BaySys Quarterly Newsletter

Issue 7 - Winter 2019/2020

Project Update

The final year of the project is well underway. Extensive data analysis since 2018 has produced exiting results from each team, and these results are now being presented in conferences, published in a variety of peer-reviewed journals, and prepared for the BaySys Phase 2 Analysis and Results report. Along with other project deliverables, this BaySys report is planned to be completed by the end of 2020. In other news, graduate students across all teams are in the final stages of their theses and dissertations, and we plan to see many of them defending and graduating in the coming months.

Meetings and Events

BaySys All-Hands Meeting - November 14-15, 2019, Winnipeg, MB.
ArcticNet 2019 - December 2-5, 2019, Halifax, NS.
Ocean Sciences Meeting - 16-21 February, 2020, San Diego, CA, USA.
BaySys SSC Meeting - (TBD)
BaySys Wrap-Up Meeting - (TBD)

Recent Publications

Petrusevich, V.Y., Dmitrenko, I.A., Niemi, A., Kirillov, S.A., Kamula, C.M., Kuzyk, A., Barber, D.G., Ehn, J.K. 2019. Impact of tidal dynamics on diel vertical migration of zooplankton in Hudson Bay. *Ocean Science - Discussions* DOI: https://doi.org/10.5194/os-2019-107

Harasyn, M.L., Isleifson, D., Barber, D.G. 2019. The influence of surface sediment presence on observed passive microwave brightness temperatures of first-year sea ice during the summer melt period. *Canadian Journal of Remote Sensing* 45(2):1-17. DOI: 10.1080/07038992.2019.1625759

Capelle, D. Kuzyk, Z.Z., Papakyriakou, T., Gueguen, C., Miller, L., and R. Macdonald. 2019. Effect of terrestrial organic matter on ocean acidification and CO2 flux in an Arctic shelf sea, *Progress Physical Oceanography*

BaySys All-Hands Workshop Recap

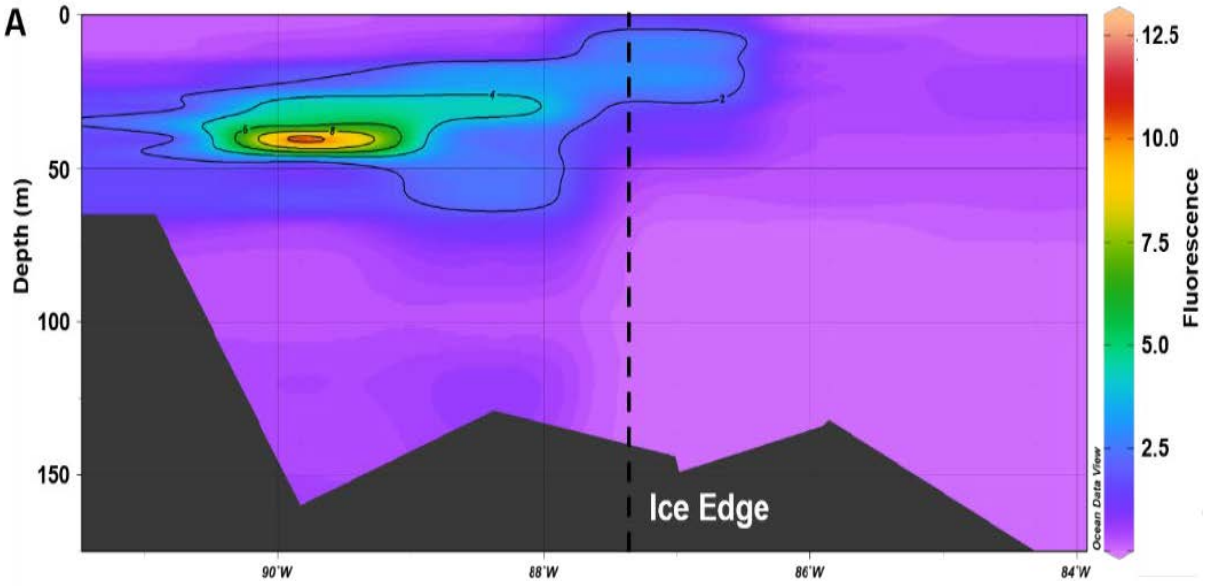
The 3rd annual BaySys All-Hands workshop was a huge success. The two-day event (November 14-15) held at the University of Manitoba, had just over 50 participants from the BaySys project in attendance. This included participants from collaborating universities all across Canada, and representatives from our partners at Hydro Québec, Ouranos, and DFO. This year, the workshop was used to present team results, plan new publications, and discuss the remaining course to completing the BaySys project deliverables in 2020. In this newsletter issue, we recap each day of the event and provide a glimpse at some of the fascinating results coming out of the project.

Main worshop room at the U of Manitoba (Photo credit: Sam Swanson)

Day 1

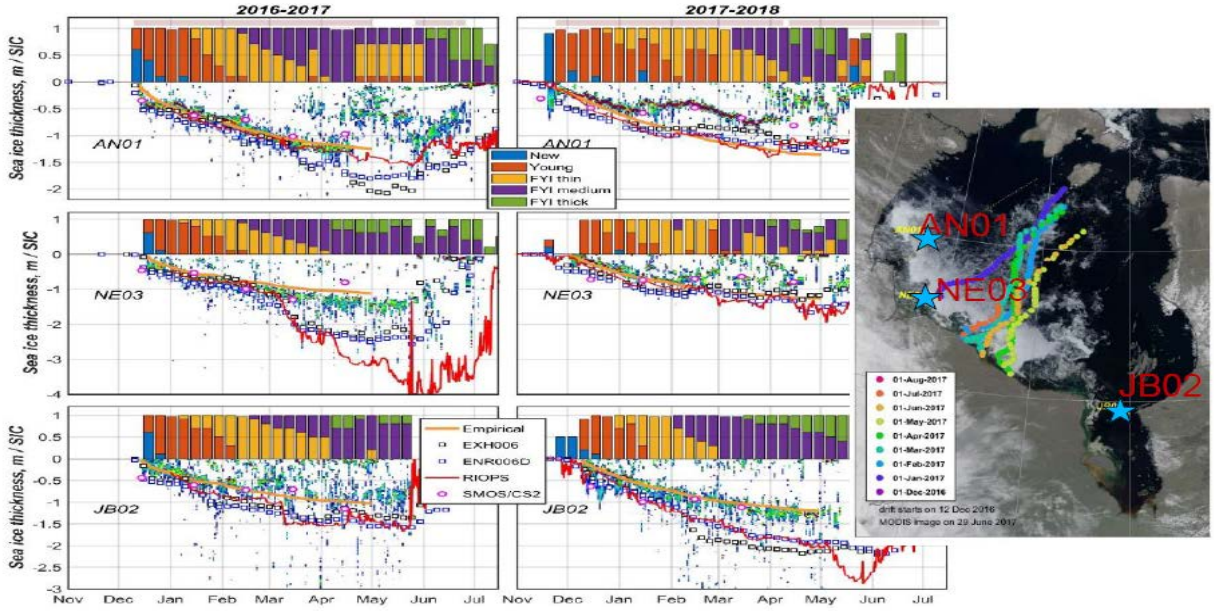
On day 1 of the BaySys-All-Hands workshop, researchers gathered in a University of Manitoba lecture hall to present and discuss several project related topics including the results of extensive data analysis from the past two years, and progress towards final project deliverables. Opening the workshop, discussions were held regarding the continued importance of data management, metadata collection, and data sharing for all BaySys project collaborators. This data management approach ensures that all BaySys project data is well maintained long into the future, and has open access availability through both the university data hub (http://lwbin-datahub.ad.umanitoba.ca/) and the Polar Data Catalogue (https://www.polardata.ca/). Following morning discussions, the focus shifted to recent team results, updated publications, and progress towards completing the Phase 2 report.

Team 1 provided details on recently published results demonstrating the impact of surface sediment on sea-ice passive microwave brightness temperatures. These results will help researchers to more accurately measure and map the rate of growth and break-up of sea ice through satellite imagery (Harasyn et al. 2019). Team 2 followed, presenting findings from their extensive hydrological modeling work. Specifically noting possible changes to the timing and magnitude of freshwater into Hudson Bay due to climate change, and the effects that hydroelectric regulation may have on that freshwater flow (Stadnyk et al. 2019). Team 3 presented the findings of several data set analyses conducted by graduate students within the team. One of such analyses highlighted the presence and localization of large and relatively deep water phytoplankton blooms in relation to the timing and ocean-atmosphere coupling for biological productivity (see figure below). An important part of primary production within the Bay.



A large phytoplankton bloom with a pronounced subsurface maximum (SCM) was observed in the north-western polynya (2018 expedition), highlighting the importance of ocean-atmosphere coupling for biological productivity. The relatively deep position of the SCM indicates that phytoplankton growth began a long time before sampling (Matthes et al. 2019).

During their presentation, Team 4 detailed how the carbon cycle, runoff, and sea-ice directly affect the $C0_2$ and acidification in Hudson Bay, within both coastal and offshore regions. Their results were derived from several analyses on marine, soil, and atmospheric observational data sets, and were presented in a way to demonstrate each as a source or sink of carbon within the bay. Similarly, Team 5 showed their current methyl mercury analysis results from several data sets stemming back to 2016. With their new results, they were able to update the mass balance model of methyl mercury in Hudson Bay , and plan to complete the budget model in the next year when the remaining sediment cores are processed and interpreted. Finally, Team 6 provided an status update on the NEMO and biogeochemical model runs, and presented a brief overview of their sea ice thickness comparison with the mooring data (See figure below). In addition to their update, they lead a group discussion on model output, analysis, and formatting.



Comparison of sea ice thickness derived through NEMO outputs to three mooring data sets from Hudson Bay. (Kirillov 2019).

Day 2

On the second day of the BaySys All-Hands Workshop, Team leads met with Project management and coordinators to plan the content and layout of the BaySys Synthesis report, a final BaySys deliverable. The synthesis report is going to be a plain language document of approximately 10 pages in length that introduces the project and its objectives, and then provides key messages to take away from the results of each team. This meeting was very productive in that each team lead outlined what they would consider to be the two to three key messages that need to be in this document, and how they plan to produce those results in a brief, plain language report. The remainder of the BaySys All-Hands Workshop focused extensively on cross-team research integration and manuscript prep and planning through several side meetings.

Stories from BaySys - Sarah Schembri

My PhD research within the BaySys project focuses on zooplankton and fish. Within the food chain, they are a link between phytoplankton and larger predators such as beluga whales, seals and walruses, all familiar sights in Hudson Bay. The species of zooplankton in the bay tend to be smaller and less abundant than those found throughout the arctic. That said, zooplankton life cycles are heavily dependent on sea-ice which, unlike in other arctic regions, melts completely during summer months in the bay. Data collected during the BaySys campaign is helping to shed light on why we see such low biomass of zooplankton in this region. Zooplankton are eaten by fish larvae which start hatching just before ice break-up. In Hudson Bay some Arctic cod tend to hatch earlier, even as early as January, and we believe that this might be due to the high freshwater input into the bay. However, in contrast to other northern regions, Arctic cod are not the predominant fish species throughout the bay, as Sand lance, Capelin and Shannies are present in relatively high abundances. Fully examining the ecology of this region requires extensive collaboration across the BaySys project, and as such, has become a favourite part of my research.

Stories from BaySys - Kathleen Munson

Mass Budget of Methylmercury in Hudson Bay

The goal of my postdoctoral fellowship is to quantify sources and distributions of methylmercury, the form of mercury that builds up in aquatic food webs. Together with fantastic graduate students, I collected samples from the Amundsen, zodiac, ice cover, and float planes beginning 2016. We measured river water, coastal and offshore waters of Hudson Bay, sediment, and biota to try to understand how much methylmercury is transported into the Bay and how much is produced within the Bay.

After years of analyzing the samples individually in the lab, we have a growing database of numbers. Now comes interpretation. We are now working on our computers, comparing distributions of methylmercury across the Bay with those of dissolved oxygen, nutrients, and carbon. Defining these relationships within areas of the Bay will better enable us to project how changes in climate and freshwater regulation will influence methylmercury distributions in the future.