20 L) of seawater at the surface to create DNA and RNA genomic libraries of the bacterial communities and identify bacterial genes involved in sulfur and DMS cycling.

At the 5 major stations, 1) measure the bacterial abundance and the concentration of greenhouse gases (CO_2, CH_4 and N_2O) along a 16 depths vertical profile, 2) filter 1 L samples at 16 depths for high resolution bacterial DNA and RNA extraction and sequencing; and 3) filter large volumes (up to 120 L) of seawater at 4 depths across the oxygen minimum zone (OMZ) to create genomic libraries of the bacterial communities.

At Station Papa, viral proteins were precipitated from 0.2 μm filtered seawater and will be examined to see if this may be a useful and interesting protocol to add to our regular Line P agenda.

Comments:

Considering the bad weather and often difficult working conditions on deck and in the lab, we are satisfied with how the cruise went. We particularly liked having all our experiments (MIMS and filtrations) in the same area of the main lab near the sinks and we will definitely try to repeat this setup in future cruises. All Line P stations were visited and we mostly sampled according to plan. We missed our 2 bacterial casts (large volume filtration for libraries) at P20 due to bad weather and had to stop our large volume cast at 1000m at P16 due to time constraints and hard working conditions on deck. Overall, we found that 2 weeks for a Line P cruise is much too short, especially in February when bad weather will almost certainly induce delays in the sampling plan. We suggest that a few days be added to the next February cruise if possible.

The sampling and filtering for all the bacterial genomics work went smoothly. Salinity samples were taken from all Niskins for our of large volume samples to identify any rosette misfirings. We also tested a portable temperature-salinity-pH-dissolved oxygen meter on each Niskin of our large volume casts to locate and discard any misfires before sampling the Rosette. The meter was much too slow for our purposes (about 2 min. per reading) and dissolved oxygen values were worthless, but we will definitely try other simpler and faster sensors in future cruises.

We tested a new sampling and gas extraction method for the underway surface gas measurements using a Liquicel membrane contactor. The operation of the MIMS using this method was simpler than the silicone membrane we were using previously and in general went smoothly. CO2 and O2/Ar data look good and will probably yield useful results, but the Liquicel was not permeable or sensitive enough to detect DMS, which was very low (<2 nM) during this cruise. Further testing will be necessary to improve sampling and detection using this new method.

We wish to thank the Tully crew for their assistance and excellent work throughout the cruise. Thanks to Marie Robert and the scientists onboard for their help on deck and in the lab. Special thanks to Mike Arychuk for running DMS samples for us.

Wiley Evans, OSU:
During the February 2009 Line P cruise aboard the CCGS J.P. Tully, an OSU CO2 system was deployed for underway surface mapping of seawater
CO2 content. After some initial problems with outlets shortening due to exposure to water, the system ran fine and data were acquired. At this point the data quality is uncertain, but assumed good. Thanks to the chief scientist and IOS for allowing our participation in this cruise.

Carbon Cycles in the North Pacific—Progress Report from Oregon State University for Tully Cruise 2009-03

Non-IOS Scientists/Technicians involved in this project on this cruise:
Joe Jennings, Oregon State University
Marnie Jo Zirbel, Oregon State University

The North Pacific Carbon Cycle Science Program is a U.S. - Canadian collaboration involving scientists at the University of Washington and NOAA's Pacific Marine Environmental Laboratory (PMEL) in Seattle, WA., Oregon State University in Corvallis, OR., and the Institute of Ocean Sciences (IOS) in Sidney, B.C. The goals of the project are to understand the processes controlling the flux of carbon between the atmosphere and ocean in the North Pacific. Under the direction of P.I. Ricardo Letelier, the main objective of OSU's component is to quantify the spatiotemporal variability of the phytoplankton community in order to understand the biological contribution to the functioning of the eastern subarctic Pacific as a carbon sink.

MOORING INSTRUMENTS: One of the major components of our study involved the deployment of three instruments on the PMEL UW mooring. These instruments included two fluorometers (surface and 25 m) and a downwelling radiometer to characterize the biological response and light availability through time. These instruments, in concert with those deployed by UW and PMEL, would have characterized the temporal variability of the carbon sink near Station Papa. Unfortunately, the mooring deployed in June 2008 was lost in December 2008. We plan to replace the 2 fluorometers (WetLabs FLNTUSBs) during the redeployment scheduled for June 2008.

DISCRETE MEASUREMENTS: In order to characterize the spatiotemporal variability in phytoplankton structure, abundance, physiology, and productivity, discrete measurements of pigments (HPLC and extracted chlorophyll), particulate carbon and nitrogen, functional absorbance, and flow cytometry were collected and ^{14}C productivity experiments (photosynthesis vs. irradiance curves) were conducted at the following stations from water collected at 5m and 30m: P4, P8, P12, P15, P26 (Papa). For each of these locations, the sample variability of the P vs E curves (Fig. 1) was quantified using pulse amplitude modulated fluorometry (PAM, Walz Instruments). Spatial variability in the surface layer was also quantified with the above measurements with water from the ship's flow through system while underway (4.5 meters) at eight additional locations.

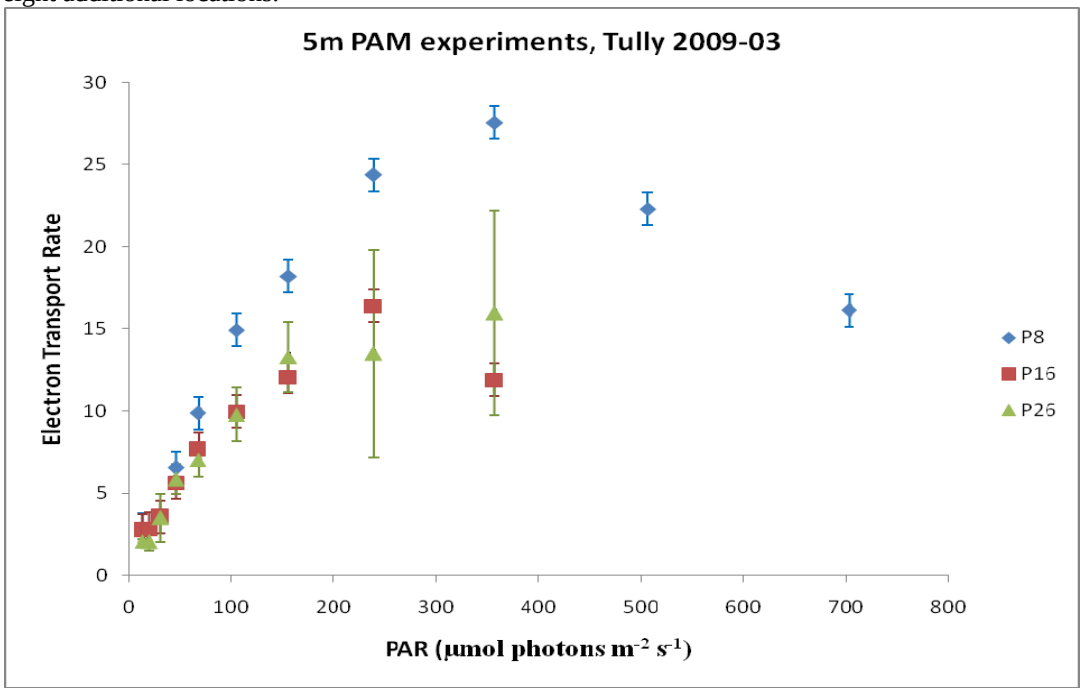


Figure 1. Representative PvsE curves for P8 (30 Jan), P16 (1 Feb) and Papa (4 Feb). Shown are mean electron transport rates (+/- SD, N = 3) as derived from PAM fluorometry over increasing PAR levels.

CONTINUOUS MEASUREMENTS: An AC-S instrument (Wetlabs) was installed in the ship's flow through system in order to obtain a continuous record of absorption and light attenuation in the surface layer. Unfortunately, one of the lamps malfunctioned after 5 February, so we switched to a backup AC-S. Heavy seas and bubbles in the loop system may have compromised a portion of the AC-S data. A Fast Repetition Rate Fluorometer (Chelsea) was also installed in the ship's flow through system to measure real-time variable fluorescence in surface waters. Variable fluorescence is a quantification of photosynthetic efficiency and has been compared to 14 C productivity in other North Pacific systems- i.e. Station Aloha (Corno et al. 2005; *J Phycol*.).
Finally, continuous measurements of photosynthetically active radiation were collected using a PAR sensor (Biospherical) that was installed on a gimbled mast on the deck above the bridge ("monkey's island") to minimize shading from the ship (Fig. 2). Light levels were quite high for the majority of the cruise with instantaneous PAR often exceeding 1000 µmoles photons m^{-2} s^{-1} (Fig. 3).

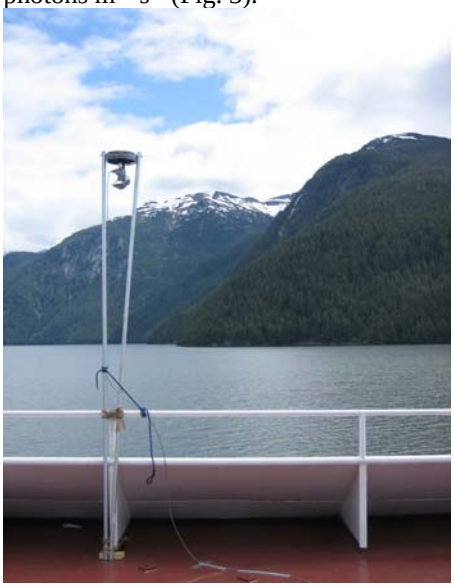


Figure 2. Gimbled PAR sensor mounted on deck above bridge.

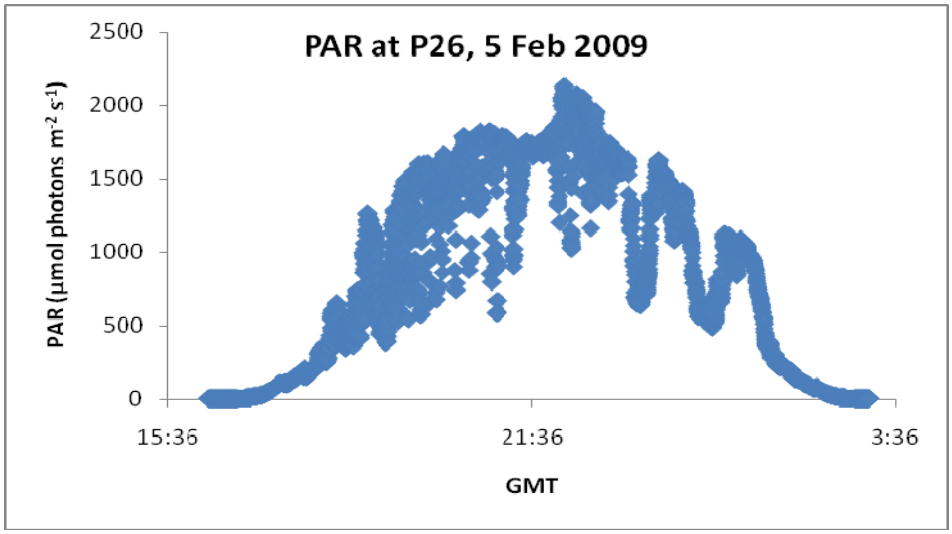


Figure 3. PAR values on a sunny day at Station Papa during 2009-03.

Once these data have been processed, we will have a near-continuous derivation of the surface biomass, physiological state and primary production that we can compare to satellite algorithms currently in progress.

The new radioactive lab van was used for all productivity experiments, PAM and discrete filtering. The hood, sea water supply and hot drain still required some work before being considered safe for isotope work, but when these issues are resolved the van will be very useful and will greatly enhance rad safety on Tully. We sent an electronic copy of our safety and ergonomic recommendations for the rad van to the PI and the captain. Considering the conditions of winter in the subarctic Pacific, we were able to accomplish a surprising amount of work- due primarily to the hard work and skill of CCGS JP Tully crew and their ability to perform difficult tasks in the unruly seas. Special thanks goes to the IOS science team involved in this effort: Chief Scientist Marie Robert for her skill in organizing and carrying out these cruises, to Doug Moore and Hugh Maclean for their excellent watch-keeping, and to Janet Barwell-Clarke, Mike Arychuk, Darren Tuele and Melanie Quenneville for logistical, equipment and lab space support.

RADIOISOTOPE USE:

Some work was done with radioisotopes (14-C) by the OSU personnel as well as with 233-Pa, 229-Th and 230-Th by the UBC personnel. Both the main lab and the rad van were cleaned and decommissioned as soon as their work was completed. Copies of the decommission lab report and other related paperwork were handed to the First Officer on board the Tully as well as to the IOS RSO.

PROBLEMS [SCIENTIFIC GEAR AND OPERATIONS]:

We had to cancel one station because of weather and three stations because of lack of time.

We lost communication with the CTD/Rosette at station P12 with one cast left to do. After testing the spare CTD with the main winch (mid-ship) as well as with the spare winch (starboard side), it was determined the problem was with the sea cable of the main winch. A quick solution would have been to utilize the spare winch. Unfortunately, a power plug had been moved during the refit period and, as a result, the cable to power the spare winch was too short. We thus had to wait for the Engineers to splice the power cord before being able to do our cast.
During that time, both ends (CTD and slip ring) of the sea cable on the main winch were re-terminated, but did not fix the problem. Two hundred meters of cable were removed from the winch and re-terminated, which restored communication with the CTD/Rosette.

At station Papa we lost the primary salinity sensor and the oxygen sensor. We had to switch to the spare CTD.

The remote temperature sensor was not hooked to the thermosalinograph, therefore we have no temperature at input. Also the file was only started at station P20.

During the second pumping cast at station P26, using the in situ UBC pumps, the hydro cable got caught on the hook holding the rosette chains while the A-frame was in the “in” position. Because there were already approximately 400 m of wire out, two pumps on the line, and the wind blowing at 30 knots, the drag on the hydro wire was quite strong. It took many people and lots of time to get the wire free, but the crew did a great job and were able to bring all the gear back on board safely.
The following day, during the third pumping cast, one of the UBC pumps fell off the hydro wire. It had been noticed that some of the clamps holding the pumps on the wire were of the wrong size for this specific wire. The clamps were modified by the Engineers on board and it was suggested that a security line, with carabineers, be used to attach each pump to the hydro wire as a secondary safety measure.

The bongo nets got tangled and ripped on two different casts. This was due to the sea state during the casts (big swells) and the speed of the winch which is hard to control at low speeds.

Two welds on the main frame of the rosette are broken, half of the PAR bracket is gone, one top valve on a Niskin was lost and the upper ring protecting the rosette has a big dent in it.

The main CTD data acquisition computers **really** need to be taken off the regular IT rules. Most of the common computers on board have “science” as user name and “science” as a password. These computers need to be accessible by everyone. Having password rules on sea-going computers is nonsense.

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SUCCESSES [SCIENTIFIC]:

We managed to get most of the equipment working in almost perfect conditions despite the state of the lab when we got on board the ship. Many cable and communication wires/boxes were missing or disconnected. Many thanks to Doug Yelland for getting the GPS signal into all the computers and instruments. Thanks also to Captain Noon and the Red Crew for letting us and helping us load our gear before the official beginning of the cruise.

For the first time in ages the science server in the lab gave us no problem at all. Thanks to Doug Yelland for fixing it and setting it back at the beginning of the cruise.

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

There were some problems with the bow thruster during the cruise. The Navigation Officers did a great job keeping station during our cast even though they had no thruster.

The "Email at Sea" system was not reliable this cruise. The signal was lost a lot earlier than during previous cruises and it was very difficult to log in. If one did manage to log into the system, it was prone to freezing and lock-ups and/or the connection would be lost.

There was no signal going to the repeater monitor by the CTD computer in the main lab. Normally this repeater shows the navigation screen used on the bridge so that we see how far we are from station.

The pump providing the water to the loop system gave us some trouble again. At the beginning of the cruise it was set so low that we didn't have enough water in any of the systems using that water. Thanks to the Engineers in helping us with this problem.

SUCCESSES [SHIP]:

We got to use the new container lab, "Rad Van", for radiation work on this cruise. Since it was its first use, there are many "bugs" that need addressing. Nevertheless, it seems that the Rad Van will be a good addition to the cruise. The main lab would have been extremely busy and crowded if the container had not been available.

DELAYS [OTHER THAN WEATHER]:

An hour or so for magnetic compass calibration.
Three hours for sea cable and winch problems.

SAFETY CONCERNS:

None.

HAZARDOUS OCCURRENCES:

None involving science personnel.

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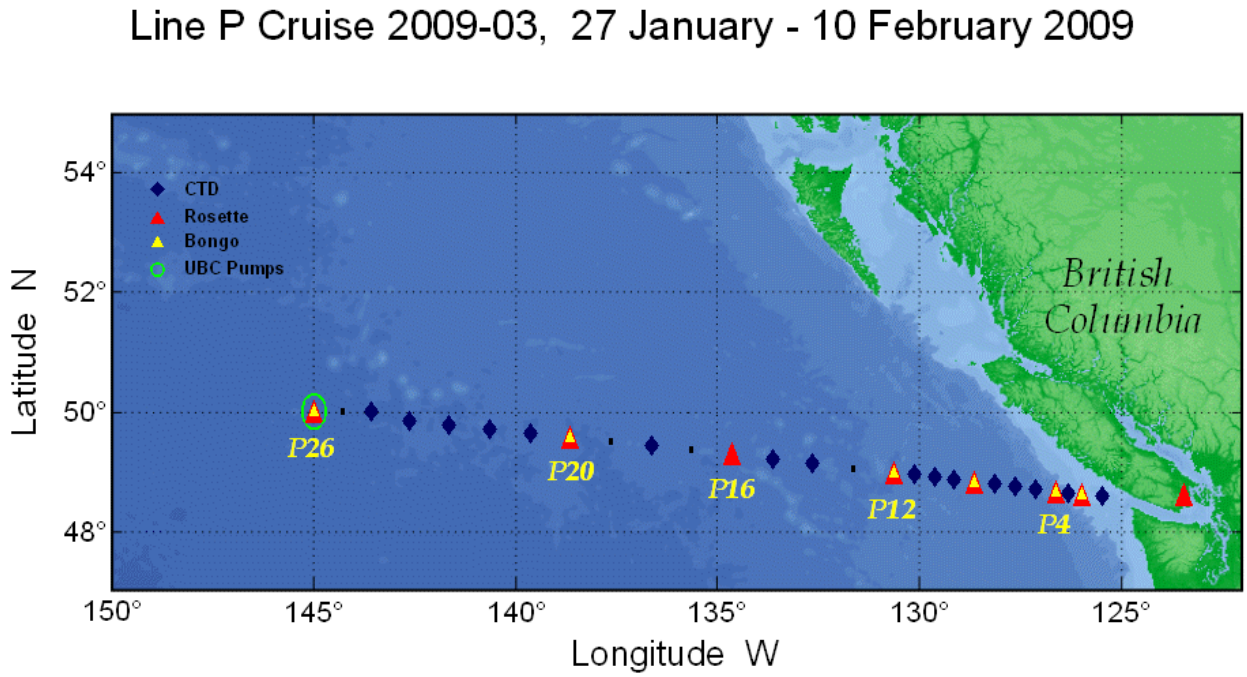
EVENT LOG:

DATE		OPERATIONS
Monday	**26 Jan:**	**Start loading the ship at IOS.**
Tuesday	**27 Jan:**	**Official crew change.**
Wednesday	**28 Jan:**	**Test cast in Saanich Inlet. Leave Pat Bay.**
Thursday	**29 Jan:**	**Start Line P.**
Sunday	**1 Feb:**	**Do station P16, go straight to P20.**
Monday	**2 Feb:**	**Do station P20, go straight to P26.**
Wednesday	**4 Feb:**	**Arrive at Station Papa.**
Thursday	**5 Feb:**	**Leave Papa. Start heading back along Line P doing CTD casts.**
Monday	**9 Feb:**	**Arrive at IOS and offload.**

CRUISE TRACK:



SUMMARY/FINAL COMMENTS:

- Thanks to **everyone** on board for such a successful cruise even though we didn't have much time.
- Special thanks to Bosun Len and "his guys" for all the help on the aft-deck, with recovering the rosette when the weather was rough, with the pump casts, and with all our many other requests!
- On behalf of my crew and myself I would like to acknowledge Janet for the time she took to attend the vessel OHS meeting to educate my crew on radio isotopes (sp?) with respect to installing and de-storing new Rad Lab. As well she spent time demonstrating the wipe tests, how the wipe tests are analyzed, and gave safety procedures and instructions which alleviated any concerns we may have had.

  Captain McGregor
- Many thanks to the whole galley crew for keeping us so well fed and taking such good care of us with great smiles!
- Finally, congratulations to Hugh for 50 Papa trips!