Regional Operations Centre
Canadian Coast Guard – Pacific

PACIFIC REGION CCG VESSEL - POST CRUISE REPORT

NAME OF SHIP/PLATFORM: John P Tully

DATE: **FROM:** 29 January 2008 **TO:** 19 February 2008

SCIENCE CRUISE NUMBER: 2008-01 **SHIP'S PATROL NUMBER:** 07-12

CHIEF SCIENTIST[S]: Marie Robert

SCIENTIFIC PERSONNEL:

Female	Male
Karina Giesbrecht (UVic)	Patrick A'Hearn (NOAA)
Maria Kavanaugh (OSU)	Doug Anderson (IOS)
Anissa Merzouk (UBC)	Michael Arychuk (IOS)
Wendy Richardson (IOS)	John Dower (UVic)
Jody Wright (UBC)	Robert Kamphaus (NOAA)
Marnie Jo Zirbel (OSU)	Hugh Maclean (IOS)
	Doug Moore (IOS)
	Akash Sastri (UVic)
	Chuck Stump (UW)

AREAS OF OPERATION: North East Pacific, Bowie Seamount, Rivers Inlet, Hakai Passage, Strait of Georgia

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 (2008-01) was greatly compromised by the weather. We had to cancel many stations, and lots of important work could not be accomplished. Line P was not completed, no stations were done on Line R and on SS Line, no mooring work was done at Station P, the Glider did not get deployed, and the Bowie Seamount mooring was not recovered. In addition, we had to do a long detour to the north of the Queen Charlotte Islands to avoid yet another storm.

CRUISE OBJECTIVE/OBJECTIVES: Repeat hydrography sections, recover/deploy moorings, deploy Glider, deploy Argo floats.

DAYS ALLOCATED: 20 **DAYS OF OPERATION:** 17

DAYS LOST DUE TO WEATHER: ~ 9 days, many stations cancelled

RESULTS:

- The Line P survey was not totally successful. 4 stations were missed and 4 casts were cancelled due to weather.
- Line R got cancelled because of bad weather.
- Line SS got cancelled because of lack of time and weather.
- The UW Sea-Glider could not be deployed because of weather.
- No mooring work whatsoever could be accomplished at Papa because of bad weather.
- The mooring at Bowie Seamount could not be recovered because of problems with the acoustic transmitter.
- 3 Argo floats were deployed, although one deployment was not accompanied by a CTD cast (bad weather).
- The samples collected include:
    - Underway: T, S, fluorescence, pCO_2, acoustic sounder, ADCP, pigment analysis (HPLC and fluorescence derived 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, and continuous measurements of beam attenuation (Wetlabs ac-s), variable fluorescence (Chelsea fast repetition rate fluorometer- FRrF), and photosynthetically active radiation (Biospherical), water vapour, N_2, O_2, Ar, CO_2, DMS.
    - Discrete (casts): T, S, fluorescence, oxygen, transmissivity, irradiance.
    - Water: oxygen, salinity, nutrients, chlorophyll, HPLC, DIC, Alk, DMS, pH, ONAR (Oxygen, Nitrogen, ARgon), CBA (Chitobiase Activity - crustacean molting enzyme), Bacterial genomic, CO_2, CH_4, N_2O, ^{14} C productivity, particulate carbon/nitrogen PCPN, Pad absorption.
    - Zooplankton using vertical net hauls.
    - Phytoplankton using a ring net.

M. Robert: water masses.

The main characteristic of the water mass along Line P during this cruise was the cooler temperatures. The temperature anomaly was negative along the whole Line down to about 100 m, with values between -1°C and -1.5°C between stations P12 and P16.

Hugh Maclean: Oxygen analysis report.

The oxygen kit used on this cruise was kit#4. The kit was complete with extra parts and chemicals. The standards and blanks were run at the beginning of the cruise and were within the manual parameters. The cruise run went very smoothly with only 4 flags for the whole cruise and these were due in large to bubbles in the system.
The new instrument lab was well suited to the analysis and minor changes in tie down hard points should be made to ensure the security of the kit in adverse conditions.

Hugh Maclean: Bowie Seamount Mooring.

The recovery of mooring BS1-A was a failure. This was my first time using an Oceananus acoustic release and a TT300 transducer/receiver. On setting up the system, I discovered that the promised instruction manual and operating instructions were not included with the kit. After some frantic phone calls and 2 different set of instructions, I, with help, figured out the sequence to send both the interogation/range code and the release code. The range code was sent from 3 different locations, one being 1 n.mile from the deployment site and two from ½ n.mile from the site. A series of about 6-7 range readings from each site were sent. Of these about 5 readings made sense and agreed with each other and 2 were out in left field. Because of the rough sea conditions and the depth of the mooring (35m), I considered this reasonable. A total of four release cycle signals were sent to the instrument from 2 different locations. On all four signal, a “received” and “executed” signal was

returned to the TT300 receiver. The instrument package did not come to the surface. After one hour it was decided to deploy the BS1-B mooring 3 cables north east of the unrecovered BS1-A mooring and leave the site. The deployment of the BS1-B mooring took minutes to execute. The total mooring length is only 4.5m and took one lift of the crane to deploy. Although the seastate had deteriorated considerably , the mooring was deployed a bit dicely but successfully in 33m of water

The window of opportunity for recovering and deploying these two moorings was fairly short. On arrival at the site the winds were 20 kts with a 3m swell . On leaving the site 4 hours later the winds were 40 kts with a 5m swell.

Doug Anderson: Salinities

This February cruise was the first chance to use the Tully's new temperature controlled lab. Our Portasal performed to specifications or better in this environment and provided a standard to check CTD sensors during the cruise. With further experience in setting the room's controller in differing outside environments, this room should provide an excellent opportunity for reliable on-board salinity analysis in the future.

Doug Anderson: Thermosalinograph (TSG)

The TSG gave us few problems this trip. Loop water was infused with bubbles due to the rough weather on this cruise causing a degree of instability in salinity data from the tsg. Some data was missed in the early stages of the cruise due to equipment problems which were resolved.

It was later found that, due to setting problems at the beginning of the cruise, there is no position available (latitude/longitude) for the thermosalinograph data. M. Robert.

Doug Anderson: CTD/Water Sampler

The CTD and water sampling equipment gave us few problems. The CTD temperature and conductivity sensors showed little drift of the course of the cruise, and the water sampler worked reliably, until the Fitz Hugh Sound stations. It then started to mis-behave.

During this cruise there seemed to be a large quantity of deep waters (from around 1200 to 1000 m) found at shallower depths (150 to 400 m). This deeper water signal could be seen in Dissolved Oxygen profiles as well as in Nutrients (Nitrate, Silicate, and Phosphate) profiles, but could not be seen in the CTD data. We now suspect that the rosette was mis-firing during the whole cruise. M. Robert.

Doug Moore: 2008-01 Line P/ Rivers Inlet net sampling report

Planned zooplankton sampling:

-bongo tows to 250 m at 7 Line P stations, 1 Strait of Georgia station
- bongo tows to greater than 500 m at 3 stations; one to 300 m at Strait of Georgia station
- bongo tows to bottom minus 10 m at 6 Rivers Inlet stations
- U-Vic ring net tows to 50 m at 6 Line P stations

Collected zooplankton samples:

-bongo tows to 250 m at 7 Line P stations, 1 Strait of Georgia station
- bongo tows to greater than 500 m at 2 stations; one to 300 m at Strait of Georgia station
- bongo tows to bottom minus 10 m at 6 Rivers Inlet stations
- U-Vic ring net tows to 50 m at 4 Line P stations

Not-collected zooplankton samples:

- bongo tows to greater than 500 m at P-26 (due to rough weather)
- U-Vic ring net tow to 50 m at P-26 (due to rough weather)

Rare deep specimens were looked for in deep casts (P8 to 800 m; Bowie Seamount to 1000 m) but no unusual zooplankton species were noted or separated from the sample

Net equipment sustained damage on the aft deck in very rough weather, such that both bongo nets needed substitution by the spare nets. One cod end was lost over the side. One net tore completely in half and had to be taken out of service. The other net was repaired.
The second set were damaged slightly (collar stretched) during the sampling cast in violent surges in large swells at P26, and one needed replacing by the first repaired net.
Repairs to bongo nets were made by sewing net pieces together, followed by application of black silicone sealant. This worked well to close potential plankton escape routes from the cone of sampling.

Support from the crew was good as always, as they continually attempted to get the best samples in trying conditions.

Ship's equipment:

-Net sampling winch was difficult to operate smoothly. Surges in the winch drive made smooth deployment and recovery over the side challenging. Safe raising and lowering on the deck and overhead was not consistent because of these sudden and unexpected winch surges.

-Winch counter reading indicated a speed of 1 m/sec but was determined to be really 2 m/sec.

-Thanks to the boson (John Gardner) who used a block suspended in front of the winch to raise the cable over mooring anchors on deck, thus preventing entanglement.

Maria Kavanaugh: Carbon Cycles in the North Pacific—Progress Report from Oregon State University for Tully Cruise 2008-01

Non-IOS Scientists/Engineers involved in this project on this cruise:

Maria Kavanaugh, 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 characterize the temporal variability of the carbon sink near Station Papa. Unfortunately, adverse weather conditions prohibited retrieving the old instruments and deploying a new mooring; the deployment is postponed to either June or August of 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

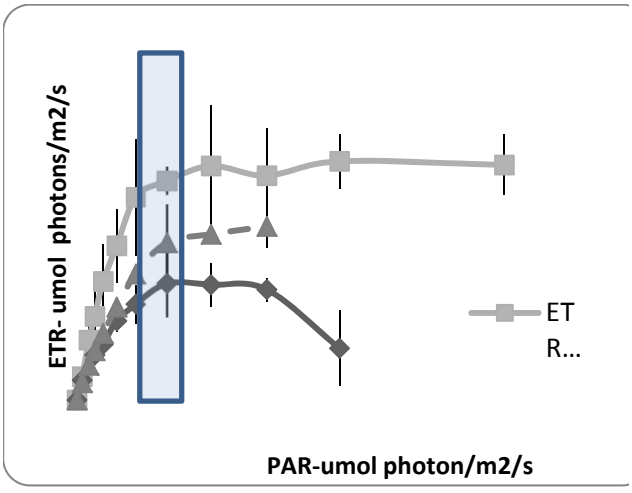

Figure 1. Representative PvsE curves: shelf slope (Feb 1), pelagic (Station Papa 50 N, 145 W, Feb 9) and coastal (Hecate Straight, Feb 14). Shown are mean electron transport rates (+/- SD, N= 3-5) as derived from PAM fluorometry over increasing PAR levels. The blue band denotes the approximate light saturation level for photosynthesis.

water collected at 5m: P6, P8, P12, P13, P16, P20, P25, P26 (Papa), PMEL mooring site and the coastal station M6. At Station Papa, P25, and at the PMEL mooring site, experiments were conducted and aforementioned characteristics quantified with water from two depths: 5 m and 30m. Where we were able to get a signal or adequately concentrate cells, the sample variability of the P vs E curves was quantified using pulse amplitude modulated fluorometry (PAM- Figure 1). Spatial variability in the surface layer was also quantified using water from the ship's flow through system while underway (4.5 meters). Due to weather-related conditions (i.e. course adjustments, delays, and seas periodically deemed too rough by us to safely dispense isotopes), we only collected about 60-70% of the data points that we had previously collected in August/September 2007, although the spatial coverage was still reasonably good.

CONTINUOUS MEASUREMENTS: An AC-S instrument (Wetlabs- Philomath Oregon USA) 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 1.5 days of use. While near continuous beam attenuation data could be collected for the duration of the cruise, characterization of wavelength-specific absorbance and scattering could not be derived. 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 Biospherical PAR sensor that was installed on a gimbled mast on the aft deck to minimize shading from the ship (Figure 2). Surprisingly, light levels were quite high for the majority of the cruise with instantaneous PAR often exceeding 300 µmoles photons m^2 s^{-1}.
Once these data have been processed, we hope to have a near-continuous derivation of the surface biomass, physiological state, and potentially, primary production that we can compare to satellite algorithms currently in progress.

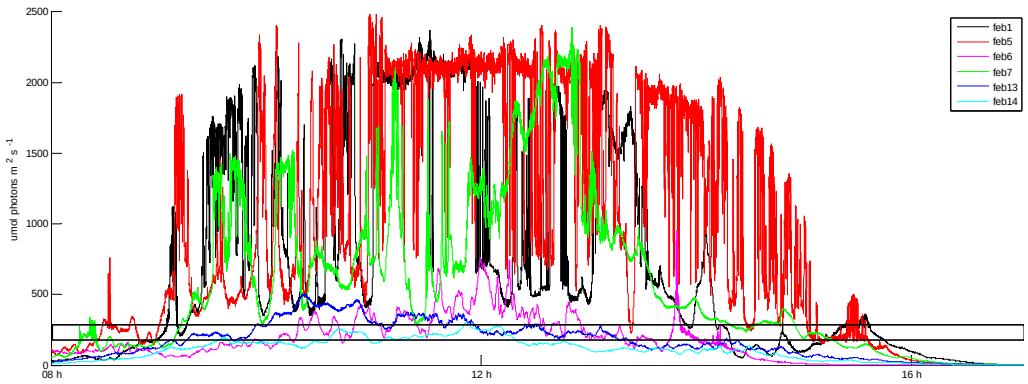

Figure 2. Instantaneous PAR for representative days of the February 2008 Line P cruise. While within-day and between-day variability was high, light levels often surpass that which is limiting to most phytoplankton assemblages (black bar and see Figure 1).

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. The addition of a -80 °C freezer on the Tully was greatly appreciated- especially for our HPLC and flow cytometry samples, and removed the difficulties associated with dealing with liquid nitrogen in rough weather. 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 Andersen and Hugh Maclean for their excellent watch-keeping, and to Janet Barwell-Clarke, Melanie Quenneville and Wendy Richardson for logistical, equipment and lab space support.

Anissa Merzouk and Jody Wright: Cruise report, UBC, Line P, February 2008

Objective:
Establish surface and depth distributions of the climate active gases nitrous oxide (N_2O), methane (CH_4), carbon dioxide (CO_2) and dimethylsulfide (DMS), 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), 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 12 depths vertical profile, 2) filter 1 L samples at 12 depths for high resolution bacterial DNA and RNA extraction and sequencing; and 3) filter large volumes (20-40 L) of seawater at 4 depths across the oxygen minimum zone (OMZ) to create genomic libraries of the bacterial communities.

Comments:
Considering the bad weather and difficult working conditions on deck and in the lab, we are very satisfied with how the cruise went. All Line P stations were visited and we mostly sampled according to plan. We missed only one bacterial cast (large volume filtration for libraries) at P20 due to bad weather.

The MIMS did not work properly during most of the cruise because of electronic problems. After troubleshooting it for a few days, the instrument was finally running but the sensitivity of the instrument was much less than usual and the quality of the results is not satisfactory.

The gas cylinders were not adequately secured on this cruise, the wooden support and binding straps will need to be improved for future cruise.

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.

RADIOISOTOPE USE:

Some work was done with radioisotopes (14-C) by the OSU personnel. The lab was 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 many stations because of weather.

The EK60 Acoustic Sounder was not set up properly at the beginning of the cruise. It took many phone calls between the Tully and the Pacific Biologic Station before being able to make it work, and even then it did not work properly.

During the first storm, the compressed air cylinders in the lab almost fell, despite a newer and more solid rack. The big tool box was also moving quite a bit. It would be good practice to always use the big straps to secure these two items together.

During this cruise there seemed to be a large quantity of deep water (from around 1200 to 1000 m) found at shallower depths (150 to 400 m). This deeper water signal could be seen in Dissolved Oxygen profiles as well as in Nutrients (Nitrate, Silicate, and Phosphate) profiles, but could not be seen in the CTD data. We now suspect that the rosette was mis-firing during the whole cruise.

The thermosalinograph was set to record position at the beginning of casts only, therefore we have no position for TSG data.

Although really useful, the new -80 freezer is very, very loud. Hopefully something can be done to muffle the sound.

SUCCESSES [SCIENTIFIC]:

Thanks to the crew, we managed to do some rosette and bongo casts in quite rough weather. There were times when we found ourselves working in conditions somewhat above our regular threshold.

Last year we acquired new metal tables for the lab. The tables were put to the test during this cruise, and we can definitely say now that they were an excellent buy.

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

When we got on board, many of the wires connecting the science server, the acoustic sounder, and the 12 kHz sounder were disconnected. There was no LAN distribution box to send and receive data and GPS throughout the ship. Nothing was working, everything had to be re-wired and reconnected. This is totally unacceptable as these instruments and connections are an essential part of our cruises. Fortunately Doug Yelland could spare us a few hours and, yet again, helped us avoiding disaster. But we now realise at the end of the cruise that many data sets are missing, either as a whole, or else missing some components (eg. GPS position/time stamps).

-Net sampling winch was difficult to operate smoothly. Surges in the winch drive made smooth deployment and recovery over the side challenging. Safe raising and lowering on the deck and overhead was not consistent because of these sudden and unexpected winch surges.
-Winch counter reading indicated a speed of 1 m/sec but was determined to be really 2 m/sec.
Doug Moore

SUCCESSES [SHIP]:

The new instrument lab was well suited to the analysis and minor changes in tie down hard points should be made to ensure the security of the kit in adverse conditions. Hugh Maclean.

This February cruise was the first chance to use the Tully's new temperature controlled lab. Our Portasal performed to specifications or better in this environment and provided a standard to check CTD sensors during the cruise. With further experience in setting the room's controller in differing outside environments, this room should provide an excellent opportunity for reliable on-board salinity analysis in the future. Doug Anderson.

The addition of a -80 °C freezer on the Tully was greatly appreciated- especially for our HPLC and flow cytometry samples, and removed the difficulties associated with dealing with liquid nitrogen in rough weather. Maria Kavanaugh.

We have been using the new lab (where the ship's office used to be) to do our salinity, dissolved oxygen, and chlorophyll analysis. It worked quite well. As well as liberating some space in the lab, it makes it much easier to run the Portasal and the fluorometer compared to where they used to be, two decks higher up. One problem with the new lab is the variation in temperature. We might have to use it only during the summer cruises, when we can cool it down, and not use it in February when the temperature is more variable.

We had access for the first time to the 'email at sea' system, which gave us access to a few TV channels as well as Internet access. We discovered that there is a limited range to the satellite access: it didn't seem to work west of about 140°W. It also seemed to be affected by specific headings. But it sure was convenient when it did work, giving us access to information/communication that turned out to be very useful for our work.

Thanks to Gerald Rohatensky for all his help at the beginning of the cruise with all the computer issues we had, mainly with the science server and with personnel computers. Gerald, you are more than welcome to join a Papa cruise! ☺
Since the Tully was in Pat Bay for self-refit, the White crew helped us loading our gear a few days before the official crew change. This worked really well since, as is more and more often the case, we had many different groups loading lots of gear, so spreading it over time made things less hectic.

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DELAYS [OTHER THAN WEATHER]:

Half-day for ship's certification.
12 hour lost for fuelling.

SAFETY CONCERNS:

None.

HAZARDOUS OCCURRENCES:

None involving science personnel.

EVENT LOG:

DATE		OPERATIONS
Friday	**25 Jan:**	**Start loading the ship at IOS.**
Tuesday	**29 Jan:**	**Official crew change.**
Wednesday	**30 Jan:**	**Certification for ship's crew in Pat Bay. Leave IOS evening.**
Thursday	**31 Jan:**	**Fuel in Esquimalt, 0800 to 2030.**
Friday	**1 Feb:**	**Start Line P.**
Friday	**8 Feb:**	**Arrive at Station P.**
Sunday	**10 Feb:**	**Leave Station P. Go to NOAA mooring site.**
Wednesday	**13 Feb:**	**Deploy Bowie Seamount mooring.**
Friday	**15 Feb:**	**Sample Koeye River/Hakai Passage stations.**
Saturday	**16 Feb:**	**Sample Rivers Inlet.**
Sunday	**17 Feb:**	**Sample station in Strait of Georgia. Arrive at IOS late PM.**
Monday	**18 Feb:**	**Offload at IOS.**

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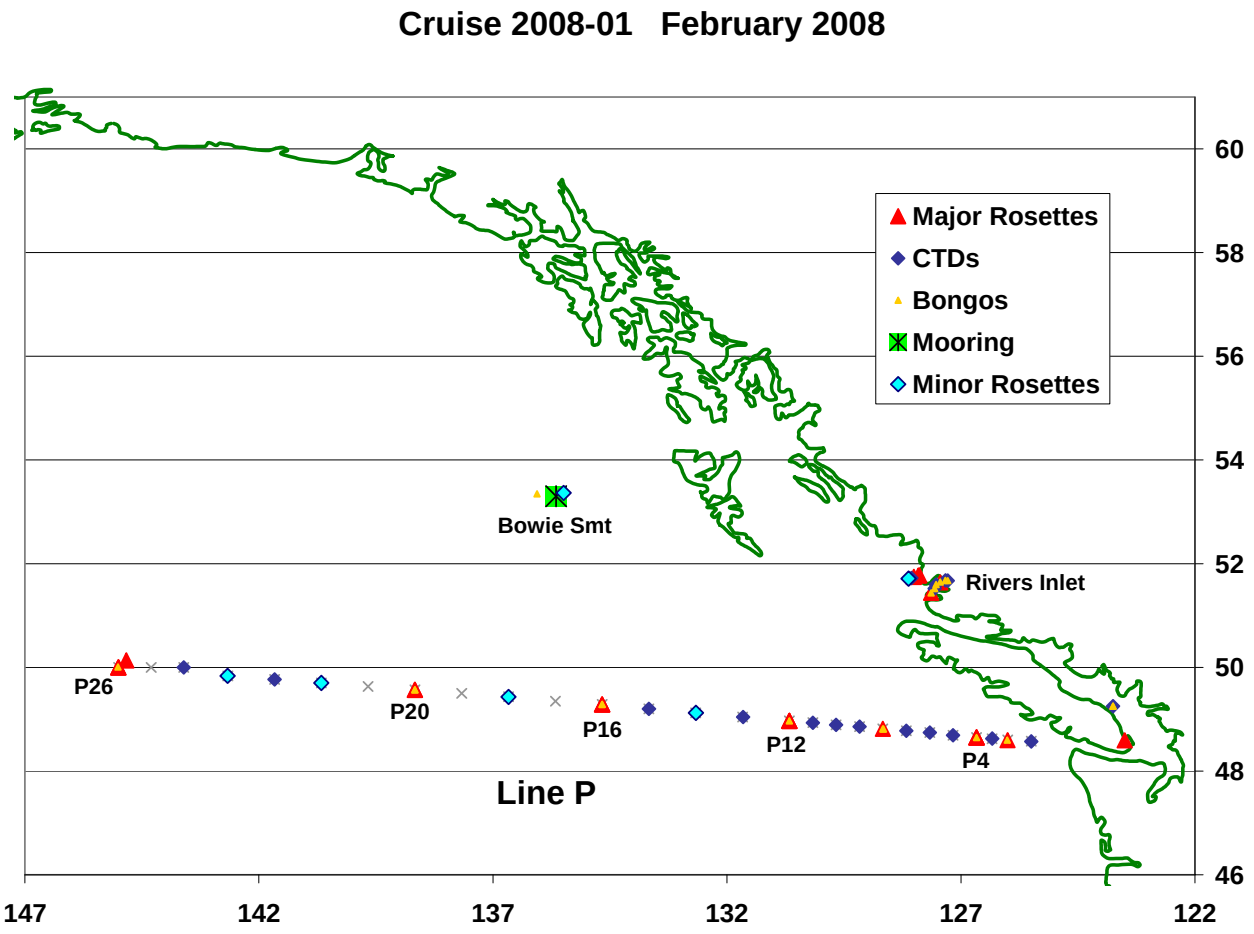
CRUISE TRACK:



SUMMARY/FINAL COMMENTS:

- Many thanks to the whole crew of the Tully for all their help in making this cruise such a success, despite all the bad weather we had. All things considered, we did really good!
- Special very big huge 'thanks' to the cooks, and the whole galley crew, for keeping us fed through winds and waves. It was a really grand achievement!
- "Thank you" to everyone on board, ship crew and science crew alike, for keeping such a good morale even though there was little work and little sleep for so many days in row.
- Finally, Robert: get well sooner! Wishing you prompt recovery …