Cruise report
Line P cruise, 2010-01

PACIFIC REGION CCG VESSEL - POST CRUISE REPORT

NAME OF SHIP/PLATFORM: John P Tully

DATE: **FROM:** 2 February 2010 **TO:** 16 February 2010

SCIENCE CRUISE NUMBER: 2010-01 **SHIP'S PATROL NUMBER:** 09-12

CHIEF SCIENTIST[S]: Marie Robert

SCIENTIFIC PERSONNEL:

Female	Male
Constance Couture (UBC)	Michael Bentley (CWS)
Alejandra Lara-Espinosa (UVic)	Glenn Cooper (IOS)
Kendra Mitchell (UBC)	Marty Davelaar (IOS)
Nina Nemcek (IOS)	Doug Moore (IOS)
Wendy Richardson (IOS)	Scott Rose (IOS)
Marie Robert (IOS)	Philippe Tortell (UBC)
Christina Scallenberg (UVic)	
Nicole Sukdeo (UBC)	

AREAS OF OPERATION: North East Pacific, Line 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 (2010-01) was quite successful despite many days of bad weather. We did not manage to work further west than station P20, about two thirds along Line P. If it wasn't for the new LARS system though, half of these 20 stations would have been cancelled. The new LARS system allowed us to work in much worse conditions than the aft-deck A-frame heave compensation system ever let us.

CRUISE OBJECTIVE/OBJECTIVES: Repeat hydrography section. Deploy three Argo floats.

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

DAYS LOST DUE TO WEATHER: ~ 3 days.

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SAMPLING:

- Not all stations and casts were completed along Line P. P11 and P21 to P26 had to be cancelled. P7 was aborted at 382 dbar (instead of 2005 dbar).
- We managed to sample part of the La Perouse LC Line, but had to stop after LC1 to LC8 because of weather.
- We used the new mid-ship LARS to do all rosette casts.
- Three floats were deployed: two Argo float for IOS at P8 and P20, and an Iridium float 10 miles west of P20 for OSU/U Maine. Unfortunately we could not deploy the Iridium float at Papa as planned. We also deployed a Drifting Buoy with Wind Sensor for the Meteorological Service of Canada.
- The samples collected include:
  - Underway: **IOS:** T, S, fluorescence, pCO_2, acoustic sounder. – **UBC (Mitchell/Allers):** N_2, O_2, CO_2, Argon, DMS.
  - Discrete (casts): T, S, fluorescence, oxygen, transmissivity, irradiance, pH.

    Water: **IOS:** dissolved oxygen, salinity, nutrients, chlorophyll, HPLC, DIC, Alk, DMS, DMSP-p, DMSP-t, pH – **UVic (Lara-Espinosa)/UW (Emerson):** Oxygen, ONAr (Oxygen, Nitrogen, Argon), Salinity, O17 – **UBC (Mitchell/Allers):** Bacterial genomic (DNA, RNA), CO_2, CH_4, N_2O, viral particles, bacterial cells.
  - Zooplankton using vertical net hauls.
  - Go-flos – **UVic (Schallenberg):** Fe, Cu, kinetic experiments with superoxide.
  - 8 drums of 2000m sea-water were filled-in for AML Oceanographic, for calibration purposes.

PROJECTS AND RESULTS:

WATER MASSES: Marie Robert, IOS

The 2009-2010 winter has been declared an El Niño winter. Even though the El Niño ocean signals usually take a few months to travel along the North American coast, it seems that the coastal waters of Line P are already warmer and saltier than usual. They are definitely warmer and saltier than in February 2009 (Figures 1a and 1b), as well as with respect to the 1956 – 1991 average (Figures 2a and 2b).

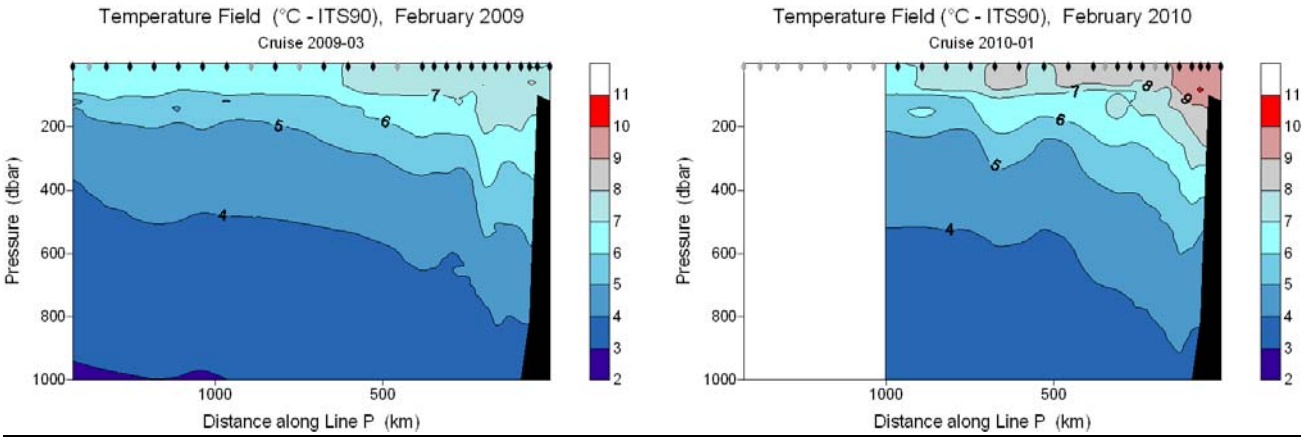

Figure 1a: Temperature Field (°C) along Line P in February 2009 and February 2010.

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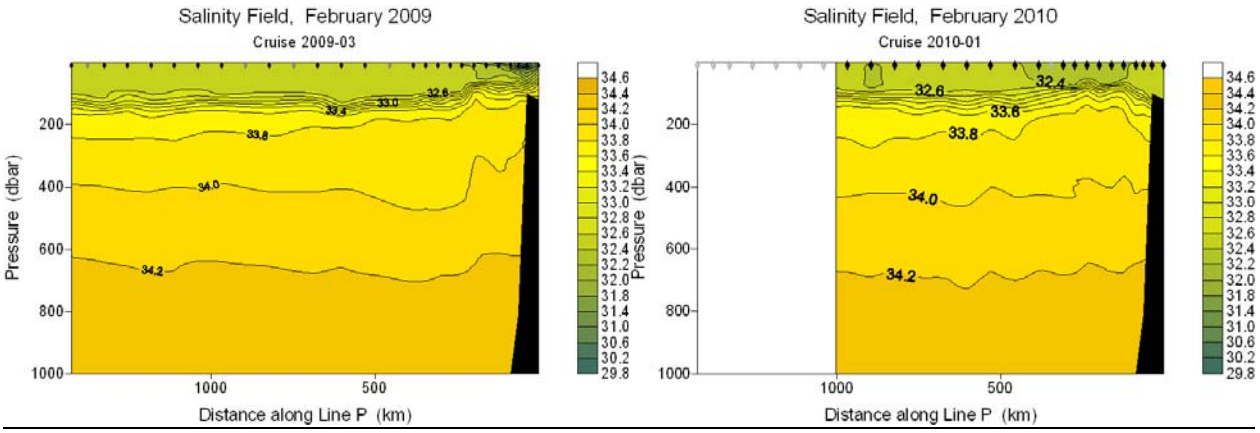

Figure 1b: Salinity Field along Line P in February 2009 and February 2010.

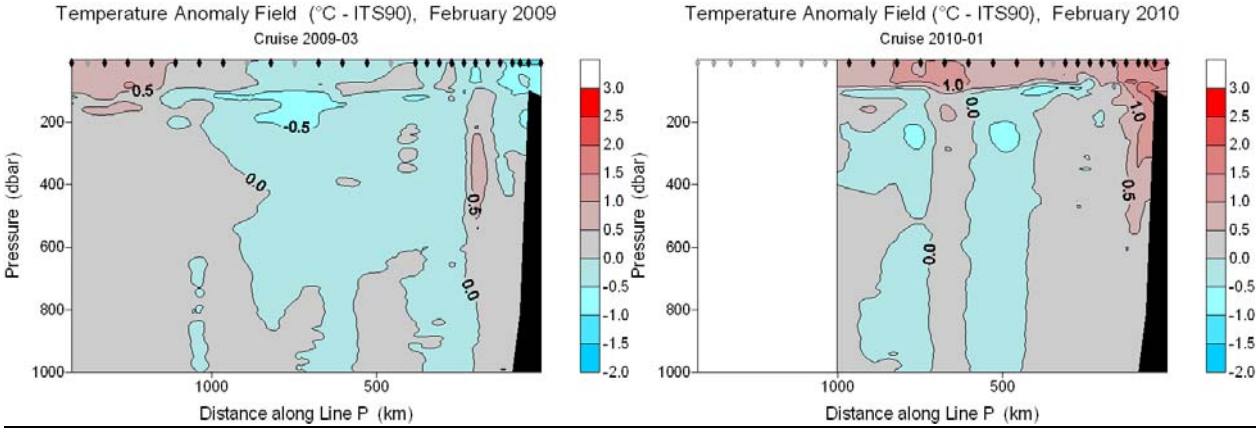

Figure 2a: Temperature Anomaly Field (°C) along Line P in February 2009 and February 2010 with respect to the 1956-1991 average.

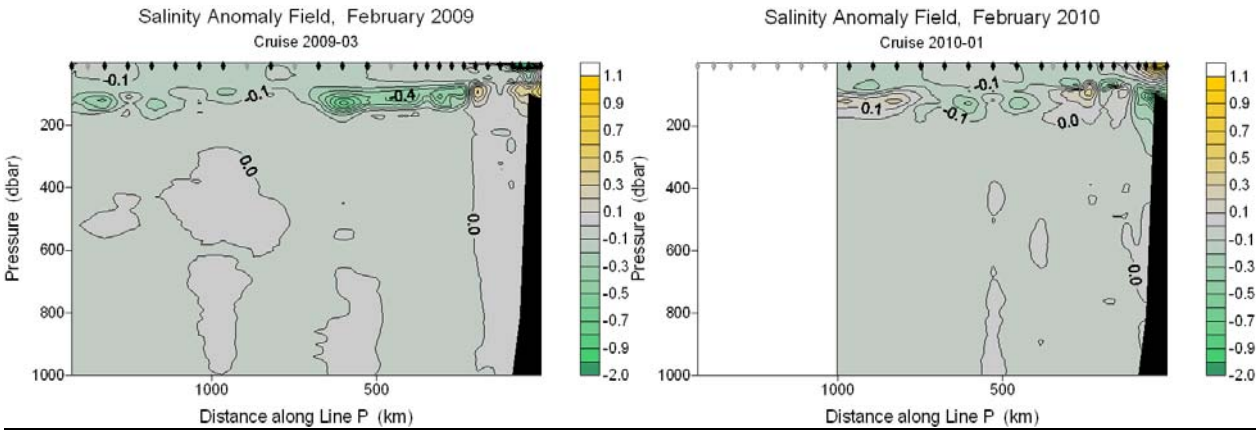

Figure 2b: Salinity Anomaly Field along Line P in February 2009 and February 2010 with respect to the 1956-1991 average.

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Christina Schallenberg, University of Victoria: Kinetic experiments of superoxide decay in seawater

Employing trace metal-clean sampling techniques with two 10-L Go-Flo bottles mounted on a Kevlar line, I was able to sample two stations: P12 and P16, down to a depth of 300m. The depths sampled were as follows: 10m, 50m, 100m, 200m, 300m. At station P12, I also took a 1-L sample from the rosette (10m depth) to compare to results obtained from metal-clean sampling. The Kevlar line was spooled on a winch on the upper deck and could be accessed from the "chains" outside the wetlab. Sampling at the other major stations was hampered by problems with unspooling of the Kevlar line (P4) and malfunctioning of the winch (P20).

All samples were filtered in a flow-hood through 0.2 μm Polysulfone membrane disk filters. Samples for on-shore metal analysis were acidified with Seastar HCl and stored, while seawater samples of 40 mL each (in duplicate) were prepared for kinetic experiments. At each depth, 6 treatments were prepared: addition of iron at two concentrations, addition of copper at two concentrations, addition of the ligand DTPA, and an untreated control. After sufficient time for the seawater to equilibrate with the added metals and ligand (at least 12 hours for DTPA treatment and 3 hours for metal additions), samples were spiked with superoxide that was generated from potassium superoxide in a sodium hydroxide solution at pH 12.7. The decay of superoxide in the sample was followed with a chemiluminescence flow injection system with a Hamamatsu photo-multiplier tube, using the chemical MCLA (2-methyl-6-(4-methoxyphenyl)-3,7-dihydroimidazo[1,2-a]pyrazin-3(7H)-one hydrochloride).

The goal of the work was to investigate the sinks of superoxide in these waters.

Alejandra Lara-Espinosa (MSc. Student, UVic, Canada) and Dr. Roberta C. Hamme (UVic)

The amount of oxygen produced in the upper ocean is one measure of biological productivity which is an important process controlling the export of carbon to the deep ocean. Because oxygen is affected by both physical and biological processes other gases are measured in order to separate these effects. This project aims at using a combination of dissolved gas measurements of Oxygen, Nitrogen and Argon (a kind of abiotic analogue of oxygen) to estimate carbon export and to determine the rate at which organic carbon is produced along Line P.

Only major stations were considered in the sampling plan. At major stations P4, P12 and P16 O2 duplicate, UVic ONAr duplicate and single salinity at 5m depth were collected. Although P20 was originally planned to be sampled in the same manner as P4-P16, the sampling plan for P26 was transferred to P20 due to contingencies caused by weather. At this station O2 duplicate, 17O duplicate and single salinity were collected at 10,50, 100, 125, 150 and 200m from cast 37; ONAr duplicate and single salinity were collected at 5, 50, 150, 500, 1000, 1400, 1700 and 2000m from cast 39/40. Finally, O2 duplicate and single salinity were collected at 0, 5, 10, 20 as well as UVic ONAr duplicate at 5m (both from cast 41).

I will be always grateful to Marie Robert's patience and passion for work, both qualities facilitate the cruise's success and a very good atmosphere to work at. I also appreciate the crew's hard work and their willingness to help us.

Kendra Mitchell, Philippe Tortell, Nicole Sukdeo, and Constance Couture, UBC

Objectives:
Describe the taxonomic and metabolic diversity of the bacterial communities involved in the cycling of major nutrients and gases along Line P, focusing on the communities in the Oxygen Minimum Zone. 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. Establish the depth distributions of several microbially significant nitrogen and sulfur species (NH_4^+, NO_2^-, S_2O_3, H_2S, and SO_2^{3-}).

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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 the 5 major stations, 1) filter large volumes (up to 180 L) of seawater at 4 depths across the oxygen minimum zone (OMZ) to create metagenomic libraries of the bacterial communities; 2) filter 1 L samples at 16 depths for high resolution bacterial community analysis; and 3) measure bacterial abundance, NH_4^+, NO_2^-, S_2O_3, H_2S, and SO_2^3, and the concentration of greenhouse gases (CO_2, CH_4 and N_2O) along a 16 depths vertical profile.

At P26 we also planned to collect viral particles as well as bacterial cells from the seawater samples of several depths in order to analyze the viral community within the OMZ and also interactions of virus and potential bacterial hosts.

Because of weather we did not make it to P26, so shifted all of our planned P26 sampling to P20.

Comments:
Given the weather conditions of February, this cruise went pretty well. Missing P26 was unfortunate but unavoidable. We are excited about the nitrogen and sulfur species that we measured this cruise and would like to continue that work, however we would need a 3rd berth to do so. I know that there is a significant waiting list for both the June and August cruises and would like our name added to that list to enable us to continue high resolution chemical sampling.

The sampling and filtering for all the bacterial genomics work went smoothly. Temperature readings were taken from all Niskins for our of large volume samples to identify any rosette misfires. Two possible misfires were identified both from Niskin 17, which I think was switched out after P20.

We have gone back to the membrane inlet for the underway gas sampling. This set up is slightly more complicated and requires the use of 2 water baths. However the sensitivity of the instrument to the gases, especially DMS, is much better and will likely be continued in the future. We would like to have the same space for the MIMS (on it's own table next to the sink with the loop) on future cruises if at all possible.

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 everyone who helped us collect samples and covered watches for us while we were filtering.

RADIOISOTOPE USE:

No radioisotopes were used during this cruise.

PROBLEMS [SCIENTIFIC GEAR AND OPERATIONS]:

The computers were not set-up properly, once again, prior to departure. The VNC remote display of the depth sounder wasn't working on the CTD computer.

The CTD computer we had did not have a secondary video card, so the remote-pressure display had to be connected to the computer. This was not a great solution since the window of the "CTD Closet" had to be left open during the entire cruise. The engineers and crew of the Tully ensured the set-up of the Closet and LARS cab was ready so that the necessary displays would be available from the CTD computer to the LARS cab. However, without the appropriate computer, their work was in vain (at least for this cruise)

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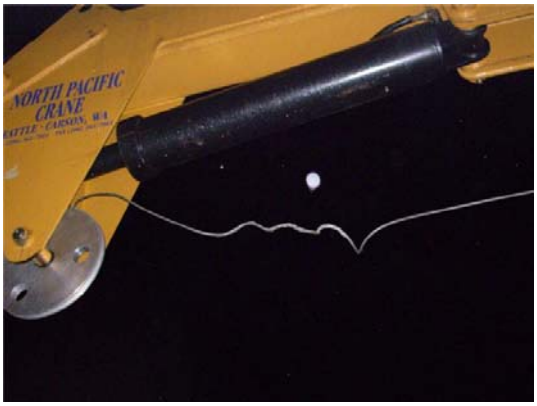
The CTD computer we had for the cruise crashed many times during CTD casts. This is the second computer (at least) having this problem. Hopefully the reason why this is happening can be sorted out before the next cruise. The NMEA sting was also acting up, with the position of the ship changing significantly during a cast.

The thermosalinograph continues to have problems receiving the GPS string, as per the last Papa cruise in August where we had to get the position using a virtual COM port.

We had to re-terminate the sea cable twice. The first time was because of so many spikes and error alarms in the CTD signal/Deck unit. Unfortunately the re-termination was unsuccessful in dealing with the spikes.

The mechanical termination of the CTD to the sea-cable is too long with the new LARS system and the end of the actual termination gets caught in the sheave. In order to prevent the fraying of the metal wires there is a whipping covering the end of the termination. However, because of the length (too long) of the present termination, the whipping itself gets caught in the sheave. A different method was tested to protect the termination (plastic cone), but this also got caught in the sheave. A shorter termination is needed for use with the LARS system.

After disconnecting the sea-cable from the CTD and re-doing the whipping at station P12, the cable was re-connected to the CTD without allowing any slack for the extension of the LARS head. As the LARS got extended to deploy the rosette for the following cast, the quartermaster on duty forgot to pay some slack in the cable since this step is usually unnecessary. It was also quite late in the evening and dark. The hydraulic pressure of the LARS snapped the sea-cable, hence the second re-termination. Fortunately, the rosette was still being held by the LARS.



The CTD Closet **really** should have two monitors. Since the Seabird acquisition software only displays 4 variables during a cast, many windows have to be opened from within that software (Altimeter, pH, PAR, NMEA string, Bottle Firing Sequence, etc). This leaves very little room on the monitor for the remote display of the depth sounder (mandatory now that there is no pinger on the rosette) or for a display of UTC and Local clocks linked to the GPS signal, etc. Actually there should be two COMPUTERS in the closet: one ONLY for data acquisition, the other for all the rest.

Some Niskin bottles were leaking and/or not working properly. One was replaced.

SUCCESSES [SCIENTIFIC]:

We used the LARS during the entire cruise. If it hadn't been for this new mid-ship Rosette station, we might have accomplished only half the work we ended up doing. It allowed us to work in rougher weather than the aft-deck system.

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The fact that we could use the rosette in rougher weather meant that people had to work in rougher weather as well, once the water was collected. Samples still had to be filtered and analysed, even though the ship was rolling a lot. Despite working in these conditions, which is more tiring and a lot trickier, there were no occurrence of spills or injuries, except for one box of oxygen flasks flipping over (see Hazardous Occurrences Section).

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

The servers on the ship got replaced during the fall and the new server changed the email settings. Thanks to some information gathered from the officers and to Doug Yelland's help, some email accounts could be restored to working conditions. But the main email account, the general ScienceLab account normally used by scientists on the Officer's Lounge computers or on personal computers, was not operational. This should have been ready to go.

It happened twice, seemingly randomly, that users got kicked-out from the main server. The Captain had to re-set the passwords of these accounts (to what it was already set to) for the accounts to be working again.

The go-flo sampling at Stations P4 and P20 was cancelled because of problems with the hydro winch. At P4, the junction box for the spooling counters had to be rewired as it was filled with water. At P20, the winch control transformer failed most likely due to the remote emergency stop box also filled with water, shorting the transformer. Thanks to the engineers for cleverly fixing the winch in awful working conditions.

The original computer operating the acoustic sounder was suppose to be fixed and returned to the ship months ago but has still not been returned. Since April 2009, the sounder has been operated by a spare computer, and this "spare" is still not secured properly in the rack.

SUCCESSES [SHIP]:

See comments above regarding the LARS.

The galley crew managed to keep us fed despite the constant rolling. THANKS!

The Internet At Sea system allowed us to look at various weather Websites which helped in making decisions about work planning.

DELAYS [OTHER THAN WEATHER]:

About 2 hours at the beginning of the cruise because of some problems in the engine room.
About 5 hours for the first re-termination of the sea-cable.

SAFETY CONCERNS:

None.

HAZARDOUS OCCURRENCES:

One box containing glass flasks fell upside-down during one big roll and half the flasks got broken. All the glass pieces got picked up quickly by the people working in the lab.

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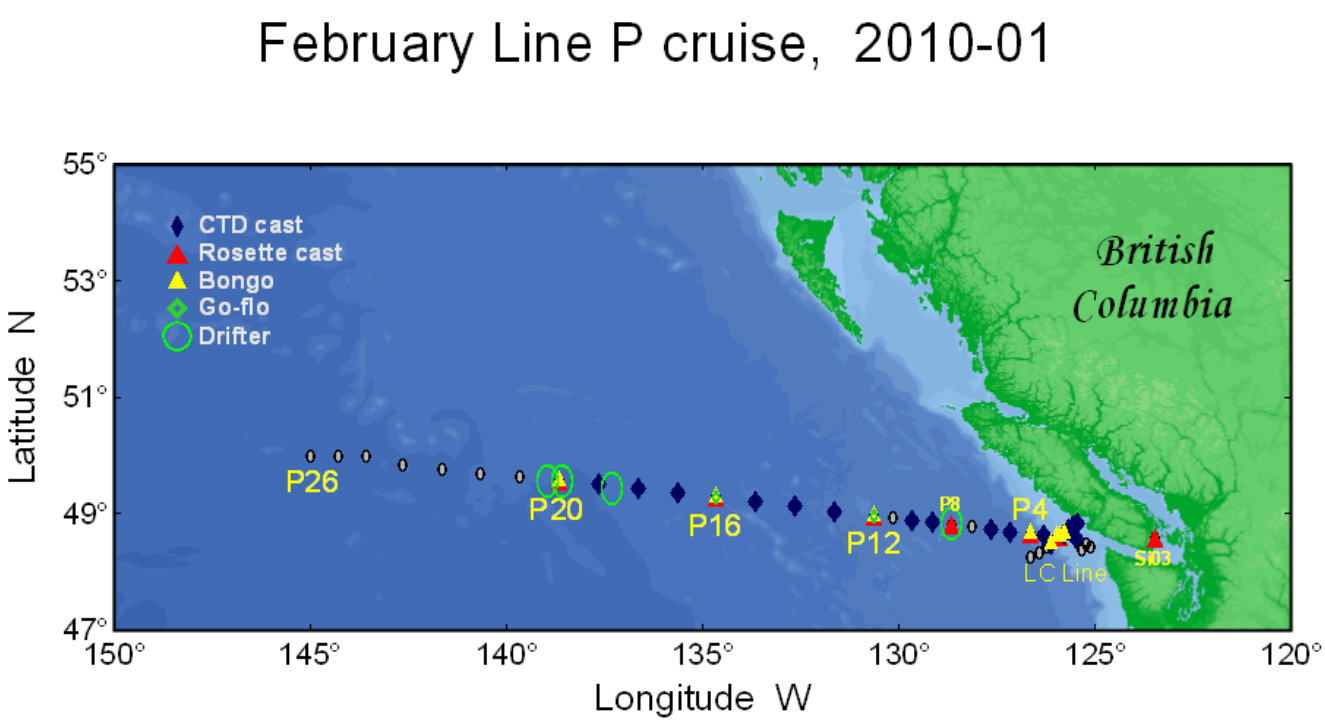
EVENT LOG:

DATE		OPERATIONS
Monday	1 Feb:	Start loading the ship at IOS.
Tuesday	2 Feb:	Finish loading. Test cast in Saanich Inlet. Leave Pat Bay.
Wednesday	3 Feb:	Start Line P.
Tuesday	9 Feb:	Turn around 10 miles west of P20. Too rough to go west.
Thursday	11 Feb:	Leave Line P, head towards LC12 on La Perouse LC Line.
Friday	12 Feb:	Too rough to work LC line. Anchor a few hours in Barkley Sound, then start LC line in the evening.
Saturday	13 Feb:	Complete LC Line as far as the weather allows us (LC8). Start heading back to IOS.
Sunday	14 Feb:	Arrive at IOS at 0800. Offload some gear.
Monday	13 Feb:	Complete the offloading.

CRUISE TRACK:



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SUMMARY/FINAL COMMENTS:

- Thanks to everyone on board for making this a successful cruise despite the bad weather.
- Special thanks to Shane and Captain Pennel for their help interpreting the weather maps and making the best possible decisions with the weather windows available.
- Thanks to the crew for working late the first day of the cruise so that we could depart that evening.
- Chief Engineer Decker, we hope you had a wonderful last Line P cruise! (sorry we can't even call it a Station P cruise …)
- Thanks again to Captain McGregor and the white crew for letting us load part of the gear prior to crew change. That allowed us to leave on crew change day.