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:** 23 January 2024 **TO:** 9 February 2024

SCIENCE CRUISE NUMBER: 2024-002 **SHIP'S PATROL NUMBER:** 23-12

CHIEF SCIENTIST[S]: Marie Robert

SCIENTIFIC PERSONNEL:

Female	Male
Natasha Buckiewicz (UBC)	Michael Arychuk (IOS)
Kailee Clarke (MUN)	Mark Belton (IOS)
Moira Galbraith (IOS)	Morgan Griffith (UBC)
Chloe Immonen (IOS)	Jody Klymak (UVic)
Marie Robert (IOS)	
Lauryn Talbot (UVic)	
Cindy Wright (IOS)	

AREAS OF OPERATION: Saanich Inlet, Haro Strait, Juan de Fuca Strait, Line P, Station Papa, Strait of Georgia.

INTRODUCTION/PROGRAMS BACKGROUND:

Line P is a long standing monitoring program which surveys a 1400 km long section 3 times annually. Data have been collected along this line since 1956 and show 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 so far offshore 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, zooplankton, trace metal, and carbon survey along Line P, continuous sampling using the MVP (moving vessel profiler) towards Scott Islands, hydrography and zooplankton stations in Knight Inlet and Strait of Georgia.

CRUISE DESCRIPTION: This cruise was totally dominated by weather. We managed to do the stations from Haro59 to P12, then we sailed straight to Station P to get ahead of a weather system that affected most of the offshore stations. After a short weather window that allowed us to sample Station Papa, we headed a little over 200 nm northwest of Station P to avoid a second weather system that spread the entire length of Line P. We towed the MVP from Station P to the "Hide-out" waypoint where we did a CTD cast to respool the CTD cable properly on the drum (see Ship problems section). We then towed the MVP towards Station P25 but had some issues with the MVP Kevlar line (see Science problems section). Back at P25 we finally resumed our work and completed sampling along Line P. We then towed the MVP from P13 to the Scott Islands and managed to sample most of the planned stations in Queen Charlotte Sound and the Strait of Georgia. Unfortunately, there was no time left to sample Knight Inlet as originally planned. It must be said that without the extra speed provided by Captain Gronmyr we would not have accomplished half of the work we did.

DAYS ALLOCATED: 17

DAYS OF OPERATION: 17

DAYS LOST DUE TO WEATHER: Roughly two days.

SAMPLING:

- The cruise was quite successful despite the weather. Most Line P stations got sampled although not in order. We had to cancel P9, P11, and P35. The deep bongo at P8 got cancelled and the trace metal cast at P12 got only partially sampled. No work was done in Knight Inlet and 5 stations of the SoG zooplankton program got cancelled.
- The samples collected include:

  1) Underway: **IOS:** Thermosalinograph (Temperature, Conductivity, Fluorescence), pCO_2, acoustic sounder, ADCP, met data (temp, winds, pressure, humidity) **– UVic (Klymak):** MVP (Moving Vessel Profiler).

  2) "E-data" from CTD: **IOS:** Pressure, Temperature, Conductivity, Dissolved Oxygen, Transmissivity x2, Irradiance, Fluorescence x2.

  3) From the Rosette: **IOS:** Dissolved oxygen, salinity, nutrients, chlorophyll, pigments (HPLC), DMS, DMSP, dissolved inorganic carbon (DIC), alkalinity, phytoplankton, biotoxins, domoic acid, bulk water, Chitobiase (secondary production estimates), LabSTAF (FLC; primary production estimate), tritium, stable isotopes **– MUN (Clarke):** total organic carbon (TOC), dissolved organic carbon (DOC), coloured dissolved organic matter (CDOM), speciation of dissolved organic matter (SPE-DOM) **– UBC (Buckiewicz):** Fatty acids, stable isotopes.

  4) Zooplankton nets: Vertical net hauls using a Bongo, 236 µm mesh size, were done to either 10 m off the bottom, 250 m, or 1200 m.

  5) Trace metal Go-flos: **IOS (Griffith for IOS):** trace metals filtered, trace metals unfiltered, ligands, nutrients, salinity.

RADIOISOTOPE USE:

No radioisotopes were used during the cruise.

PROBLEMS [SCIENTIFIC GEAR AND OPERATIONS]:

A new TSG was used on this cruise. The TSG software was not updated with the correct baud rate so we had no lab temperature and conductivity readings for roughly the first 20 hours. Once we received the new code with the appropriate baud rate we could log Temp and Cond, but the TSG flow reading became negative. After 19 hours of data with a negative flow rate, roughly 48 hours of TSG data went missing. Finally, the old software code got modified using the new baud rate and most issues were resolved, thanks to Chloe. Then for the last two days of the cruise the fluorescence flow meter on the TSG stopped functioning and the data extraction software does not seem to be working as it should.

It would still be preferable if the TSG software was not running on the same computer as the ADCP. This is a repeat request from May and August.

The Python script on the science server used to record TSG and weather data shuts itself down after recording 10 lines of data.

When the sea cable broke (see Problems – ship equipment section) it seems to have affected the CTD and/or the deck unit. The spare CTD had to be used for the reminder of the cruise.

As we were sailing back from the "Hide-out" location the MVP cable backwound and created a birdcage. This likely happened because we were in very rough seas and tension was not maintained adequately during pay-in. The cable appeared broken, so we re-terminated, with Chloe Immonen from IOS providing the electrical re-termination.

Jody Klymak

SUCCESSES [SCIENTIFIC]:

See above for the TSG data missing and the weather data recording script malfunctioning. Those two scripts (TSG and weather data) were written by someone at IOS who doesn't sail on the Tully regularly. Chloe and Mark did a great job solving the issues with the codes so that we could collect some data during the cruise. Without them we would have had very poor-quality TSG data. The weather data is being recorded somewhere at all time but it's better to have access to it.

The retermination of the CTD conducting wire was done very calmly and without any issues despite being Chloe's first retermination at sea. Great work Chloe!

pCO_2 – Michael Arychuk:

After nearly a three-year absence the recording of pCO_2 resumed on this cruise. Essentially the program was debugged, repaired and re-written to allow the GPS to be captured with an external "puck" versus going through the ship's network. Graphing and com port assignment issues were also addressed and corrected. Overall, the software performed very well on this cruise and previous problems of capturing the GPS, or COM port conflicts, were non-existent. The only issue that occurred from time to time was that of the mass flow controllers (MFC) losing their ability to control the flow of gas through the LiCor which affected the continuity of the readings. The issue is not with the MFCs themselves but rather some sort of electrical blip that causes a fault within the flow sensor. The MFC don't seem to be able to recover from the "blip" and become non-functional and lose their ability to regulate the flow. If one unplugs the sensors and then plugs them back in, they seem to re-set and the MFCs are functional until the next electrical event. Unfortunately, the MFCs get their power from an output on a board under the control unit so it is very difficult to check those connections without pulling the whole system apart. The best that could be done during the cruise was ensure the plug that supplies the power to the main board was snug and secure. This was done and seemed to make a difference. In any case it is suspected that the vibration from the ship is causing connections to come loose and it is something that probably should be looked at closer when the system in back in the lab.

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

The loading at the beginning of the cruise took a long time. Even though the previous crew loaded one aft-deck winch and the containers before crew change, we still didn't leave the dock until 15h30 on January 24th. Part of the problem was that the bosun only showed up by dinner time, although it must be said that the boatswain's mate Michael Carere and the leading deckhand Hannah Hollyoak did a fantastic job of acting for the bosun. Another issue was that the chief officer did not show up until the next morning.

The 10-ton wire of the ship's crane is not certified. The crew managed to put the bongo winch on Pad I by using the 5-ton wire in its maximal configuration and push the winch in place but this is a potentially dangerous method of loading a winch.

At the moment there are no winch (ship or shore) certified to lift a "man basket" in order to secure blocks and service the heave compensator at the top of the main A-frame. Although the chief officer is working on finding a solution for this issue we thought that it was still worth mentioning here as this could have a huge impact on our coming spring cruises. It would be ideal to have the means of accessing the top of the A-frame while at sea as we've had issues in the past with that system in the middle of a cruise. This issue needs urgent consideration.

When we left for the cruise, none of the quartermasters were fully trained on how to operate the LARS to deploy and recover the rosette, which is by far the most important instrument on our cruise. If we have no rosette, we might as well turn around and go home. Quite a few hours were spent training the new crew members on LARS operations. During the long stations, the order of operations had to be modified so that rosette casts would not happen during specific watches, sometimes entailing a less-than-ideal use of ship time. Even though we realise that retaining experienced crew members can be somewhat difficult, it is hard to comprehend why totally inexperienced individuals are put in charge of a $250k package that is absolutely crucial to all our operations, especially for a winter cruise which can pose significantly higher risks due to weather and sea conditions.

As we were deploying the rosette for the deep cast at Station P the conductive cable snapped. We were lucky that the rosette had just been secured in the head of the LARS before the wire broke.

As the rosette was coming up from 4315 dbar during the deep cast at Station P, the main Hawboldt winch had some spooling issues and the wire ended up crossed over at one end of the drum. It was noticed too late on the upcast to deal with the issue right away so we completed the cast. We then had to do another almost 4-hr cast to 4315 dbar only to respool the wire properly on the drum.

We had a crew member in science cabin B. All other ship's crew berths were occupied. The coming Line P cruises will have more science staff and we will need all our science cabins. Is has been decided that a nurse will now sail on all cruises going further than 200 nm. Although it is not a science issue to determine where the nurse will stay on board, we want to point out that, not only there won't always be a science cabin available for crew members, but also an IT tech seems more important to have on board than a nurse, especially when there are already at least two certified MEDICs on board.

SUCCESSES [SHIP]:

The trace metal winch seems to be fixed! We performed six casts with it and there were absolutely no spooling issues whatsoever. Many thanks to everyone in the winch shop who worked on this project.

Both the ONC (science) and the Starlink (ship) Internet systems worked very well during the whole cruise.

Despite having to use different software than he was used to, Captain Gronmyr did an awesome job reading the weather forecast files we were receiving and planning various courses so we could make the most of our sea-time while staying out of the worst weather. Many thanks for the extra speed when needed.

All officers of the bridge did a great job of holding station without constant use of the bow thrusters. Thank you!

DELAYS [OTHER THAN WEATHER]:

About 20 hours for the 1st officer to get on board.
About another eight hours to finish securing everything before departure.
Roughly two hours for problems with the grey water pumps.
A few hours for training of new staff on LARS operations.

SAFETY CONCERNS:

Inexperience people operating the LARS.

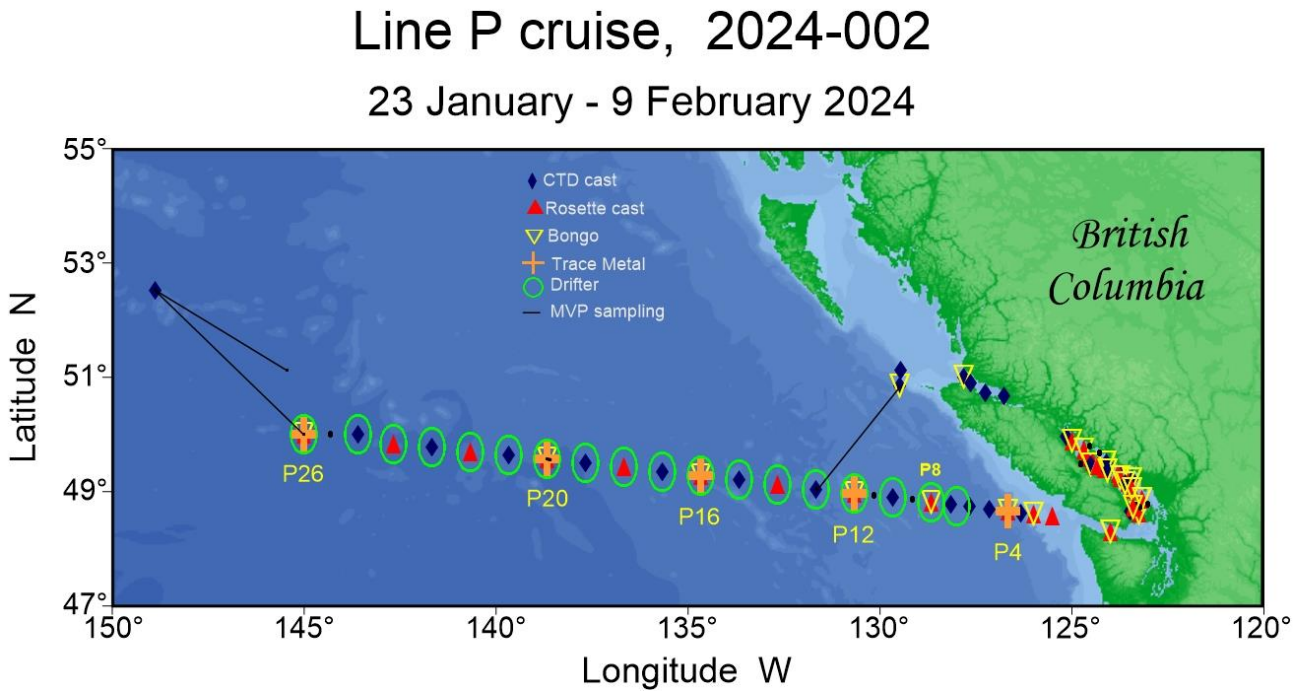
HAZARDOUS OCCURRENCES:

None in the science group.

EVENT LOG:

Tuesday 23 January:	Load the IOS gear in the cube van in the morning. Start loading the ship after the RMK crane departs, around 1530. Keep setting up into the evening.
Wednesday 24 January:	Bongo winch and MVP get loaded. Arrival of Chief officer in the morning. Safety meeting at 0830, science meeting at 1030. Fire and boat drill at 1300. Leave the dock around 1530. Test cast, station Haro59.
Thursday 25 January:	JF2, P1 to P3, start P4.
Friday 26 January:	Complete P4, P5, P6, P7, P8, skip station P9 to stay ahead of the weather, do P10. Deploy UCSD drifters at P8 and P10.
Saturday 27 January:	Skip P11, do P12, start heading towards Station P. Deploy a drifter at P12.
Sunday 28 January:	Weather sail to Station P.
Monday 29 January:	Arrive at Station P around dinner time, start work after dinner.
Tuesday 30 January:	Complete Papa, deploy drifter. Start towing MPV heading NW for "hide-out" location.
Wednesday 31 January:	Deep cast to fix spooling issues on CTD winch. Start towing MVP towards P25.
Thursday 1 February:	Keep towing MVP towards P25.
Friday 2 February:	P25, P24, P23, P22. Deploy a drifter at each of these stations.
Saturday 3 February:	P21, P20, P19. Deploy a drifter at each of these stations.
Sunday 4 February:	P18, P17, P16. Deploy a drifter at each of these stations.
Monday 5 February:	P15, P14, P13. Deploy a drifter at each of these stations. Tow MVP towards Scott3.
Tuesday 6 February:	End of MVP sampling at Scott3. Do Scott3, Scott2, CPE1, LBA1, QCS3, QCS1.
Wednesday 7 February:	Start of SoG work: stations 16, 14, 12, 9, 6, CPF2, 3, 2, 24, CPF1, 27, GEO1, 39.
Thursday 8 February:	End of SoG work: stations 40, 42, 46, 58, GI-01, SC04. Arrive at IOS, start offloading.
Friday 9 February:	End of offloading. Ship cleared by noon.

CRUISE TRACK:



SUMMARY/FINAL COMMENTS:

- Many thanks to everyone at IOS who packed and prepared all the gear and helped loading, as well as everyone who did the forklifting.
- As usual, many many thanks to *everyone* on board for all your help: the whole galley crew for all the special meals and smiles and special attention; the deck crew with your constant help; the engineers with answers to all our questions; and the officers for keeping station hours on end. With special thanks to the deck crew who carried all those drifters from the hold to the lab for us every day.
- Special thanks to Captain Gronmyr for spending so much time analysing the weather forecasts so we could make the best use of our ship time, as well as for the use two engines otherwise we'd still be at the "hide-out station" trying to get back home. And I guess … thanks for coming out of retirement so we could sail away!
- And last but not least, many thanks to Shane for the cables and power supply, the help with the scripts and mis-behaving laptop, and the daily offer for help!

Marie Robert

- I would like to thank the captain and crew of the J.P Tully for making this cruise possible. A big thank you to the cooking staff for the exceptional food throughout the cruise. Many thanks go to Chief Scientist Marie Robert for the planning and preparation of Line P and for inviting me to be apart of it. I would like to thank my watch leader, Moira Galbraith, for all the guidance and help provided during the cruise. And thank you to all members of the scientific team for their hard work and for making this trip a memorable experience.

Natasha Buckiewicz

- Thank you to the wonderful captain and crew of the John P. Tully, for the assistance they provide us with, and their patience and friendliness as I filtered on deck. I greatly appreciate Susan and Gage for always maintaining their enthusiasm. Special thanks to Cindy Wright for the at-sea carbon collection advice, and for filtering long hours in the cold to help keep my sleep schedule on track. And of course, thank you to Marie, for all of the help getting here and for providing a great learning experience and working environment.

Kailee Clarke

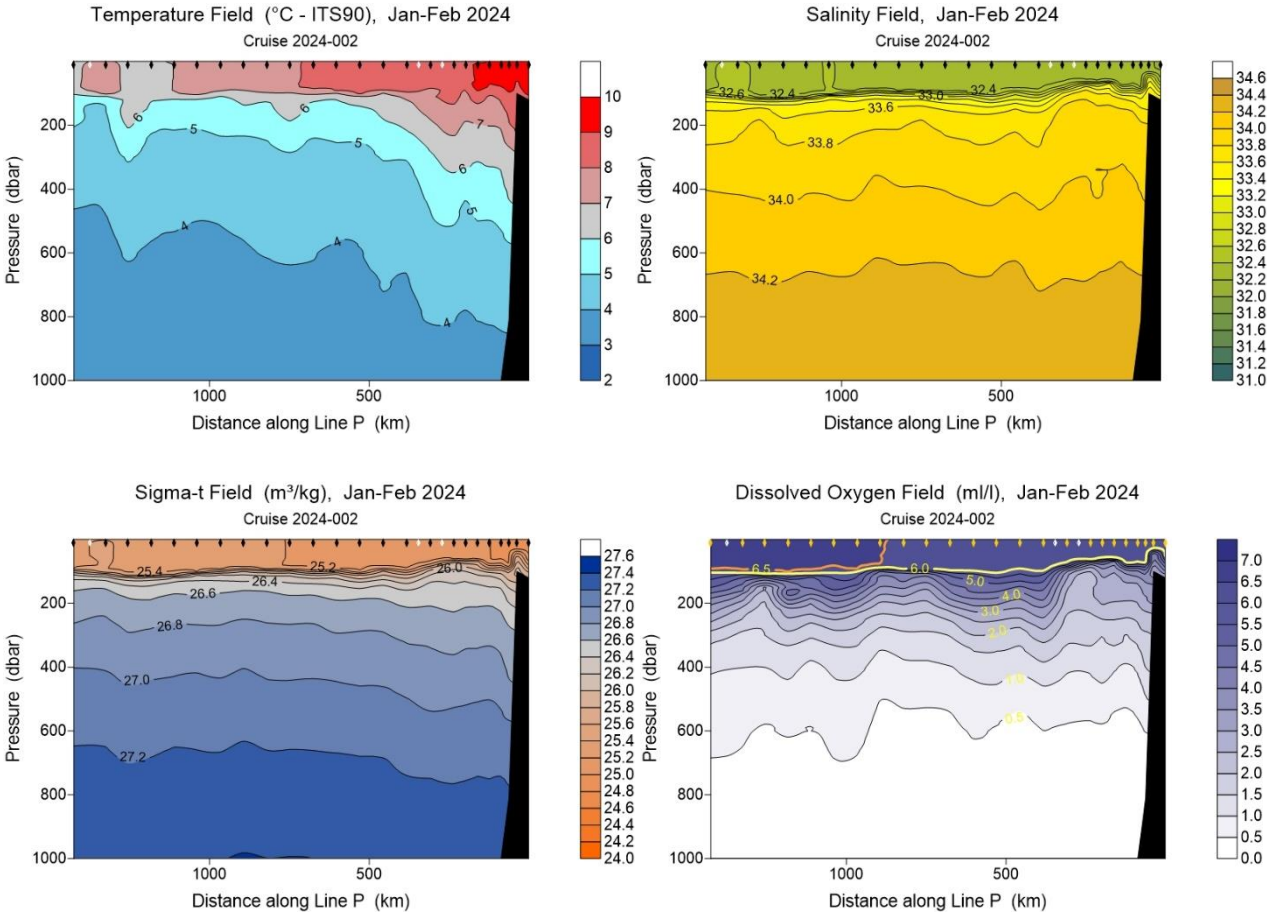
- Thank you to the officers and crew for a great expedition, and to the IOS crew for their expert assistance and advice, particularly Chloe Immonen for fixing our electrical termination so quickly. Thanks to the rest of the science party for keeping us company while doing the MVP watches. As always, thanks to Marie Robert for all her organization and communication efforts.

Jody Klymak

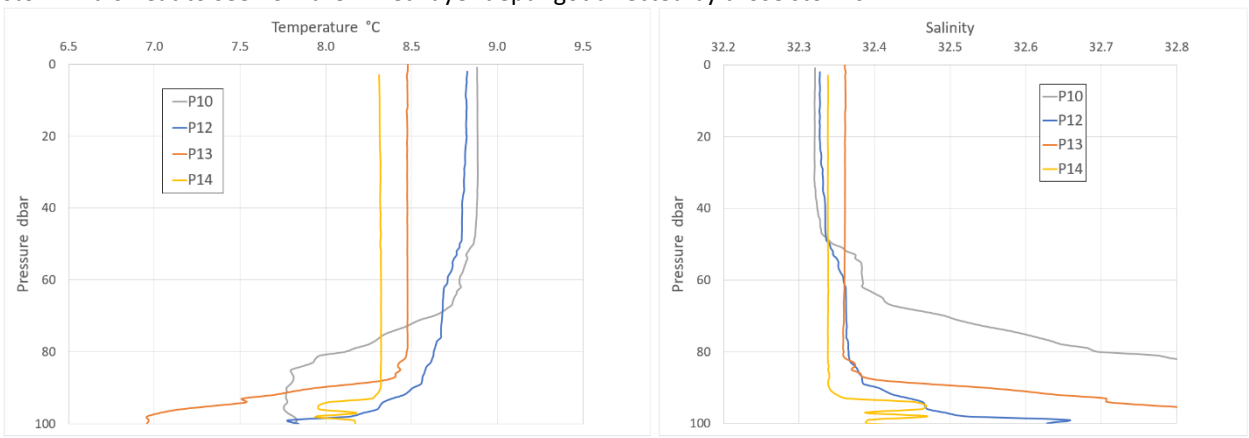
PROJECTS AND RESULTS:

Water masses – Marie Robert, DFO/IOS.

As mentioned in the Cruise Description part of this report, this cruise was totally dominated by the weather. Stations P1 to P12 were sampled between 25 and 27 January, we were at P26 on 29-30 January, and the rest of the Line, from P25 to P13, was done between 2 and 5 February. Because of this spread of dates it is difficult to calculate the anomalies here while at sea since the averages on hand are monthly averages. So here are the actual conditions for temperature, salinity, density and dissolved oxygen.



These last two graphs show the temperature and salinity profiles from the surface to 100 dbar for P10 and P12, which were sampled in January before the first big storm, and for P13 and P14 which were sampled in February after the second big storm. It is neat to see how the mixed layer depth got affected by those storms.



January 2024 Line P Trip Report – Natasha Buckiewicz, UBC

Fatty acids play a crucial role in marine environments, serving as biomarkers for various biological processes and environmental conditions. Assessment of fatty acids in marine environments are a useful tool for indicating the source and quality of organic matter, assessment of primary production, trophic relationships, and energy flow within marine ecosystems. Particulate organic matter (POM) makes up the base of the pelagic food web and is a significant source of high-quality fatty acids for higher trophic level organisms (i.e omega-3). Along Line P, I collected seawater from 5m depth at 11 stations (P1, P3, P4, P8, P12, P14, P16, P18, P20, P23, P26) and 6 stations in the Strait of Georgia (14, 12, 2, 27, 39). Water was vacuum filtered on GF/F filters for fatty acid analysis back in lab, as well as for complementary stable isotope analysis. This data will be used to characterize the nutritional quality of POM available for predators along Line P and Strait of Georgia.

Zooplankton make up a key component of marine food webs, linking primary producers to higher trophic level organisms. Zooplankton species have different fatty acid profiles, with some considered of higher nutritional quality for predators. Characterizing zooplankton fatty acid profiles is therefore essential for understanding ecosystem nutritional health, building trophic relationships, and interpreting changes due to shifts in species composition. Along Line P, I collected zooplankton species commonly found offshore from IOS bongo net casts from stations P4, P8, P16, P20 and P26. These casts ranged from 135m to 1200m in depth. Zooplankton species were collected, identified and frozen for fatty acid analysis back in lab. These profiles will be used to compare with data from other Line P surveys for changes in fatty acid composition both seasonally and spatially (Coastal, on shelf etc.).

Acknowledgements

I would like to thank the captain and crew of the J.P Tully for making this cruise possible. A big thank you to the cooking staff for the exceptional food throughout the cruise. Many thanks go to Chief Scientist Marie Robert for the planning and preparation of Line P and for inviting me to be apart of it. I would like to thank my watch leader, Moira Galbraith, for all the guidance and help provided during the cruise. And thank you to all members of the scientific team for their hard work and for making this trip a memorable experience.

Cruise Report: LineP 2024-002 – Kailee Clarke - Graduate student from Memorial University of Newfoundland collecting total organic carbon (TOC), dissolved organic carbon (DOC), chromophoric dissolved organic matter (CDOM), and samples for solid phase extraction of dissolved organic matter (SPE-DOM).

Previous years of TOC analysis along Line P have shown unexpectedly high concentrations of carbon export to depth during productive seasons (Spring and Summer), with high spatial and interannual variation. Understanding the reactivity and eventual fate of the organic carbon measured during these sporadic high export events is important in understanding ocean carbon cycling and the ocean's ability to continue atmospheric carbon dioxide uptake as concentrations continue to increase globally. TOC, DOC, and CDOM samples were collected at P2, P4, P12, P14, P16, P18, P20, P22, P24 and P26, with TOC being collected directly from the Niskin bottles. At P8 only TOC samples were collected due to seasickness. Samples for SPE-DOM were collected at 2000m from stations P18, P20, P22, P24 and P26. DOC, CDOM, and SPE-DOM samples were filtered directly from the Niskin bottles through a 0.2µm filter cartridge (Whatman AS-75). DOC, TOC, and SPE-DOM samples were acidified in the fume hood of the lab using 4N Hydrochloric Acid. All samples were stored in the cold-room.

Once all samples were collected, the SPE-DOM were passed through prepared PPL resin SPE cartridges (Agilent) on board. PPL is a specialized resin that targets polar organic compounds and is relatively effective for isolating DOC. Solid phase extraction allows DOC to be concentrated and dried for high-resolution analysis of structural properties of the organic carbon at depth in the open ocean, providing preliminary information about organic carbon quality in this region that we hope to compare to the to DOC seen at depth during the productive seasons to gain insight about how it is transformed over time. This was done during travel time, while no open solvents or volatile chemicals were being used in the lab, to minimize risk of DOC contamination. TOC and DOC measurements will be used as a quantitative assessment of carbon concentrations, and an indicator of if carbon export to depth is being driven by sinking biological particulate or microbial transformations of dissolved molecules. CDOM will provide further qualitative information about the origin of dissolved organic carbon.

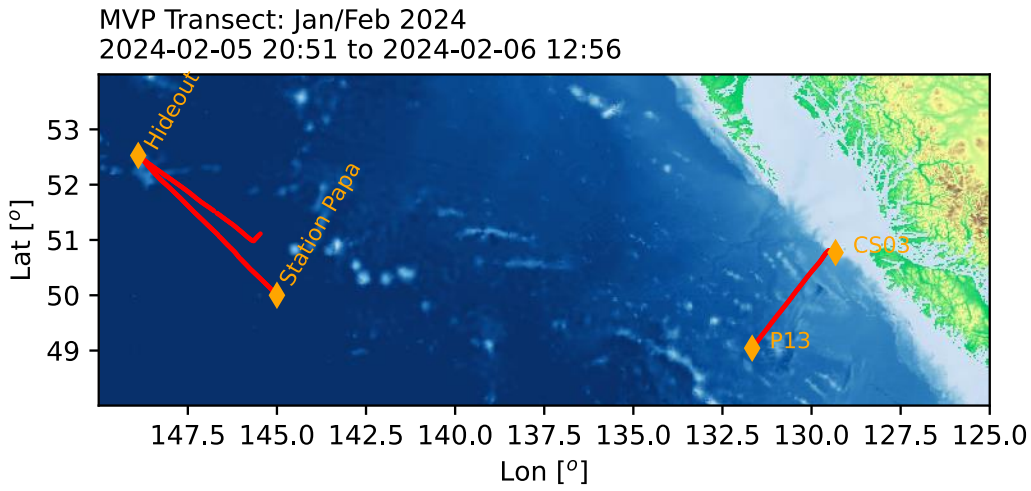
Thank you to the wonderful captain and crew of the John P. Tully, for the assistance they provide us with, and their patience and friendliness as I filtered on deck. I greatly appreciate Susan and Gage for always maintaining their enthusiasm. Special thanks to Cindy Wright for the at-sea carbon collection advice, and for filtering long hours in the cold to help keep my sleep schedule on track. And of course, thank you to Marie, for all of the help getting here and for providing a great learning experience and working environment.

Cruise Report: UVic MVP operations LP24a – Jody M. Klymak, University of Victoria

Setup and deck operations

These were great as usual. MVP setup was smooth, and officers and crew were very helpful.

Data



Cruise plan was changed due to weather, with MVP run made from P26, to northwest of P26. This was suboptimal in terms of comparing with previous efforts, however it was a unique opportunity to capture the upper ocean of the Northeast Pacific in winter. The return leg of this deployment was cut short when the MVP cable backwound and created a birdcage. This likely happened because we were in very rough seas and tension was not maintained adequately during pay-in. The cable appeared broken, so we re-terminated, with Chloe Immonen from IOS providing the electrical re-termination.

After finishing LineP, we deployed the MVP again from P13 to Cape Scott.

MVP

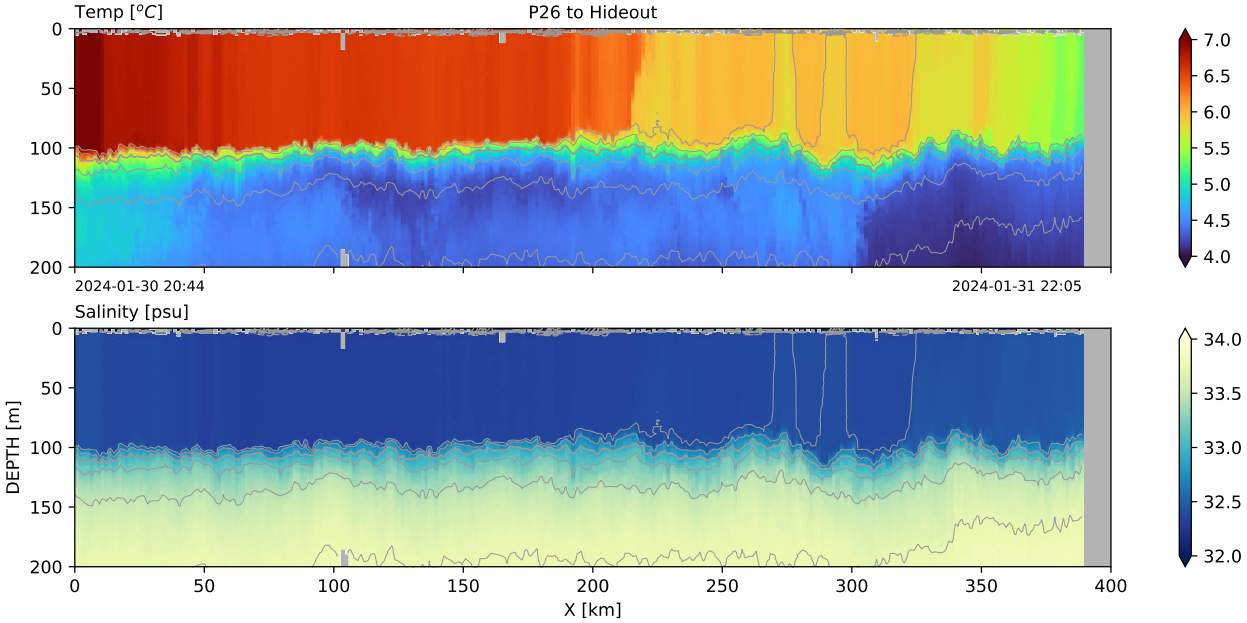


Figure 1: P26 to Hideout temperature and salinity sections. Contours are potential density.

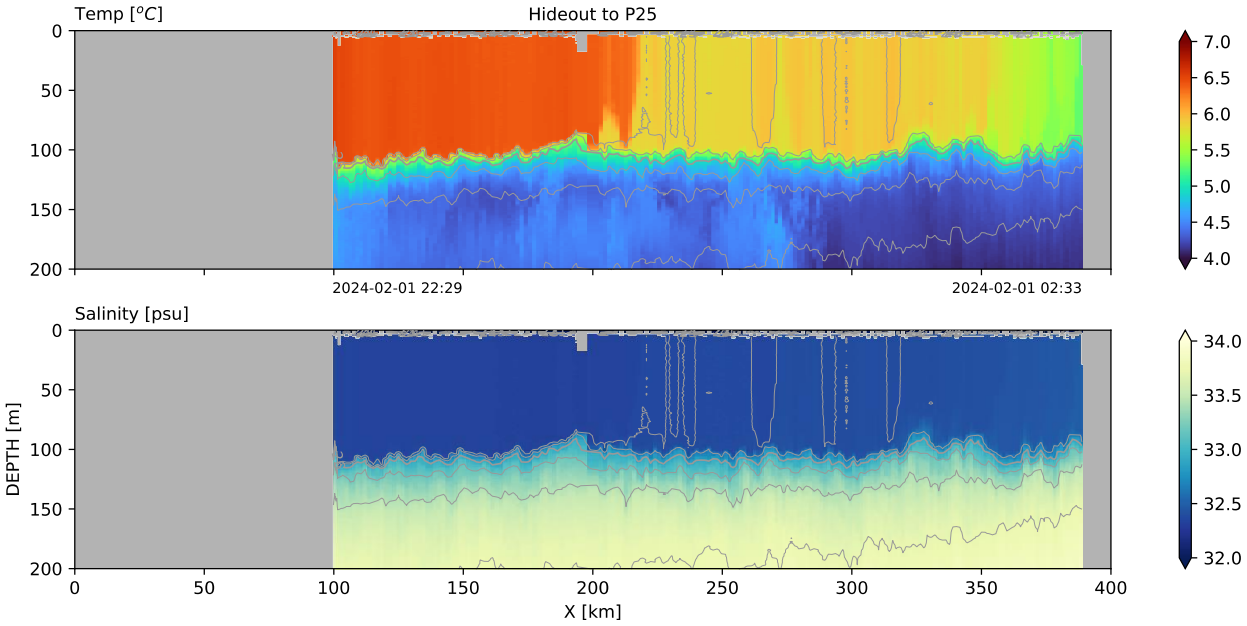


Figure 2: Transit from Hideout to P25 (x=400 was Hideout). Curtailed due to winch malfunction.

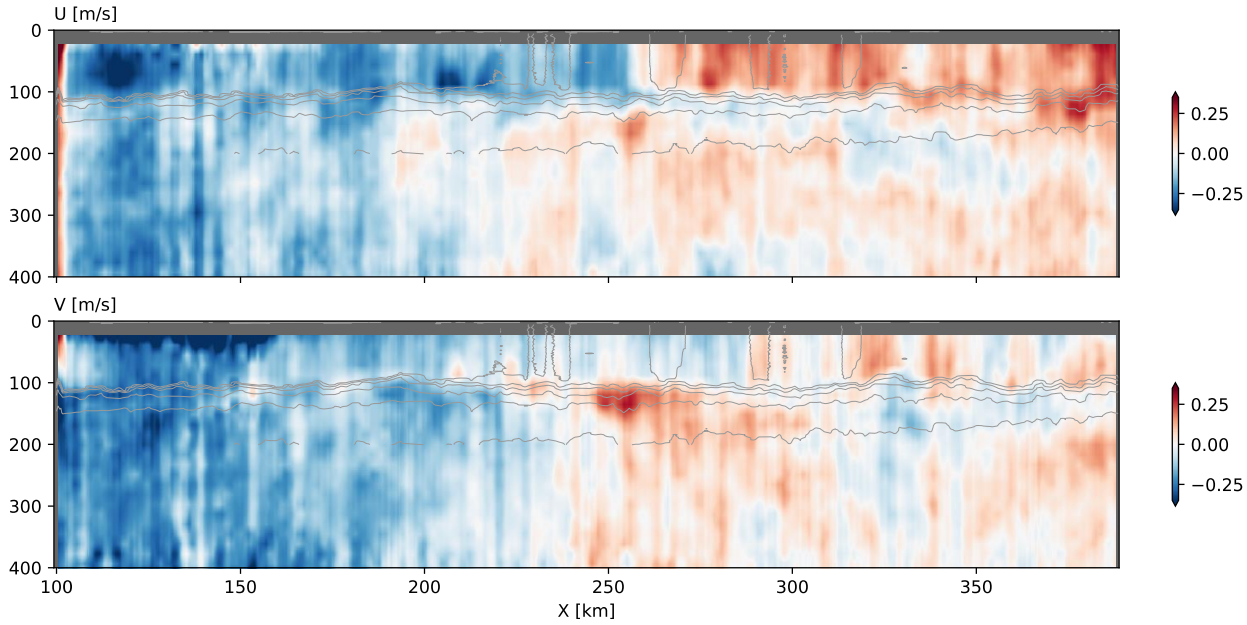


Figure 3: Hideout to P25 velocity section.

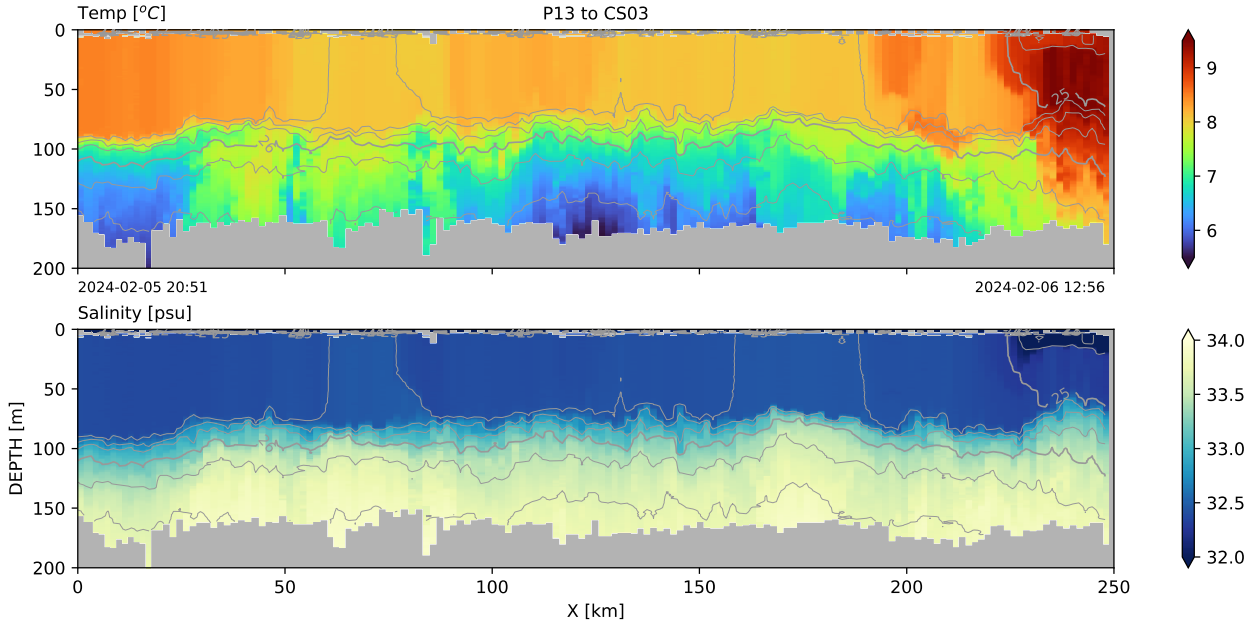


Figure 4: MVP section from P13 to Cape Scott. Depth limited by shorter cable after winch malfunction.

Issues and recommendations

- It would be preferable if the TSG were not running on the same computer as the ADCP. This is a repeat request for the last few cruises. Both the ADCP and TSG are vital instruments, and it would be preferable to not do realtime data acquisition on the same system.

- For the acoustics, it is nice for the ADCP to get as many pings as possible. It is also good for it to by synced to the EK80. Recommend that the EK80 be left with a Maximum Depth setting of 750 m, except at stations, where it can be set to something greater. This will keep it pinging once a second.

Thank-yous

Thank you to the officers and crew for a great expedition, and to the IOS crew for their expert assistance and advice, particularly Chloe Immonen for fixing our electrical termination so quickly. Thanks to the rest of the science party for keeping us company while doing the MVP watches. As always, thanks to Marie Robert for all her organization and communication efforts.