SKQ201709S Cruise Report
to the Arctic Integrated Research Program

9-28 June 2017

Arctic Shelf Growth, Advection, Respiration and Deposition (ASGARD)
Rate Measurements Project

Compiled by Seth Danielson, Opik Ahkinga, Lorena Edenfeld, Lisa Eisner, Caitlin Forster, Sarah Hardy, Steven Hartz, Brenda Holladay, Russ Hopcroft, Brittany Jones, Jeff Krause, Kathy Kuletz, Rachel Lekanoff, Mike Lomas, Kofan Lu, Brenda Norcross, Stephanie O'Daly, Jessica Pretty, Catherine Pham, Alex Poje, Ethan Roth, Sarah Seabrook, Pete Shipton, Brendan Smith, Caitlin Smoot, Kate Stafford, Dean Stockwell, Atsushi Yamaguchi, and Ann Zinkann

Introduction:
The Arctic Shelf Growth, Advection, Respiration and Deposition (ASGARD) Rate Measurements project is funded as part of the North Pacific Research Board's (NPRB's) Arctic Integrated Ecosystem Research Program (IERP; http://www.nprb.org/arctic-program/). The program and research on this expedition is sponsored by NPRB, the Collaborative Alaskan Arctic Studies Program (CAASP, formerly the North Slope Borough/Shell Baseline Studies Program), the Bureau of Ocean Energy Management (BOEM), the National Science Foundation, and the Office of Naval Research Marine Mammals and Biology Program. In-kind support for this research cruise is contributed by the National Oceanic and Atmospheric Administration and the University of Alaska Fairbanks.

In recent years, our understanding of the composition and structure of the Chukchi ecosystem has increased greatly, yet our knowledge outside of summer and fall months and year-round of the rates at which fundamental processes operate remains sorely lacking. This research expedition is one of a pair of late spring cruises to the northern Bering and southern Chukchi seas in 2017 and 2018 at infrequently sampled locations and times of year to conduct a closely integrated set of multi-disciplinary process studies. These will reveal new insights about the transfer and fate of organic carbon in this highly productive and strongly advective region.

The ASGARD measurements are designed to quantify: the physical and chemical environments; planktonic and benthic microbial and infaunal communities (composition, abundance and biomass); water mass, heat, salt, nutrient, and particulate advection rates; phytoplankton growth rates; zooplankton growth, reproduction, feeding and respiration rates; quantity, quality, and degradation rates of sediment organic material; benthic respiration rates; and particle sinking and deposition rates. Year-round biophysical and biogeochemical moorings will provide temporal context of select parameters at sites along the primary advective pathways and within multiple water masses and biogeographical regimes. ASGARD principal investigators include Danielson (physics & chemistry), Blanchard (statistics), Hardy (benthos), Hopcroft (zooplankton), McDonnell (particles) and Stockwell (chemistry & phytoplankton). Companion studies on this cruise include those led by Norcross (fish/epibenthic trawls), Stafford (marine mammal recordings and observations), Kuletz (bird observations), and Eisner (size fractionated primary production/biomass, fatty acids of seston and mesozooplankton), and Lomas/Krause (microzooplankton).

By focusing on physical and biological rate measurements we will be better equipped to anticipate, understand, and prepare for the ecosystem ramifications of an Arctic experiencing fewer days of ice cover and an accelerated ice retreat. By expanding our boundaries of knowledge and understanding, our work will directly improve the Arctic management and policy decisions that require guidance as we approach the coming decades.

This year's cruise was notable for sampling in June shortly after a very early ice retreat, with warmest-ever recorded annual sea surface temperatures in 2016 (compared to the 1900 to 2016 period of record) and a number of highly unusual winter conditions and notable observations. For example, a late freeze-up left open water across Chirikov Basin well into January, a January bowhead whale harvest occurred in Savoonga in January 2017, and a very early spring whale harvest occurred in Barrow. Given the vast amount of open water, heading into the field we expected to find mostly nitrate-deplete surface waters and blooms conditions that were already past. We found low-nutrient water in most coastal areas but over large expanses of Chirikov Basin, Bering Strait and the southern Hope Sea Valley the surface water nitrate sensor recorded nitrate values of 10-20 uM, suggesting that plenty of nitrate was still available to support blooms. At some stations we found active diatom blooms still in progress, while at other stations we found phytoplankton had settled onto the seafloor, presumably the result of a recent water column bloom.

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Science Party Cruise Participants

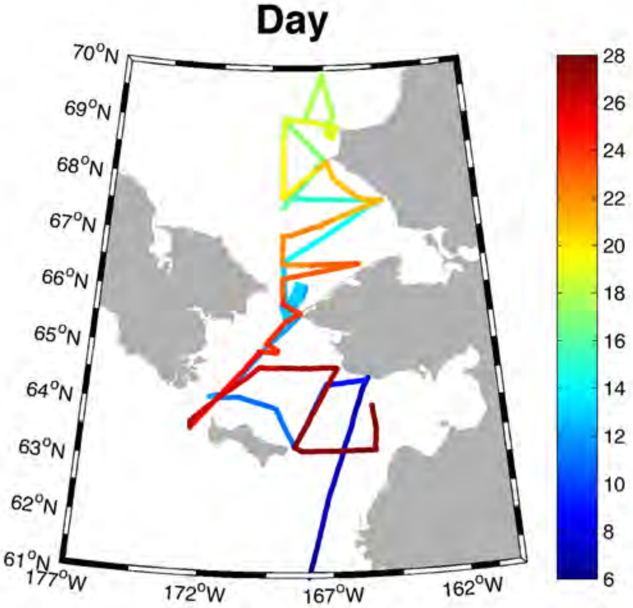
Participant	Discipline	Role	Affiliation
Seth Danielson	Physics	Chief Scientist, Disciplinary Lead	UAF
Kofan Lu	Physics	Graduate Student	UAF
Brendan Smith	Physics	CTD Watchstander & Media	NPRB
Pete Shipton	Physics	Mooring Technician	UAF
Dean Stockwell	Chemistry/Phytoplankton	Disciplinary Lead	UAF
Lisa Eisner	Chemistry/Phytoplankton	NOAA Collaborator	NOAA
Rachel Lekanoff	Particles	Graduate Student, Disciplinary Lead	UAF
Stephanie O'Daly	Particles	Graduate Student	UAF
Mike Lomas	Microzooplankton	Disciplinary Lead	Bigelow
Jeff Krause	Microzooplankton	Collaborator	Dauphin Island Is. Sea Lab
Russ Hopcroft	Mesozooplankton	Co-chief scientist, Disciplinary Lead	UAF
Caitlin Smoot	Mesozooplankton	Technician	UAF
Alex Poje	Mesozooplankton	Graduate Student	UAF
Atsushi Yamaguchi	Mesozooplankton	International Collaborator	U. Hokkaido
Sarah Hardy	Benthos	Disciplinary Lead	UAF
Brittany Jones	Benthos	Graduate Student	UAF
Sarah Seabrook	Benthos	Graduate Student	OSU
Jessica Pretty	Benthos	Graduate Student	UAF
Caitlin Forster	Fish	Graduate Student	UAF
Ann Zinkann	Fish	Graduate Student	UAF
Lorena Edenfeld	Fish	Disciplinary Lead	BOEM
Catherine Pham	Seabirds	Disciplinary Lead	USFWS
Kate Stafford	Marine Mammals	Disciplinary Lead	UW
Opik Ahkinga	Science support	Observer/Communicator & Field Assistant	Native Village of Diomede
Ethan Roth	Science support	Marine Technician	UAF
Steven Hartz	Science support	Marine Technician	UAF

Note: In addition, Andrew McDonnell rode Sikuliaq only from Dutch Harbor to Nome on leg SKQ201708T to set up the particle optics equipment and to provide training to R. Lekanoff and S. O'Daly.

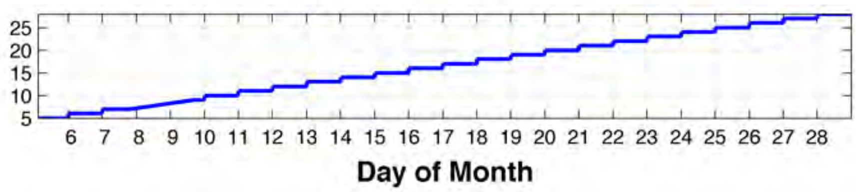
List of Acronyms

AIERP	Arctic Integrated Ecosystem Research Program
AMBON	Arctic Marine Biodiversity Observation Network
ASGARD	Arctic Shelf Growth, Advection, Respiration and Deposition project
BOEM	Bureau of Ocean Energy Management
CAASP	Collaborative Alaskan Arctic Studies Program
CBE	Chirikov Basin East transect
CBW	Chirikov Basin West transect
CL	Cape Lisburne transect
CNL	Convention Line transect
CPL	Cowpatch Line transect
CTD	Conductivity-Temperature-Depth datalogger
DBO	Distributed Biological Observatory
FRRF	Fast Rate Repetition Fluorometer
HL	Hope Line transect
IABP	International Arctic Buoy Programme
IL	Isilivik Lagoon transect
IKMT	Isaacs-Kidd Midwater Trawl
KL	Kivalina Line transect
NCL	North of Cape Lisburne Transect
NOAA	National Oceanic and Atmospheric Administration
NPRB	North Pacific Research Board
NSF	National Science Foundation
ONR	Office of Naval Research
PMEL	Pacific Marine Environmental Laboratory
PSBT	Plumb Staff Beam Trawl
SKQ	Sikuliaq
SLY	St Lawrence to Yukon River transect
UAF	University of Alaska Fairbanks
UW	University of Washington

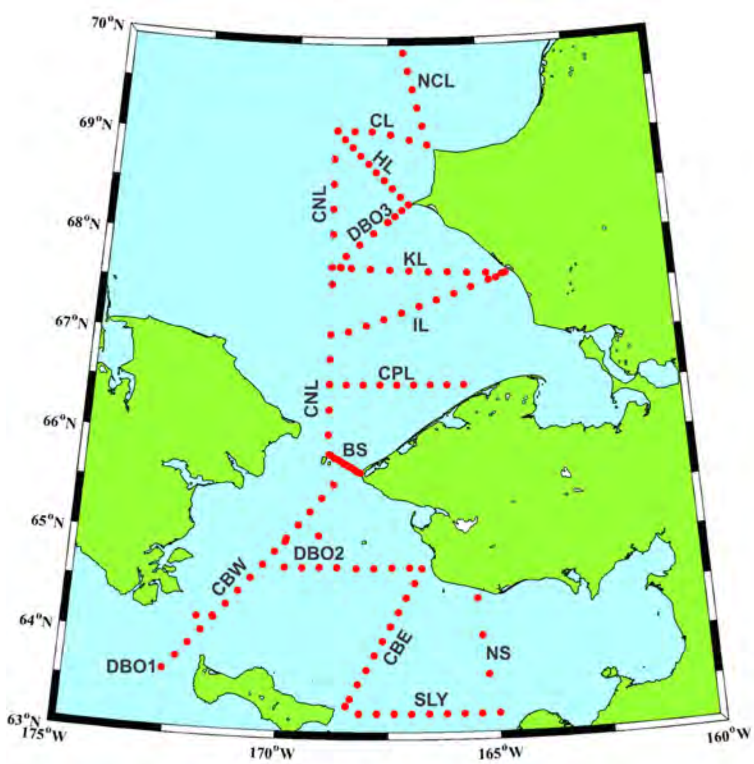
SKQ201709S cruise track and station locations



Vessel trackline colored by day of month over 6-28 June, 2017.



Transect abbreviations and location of sampling stations



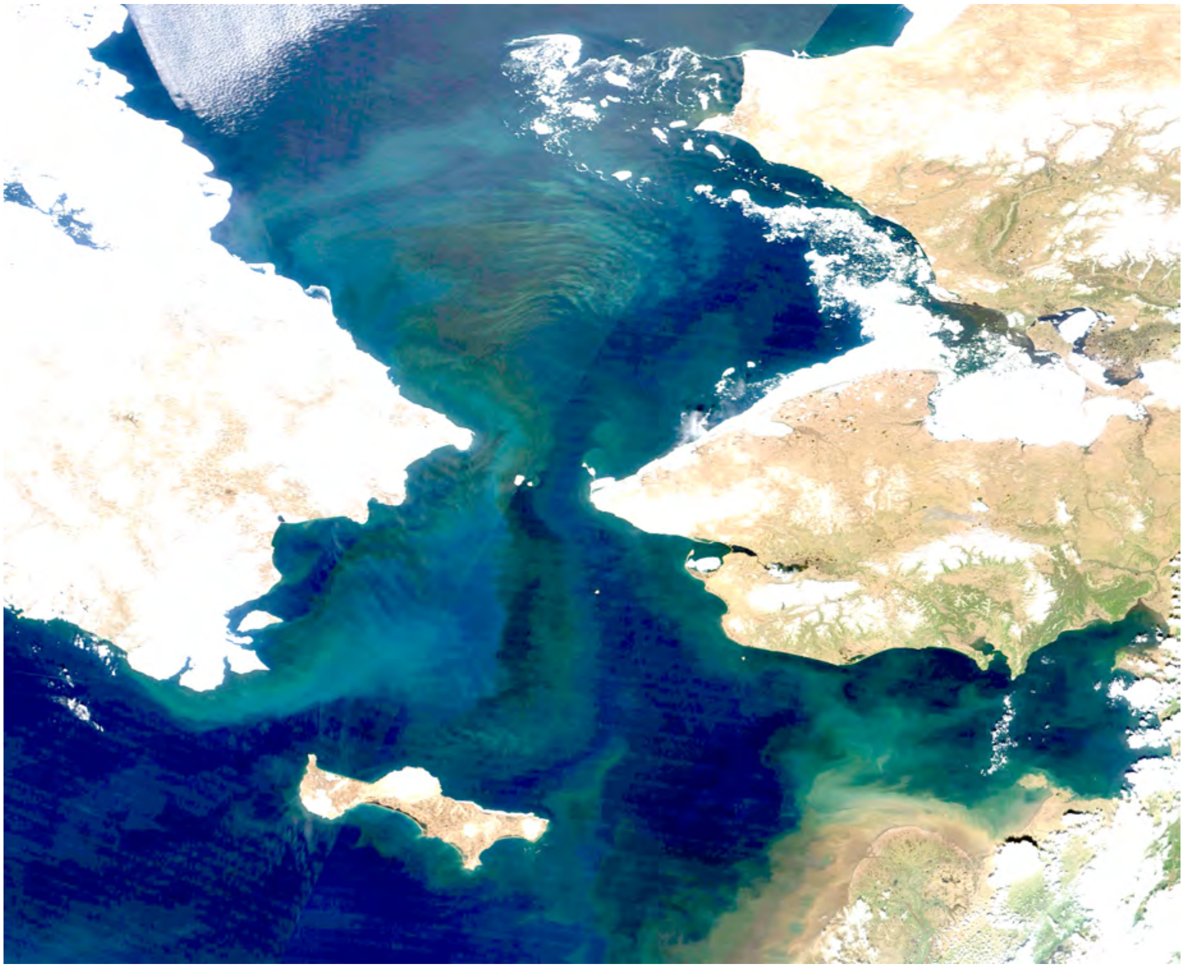
Cruise Narrative

31 May-3 June
A subset of the science party arrived in Dutch Harbor to take advantage of the Bering Sea transit to set up gear and collect a few samples en route to Nome. Scheduled loading day is June 3rd but the barge with two 20' containers of gear had not yet arrived from Seward. Apparently it is in transit and getting close; we ask to have our freight expedited to the ship when it arrives. Captain Piper manages to move the fueling operation from 4 June to 3 June.

4 June
Barge arrived in Dutch Harbor at noon (… *10 days late!* …) tied up right next to Sikuliaq, and began unloading containers. By 2 pm they had begun work on the first of our containers and had a forklift operator ferrying equipment over to Sikuliaq where pallets were sling-loaded aboard and broken down or secured. Two containers (23,000 lbs) were emptied and loaded onto Sikuliaq before 5 pm. We secured cargo and sailed from Dutch Harbor for Nome around 6 pm.

5-7 June
Transit to Nome. Science party began collecting underway samples and testing equipment; took three CTDs during the transit for the Krause/Lomas silicon uptake experiments. The McDonnell particle team worked on the LISST and UVP optics systems. Pete Shipton and I began assembling and programming mooring instruments. Pete worked on releases, frames, ADCPs and T/C sensors and I primarily worked on the AquaMonitor water sampler. Dean Stockwell worked on the FRRF instruments and began underway sampling for algal toxins.

Dean Stockwell cleaning the uncontaminated seawater optical sensor suite. The ISUS for underway nitrate samples is shown strapped to the bench on the left. Prior to our arrival marine technicians Ethan Roth and Steve Roberts had integrated the data stream into the ship's continuous underway sampling suite.



Cloud-free day on 6 June gives excellent view of our study region as we go into the field. Color has been adjusted to highlight ocean coloration features.

8 June 2017

Mobilization day in Nome. Science party moved aboard starting at 08:00, became familiar with the ship layout, unpacked pallets, stowed gear and set up lab spaces. Held an all-hands science party meeting at 15:30, where the captain and department heads introduced themselves and provided an orientation to the Sikuliaq's operating procedures and customs. At 18:30 disciplinary leads for the science team provided a 1-hour overview of the cruise at the "Strait Science" lecture series at the UAF Nome campus, hosted by UAF MAP agent Gay Sheffield. The presentation was attended by students going on the cruise as well as local Nome residents (~35 attendees). A reporter from the Nome Nugget came to take notes for a future human interest article.

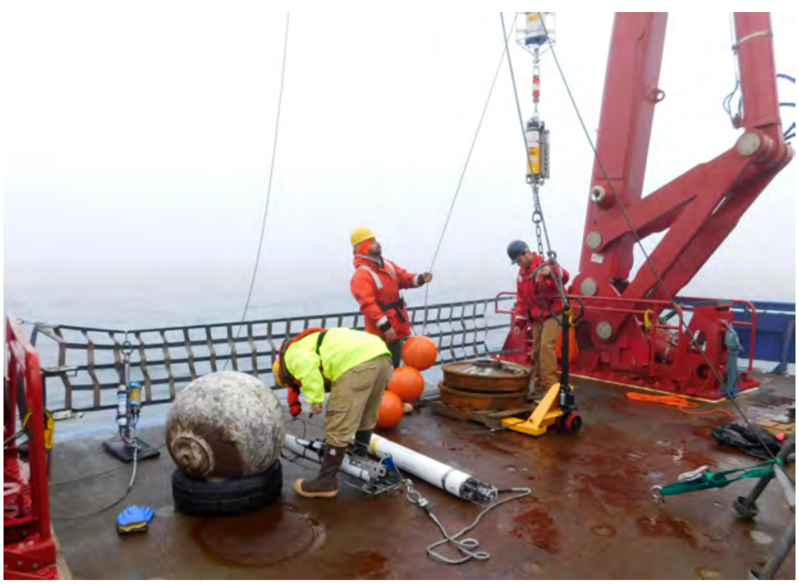
9 June 2017

Departed Nome at 08:00 local time. Continued to unpack science equipment and secure for the transit to the first station. At 09:30 we watched UNOLS safety training and sexual harassment videos, followed by an abandon ship drill, donning of arctic survival suits, basic firefighting training and introductions of the science party to one another.

Began station CBE9 just after lunch. We progressed through each sampling operation with the marine technicians, working out ship interface, procedural and operations issues as they arose.

CTD profile at the first station showed a strongly stratified 2-layer system with temperatures of about -0.4 near the bottom and +7 near the surface. Salinity was about 32.1 at the surface and 33.0 near the bottom. Chlorophyll showed a bottom-intensified phytoplankton bloom with fluorescence readings near zero in surface waters and about 2 mg m^{-3} at the seafloor. We decided to collect two sets of nutrients at the process stations: one set that corresponds to the primary productivity light level incubation depths and one set collected at standard 10-m intervals between the seafloor and the surface. By the end of the cruise this approach should provide at least 10 sets of surface and seafloor nutrient replicates. Three CTD casts were made for water collection for the zooplankton growth experiments. We set the station order so as to first do a bongo net tow as we approach station, second take a full-water CTD profile stopping at standard 10m depth intervals for nutrients and water collection for zooplankton incubation experiments. This was followed by two shallow CTDs only for zooplankton water and then finally the primary productivity cast with water taken at the 100%, 50%, 25%, 10%, 5% and 1% light levels. The Krause/Lomas team were thus afforded plenty of time to draw water despite the lengthy cycle time of their pump and filtration system.

A FastCat CTD was attached to the over-the-stern .322” conducting wire so that the depth of the bongo net could be monitored. Trawls and coring were done from the 9/16” heavy trawl wire. This first plumb staff beam trawl yielded what looked like a decent catch. The multi-core was deployed a few times but the sediment was fairly coarse and a full set of usable cores was not feasible. Talked through the mooring deployment with the bridge and deck crew, then deployed mooring N3: a simple, single-pick anchor-first deployment using a pelican hook for the quick release. Given the setup and somewhat sensitive nature of the sediment traps and water sampler that will go on other moorings, we decided to do all deployments anchor-first on this cruise.



Preparing mooring N1 for deployment

10 June 2017
Station CBE1: Too busy today to write a full recap. Continuing to become accustomed to the ship, each team is beginning to refine their sampling procedures. Deployed mooring N1.

11 June 2017
Station CBW5: In the morning we got word that a skiff with two persons aboard had been missing from Wales since 3:30 AM. We relayed our position to the Coast Guard Search and Rescue team and offered to assist in a search if our help would be useful.

Deployed mooring N2 with the GreenEyes water sampler attached. After finishing CBW5 we decided to occupy an opportunistic set of CTD stations on a West-to-East transect that began near the Convention Line, passed through CBW5, and continued to the east. This line was designed to give the scientists setting up process station experiments time to complete their work prior to starting the next process station. It also would get the productivity station begun near the start of the day so as to take best advantage the daylight hours. After occupying only the first of these stations we got word from the Coast Guard that our offer to help search for the missing skiff was accepted and we changed course for Bering Strait around 5 PM, with an ETA of approximately 5 AM.

12 June 2017
Searching in Bering Strait. We arrived near Wales at approximately 05:00 and began running a search grid pattern with parallel lines spaced 1-2 miles apart. Grid lines were placed so as to cover the main cluster of points that the Coast Guard drift model suggested that a drifting boat or person would reach. The Coast Guard flew complementary patterns closer to shore and across our transects. Over the course of the day we saw one floating dead walrus carcass, a few pieces of foam, one green hat (?) and two small buoys (orange and brown) that were tied together. No sign of the missing skiff or its occupants. After about 12 hours of searching we decided to continue searching through the night (a decision driven in part by input from Opik Ahkinga). We set up a 2-hour watch system to ensure that we would have a minimum of two scientists at all times plus ship's crew looking for the missing people. During much of the day there were usually at least four scientists on the bridge at any given time.

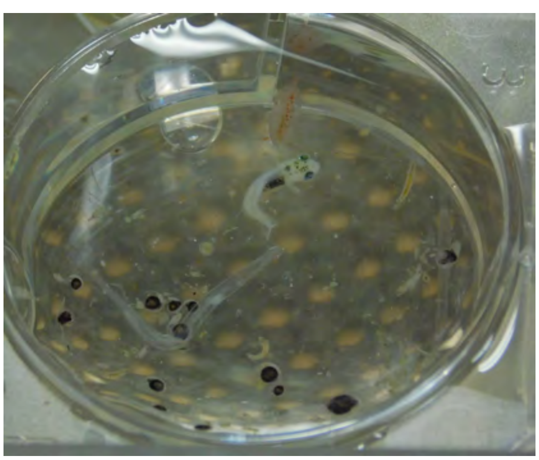
13 June 2017
Report from the bridge: Local SAR team found wreckage of the missing skiff north of Wales on the beach, which was positively identified by the owner. The depths of the Prince of Wales shoals excluded the Sikuliaq from moving in to the crash site and continuing a more local search for bodies. Search was called off at about 2 AM. Before heading north to our

next sampling station, we stopped by Little Diomede so that Opik Ahkinga could chat by cell connection directly with her family.

Station CNL3: Started sampling around 13:00 and finished around 21:00, which was a bit late to finish up because cloud cover reduced PAR levels so much that little was available for photosynthesis. All groups collected all needed samples. Multi-core worked very well in the muddy sediment here and three good deployments were made.

Sorting bottom trawl catch at CNL3

Midwater and bottom trawls yielded productive tows. Upper water column was mostly devoid of phytoplankton but biomass increased toward the seafloor. One interpretation is that the upper water column bloom was settling down toward the bottom and that the high fluorescence near the bottom was due to both this sinking biomass and an ongoing bloom. Light levels were very low close to the bottom. Brendan Smith took some videos of over-the-side operations and the ship using a drone.



14 June 2017

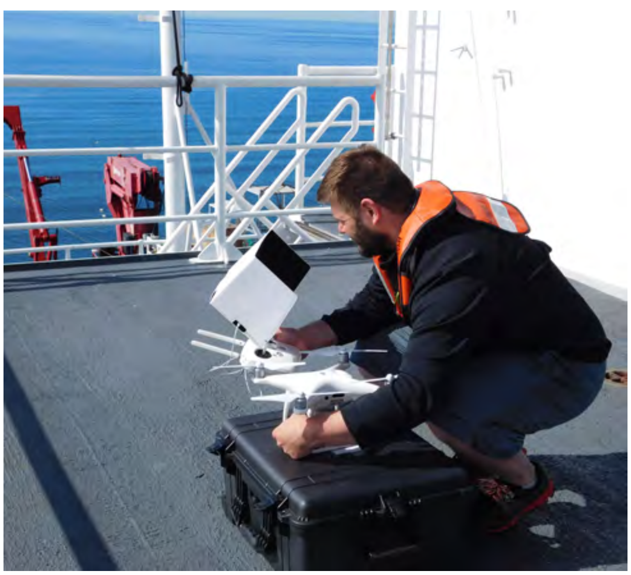
Station IL2: Near-freezing water at the seafloor along with near-bottom chlorophyll maximum. Lots of tiny (1-1.5 cm) cod in the zooplankton net tows. Dean Stockwell says that the FRRF suggests that near-bottom phytoplankton have been active and healthy but the near-surface ones no so much. Deployed mooring N5 in 31 m water depth. The charts were off by about 5 m (soundings shallower than actual depths) so we steamed quite a way between the target deployment location and the actual deployment site. We got back on schedule today, starting the process station at just about 08:00. Despite IL2 being located in coastal waters, we still found a good (surprisingly muddy) seafloor for coring.

We saw a band of ice a few miles from the mooring site so we moved to the edge of it to do a CTD cast and measure the water properties at that site. Bottom temperatures about -1.4C but surface temperatures were at +4C just 100 m from the ice. We did not move into the broken ice because the centerboard was deployed with all acoustic sensors.

To take advantage of a few extra hours after station IL2, overnight we occupied a transect between the inner IL line and DBO 3.8. Marine mammal observations showed some unexpected sightings: many humpback whales (early for them?) but few gray whales. Plus one fin whale. (Note humpback and gray whales eat different foods.) There was also a lot of acoustic backscatter in the water column at all of the EK80 frequencies. The transect saw fully mixed water columns, profiles with no chlorophyll a at all and near the end of the line, profiles with strong chlorophyll a signals at the base of the 10 m surface mixed layer. The latter co-occurred with relatively high levels of nitrate in the surface layer.

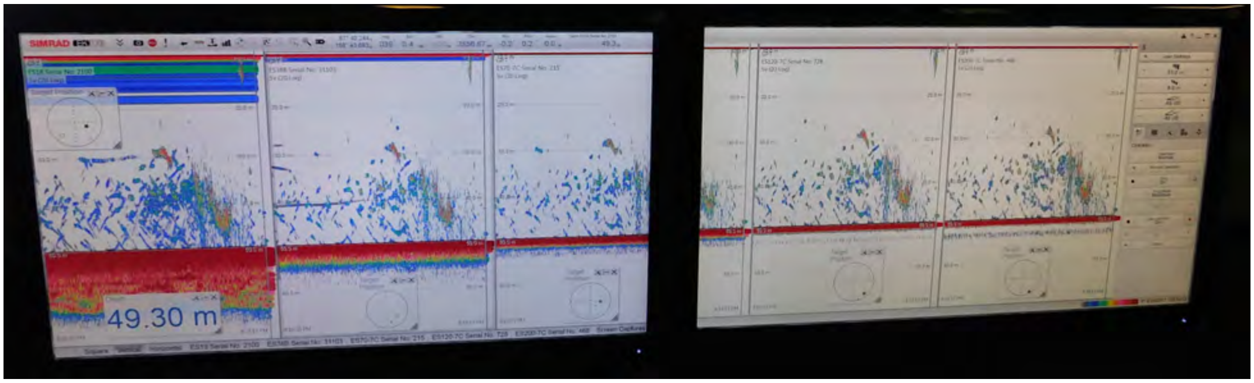
15 June 2017

At station DBO3.8 we saw that the surface nitrate levels had decreased from those found at KL9 so we moved back in the direction of station KL9 until we saw the surface nitrate levels rise again in the through-flow system (about 3 miles east of DBO3.8, which we named DBO3.8A). The rationale was that a primary productivity station on a very sunny day in a spot with high nitrate levels would be extremely beneficial to the aims of the cruise. Near-zero winds, Beaufort 0 sea conditions made for spectacular conditions for flying the drone for off-ship videography and seabird and marine mammal observations.



Brendan Smith preparing the drone for a flight on a sunny, windless day.

Station DBO3.8A: Near surface nitrate between 10 and 15 according to the ISUS on the flow-through system. A modest chlorophyll peak just below a shallow mixed layer and a water column with appreciable levels of chlorophyll all the way to the seafloor. Water temperatures throughout were 2 °C or above: no winter water at all. At this station we added extra core tubes to the multi-core and were able to collect as many as 6 good cores in a single cast. There was considerable acoustic backscatter at all frequencies in the 30-50 meter depth layer. The trawl team found an appreciable number of arctic cod in the midwater trawl. Lots of clams in cores.



Acoustic backscatter on the DBO3 line from the Simrad EK80 instrument

Station DBO3.6: After DBO3.8A we went to DBO3.6 so that the trawl team could do their midwater and seafloor trawls at this station. This will save us some time later in the cruise and allow us to better get a synoptic CTD survey without stopping for trawls. At station DBO3.6 there were some large number of (many dozens?) of gray whales in the vicinity. Windless, flat calm conditions allowed us to often see 3-4 whales breathing at any given time off to the north of the ship. Most whales where well over a mile away; a few briefly ventured closer to the ship. While stopping on station for the CTD cast prior to the trawl, one whale appeared just a couple hundred yards from the vessel and then continued past.

16 June 2017

Some small bits of ice here and there throughout the day. Science operations running quite smoothly; we completed all process station sampling in only seven hours, including a re-do of the bongo net tow.

Scattered ice on the DBO3 line.

DBO 3.3: Back to coastal waters. Lots of tiny (<1.5 cm) cod larvae in zooplankton net tows. Nitrate back to low levels (~2.5) and not a lot of chlorophyll. Waters modestly fresher than offshore – back in the coastal zone. Gravelly seafloor with flocculent layer in cores.

DBO 3.4: Fish trawls at this station completed trawling here on the DBO3 line. CTD found almost no chlorophyll at all.

Evening: CTD line between DBO3.1 and CL3. Nine stations were added to stretch between the two endpoints. Station spacing of approximately 11 km apart.

DBO3.1 and HL2: Fresh water: On transect from DBO3.4 salinity dropped from above 32 to below 29. Sea surface temperatures (< 6) as low as we have seen on the cruise. Winds increased shortly after beginning this line and built during the night. Poor conditions for seabird and marine mammal observations.

17 June 2017
Station CL3: Winds up to 30 kts overnight, blowing 20 during the day. Seas mostly 3-6 feet with occasionally larger sets. Deployed an IABP ice drifter for UW scientist Inatius Rigor. Water column becoming less stratified. Mixed layer depth about 13 m below surface. Salinity 32.5 at surface and 32.7 below MLD. Temperature 6 at surface and 2.4 at bottom. In the mesozooplankton net tows, we found massive number of euphausiid calitopis (young stage after nauplii). Also lots of larval crabs. May help answer the question of where arctic euphausiids come from in this region of the world? Today's cores: missing the flocculent layer at sediment-water interface. Report of 45,000 (!!) baby clams in the bottom trawl.

Following CL3 we moved to CL2 to do IKMT and PSBT trawls along with a CTD for water masses. We then transited north to deploy two satellite-tracked drifters in the southern Central Channel and did a line of CTD back toward Cape Lisburne.

18 June 2017
At 1 AM we deployed two SVP drifters for NOAA-PMEL and one ice drifter for UW-IABP at station NCL5. Ran line to NCL1. Right near NCL1 there was a narrow band of sea ice with about two dozen walrus lounging. A couple lifted their heads to look at us while we were stopped on station to sample but most paid no attention at all. We drove east around the ice and then transited to station CL1 for the day's process station.

At CL1 there were scattering layers at 30 and 40 m depth in the 120 and 200KHz EK80 frequencies. Russ reported many larval cod in the bongo tow at this coastal station. It appears that these small cod are most closely associated with the coastal waters. Multibeam traces suggested that the bottom should have been decent for coring. It turned out that the seafloor is in fact very soft, thick clay and with a fluffy brownish-green layer on the surface. Brendan got another flight in with his drone today and was able to avoid the compass abort problems that he experienced previously. The phytoplankton, zooplankton and benthic teams needed time to finish processing samples from the last processes station prior to shifting from process experiments over to more rapid sampling of the survey transects. With this available time we trawled at CL0, finding primarily shrimp in the

Core tube from CL1

bottom trawl and one sculpin that had big horns on the side of its head. To fill the 6 hours between the last of the fish trawls and the start of the survey transect, we opportunistically outlined a triangle-shaped track for the bird and marine mammal observers to follow offshore from Cape Lisburne.

19 June 2017

Cape Lisburne (CL0-CL3) transit and then south along the convention line at stations CNL12-CNL9. Winds were relatively weak. Today: no coring or fishing, to give the coring team a chance to catch up with their samples and for the rest of us to catch up with the fish team, which has done more trawls than initially planned in the last few days. Teams are still working on process station experiments as we begin this first day of synoptic surveys. Everyone has been working flat-out for the last 10 days, so today feels like a welcome transition back into a more measured pace. Between CNL11 and CNL10 the surface nitrate increased to over 11 uM and the salinity reached 32.8. Water column scatterers disappeared in this water mass. At Station CNL11 the benchtop FRRF indicated higher levels of phytoplankton activity than found previously on the cruise, suggesting a growing and healthy crop.

20 June 2017

For the second time in 5 days we visited station DBO3.8. Last time the chlorophyll maximum was more modest here (~5 mg/m^3) though nearby at station KL9 the peak was very large below the surface mixed layer (~ 10 mg/m^3). This time the fluorescence peak is near the surface (15 ug/l) and D. Stockwell reports FRRF measurements of about 0.5, indicating that the diatoms are actively growing. We decide to run a second primary productivity experiment here. Near-surface nitrate levels are depressed at DBO3.8 (~5 uM) relative to DBO3.7 (~16 uM) and it is very foggy/cloudy, suggesting that the region is just waiting for some sunlight for the bloom to further take off. Filtration mesh on hoses that drain the CTD are clogged with a thick brown algae. We stopped at station DBO3.6 for a set of multi-core deployments. We went in and out of fairly dense fog all day; near the coast the sea temperatures plunged to < 2 °C (ice melt) and surface salinity dipped to below 31.7.

Filters clogged with algae at DBO3.8.

21 June 2017

Winds increased overnight, now blowing 20-30 kts with higher gusts and 4-6' seas. Forecast was for winds to continue to ramp up to 30 kts with 8' seas through Friday night (the 23rd), although by then we should be done in the Chukchi and back into Chirikov Basin where the forecast is only for 20 knots through the week. (In the end it turned out that the wind slowed our progress enough so that we were caught in the strong winds of that Friday night, which showed up as forecast.)

IL (Ipiavik Lagoon) transect from near Kivalina to the southwest. Again, in coastal waters with a fresh ice melt signature we found many very small (< 1cm) cod larvae in the zooplankton net hauls. Surface salinity down to 28; salinity front between IL1 and Il2 very sharp with a salinity difference of 3 from side to side. Cored at station IL4. Took multi-core samples at IL4 and ran a microzooplankton grazing and nitrate uptake experiment here. Benthic and midwater fishing occurred at station IL7.

22 June 2017

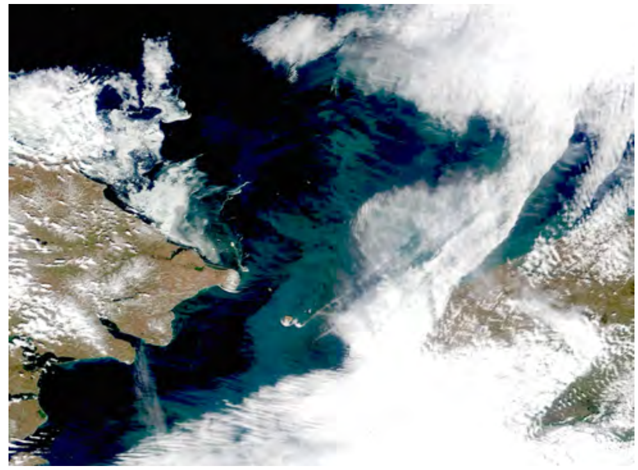
Winds continued to blow in the range of 15-25 and seas have moderated somewhat; forecast was more of the same. Transit between stations was slower than normal yesterday and last night (~ 8-9 kts) but today with the reduced swell and wind on our beam we made over 10 kts.

Strong winds on the CPL transect make a stormy sea.

CPL (Cowpack Lagoon) transect along the north side of the Seward Peninsula. Back into high nitrate water near the convention line and water column profiles with > 5 mg m^{-3} of chlorophyll *a* fluorescence readings. Integrated standing stock from the CTD fluorometer will probably be found to be quite high at some stations… possibly above 250 mg m^2. At station CPL8 a bottom core found some thin mud on top of a sandy bottom and the extracted cores were much shorter than those from the stations north of here. Due to the recent stormy weather, most hydrographic stations showed little if any temperature, salinity and density structure. Up on the shallow shoals that lies east of the 50 m-deep Bering Strait channel, the waters became just slightly fresher (32.8 to 32.2) and cooler (4 to 3 °C) and the strong chlorophyll signal decreased to about 1 mg m^{-3} throughout the unstratified water column; surface nitrate read about 5.5 uM. We did midwater and bottom trawls and a primary productivity experiment at station CPL6, the first station at about 25 m depth. Midwater trawl at CPL6: a few 2-3 cm cod, along with tenophores and neocalanus. At 2 AM (6/23) we finished the CPL transect where bottom depth was 16 m, salinity was down to 30.7. Very large numbers of small jellyfish in the tows. R. Hopcroft said there were so many that sometimes two would fight for the same piece of food and that he had to untangle their tentacles in order to count them (bonus points for going beyond the call of duty, in my opinion).

23 June 2017

Into Bering Strait from the north. Third day in a row with winds above 25 kts. Bouncing along, our transit at times limited to 7-8 kts over ground, but we did not have to seriously consider shutting down our survey operations. As of noon winds were at a consistent 30-35 kts and seas rolling by at a good 9-10 ft. Later in the day we felt wind being funneled past Little Diomede Island with gusts exceeding 50 kts at times.

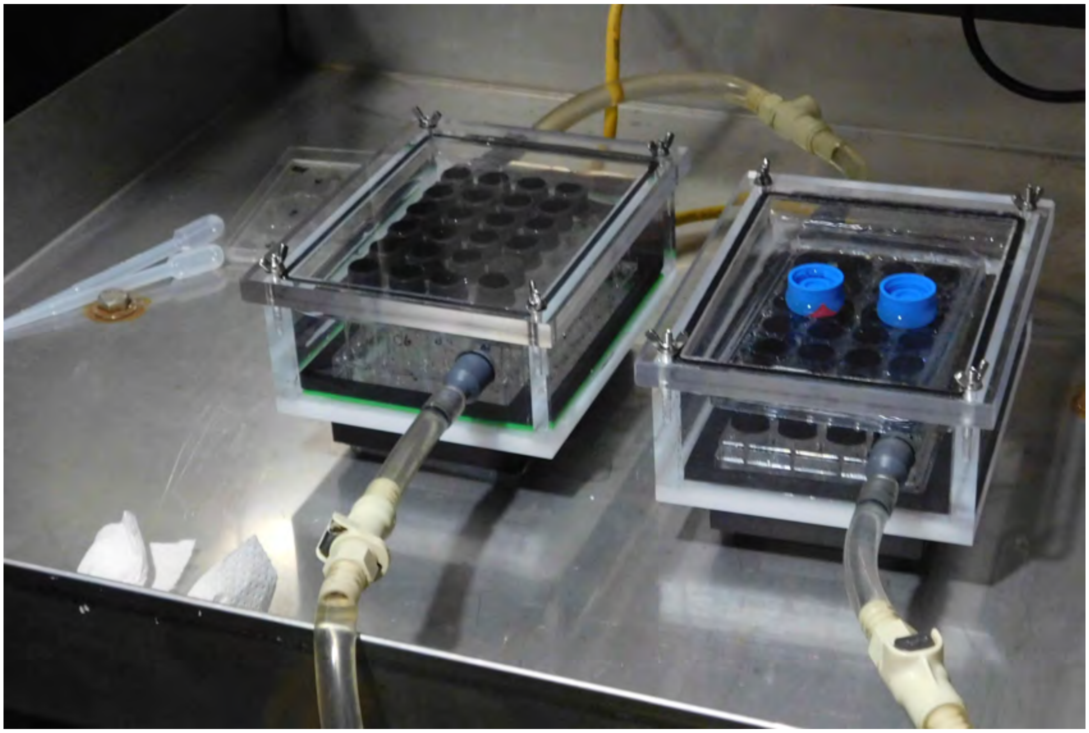
23 June seawater coloration variations in Bering Strait. Satellite image (right) from 22 June has been color-adjusted to accentuate the signal.

Due to the heave of the stern in these big waves and the wind we have ceased our zooplankton net sampling and transitioned to doing CTDs only. Given the improving forecast and a desire to delay our expected operations tomorrow until this wind event has passed through, we added a CTD transect across the US Bering Strait waters from Little Diomede to Wales, stopping midway to trawl for fish (IKMT only; the 2 knot current, heavy seas and strong wind made us decide to not try the PSBT sampling). The CTD transect was comprised of 12 stations spaced 2 miles apart each. Executed a CTD at station BS13 with winds of 40-50 kts. The swell was down relative to the stations 30 miles north.

We were able to make good time on the transect, with station-to-station times of only about 35 minutes and transit speeds of 7 kts. Currents are about 1.8 knots mid-channel and up to 3 knots at the station closest to Nome. Lots of cholorophyll in the water still. Is this all resuspended material from the bottom? Would this material have a chance to re-seed a bloom once the winds calm and the water column re-stratifies? It appears that there is plenty of light for production over ¾ of most water columns. On the transect south from CNL2 to CNL1 we observed from the bridge patches of differently colored waters. Their locations coincided with fluctuations in the underway chlorophyll and nitrate sensors. Similar features are also seen in a MODIS satellite image from Day 172. The closest station to shore, BS3, showed salinity stratification and surface salinity fell below 30. Took nutrients and chlorophylls here for the Alaskan Coastal Water end-member.

24 June 2017

Back in the Bering Sea. Begin the day running stations along the US-Russia Convention Line, down to 65 N, where we occupied two stations that are part of the international Distributed Biological Observatory (DBO2.4 and DBO2.5). Winds slowly diminished through the day, down to about 20-25 kts in mid-morning and to 10 kts by 6 pm. We trawled, did a CTD cast and zooplankton nets at DBO2.5 and then moved to DBO2.4 to complete the previously missed process station work. With so little time left in the cruise we were unable to set up an egg production experiment but most other process station activities were undertaken. The primary productivity cast happened later in the day than most others but still close to solar noon (mid-afternoon). Water column at all stations was fully destratified. Multi-core deployments 33-36 for the cruise were done here at DBO2.4. Deployed mooring N4 at about 8 pm under sunny skies and light winds. After the mooring we continued sampling down the CBW line into Anadyr Strait and toward western St. Lawrence Island.



Zooplankton respiration incubations

25 June 2017

Moving SW along the Convention Line toward western St. Lawrence Island and Anadyr Strait. We add an additional CTD cast located 100 m away from mooring N2 in order to take calibration nutrient and chlorophyll samples for the optical sensors. At the end of the line, station DBO1-10, a persistent swell from the south and a somewhat sandy seafloor made for multiple failed multi-core deployments so our attempt to collect bottom material at DBO1.10 was unsuccessful. Trawls came up with crabs and shrimp both bearing eggs but comparatively little biomass overall. We crossed a thermal and haline front between CBW7 and DBO1.10, which apparently separates the cold, high-nutrient waters of western Anadyr Strait from the warmer, low-salinity waters of the central Bering shelf. The front shows up clearly in the NOAA-NESDIS 5-km blended SST analysis for June 24. CTD required retermination after the DBO1.10 cast, a fortuitous location for that to occur as we were immediately heading into an 9-hour transit back to the central Chirikov Basin.

26 June 2017

Back to DBO2 region, with 3 stations for trawls and coring today. At station DBO2.1 a pin on the multi-core unit that had become obviously fragile recently broke before the first drop, rendering the multi-core inoperable. We switched to the Haps core to make 8 drops (6 successful, two water hauls) for mud that Ann Zinkann will take back to UAF for microbial analyses. The deck crew and marine technicians worked on the broken multi-core and had it functional again before it was needed at station DBO2.2. All three trawls came up with large biomass tows and exhibited an impressive variety of shrimp, fish, bryozoans, sea peaches, and other critters. We transitioned from nutrient-rich to nutrient-poor surface waters between DBO2.1 and DBO2.3, and the chlorophyll and stratification profiles appeared to tell a consistent story, with weak stratification/high nitrate to the west, higher stratification, suggestions of an older bloom, and low nutrients in the east. Between the two, we found abundant nutrients and an apparently healthy and growing fluorescence peak. A sample of the water from the phytoplankton incubation tank sent the FlowCam into overdrive, finding hundreds of thousands of plankton to image. Forecast looks decent for the last two days of the cruise and timing is such that we may be able to wrap up with a "bonus" transect from St Lawrence Island eastward over to the mouth of the Yukon River.

Trawls from DBO2.1 (left) and DBO2.2 (right).

27 June 2017

Finished the E-W DBO-2 line and then started a CTD and zooplankton net tow transect between the mainland and Northeast Cape on St Lawrence Island. Coastal waters were found in the stations closest to shore, with maximum temperatures reaching nearly 10C and salinity as low as about 30. The seafloor core and trawl teams started cleaning and packing up their equipment today; their sampling is finished. There are still zooplankton incubations and primary productivity experiments running. We are planning to run the transect to St Lawrence Island then turn east and sample from the island over to the mouth of the Yukon River. Given the ship speed, operations time, and the present good weather, it looks like we will be able to complete both of these transects and make it back to Nome by 18:00 tomorrow night.

28 June 2017

Transect from St. Lawrence Island to the mouth of the Yukon River, then three stations across Norton Sound and back to Nome. Managed a CTD profile in 16 m of water, where the salinity dipped to below 25 and surface temperature rose above 11. Water was noticeably turbid and CDOM and turbidity signals both climbed to high values as we approached the station closest to the Yukon. At the most coastal station the water was too silty for a good zooplankton tow, but net tows, cholorphylls and nutrients were collected at all stations crossing the Sound back to Nome Science crew is busy packing gear in anticipation of offload.

Disciplinary Summaries

PHYSICS AND NUTRIENTS -

We conducted 172 CTD casts over the course of the cruise at ~130 distinct stations. At each "process" station we typically conducted four casts: one full water column cast for the sensor profile, nutrients at standard 10-m depth intervals, and 18-19 bottles tripped at one depth to collect water for the zooplankton cohorts incubations. Two additional casts were made in rapid succession to the same water collection depth in order to provide more than 720 liters to the Hopcroft team for incubation experiments. A fourth and final cast was made to just above the seafloor and bottles were tripped at the 100%, 50%, 25%, 10%, 5% and 1% light levels for the primary productivity incubations and microzooplankton grazing experiments. Discrete nutrient samples were also taken at each PP light depth level. All CTD casts were made to within 5 m of the bottom. In good weather the CTD was lowered to within 3-5 m of the seafloor. The rosette was held stationary for at least 30 seconds prior to bottle trips.

Surface meteorological data were plotted in real time on the ship's underway strip chart display and we include maps of some of the underway parameters in Appendix A. We installed on the ship's uncontaminated flow-through seawater system (6m depth intake) a Satlantic ISUS instrument supplied by Lisa Eisner. This sensor's nitrate data proved to be a useful addition to the real-time data system. We applied a basic set of data thresholds to all meteorological, seachest sensor and ADCP data streams and plotted time-averaged series and spatial distributions on maps. CTD data were given an order-1 processing on board and vertical profiles and hydrographic cross-sections for each transect were compiled and stored on the ships public share directory for all cruise participants to access (see plots below in Appendix C).

We collected approximately 630 discrete nutrient samples, including a handful from the underway flow-through system, although given the well-mixed surface layer it will be the regular CTD 0 m and 10 m depth nutrient and chlorophyll samples that will provide the best samples for calibrating the underway sensors.

For data plots of the underway data and hydrographic transects, see Appendices A, B and C.

MOORINGS

On June 5th, four 300 kHz ADCPs (sns 1075, 3329, 16114, and 11043) were programmed with ASGARD_300KHz_45mplan.txt and two 300 kHz ADCPs (sns 3382 and 3302) were programmed with ASGARD_300KHz_25mplan.txt. The start date for all six ADCPs was set for 00:00:00 on June 9th, 2017 (UTC). The 7 SBE37s (sns 0252, 0455, 0709, 0454, 3389, 4600, and 10649) were set with converted engineering data format (format=1), sampling every 900 seconds and set to start at 00:00:00 on June 9th, 2017 (UTC). The viny frame for N3 and the water sampler frame for N2 were also assembled and instruments mounted.

While the ship was transiting from Unalaska to Nome, the mooring diagrams were completed; line was spliced for N1 and N2, and N1's 2 CART releases were batteried, cleaned and inspected. While in Nome, the swivels that were shipped to Gay Sheffield at UAF in Nome from Seward were picked up; N3, N1, and N2's swivels were prepped for each of their moorings. The 2 Hydrobios sediment traps also arrived in Nome via Alaska Air Cargo on June 8th. Seth Danielson and I discussed the sampling schemes for the 16plus's. It was determined that all sampling at 2 hour intervals (7200 seconds) would be better than some sampling at 1 hour intervals and those with more power intense auxiliary sensors sampling at 2 hour intervals. All instruments were set to output salinity, to have a converted engineering data format (format=3), and to have the pumps run for 5 seconds before sampling.

On June 8th (local date) SBE16plus sn 4973 (N3) was set to start sampling at 02:00 on June 9th, 2017. The pump was disconnected to avoid running while dry, and the fluorometer (FLNTUS-516) was seen taking its first sample. At 0800 local time (16:00 UTC) on June 9th, the Sikuliaq departed Nome. 4973's pump was plugged in a little after 18:00 (UTC) after having seen FLNTUS-516 flash. The mooring N3-17 was deployed at 18:55 UTC on June 9th in 29 meters of water at 64° 23.37' N, 167° 05.16' W.

On June 9th (local date), while transiting to the N3 mooring site, SBE16plus sn 7051 (N1) was setup, the pump was unplugged, and was set to start at 00:00:00 on June 10th, 2017. After deploying N3, SBE16plus sn 7051 was mounted into a 16/19 cage and the ADCP sn 1075 was also mounted into a short ADCP frame. SBE37-SM sn 0252 was hose clamped, tied and zip-tied to the center of the dual CART releases. The N1 shackles and links were lined out. At around 07:50 on June 10th (UTC), SBE16plus sn 7051 had its pump cable plugged in. At 08:00, the pump was heard turning on. After the pump had stopped pumping it was again unplugged to prevent it from running more before deployment. The pump was plugged in about 12 hours later while on deck and N1 was deployed at 20:19 UTC June 10th in 42 meters of water at 63° 17.7905' N, 168° 25.6792 W.

After deploying N1, SBE16plus sn 4639 (N2) was set up, pump unplugged and set to start at 00:00:00 on June 11th, 2017. At 22:00 June 10th local time, the fluorometer was seen flashing; indicating that it had begun sampling as expected. Also on June 10th, N2's lines were completed and ADCP sn 3329 and SBE37-SM sn 3389 were mounted to the 32" ADCP buoy. At about 19:00 UTC on June 11th, setup began on the back deck for N2. The pump was reconnected to SBE16plus sn 4639, and it was installed in the top 35" ADCP buoy. The biowiper on SUNA 840 was seen moving on deck prior to the deployment. N2 was deployed at 20:07 UTC on June 11th, 2017 in 46 meters of water at 64° 09.2704' N, 171° 31.5576' W.

During the afternoon of June 11th, after N2 was deployed, the bridles for sediment trap (sn 119 05 17) were completed and N4's 16plus (sn 4787) was setup and set to start at 04:00:00 UTC on June 12th, 2017. Both PORTs (sn 36425 and 36427) were also batteried, greased, and tested. Because the Sikuliaq had transited so far north for the search and rescue operation, N4's deployment was postponed and N5 was to be the next mooring.

N5’s 16plus (sn 4956) was setup and set to start at 02:00 UTC on June 13th, 2017. N5’s SUNA (sn 843) was calibrated with DI water and then the nitrate standard at 03:53 UTC on June 13th and setup for hourly sampling one the batter was connected. The frame was assembled with its ADCP (sn 3302), 16plus and SUNA. The remaining 3 swivels were also setup with the appropriate links and shackles for the three remaining moorings. The PAR sensor was mounted to the N5 frame and all cabling was secured. Bridles were started for N6’s sediment trap (sn 118 05 17). At 06:00:00 UTC on June 14th the N4 16plus and the ADCP were seen/heard sampling. At 22:11 UTC on June 14th, N5 was deployed in 31 meters of water at 67° 33.4570’ N, 161° 40.740’ W.

During the afternoon of June 14th N6 was prepped and assembled. N6’s 16plus (sn 6049) was set to start at 00:00:00 UTC on June 15, 2017. The fluorometer was seen flashing at midnight UTC, confirming it started sampling when scheduled. It was then installed in its 16/19 frame. The sediment trap (sn 118 05 17) was seen to leak formalin; all bottles were checked and hand tightened and all fill caps were synched down with a flathead screw driver. SBE37 (sn 0455) was zip-tied and tied with 1/16 inch spectra to the sediment trap’s frame. N6’s ADCP (sn 11043) was mounted on the long ADCP frame. SBE37 (sn 10649) had its rope clamps drilled to 1/2 inch diameter and was clamped to the ADCP frame. The mooring (N6) was setup on deck and deployed at 00:48 UTC on June 16th, 2017 in 50 meters of water at 67° 40.2446’ N, 168° 44.7437’ W.

The N4 mooring was rescheduled to be deployed after a process station, most likely to occur on June 24th or 25th. On the afternoon of June 23rd, 2017 N4’s ADCP (sn 16114) was mounted in an ADCP buoy and SBE37 (sn 4600) was clamped to a titanium “arm” and attached to the ADCP buoy. At 04:00:00 UTC on June 24th N4’s 16plus (sn 4787)’s flourometer was seen flashing, confirming that it was sampling. In the afternoon on June 24th, the 16plus had its pump plugged in and was mounted in the top ADCP buoy. All components were assembled on deck. N4 was deployed at 04:38 UTC on June 25th, 2017 in 49 meters of water at 64° 55.7017’ N, 169° 55.0900’ W.

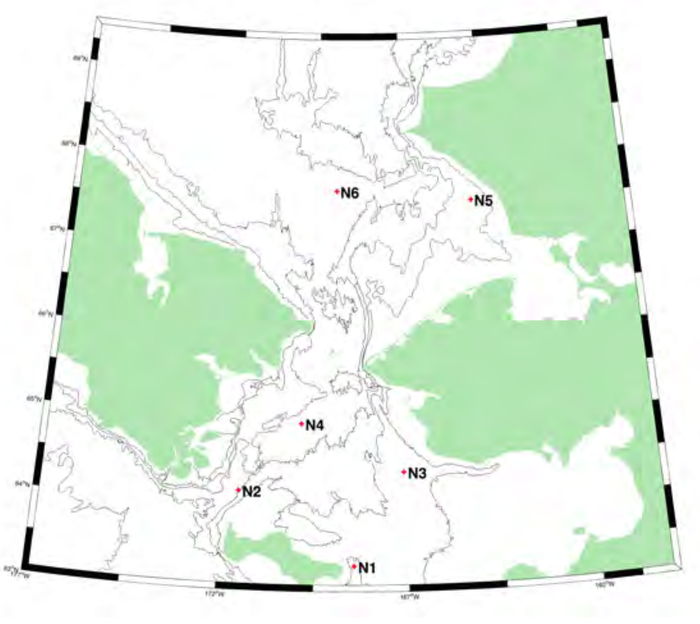


Figure Mo1: *Location of moorings*

Mooring Deployment coordinates:

Mooring	Depth	LAT	LON	Deployment Time (UTC)	Deployment Date (UTC)
N1	42	63° 17.7905'	168° 25.6792'	20:19	2017 June 10
N2	46	64° 09.2704'	171° 31.5576'	20:07	2017 June 11
N3	29	64° 23.37'	167° 05.16'	18:55	2017 June 9
N4	49	64° 55.7017'	169° 55.0900'	4:38	2017 June 25
N5	31	67° 33.4570'	164° 40.7400'	22:11	2017 June 14
N6	50	67° 40.2446'	168° 44.7437'	0:48	2017 June 15

Mooring Configuration:

Mooring	16plus	Flourometer	PAR	SBE37	300kHz ADCP	AURAL	Water Sampler	Sediment Trap	SUNA	Release
N1	7051	WS3S-615P		0252(47m)	1075	267				CART 32538
										CART 35390
N2	4639	AFL-023	SPQA 2777	0709(35m)	3329	269	3006		840	8242 30593
				3389(45m)						
N3	4973	FLNTUS-516			3382					8242 31401
N4	4787	AFL-034		0454(35m)	16114	270		1190517		PORT 36425
				4600(45m)						PORT 36427
N5	4956	AFL-024	SPQA 3059		3302				843	8242 31397
N6	6049	FLNTUS-1036		0455(35m)	11043			1180517		PORT 53341
				10649(45m)						PORT 53381

PHYTOPLANKTON -

(Stockwell) During SKQ2017S09S, more than 700 filters were collected for chlorophyll analysis. These include samples for total chlorophyll, size fractionated chlorophyll and underway chlorophyll. An additional 25 filters were collected for phycoerythrin and phycocyanin pigment analysis. Throughout the cruise, water column primary productivity measures were made at 18 stations and 3 mud production estimates were made at 3 sites. During these production stations approximately 100 samples were collected for particulate organic carbon (POC). In addition, more than 200 discrete estimates of fast repetition rate fluorometry were made at both production and survey sites.

Samples were also collected for harmful algal toxins utilizing the underway sea water system. Before an assessment of conditions can be made these sample need to be processed and analyzed back in Fairbanks.

Bloom conditions were evident north of the Bering Straits and nitrate concentrations taken from underway instrumentation were high through out the northern regions of the cruise.

(Eisner) Samples for size fractionated primary production were collected at 14 stations at 3-6 depths in the north Bering and Chukchi seas to estimate the production for small (<5 μm) and large (>5 μm) size fractions. These samples were collected at stations and depths where total (whole water) primary production, silica uptake, and microzooplankton grazing experiments were performed. Stable isotopes for carbon, nitrate and ammonium were added to measure uptake at 3-6 light levels (100-1.5% surface irradiance). Water samples were incubated in on-deck incubators cooled with surface seawater for 6 hours, filtered and filters stored frozen until analysis at Bigelow Laboratory for Ocean Sciences. Fatty acid samples were collected at ~ 24 stations for large zooplankton and seston (particles < 200 μm (microzooplankton, phytoplankton and detritus).

Samples for zooplankton were kindly provided by Russ Hopcroft lab (vertical net tows) and by the Norcross lab (IKMT). Individual zooplankton and seston (filtered onto GFC filters) were stored frozen for later analysis of fatty acids and total lipids. This data will be used to determine what types of fatty acids (e.g. markers for different phytoplankton) are found in different water masses and if and where these fatty acids move up the food web to different zooplankton species and larval fish (samples collected in the IKMT). Numerous scientists assisted with collection of zooplankton (e.g., Russ Hopcroft, Caitlin Smoot, Lorena Edenfeld, Kate Stafford), and their help is much appreciated!

PARTICLES -

Optical Instruments

Underwater Vision Profiler 5 (UVP5) was deployed with the CTD rosette at every process station and nearly every survey station for a total of 155 casts. Images of particles were successfully acquired, though recurring issues with processing of images in custom software has prevented from processing data and viewing profiles of particle concentrations like normal. The UVP5 was taken off the CTD during the CBE transect in the second to last day of the cruise due to the necessity to troubleshoot some recurring issues. Prior to that, data were successfully acquired.

Laser In Situ Scattering Transmissometer (LISST) was deployed successfully at every survey and process station. Data will be processed when back on shore. The LISST counts particles ranging in size from 2.5 to 500 μm. Particle abundance based on size-bins is produced.

Direct Particle Collection

Direct collections of particles included two sediment traps deployed with moorings, and collection and filtration of seawater. One sediment trap was deployed in the Chukchi Sea at 67˚40.2446 N, 168˚44.7437 W. The second was deployed in the Bering Sea at 64˚55.7017 N, 169˚55.0900 W. Each trap has 24 bottles containing a formalin brine to preserve captured particles. Sediment traps are programmed to rotate their bottles every seven to forty days until June 2018 when the traps will be recovered on the next ASGARD cruise. The bottles are programmed to be open for shorter time intervals during the more productive summer months and for longer time intervals during the less productive winter months. Seawater was also collected from the CTD rosette at two to three depths at each process station and most process stations, totaling in about 650 samples. These filtered samples will be analyzed for particulate mass, total carbon, nitrogen, silicon, calcium, and aluminum in collaboration with the Lalande lab.

Microbe Sampling
Seawater was collected and filtered through various filter sizes (20, 3, and 0.2 μm) to collect microbes, including phytoplankton and bacteria. Eight to ten liters of water was collected from three depths at each of the ten process stations and filtered through an in-line filtration stack of 20, 3, and 0.2 μm filters. At nearly all the survey stations one to two liters of seawater from two to three depths was filtered through a single 0.2 μm filter. Sampling depths included surface and bottom water, and, if present, chlorophyll max, pycnocline, and thermocline. Samples will have their genetic material extracted later in the lab and sequenced. DNA samples will be processed on the Illumina MiSeq platform in the DNA core lab facility at University of Alaska Fairbanks. Resulting sequences will be analyzed for microbe species and gene functions using 16S and 18S ribosomal RNA (rRNA) and metagenome analysis.

MICROZOOPLANKTON -

The highly productive and economically important Walleye Pollock commercial fishery of the Bering Sea depends on poorly understood food web pathways. Primary producers of organic carbon, notably diatoms, are consumed by large crustacean zooplankton, which, in turn, are consumed by juvenile Pollock. However, there is no consensus on the mechanistic relationship of how diatom carbon from the lower trophic levels flows to fisheries, thus there remains a nearly two-order-of-magnitude uncertainty when using simple biomass predictive models. A major knowledge gap exists in the understanding of the magnitude of diatom loss processes specifically that associated with microzooplankton. The pertinent pathways for constraining the movement of diatom particulate organic matter to higher trophic levels in the euphotic zone include: 1) mortality by microzooplankton, 2) loss from the ecosystem primarily through particle export and lateral advection (e.g. off the shelf) and 3) internal recycling (i.e. remineralization, which is not mutually exclusive from microzooplankton mortality[1]). A surprise finding in the BEST program was that microzooplankton grazing losses, even in the spring bloom dominated by diatoms, were ~50% of primary production; this additional trophic link can markedly reduce the flow of carbon to higher trophic levels. Thus constraining the microzooplankton term appears essential for understanding trophic level connections. By understanding bottom-up controls affecting the total production of diatom organic-matter and ecological interactions

[1] Krause et al. 2010.

[2] Sherr EB, Sherr BF, Ross C. Microzooplankton grazing impact in the Bering Sea during spring sea ice conditions. Deep Sea Research II. 2013; 94:57-67. Stoecker DK, Weigel A, Goes JI. Microzooplankton grazing in the Eastern Bering Sea in summer. Deep Sea Research II. 2014;

between the lowest trophic levels, we can quantify the maximum amount of produced diatom organic matter which is potentially available for efficient trophic transfer to LCZ.

Microzooplankton grazing: For the estimation of microzooplankton grazing rates (1) and biomass (2) we will use the methods previously used in the Bering Sea[2]. Briefly, to estimate microzooplankton grazing rates we will use a dilution technique that reduces the encounter rate between phytoplankton and their predators. As a result both the microzooplankton grazing rate and the physiological maximum growth for phytoplankton can be calculated. Microzooplankton biomass will be estimated from samples settled in a Utermohl's chamber, where individual cells will be sized and biovolume calculated using appropriate geometric shapes and converted to carbon biomass using standard carbon density conversions. For both measurements we will collect samples using Niskin bottles and will focus on two depths, near surface and the deep chlorophyll maximum (or at the base of the euphotic zone if a distinct deep chlorophyll maximum is not present). For grazing rates, samples will be diluted and incubated on deck in a flowing seawater incubator for 24hours. Samples for biomass estimates will be preserved for analysis back in a shoreside laboratory. For both measurements we will target stations where we are measuring primary production and collecting the broad suite of phytoplankton taxonomic data so as to provide as robust a dataset, within the context of the larger project, as possible.

Diatom Biomass and Productivity:
Diatoms have an obligate requirement for silicon, which they use to build their ornate shells. These phytoplankton actively take up Silicon immediately before cell division, therefore tracing the uptake of silicon in a field environment dominated by diatoms (e.g. Bering and Chukchi Seas) provides an independent and more direct metric of their productivity compared to size-fractionation productivity assumptions (i.e. all larger cells are diatoms) in C and N uptake experiments. During the transit between Dutch Harbor and Nome, and the main ASGARD cruise, silicon-32 radioisotope tracer was used by the Krause/Lomas group in the isotope van at depths aligning with the microzooplankton grazing experiments. Silicon-32 samples were run in triplicate, incubated for ~24 hours on deck at the approximate relative irradiance as the depth of collection (e.g. 50%, 5%, 1% of surface irradiance). Samples will be transported back to the Dauphin Island Sea Lab and the radioisotope aged into secular equilibrium (120 days) with its short-lived daughter isotope, phosphorus-32, prior to quantification of the activity by gas-flow proportional counting. All open radioisotope was confined to the radioisotope van and transport of the isotope in sealed bottles was limited to transit between the van and the back-deck

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[2] Sherr EB, Sherr BF, Ross C. Microzooplankton grazing impact in the Bering Sea during spring sea ice conditions. Deep Sea Research II. 2013; 94:57-67. Stoecker DK, Weigel A, Goes JI. Microzooplankton grazing in the Eastern Bering Sea in summer. Deep Sea Research II. 2014; 109:145-156. Stoecker DK, Weigel AC, Stockwell DA, Lomas MW. Microzooplankton: Abundance, biomass and contribution to chlorophyll in the Eastern Bering Sea in summer. Deep Sea Research II. 2014; 109:134-144.

incubator. ASGARD program nutrients, specifically the silicic acid values, will be critical to contextualize the isotope data. We also filtered for particulate biogenic silica (also in triplicate) at the same depth, which will enable normalization of uptake rates to the silica standing stock to estimate specific rates (proxy for growth rate).

Pico-/Nanoplankton Community dynamics: We are collecting samples for flow cytometric determination of pico- and nanoplankton abundances in the Northern Bering Sea and the Southern Chukchi Sea. This newly collected data will integrate with data that Lomas collected as part of the BEST program in 2008-2010, and will help build a seasonal and multiyear baseline of pico- and nanoplankton dynamics in this region[3]. These samples will be collected on the Arctic IES cruises in summer/fall 2017 and 2019 and again on the ASGARD 2018 cruise. The resulting dataset will span from the Aleutian Arc to the Beaufort Sea. Other regions in the Canadian Arctic have shown that as waters warm and become more stratified; larger diatoms are replaced by replaced by these smaller phytoplankton with no apparent change in chlorophyll[4]. The impact on phytoplankton carbon is not known at this point, particularly if this group of small plankton (the grazing upon which is selectively being measured as part of this project) increases in importance and is channeled through microzooplankton.

Particulate Organic Phosphorus:
We are collecting samples for sestonic particulate organic phosphorus (POP), which when combined with the sestonic particulate carbon and nitrogen derived from the production incubations, will provide a broad dataset on the elemental stoichiometry of the lower trophic levels in this region. A recent global compilation of sestonic elemental macronutrient ratios shows clear global trends in sestonic C:P and N:P ratios[5]. These ratios suggest values below the Redfield Ratio, however there are relatively few data from Arctic regions.

FlowCAM:
Flow cytometers are routinely used for quantifying the oceans most numerous cells (e.g. pico- and nano-plankton). However, because the flow cytometer typically requires abundances on the order of 103 – 105 per mL and are optimized for particles <20 μm, FlowCAM fills the gap using an imaging-in-flow approach and can visualize cells ranging from 5 – 2000 μm depending on the instrument configuration. One of the benefits to a FlowCAM, vs. typical cytometers, is the detection of larger and more rare particles while archiving its image and particle characteristics. During ASGARD, we used the FlowCAM with a 200 μm flow cell (minimum linear dimension) to visualize larger phytoplankton groups including diatoms, dinoflagellates, cyanobacteria and prymnesiophytes. Additionally, FlowCAM may quantify heterotrophic plankton, allowing for detection of

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[3] See also earlier data by Liu, H. B., K. Suzukil, C. Minami, T. Saino, and M. Watanabe. 2002. Picoplankton community structure in the subarctic Pacific Ocean and the Bering Sea during summer 1999. Mar. Ecol.-Prog. Ser. 237: 1-14.

[4] Li, W. K. W., F. Mclaughlin, C. Lovejoy, and E. Carmack. 2009. Smallest algae thrive as the Arctic Ocean freshens. Science 326: 539.

[5] Martiny, A.C., Pham, C.T.A., Primeau, F., Vrugt, J.A., Moore, J., Levin, S.A., Lomas, M.W., 2013. Strong latitudinal patterns in the elemental ratios of marine plankton and organic matter. Nature Geoscience 6, 279-283.

heterotrophic dinoflagellates, ciliates and tintinnids. FlowCAM samples were analyzed at all microzooplankton experimental depths in three different instrument modes: auto image, and laser trigger mode where particles are detected by either fluorescence or scatter. Additional samples were run at selected depths and stations sampled by Lisa Eisner and Dean Stockwell. When using the 200 µm flow cell, 10 mL of volume took ~30 minutes to image.

Samples Collected:
The stations where we have conducted microzooplankton grazing experiments and collected samples are summarized in the following table.

Station/ Sample	MZP grazing	Phytoplankton growth rate	Silica Uptake	Biogenic Silica	POP	Pico/Nano-plankton	FlowCAM
SKQ201708T-CTD 1	X	X	X	X	X	X	X
SKQ201708T-CTD 2	X	X	X	X	X	X	X
SKQ201708T-CTD 3	X	X	X	X	X	X	X
SKQ201709S-CBE-9	X	X	X	X	X	X	X
SKQ201709S-CBE-1			X	X	X	X	X
SKQ201709S-CBW-5	X	X	X	X	X	X	X
SKQ201709S-CNL-3	X	X	X	X	X	X	X
SKQ201709S-IL2			X	X	X	X	X
SKQ201709S-DBO-3.8A	X	X	X	X	X	X	X
SKQ201709S-CNL-7			X	X	X	X	X
SKQ201709S-DBO-3.3	X	X	X	X	X	X	X
SKQ201709S-CL-3	X	X	X	X	X	X	X
SKQ201709S-CL-1	X	X	X	X	X	X	X
SKQ201709S-CL-2					X	X	
SKQ201709S-DBO-3.8bloom	X	X	X	X	X	X	X

Results and Commentary:
Of the experiments conducted, generally we are observing the experimental outcome that we expect. The small size fraction (<5um) of chlorophyll is consistently tightly controlled

by ciliate and dinoflagellate grazing. The larger diatom fraction sometimes appears controlled by grazing, and sometimes not. We hypothesize that is related to the both the type of diatom (single cell vs. chain formers) that are present in a sample as well as the absolute amount of biomass – with lower biomass more easily controlled by grazers. We will continue to analyze these experiments in the context of the environmental data. Having the FlowCAM allowed for near-real time analysis of the phytoplankton assemblage within the water column while we were still on station. These data will also be useful for comparing assemblage structure in the >5 µm size class during the dilution experiments; as noted earlier, the most variable and erratic responses in the dilution experiments were in this size class. FlowCAM samples were taken at all stations and depths where we conducted microzooplankton grazing experiments. An assortment of images was shared with the vessel personnel via the Sikilaq's server; a few images are provided below to highlight the diversity of phytoplankton present in the samples. (size differences among all images reflects actual relative scale within and among different phytoplankton types).

MESOZOOPLANKTON "McHopcroft's: billions and billions *pre*-served"

Process Mode (first 10 days)
Growth rates: Artificial cohort experiments were set up at 9 of the 10 proposed process stations. Initial communities in the northern Bering Sea were dominated by *Pseudocalanus* spp. (mostly adults and C5 copepodites) and *Neocalanus flemingeri* C5: these stage distributions may not yield robust growth rate estimates. As we moved into the Chukchi Sea, *Calanus* spp. copepodites began to appear in the samples, as did earlier stages of *Pseudocalanus*. It is likely growth rates can be successfully determined from these later samples. Single stages of *Calanus* were also sorted and incubated in parallel at 3-4 Chukchi stations to determine growth rates. Temperature loggers in the incubators suggested an average experimental temperature of ~4°C, except for the last 2 experiments that experienced warmer Bering Sea temperatures; as high at 10°C for the last day(s) of incubation.

Egg Production: With the exception of *Pseudocalanus* spp., adult females of copepods were rare, and below the numbers required to setup robust egg production experiments. Between 120-150 *Pseudocalanus* females were sorted and maintained in the walk-in incubators at all 10 process stations. Notable deviations occurred at DBO 2.4 which was not setup until occupied initially, and CBE9 for which the walk-in incubator was not yet at temperature during day-1 of cruise; both these stations were setup during the survey portion of the cruise. An unrecognized temperature offset on the walk-in incubator controls resulted in all but the last experiment being executed at ~8°C rather than the 4°C intended.

Respiration: Respiration experiments were set up for each process stations (with deviations as for egg production). Sets of 20 medium- to large-sized female *Pseudocalanus* were setup at each station in 2 ml vials, and either *Metridia pacifica* females, *Calanus* females (or C5), or *Neocalanus flemingeri* C5 were setup in 5 ml vials. The initial *Pseudocalanus* experiments were plagued by bubble formation within the vials, and those stations were re-run when re-occupied during the survey portion of the cruise. All respiration experiments were conducted at 4°C, maintained by independently-cooled waterbaths within the walk-in incubators.

Fecal Pellet Production: Experiments were executed at the 9 process stations occupied during the first half of the cruise. The high concentrations phytoplankton encountered during the cruise combined with high numbers of meroplankton (found grazing on the fecal pellets) will likely compromise these experiments, although this will not be clear until some analyses are completed.

Initial conditions: Both Bongo net (505µm mesh) and vertical nets (150µm mesh) were collected at all process stations to describe the communities composition and abundance. We are relying on other ASGARD components to describe the physical and chemical environment, as well as prey fields (phyto- and microzoo-plankton).

Survey Mode (second 10 days)
Metazooplankton: Both Bongo net (505µm mesh) and vertical nets (150µm mesh) were collected at all process stations to describe the communities composition and abundance. In total collections were made at 62 stations. At each station a 505µm collection was examined by pouring aliquots into a shallow dish over a light table – all ctenophores and jellies (except for *Aglantha digitale*) larger than ~3mm were enumerated, measured and removed from the samples. Larval fish were also removed and placed into ethanol. One 505 µm net will be sent to the Polish Sorting Center by NOAA for ichthyoplankton analyses. For the pair of 150 µm nets, one was preserve immediately in formalin, and one split with half preserved in ethanol (for metagenetics), and half going to Japan for parallel quantitative analysis.

Our general impression was that the zooplankton diversity was extremely limited, with the importance of *Neocalanus* as both a grazer and prey resource during late spring had been greatly underestimated. *Neocalanus* biomass exceeded that of *Calanus* at most stations. Despite low abundance, the jellyfish community readily reflected changes in water mass types. *It is notable that although collected, analysis was only proposed for 20-30 of these survey stations, contingent on funding outside of ASGARD funding.*

Microzooplankton:
Although a GAP proposal was funded for microzooplankton analyses on all Arctic-IERP cruises, no supplies were provided by that team to ASGARD for microzooplankton on the cruise – this was not discovered until mid-cruise as we prepared for survey mode. Hopcroft had sufficient supplies that a mixed-layer and lower-water-column sample could be collected at nearly all stations (~50 in total) for which net collections were made. *Hopcroft had proposed (and budgeted) analysis at only 20-30 stations, a budget he had expected to divert to metazooplankton analyses following the funding of the Microzooplankton GAP proposal – who bears these costs and responsibilities needs to be resolved.*

BENTHOS -

We conducted 44 multi-core (MC) deployments and 6 HAPS cores. Nearly all samples were taken from the MC, but the HAPS core was used to test substrate in areas where the substrate appeared to be harder based on displays from the sub-bottom profiler. We attempted to sample at 17 stations, but did not have good success with coring at a few locations due to substrate type. In total, we collected a full suite of samples at 13 stations. The multi-core worked very well at nearly all the soft-bottom locations except one (DBO 1.10), where it seemed that suction was causing hard pull-out from the bottom causing cores to be very disturbed. Heavier seas were also a complication at that station. In sandier areas, cores were shorter but still very good quality. We were able to obtain good vertically-stratified samples at all sampled sites.

A summary of sample numbers collected at each site is provided in the table below. We collected replicate cores for vertical profiles of chlorophyll-a and other metrics of labile organic matter down to 15 cm (or to 10cm at some locations where cores were shallow). These profiles will be used to model degradation rates of labile organic matter. We also collected 2 – 3 replicate cores for macrofauna biomass and abundance at most sites. Other cores were allocated for meiofauna biomass and abundance, environmental DNA, grain size, and ^{234}Th profiles, the latter to be used to model bioturbation rates. At three sites, samples of the flocculent detritus layer on the core surfaces were incubated at 1% light levels to estimate primary productivity of microphytobenthos and/or newly deposited phytoplankton arriving at the seafloor. Depth-stratified samples were also collected by Jeff Krause for construction of a silicate budget.

We conducted core incubations at 12 sites. Replicate cores were incubated at 0-1°C and 5-6°C in either the walk-in environmental room or a chest freezer. Sediment community oxygen consumption was measured over the course of these incubations. We also sampled for nutrients and DIC in the overlying water to examine nutrient fluxes and carbon remineralization rates in the two different temperature treatments. In addition, respiration rates were measured for individual infaunal organisms, including the bivalves *Macoma* sp. and *Serripes groenlandica*, a Nephtyid polychaete, and a burrowing amphipod cf. *Ampelisca* sp. These data will be used to estimate the contribution of these key benthic species to sediment community respiration and remineralization of particulate organic matter deposited to the seafloor.

Table B1. Summary of sediment sampling activities

Station	Macro-fauna	Meio-fauna	Chl a/ labile OM	eDNA	Grain size	^{234}Th	Oxygen Flux Inc.	Notes
CBE 9	2							shallow layer of sandy sediment over gravel; coring difficult
CBE 1	1							gravelly; coring not successful
CBE 1.5	2	1		1	1		X	sandy with gravel and shell hash
CBW 5								rocky bottom, no samples
CNL 3	2	1	2	1	1	1	X	muddy sand with shallow anoxic zone; deep-burrowing polychaetes, Macoma
IL 2	3	1	2	1	1	1	X	soft mud with flocculent layer
DBO 3.8A	2	1	2	1	1	1	X	soft mud with flocculent layer
DBO 3.3	3	1	2	1	1	1	X	soft mud with flocculent layer
CL 3	3	1	3	2	1	1	X	soft mud
CL 1	3	1	3	2	1	1	X	soft mud with flocculent layer; anoxic layer beneath floc
DBO 3.6	3	1	3	1	1	1	X	soft mud; deep-burrowing Macoma, large Serripes; anoxic below ~5 cm
IL 4	3	1	2	1	1	1	X	soft mud; anoxic layer at ~2 cm
CPL 8	3	1	2	1	1		X	~5 cm muddy sand over pebbles; flocculent surface layer
DBO 2.4	3	1	3	1	1	1	X	muddy sand
DBO 1.10								muddy sand; cores very disturbed--**no samples**
DBO 2.2	3	1	3	1	1		X	sandy mud; burrowing amphipods
DBO 2.3	3		1		1			sandy mud; burrowing amphipods

FISH AND EPIFAUNA -

Version 2: modified by Caitlin Forster and Brenda Holladay, 25-July-2017
Version 1: by Lorena Edenfield, Caitlin Forster, Ann-Christine Zinkann was submitted to chief scientist at end of cruise, 29-June -2017

This report summarizes fish and epifauna collections of the ASGARD 2017 cruise SKQ201709S during 7–29 June 2017 in the northern Bering and eastern Chukchi seas. Demersal fish and epibenthic organisms were targeted with a 3-m plumb-staff beam trawl (PSBT-A; modified from Abookire and Rose (2005) by reinforcing the beam). Opportunistically, as wire time allowed, fishes were targeted with an Isaacs-Kidd Midwater Trawl (IKMT; Isaacs and Kidd, 1953. Trawl hauls were conducted at 21 stations by PSBT-A and at 21 stations by IKMT. Nineteen of 24 PSBT-A hauls and 21 of 21 IKMT trawls successfully sampled a quantified area (Table 1, Table 2). Weather conditions prevented deploying PSBT-A at one previously designated trawling station, BS8.

Assembly and deployment of PSBT-A and IKMT gear was in accordance with the following specifications. The PSBT-A had a 4.7 m headrope and 4.6 m footrope, 7 mm mesh in body and 4 mm mesh as codend liner. The beam was a rigid 3.05 m pipe forward of the mouth which it held open for an effective swath of 2.26 m. This allows accurate quantifications of trawl area swept and calculation of trawl effort. Below the footrope, 10.2 cm rubber disks were threaded on a steel chain and served to exclude boulders and rocks, and to avoid digging into mud substrate (Abookire and Rose 2005). We further modified the Abookire and Rose (2005) design by reinforcing the towing beam. A temperature depth recorder (TDR) was fastened just below the PSBT-A headrope to provide a post-haul record of depth and duration on bottom. A SIMRAD depth and height sensor was attached at the PSBT-A towing swivel to provide real-time feedback during the haul. The PSBT-A was deployed from the stern and towed with the current at vessel speed of 1.5–2 kts speed over ground. Larval and small juvenile pelagic fishes were collected using an IKMT that was fished from the surface of the water to 10 m above the substrate. The IKMT had 3 mm mesh throughout body and 1 mm mesh in a hard PVC codend with mouth dimensions of 1.5 m wide by 1.8 m high, and had an effective fishing area of 2.137 m^2 when fished at 45º angle. A rigid diving vane kept the mouth of the net open during towing and exerted a depressing force to stabilize the net vertically. The IKMT was deployed from the stern and towed with the current at approximately 3–4 kts speed over ground in a double oblique tow. During the haul, the towing cable was continuously released and retrieved at the rate of approximately 30 m/min; rate was modified to maintain the target 45º wire angle.

Upon retrieval of the net, the catch was determined to be either qualitative or quantitative. A haul was considered qualitative if the net was damaged during the tow sufficiently to lead to loss of catch or to alter the net dimensions, overfull cod-end occurred, high proportion of pelagic rather than demersal animals collected, or problems occurred with launching and retrieving the net. The catch was dumped into a large tub and a digital photograph was taken with a label indicating the station name. Muddy catches were dumped into 2 mm mesh sieves and sprayed with a hose to remove mud before sorting the catch. The approximate volume and sediment type of each tow was recorded. Catches were processed on deck and using a sorting table in the vessel's wet lab. Euthanasia of fishes followed University of Alaska Fairbanks (UAF) Institutional Animal Care and Use Committee instructions, protocol 1054017. Euthanized fishes were sorted by species, measured in 10-mm increments of total length, and an aggregate weight was measured of each species. Epibenthic invertebrates were sorted, counted and an aggregate weight was measured; colonial animals received a count of 1.

Abundance and biomass were calculated as follows. For PSBT-A hauls, vessel position and time were recorded when the towing cable was fully deployed and when haul-back began. This information, along with the TDR depth profile that indicated depth, true bottom time, and the effective swath of net was used to calculate a conversion factor that is in turn used to calculate the catch-per-unit-effort (CPUE; # of fish per 1000 m^2). Likewise biomass-per-unit-effort (BPUE) was calculated (reported as grams of fish per 1000 m^2). For IKMT hauls, towing distance was calculated between vessel positions when the net was fully submerged at the surface and when the net left the water. IKMT catch is reported as # of fish per 1000 m^3 for the IKMT. The weight of larval fishes was negligible, and therefore we did not report biomass for IKMT catches.

Fish Summary
Nine families and at least 30 species were represented (Table F3). Four individuals were identified to the genus *Lycodes*. A total of 417 fishes were collected by PSBT-A and 301 were collected by IKMT for a total of 718 fishes captured (Table F3).

All fishes were retained from the PSBT-A trawls and were transported to the Fisheries Oceanography Lab (FOL) at the University of Alaska Fairbanks (UAF) in a frozen state. Fishes will be processed at the FOL following a systematic protocol that has been used in Norcross's lab for several years: measured, weighed, and samples taken of otoliths, stomachs (archived for future analysis), and tissues (archived for future potential stable isotopes). Visual assessments of maturity can be made as requested. Fishes captured in the IKMT were discarded after being measured, with the exception of cods (Gadidae), which were preserved in ethanol for Dr. Franz Mueter Juneau/CFOS/UAF, while older cods were frozen and returned to UAF, as with fishes caught by PSBT-A.

Catches of fishes collected in the PSBT-A and IKMT were adjusted for fishing effort using an effort conversion factor. For the PSBT-A, catches by number of individuals were dominated by Stichaeidae and Cottidae families (Figure F1). Biomass was also dominated by Cottidae, and to a lesser extent, Stichaeidae families (Figure F2). For the IKMT, catches were dominated by Cottidae, Gadidae, and Liparidae families (Figure F3). Biomass for not reported as the weight of larval fishes is negligible.

Epifauna Summary
We completed sampling of epifauna along a 24-station subset of the full station grid. For epifauna community, we identified approximately 179 distinct taxa. The final taxon list will be verified based on voucher samples collected.

The community was dominated in taxon diversity by gastropods, bivalves and crustaceans in terms of numbers of individuals (Figure F4); we also observed many bryozoans and ascidians, but as these colonial animals received a count of 1 where present they are underrepresented in calculated abundance. Weight was dominated by echinoderms and crustaceans (Figure F5). The reported weight and count data of epibenthos were not standardized to 1000 m^2. However, in graphs of the raw data it already is obvious that taxa particularly high in abundance and/or biomass were within the echinoderms (the seastar *Leptasterias polaris*, *Leptasterias arctica* and the basket star *Gorgonocephalus eucnemis*) and the decapods (the snow crab *Chionoecetes opilio* and the shrimps *Argis sp.* and *Eualus spp*.).

We also measured the size, determined the sex, shell condition, maturity assessments of approximately 200 snow crab, ranging in size from 15.1 mm to 68.6 mm carapace width. Snow crab samples were frozen for further maturity assessments.

Citations

Abookire AA, Rose CS (2005) Modifications to a plumb staff beam trawl for sampling uneven, complex habitats. Fisheries Research 71:247–254

Isaacs JD, Kidd LW (1953) Isaacs-Kidd midwater trawl. SIO Reference 53-3. Oceanographic Equipment Report No. 1. University of California, Scripps Institute of Oceanography

Table F1. PSBT-A fishing events during ASGARD-2017 by haul. The conversion factor standardizes the catch of quantitative hauls to 1000 m^2. Non-Quantitative hauls were not processed for specimens. Fish split column indicates percentage of fish catch sampled; a value of 0 indicates that the haul was not processed for fish. Invertebrate split column indicates percentage of invertebrate catch sampled. In some cases, select invertebrate taxa were sampled in proportions differing from the remaining catch, indicated by a note after the semicolon.

Station	Gear	Haul	Date and Time (UTC)	Lat.	Long.	Max Gear Depth (m)	Trawl Duration min (decimal)	Distance fished (m)	Quant-itative	CPUE Conver-sion Factor	Fish Split (%)	Invertebrate Split (%)
CBE9	PSBTA	1	6/10/2017 3:36	64.396	-167.102	27	6.58	299	Y	1.4825	100	100; 12.5 shrimp
CBE1	PSBTA	2	6/10/2017 21:54	63.315	-168.467	41	7.75	377	Y	1.1758	100	100, 25 shrimp
CBW5	PSBTA	3	6/11/2017 21:51	64.183	-171.491	43	9.83	526	Y	0.8427	100	100
CNL3	PSBTA	4	6/14/2017 5:17	66.521	-168.953	51	5.83	268	Y	1.6540	100	100
IL2	PSBTA	5	6/15/2017 2:16	67.570	-164.905	33	5.17	231	Y	1.9189	100	100
DBO 3-8A	PSBTA	6	6/15/2017 22:47	67.694	-168.679	46	6.67	311	Y	1.4253	100	0.33
DBO 3.6	PSBTA	7	6/16/2017 4:41	67.880	-168.213	54	7.08	326	Y	1.3597	100	0.25
DBO 3.3	PSBTA	8	6/16/2017 22:16	68.232	-167.369	43	5.50	267	Y	1.6602	100	100
DBO 3.4	PSBTA	9	6/17/2017 0:11	68.122	-167.482	47	9.33	-	N	-	0	0
DBO 3.4	PSBTA	10	6/17/2017 0:58	68.160	-167.427	45	5.42	247	Y	1.7946	100	100
CL3	PSBTA	11	6/17/2017 23:21	69.057	-168.862	49	5.58	272	Y	1.6296	100	100; exc *Nuculana sp.*
CL2	PSBTA	12	6/18/2017 2:44	69.033	-167.934	46	4.75	-	N	-	100	100
CL1	PSBTA	13	6/18/2017 23:04	68.972	-166.872	43	5.75	282	Y	1.5719	100	100
CL0	PSBTA	14	6/19/2017 1:15	68.900	-166.424	28	5.75	-	N	-	0	0
IL7	PSBTA	15	6/22/2017 3:15	67.193	-167.173	39	8.00	-	N	-	0	0
IL7	PSBTA	16	6/22/2017 3:45	67.181	-167.186	39	7.67	-	N	-	0	0
CPL6	PSBTA	17	6/23/2017 1:18	66.489	-167.703	23	6.75	293	Y	1.5128	100	0; 100 *Chionocetes opilio*
DBO2.5	PSBTA	18	6/24/2017 21:07	64.962	-169.176	43	7.67	373	Y	1.1884	100	100
DBO2.4	PSBTA	19	6/25/2017 3:32	64.908	-169.989	47	8.25	375	Y	1.1820	100	100
DBO1.10	PSBTA	20	6/26/2017 4:42	63.677	-172.589	53	7.17	324	Y	1.3681	100	100
DBO1.10	PSBTA	21	6/26/2017 5:03	63.686	-172.589	53	7.42	535	Y	0.8285	100	100
DBO2.1	PSBTA	22	6/26/2017 18:20	64.684	-169.791	44	8.00	363	Y	1.2211	100	100
DBO2.2	PSBTA	23	6/27/2017 0:13	64.682	-168.974	42	6.75	360	Y	1.2313	100	100
DBO2.3	PSBTA	24	6/27/2017 5:23	64.676	-168.110	34	6.67	317	Y	1.3983	100	50

Table F2. Isaacs-Kidd midwater trawl (IKMT) fishing events during ASGARD-2017 by haul. The conversion factor standardizes the catch of quantitative hauls to 1000 m^3. Fish split column indicates percentage of fish catch sampled. Invertebrate split column indicates percentage of invertebrate catch sampled, a value of 0 indicates that the haul was not processed for invertebrates

Station	Gear	Haul	Date and Time (UTC)	Lat.	Long.	Max Gear Depth (m)	Trawl Duration min (decimal)	Distance fished (m)	Quant-itative	CPUE Conver-sion Factor	Fish Split (%)	Invertebrate Split (%)
CBE1	IKMT	1	6/10/2017 21:16	63.300	-168.453	14	9.55	878	Y	0.5330	100	0
CBW5	IKMT	2	6/11/2017 21:22	64.166	-171.512	27	11.12	1061	Y	0.4410	100	0
CNL3	IKMT	3	6/14/2017 4:19	66.504	-168.961	32	16.87	1674	y	0.2795	100	0
IL2	IKMT	4	6/15/2017 1:36	67.544	-164.883	26	16.20	1878	Y	0.2492	100	0
DBO 3-8A	IKMT	5	6/15/2017 22:14	67.677	-168.714	43	14.55	1312	Y	0.3567	100	0
DBO 3.6	IKMT	6	6/16/2017 3:58	67.894	-168.236	34	18.25	2008	Y	0.2330	100	0
DBO 3.3	IKMT	7	6/16/2017 21:37	68.188	-167.313	33	14.40	1545	Y	0.3029	100	0
DBO 3.4	IKMT	8	6/17/2017 1:17	68.166	-167.442	39	16.13	1708	Y	0.2740	100	0
CL3	IKMT	9	6/17/2017 22:40	69.036	-168.888	40	18.40	1848	Y	0.2532	100	0
CL2	IKMT	10	6/18/2017 3:12	69.043	-167.926	31	16.03	1735	Y	0.2697	100	0
CL1	IKMT	11	6/18/2017 22:32	68.953	-166.902	36	14.57	1395	Y	0.3354	100	0
CL0	IKMT	12	6/19/2017 1:37	68.908	-166.433	17	10.05	1101	Y	0.4250	100	0
IL7	IKMT	13	6/22/2017 2:36	67.214	-167.154	29	16.25	1726	Y	0.2711	100	0
CPL6	IKMT	14	6/23/2017 0:47	66.496	-167.698	15	11.10	1176	Y	0.3979	100	0
BS8	IKMT	15	6/24/2017 4:44	65.709	-168.520	38	19.08	1231	Y	0.3801	100	0
DBO2.5	IKMT	16	6/24/2017 20:10	64.957	-169.180	26	14.30	1436	Y	0.3259	100	0
DBO2.4	IKMT	17	6/25/2017 2:58	64.918	-169.971	29	15.93	1687	Y	0.2774	100	0
DBO1.10	IKMT	18	6/26/2017 4:02	63.604	-172.591	33	17.08	1801	Y	0.2598	100	0
DBO2.1	IKMT	19	6/26/2017 17:30	64.672	-169.911	29	16.72	1661	Y	0.2817	100	0
DBO2.2	IKMT	20	6/26/2017 23:23	64.680	-169.099	31	23.73	4624	Y	0.1012	100	0
DBO2.3	IKMT	21	6/27/2017 4:23	64.670	-168.218	22	13.53	1371	Y	0.3413	100	0

Table F3. Preliminary identification of fishes collected by plumb staff beam trawl (PSBT-A) and Isaacs-Kidd midwater trawl (IKMT)

Species	IKMT	PSBTA	Total
Teleost			
Teleost unid.	2	-	2
Gadidae			
Gadidae unid.	50	-	50
Boreogadus saida	9	6	15
Eleginus gracilis	-	2	2
Cottidae			
Cottidae unid.	122	-	122
Artediellis scaber	-	42	42
Enophrys diceraus	-	1	1
Gymnocanthus tricuspis	-	51	51
Hemilepidotus c.f. jordani	-	3	3
Myoxocephalus jaok	-	5	5
M. polyacanthocephalus	-	1	1
M. scorpius	-	15	15
Triglops pingelii	-	3	3
Hemitripteridae			
Nautichthys pribilovius	-	5	5
Agonidae			
Agonidae unid.	6	-	6
Aspidophoroides monopterygiu	-	3	3
A. olrikii	1	40	41
Podothecus veternus	-	2	2

Species	IKMT	PSBTA
Liparidae		
Liparidae unid.	76	-
Liparis fabricii	1	-
L. gibbus	-	8
L. tunicatus	-	4
Zoarcidae		
Gymnelus hemifasciatus	-	10
G. viridis	-	5
Lycodes mucosus	-	3
Lycodes sp.	-	4
Stichaeidae		
Stichaeidae unid.	30	-
Anisarchus medius	-	4
Eumesogrammus praecisus	-	1
Lumpenus fabricii	-	144
Stichaeus punctatus	-	10
Pholidae		
Pholis fasciatus	-	1
Pleuronectidae		
Pleuronectidae unid.	4	-
Hippoglossoides robustus	-	21
Limanda aspera	-	2
Liopsetta glacialis	-	21
Total	301	417

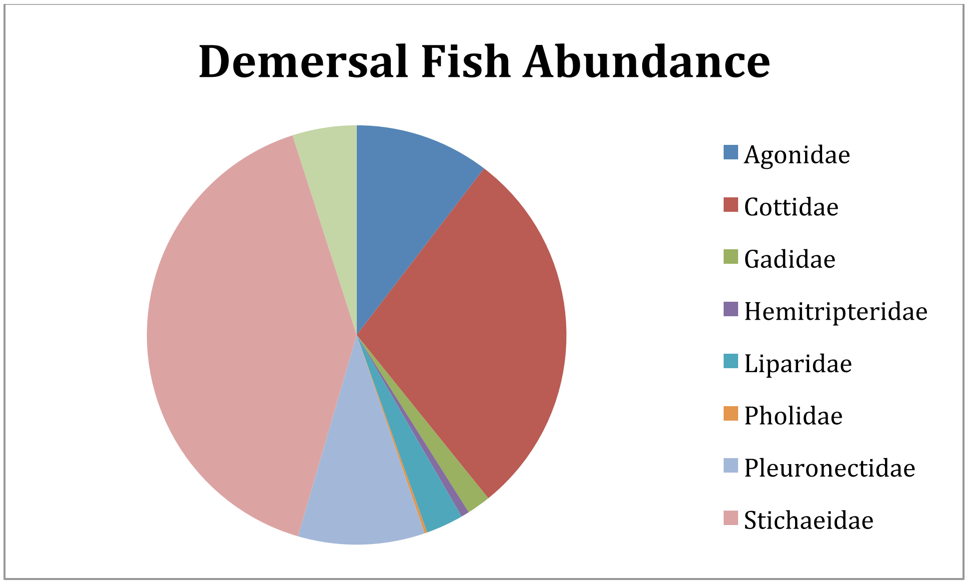


Figure F1. Relative abundance of fish families caught in the beam trawl. Catches were standardized to # of fish per 1000 m^2.

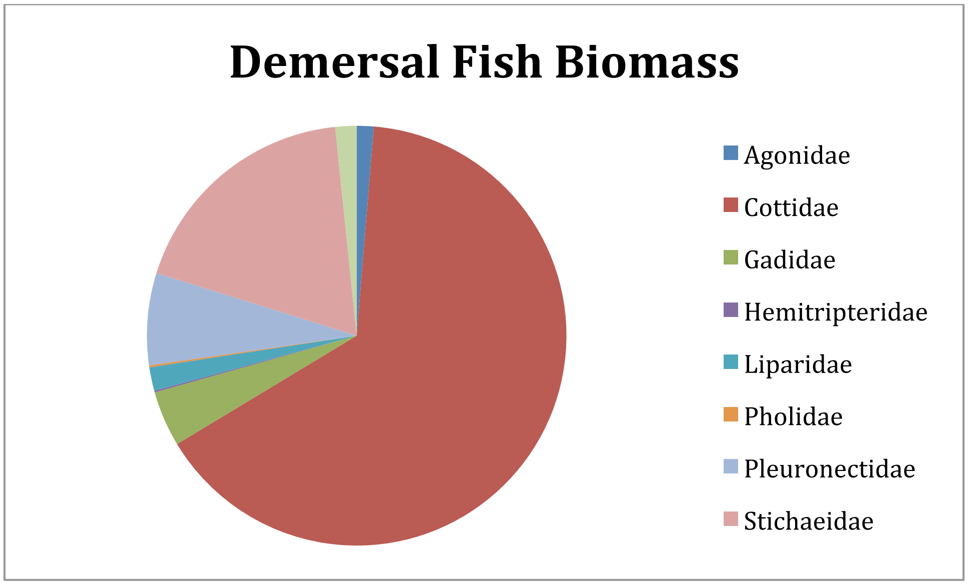


Figure F2. Relative biomass of fish families caught by beam trawl. Catches were standardized to grams of fish per 1000 m^2.

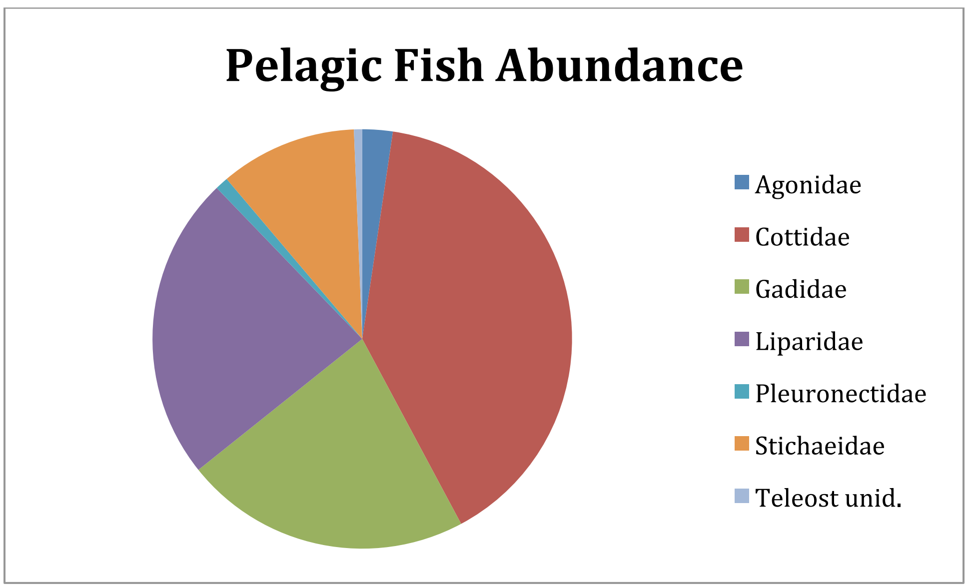


Figure F3. Relative abundance of fish families caught in the Isaacs-Kidd midwater trawl. Catches were standardized to # of fish per 1000 m^3.

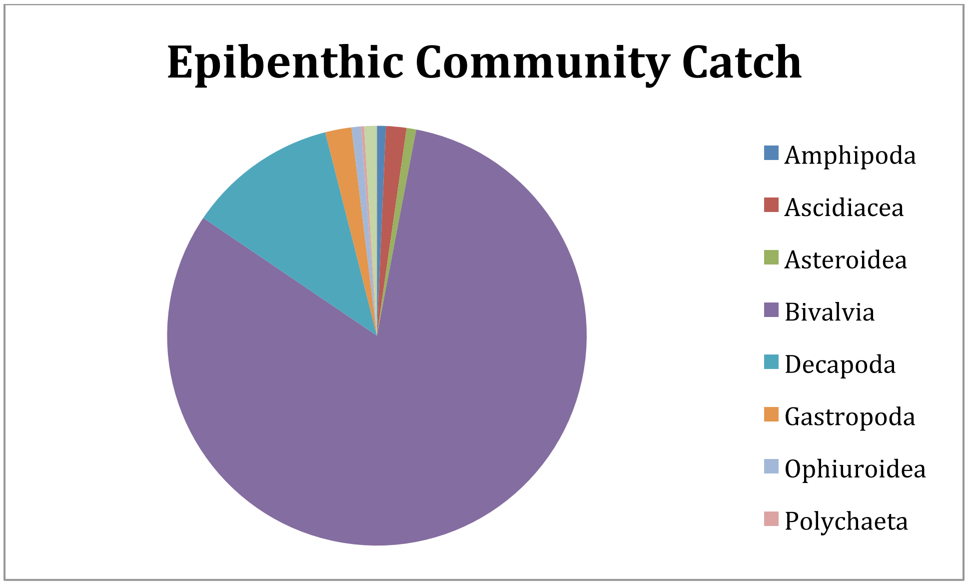


Figure F4. Proportional number of individuals within larger taxon groups found for epibenthic communities from plumb staff beam trawl hauls. Numbers are not adjusted for area towed.

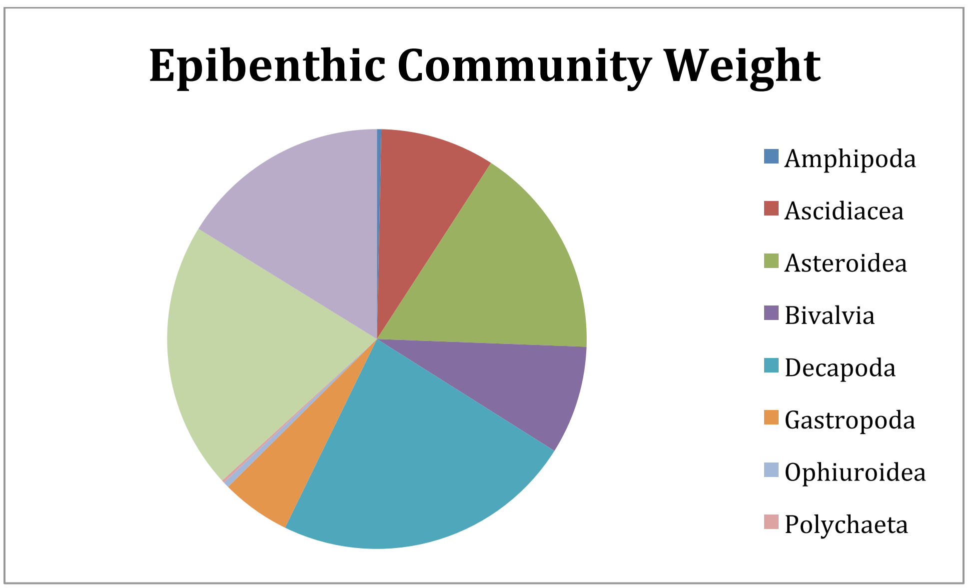


Figure F5. Proportional weight of taxa within larger taxon groups found for epibenthic communities from plumb staff beam trawl hauls. Weight is not adjusted for area towed.

SEABIRDS

The U.S. Fish and Wildlife Service (USFWS) provided the seabird component of ASGARD (P.I. Kathy Kuletz), with at-sea surveys conducted by A. Catherine Pham, who also summarized the data and co-authored this report. The USFWS was supported by an Interagency Agreement with the Bureau of Ocean Energy Management (M17PG00017) for project AK-16-07C: Seabird Community Structure and Seabird-Prey Dynamics. This study examines the distribution of marine birds relative to prey and oceanographic properties, and timing of use by marine birds in the Beaufort and Chukchi Planning Areas.

Methods

Seabird surveys were conducted whenever the vessel was traveling and visibility was at least 100 m. All sightings within 300m and a 90° arc forward from the line of travel were recorded. All birds, marine mammals, and debris on the water were recorded continuously, while flying birds were recorded at intervals (typically every 60 sec) depending on vessel speed. We recorded species, number of individuals, behavior (water, scan, flying), and distance bin (0-50 m, 51-100 m, 101-150 m, 151-200 m, 201-300 m, off transect) was recorded. Although marine mammals were recorded, this survey was done to marine bird protocol, therefore marine mammal densities are not comparable to those conducted under marine mammal protocols. Environmental variables such as sea state, cloud cover, and fog conditions were recorded and updated as necessary. When time permitted, straight line distance bin and angle from the line of travel to the sighting were recorded. Surveys were conducted from the port side, as the marine mammal observer surveyed from the starboard side.

Observations were entered into a laptop integrated with the vessel's GPS to obtain waypoints, using survey software DLog3. Binoculars (10x42) were used to aid in species identification, and a digital camera was occasionally used to confirm identification. A marked wooden dowel was used to verify distance estimates, as well as a Leica Rangemaster 1200 rangefinder and Vortex Viper HD R/T 50 mm tactical binoculars.

Big seas hampered surveying on 17, and 21-24 June, and fog hampered surveying on 10, 13, and 20 June. Transect width was reduced as necessary, and surveying had to be stopped completely when sea conditions exceeded Beaufort Scale 6, or fog reduced visibility to < 100 m. During the first half of the cruise, transects were conducted primarily at night because the ship occupied a single process station for much of the day. During the second half of the cruise, the ship conducted short survey stations at approximately 10 nm intervals throughout the 24 hr period, thus transects were conducted night and day as conditions allowed.

Results

Over 20, 118 transects were completed for a total of 128 hr and ~2,240 km surveyed, with ~1,080 km and ~1,160 km surveyed during the first and second half of the cruise, respectively. Thirty-five species and 14 taxa (identified to genus or family) comprising 5,402 birds were recorded on transect. An additional seven species and one taxa were recorded off transect. The ten most abundant species accounted for 80% of all birds recorded on transect (Table S1); these were Least Auklets (Fig. S1), Short-Tailed Shearwaters (Fig. S2), Thick-Billed Murres (Fig. S3), Black-Legged Kittiwakes, Crested Auklets, Parakeet Auklets, Common Murres, Northern Fulmars, Horned Puffins, and Tufted Puffins. [Note that densities in Figures 1-3 have not been corrected for detectability, or pro-rated from unidentified taxa to species. Two transects not included here due to GPS problems will be interpolated at a later date].

Nearly all Short-Tailed Shearwaters were observed during the second half of the cruise, particularly when the ship was in the northern Bering Sea (Fig. S2). The distribution of shearwaters suggests that the cruise coincided with the annual shearwater migration into the northern Bering Sea, just prior to their widespread occurrence in the Chukchi Sea. Anecdotally, many of the shearwaters appeared to be molting, based on missing wing feathers. Additionally, nine dead birds were recorded (Fig. S4), of which four could be identified as murres (*Uria* spp.).

Table S1. Relative abundance of marine birds during the 2017 ASGARD cruise. Birds recorded "off transect" were outside the survey window, flying through but not during a "scan," and dead birds. Species are listed from most to least abundant. Taxa include birds unidentified to species (Unid.).

Taxa	**No. on transect**	**Rel. abund. (%)**	**No. off transect**
Least Auklet	847	15.68	58
Short-Tailed Shearwater	757	14.01	1253
Thick-Billed Murre	730	13.51	233
Black-Legged Kittiwake	591	10.94	217
Crested Auklet	535	9.90	209
Parakeet Auklet	245	4.54	30
Common Murre	236	4.37	47
Northern Fulmar	156	2.89	861
Horned Puffin	113	2.09	59
Tufted Puffin	104	1.93	30
Red Phalarope	46	0.85	29
Red-Necked Phalarope	38	0.70	8
Pigeon Guillemot	24	0.44	15
Glaucous Gull	23	0.43	44
King Eider	14	0.26	48
Pomarine Jaeger	13	0.24	11
Parasitic Jaeger	12	0.22	26
Glaucous-Winged Gull	7	0.13	12
Pacific Loon	5	0.09	4
Pelagic Cormorant	5	0.09	5
Dovekie	4	0.07	0
Sabine's Gull	3	0.06	1
Long-Tailed Jaeger	2	0.04	11
Ancient Murrelet	1	0.02	0
Kittlitz's Murrelet	1	0.02	0
Long-Tailed Duck	1	0.02	3
Northern Pintail	1	0.02	0
Slaty-Backed Gull	1	0.02	2
Common Eider	0	0.00	12
Greater White-Fronted Goose	0	0.00	21
Harlequin Duck	0	0.00	2

Herring Gull	0	0.00	3
Steller's Eider	0	0.00	3
White-Winged Scoter	0	0.00	1
Yellow-Billed Loon	0	0.00	1
Unid. murre	775	14.35	389
Unid. auklet	49	0.91	4
Unid. eider	32	0.59	31
Unid. alcid	15	0.28	1
Unid. passerine	7	0.13	6
Unid. gull	3	0.06	4
Unid. *Brachyramphus* murrelet	2	0.04	4
Unid. shorebird	2	0.04	0
Unid. jaeger	1	0.02	1
Unid. puffin	1	0.02	0
Unid. bird	0	0.00	2
Unid. guillemot	0	0.00	1
Unid. goldeneye	0	0.00	2
Unid. loon	0	0.00	1
TOTAL	5402		3705

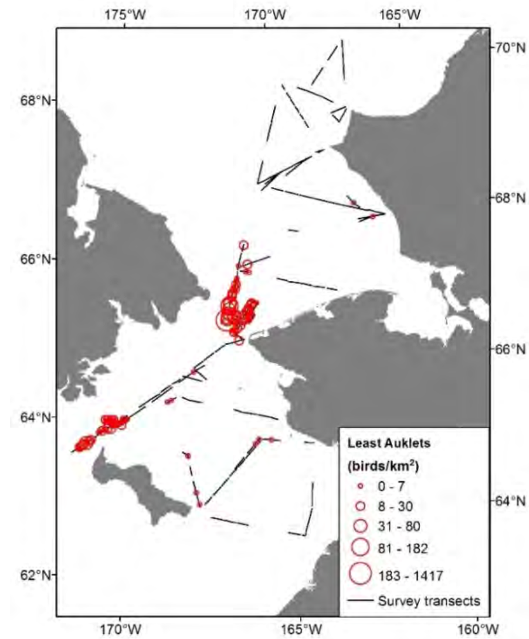


Fig. S1. Distribution of Least Auklets, in 3-km bins.

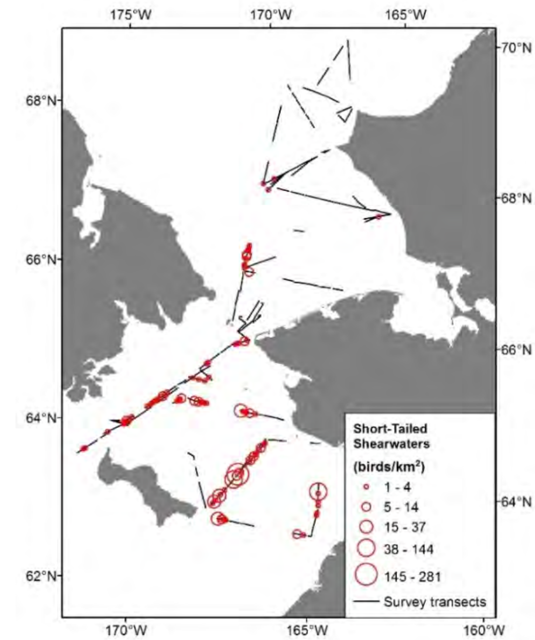


Fig. S2. Distribution of Shearwaters in 3-km bins.

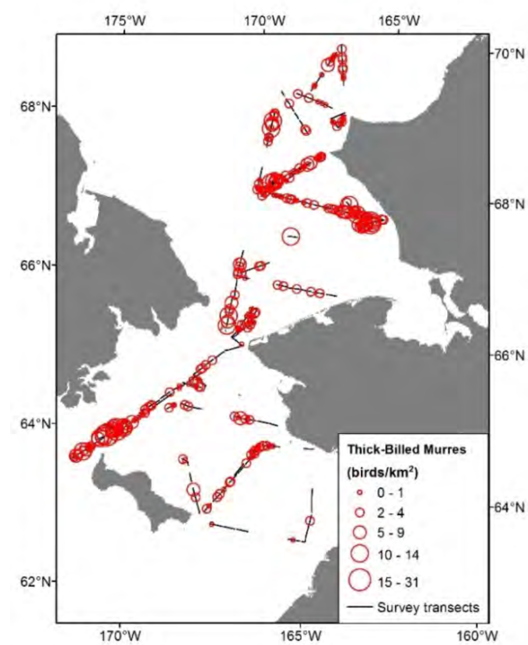


Fig. S3. Distribution of Thick-Billed Murres in 3-km bins.

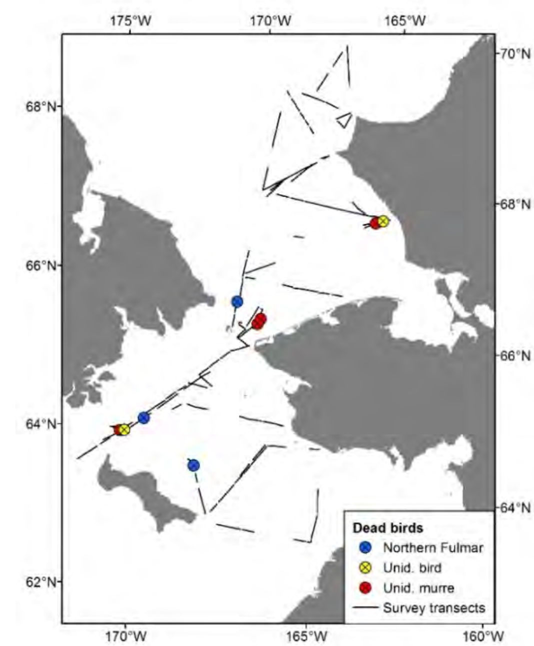


Fig. S4. Locations of nine dead birds recorded during transits.

MARINE MAMMALS

Hydrophones on moorings:

Hydrophone packages (Multi-electronique Aural M2) were deployed on moorings N1, N2 and N4. All 3 were programmed to record for the first 25 min each hour at a sample rate of 16384 Hz for a bandwidth of 10 Hz-8192 Hz. The instruments on N1 and N2 (S/N 0267 and 0269) were programmed to start recording on 15 June 2017 at 0000 GMT while the instrument on N4 (S/N 0270) was programmed to start on 25 June 2017 at 1200 GMT (this delay was due to the *Sikuliaq* being divert for the Search and Rescue operations. On this duty cycle, all three instruments should record at least through 12 July 2018.

Marine Mammal Watch:

A marine mammal watch was undertaken by a single observer on the starboard side of the bridge during daylight hours when the ship was traveling at speeds greater than 5 kts, visibility was at least1 nmi and sea state was judged to be Beaufort 5 or less. These conditions precluded the majority of underway trackline as fog and/or high winds and seas were common.

From 9-27 June 2017, 745 nmi of trackline were surveyed. The average sea state was Beaufort 3 and visibility ranged from 0.5 nmi to over 6 nmi.

The total number of on-effort and off-effort sightings was 196 sightings of a best estimate of 477 individuals. Only 5 species of cetacean were seen including gray, humpback, fin, minke, and unidentified large whales as well as harbor porpoise (Table M1). Pinniped sightings were uncommon but that is likely due to the observer scanning far out from the ship, therefore pinnipeds, which will often surface near the ship, were missed. Roughly 35 walrus were seen on rotten ice northwest of Cape Lisburne. Sightings were not uniformly distributed along the trackline with the overwhelming majority of sightings occurring in the vicinity of DBO 3.5 to DBO 3.6 (Figure M1).

Recommendations:

Although it is understood that it is highly unlikely, should future cruises have a marine mammal watch as part of the cruise, both funding for an observer(s) and also a berth for a second observer would be ideal. The 24 h of daylight in the study area at the time of year of the ASGARD cruises mean that observations can occur at all hours of the day. While the long process stations allowed for some rest, as did poor weather, maintaining a round-the-clock watch was challenging. An option to address this would be to identify specific transects (i.e. DBO lines) to cover and forgoing some of the transits.

The *Sikuliaq* bridge is a very comfortable, welcoming place to conduct marine mammal watches. The only issue is the mercurial windshield washing system in which the wiper blades don't actually contact some of the windows and wiper fluid sometimes worked, sometimes did not. The ship is well aware of this problem but I thought it might be worth highlighting here as this did impact viewing conditions at times

Table M1. Species seen during Marine Mammal Watch 9 – 27 June 2017

Species	Number of sightings	Total number of animals best (low high)
Gray whale	104	322 (311 495)
Unidentified large whale	55	126 (114 198)
Humpback whale	34	40 (40 47)
Minke whale	5	5 (5 5)
Fin whale	2	3 (3 4)
Harbor porpoise	2	3 (3 4)

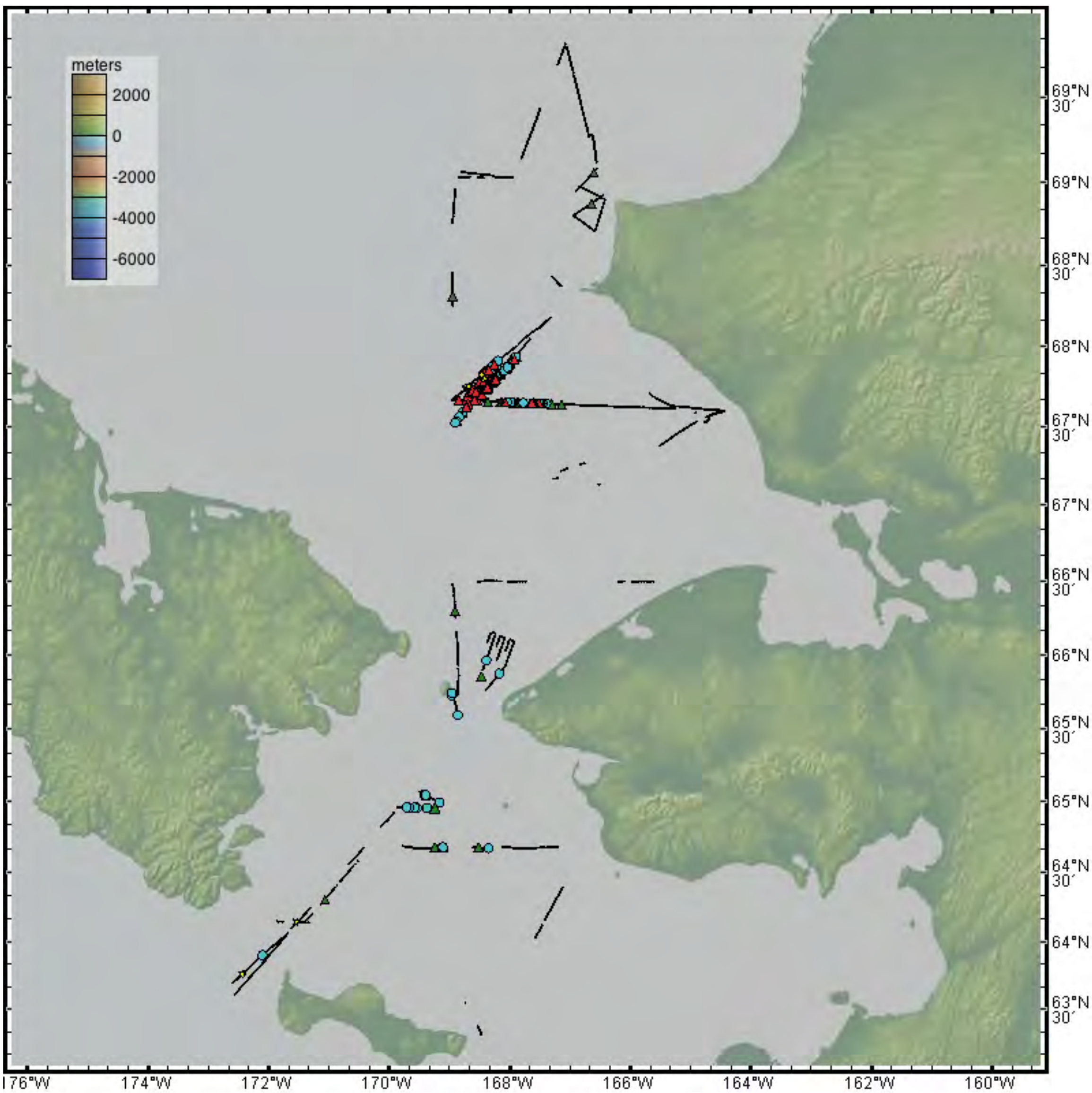
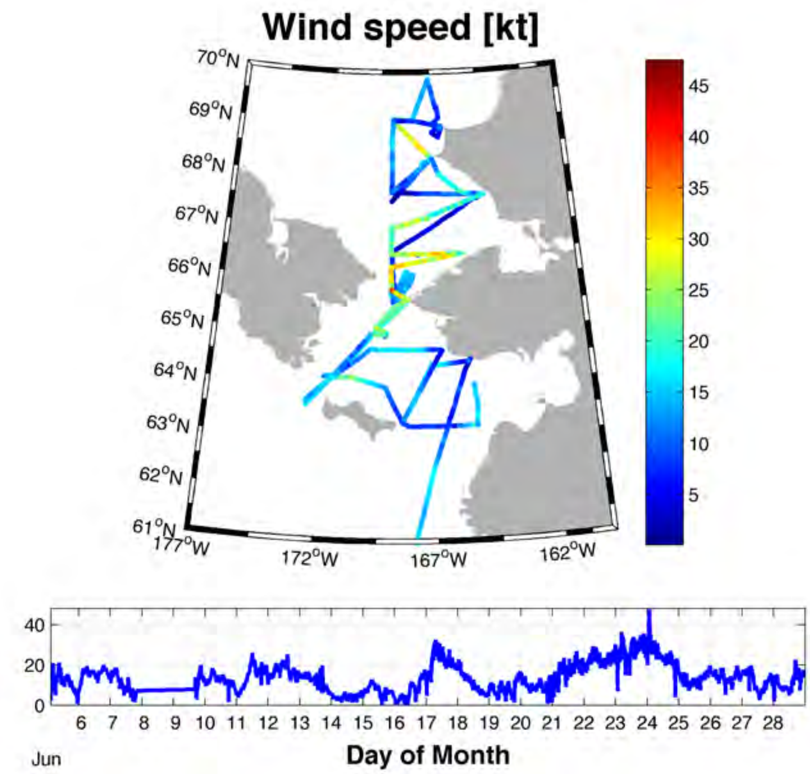
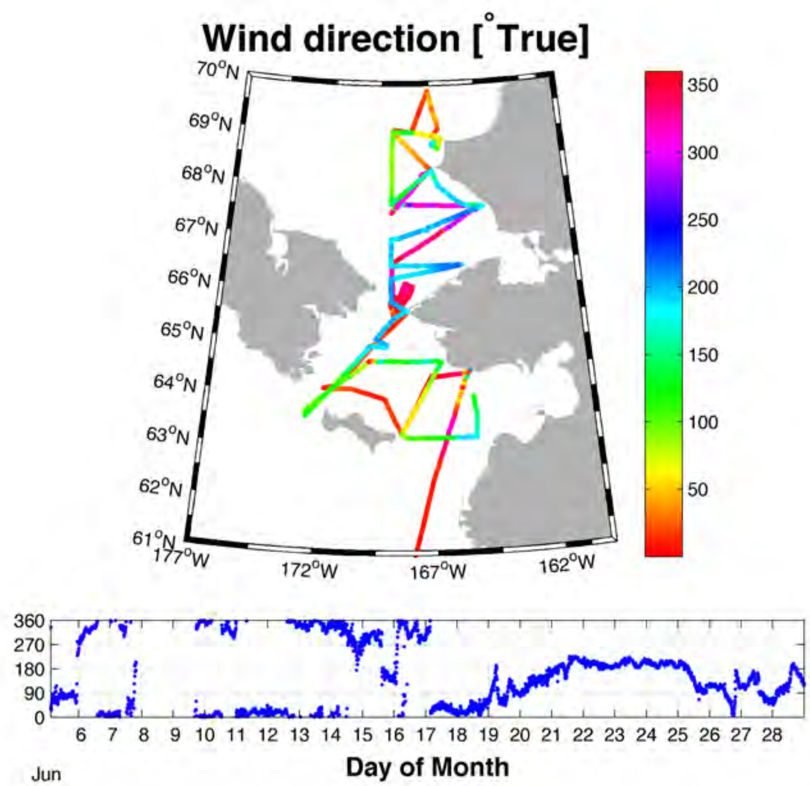
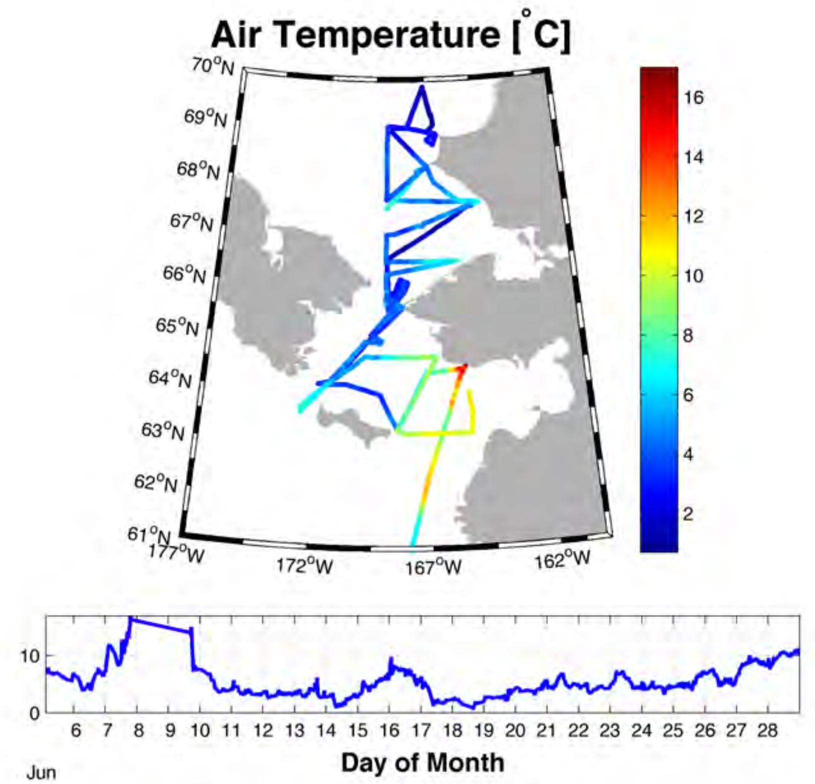


Figure M1. Map of all large whale sightings from 9-27 June and on-effort trackline (black lines). Gray whales (blue circles), humpback whales (red triangles), unidentified large whales (green triangles), minke whales (yellow stars), fin whales (black triangles).

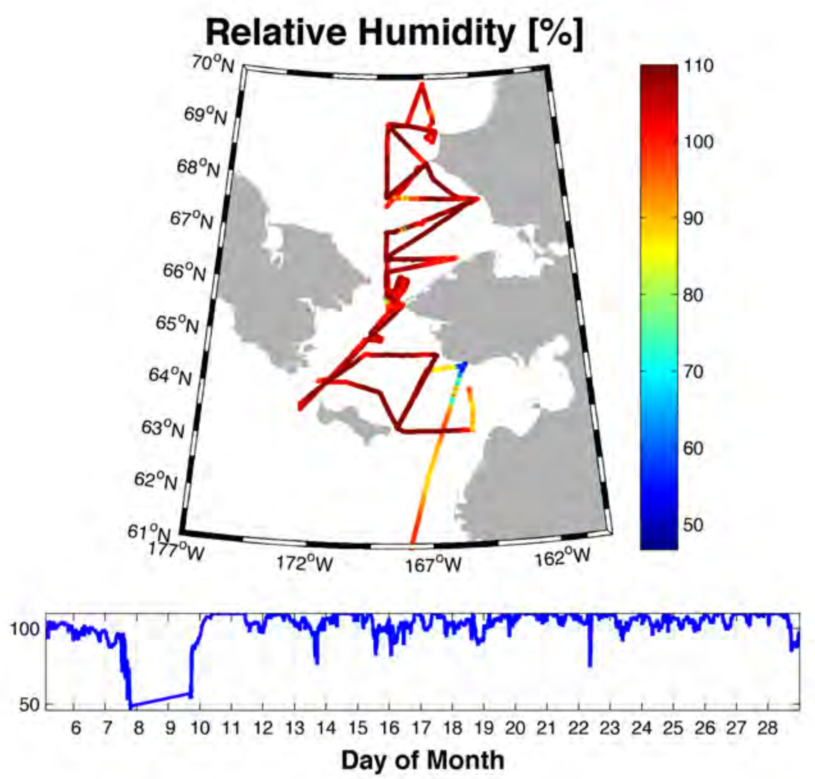
Appendix A: Underway Meteorological Measurements



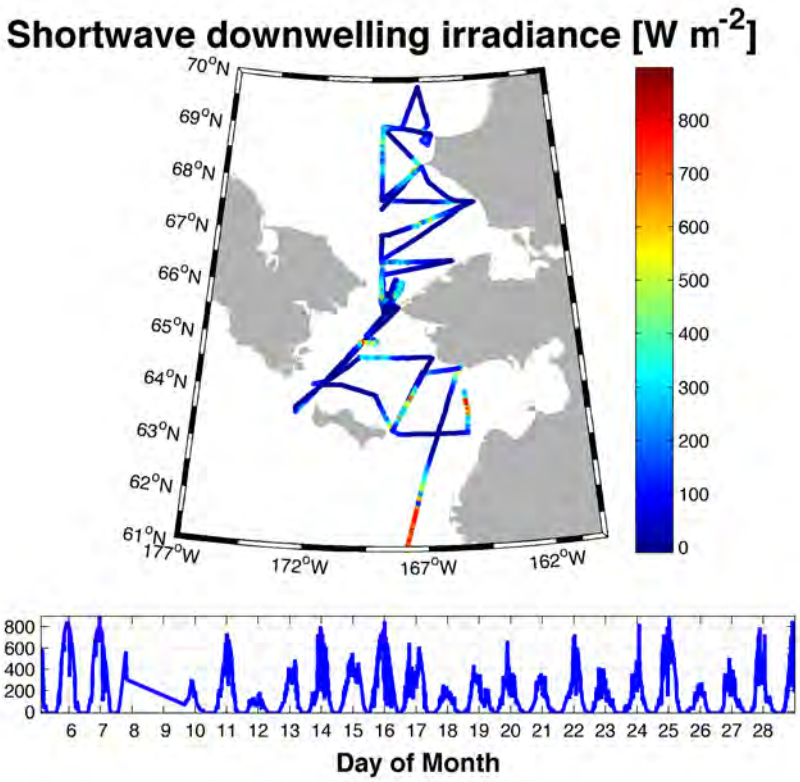


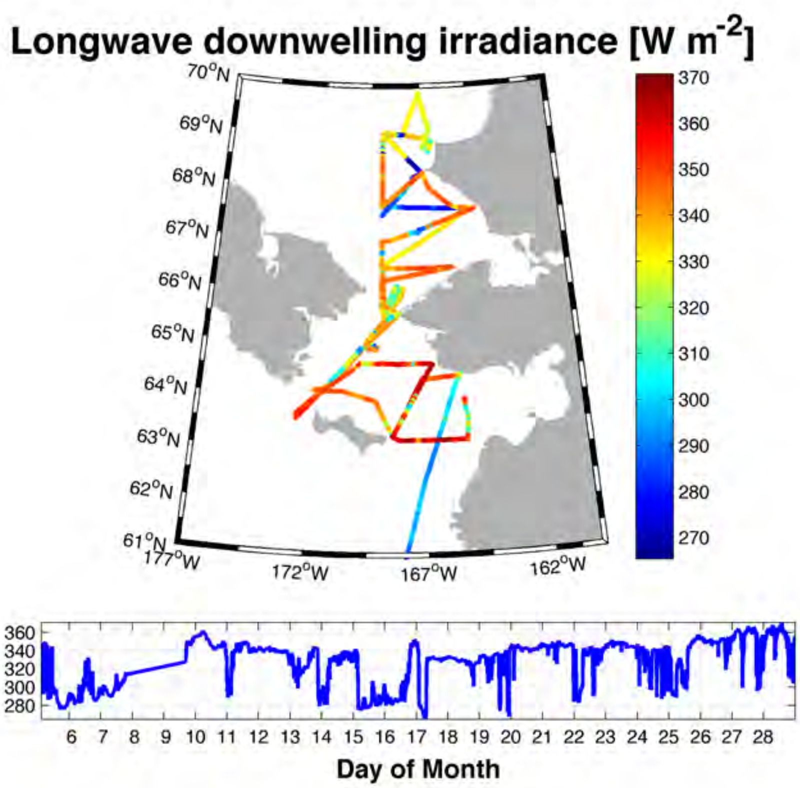


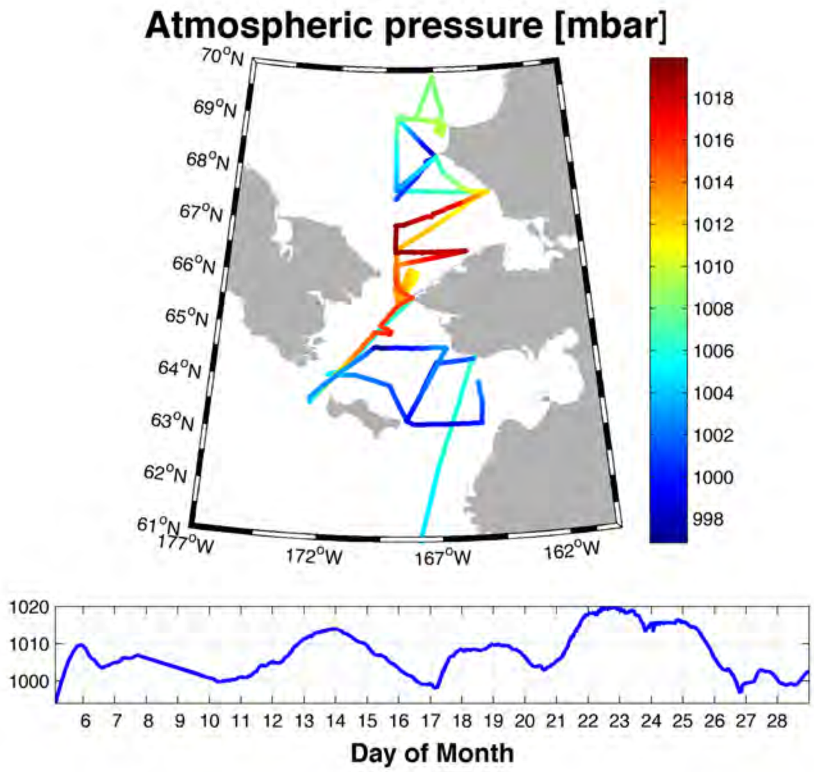
Air Temperature [°C]
70°N
69°N
68°N
67°N
66°N
65°N
64°N
63°N
62°N
61°N
177°W
172°W
167°W
162°W
16
14
12
10
8
6
4
2
10
0
6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
Day of Month
Jun

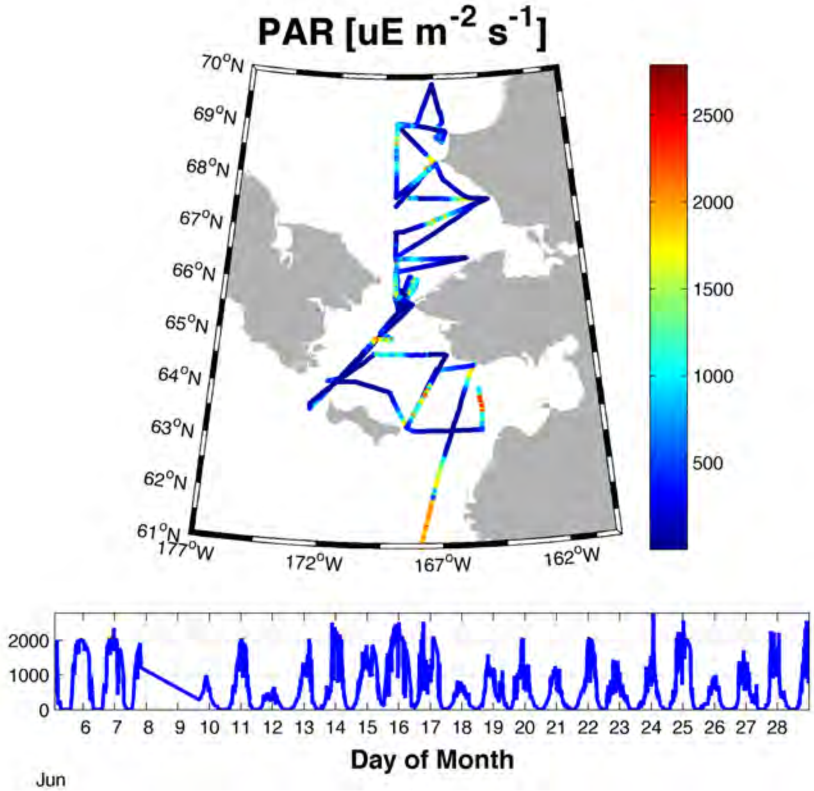


Relative Humidity [%]
70°N
69°N
68°N
67°N
66°N
65°N
64°N
63°N
62°N
61°N
177°W
172°W
167°W
162°W
110
100
90
80
70
60
50
100
50
6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
Day of Month

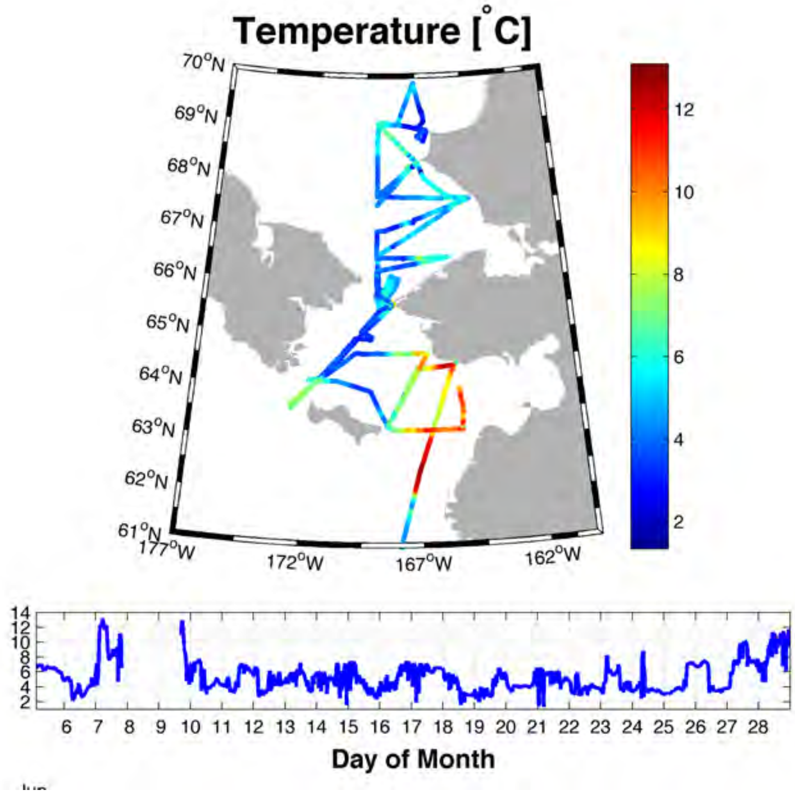

Shortwave downwelling irradiance [W m-2]
70°N
69°N
68°N
67°N
66°N
65°N
64°N
63°N
62°N
61°N
177°W
172°W
167°W
162°W
800
700
600
500
400
300
200
100
0
Day of Month

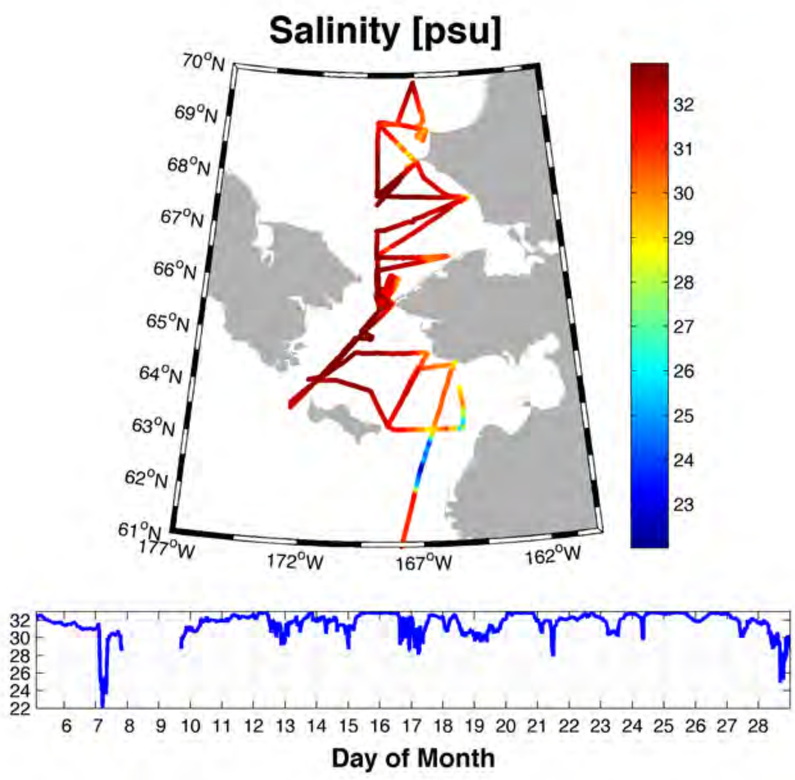

Longwave downwelling irradiance [W m-2]
70°N
69°N
68°N
67°N
66°N
65°N
64°N
63°N
62°N
61°N
177°W
172°W
167°W
162°W
370
360
350
340
330
320
310
300
290
280
270
Day of Month

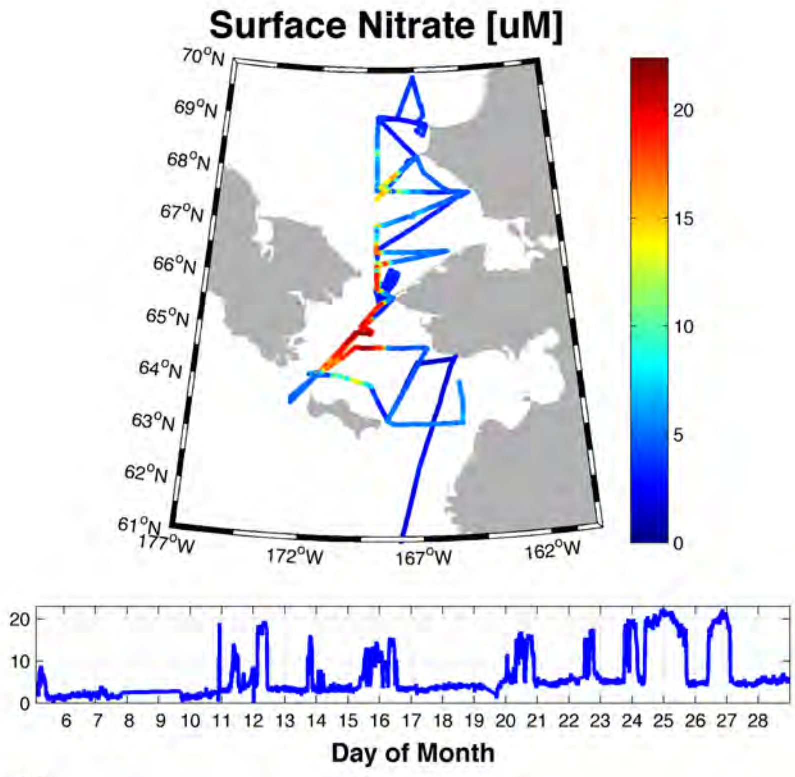

Atmospheric pressure [mbar]
70°N
69°N
68°N
67°N
66°N
65°N
64°N
63°N
62°N
61°N
177°W
172°W
167°W
162°W
1018
1016
1014
1012
1010
1008
1006
1004
1002
1000
998
1020
1010
1000
6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
Day of Month

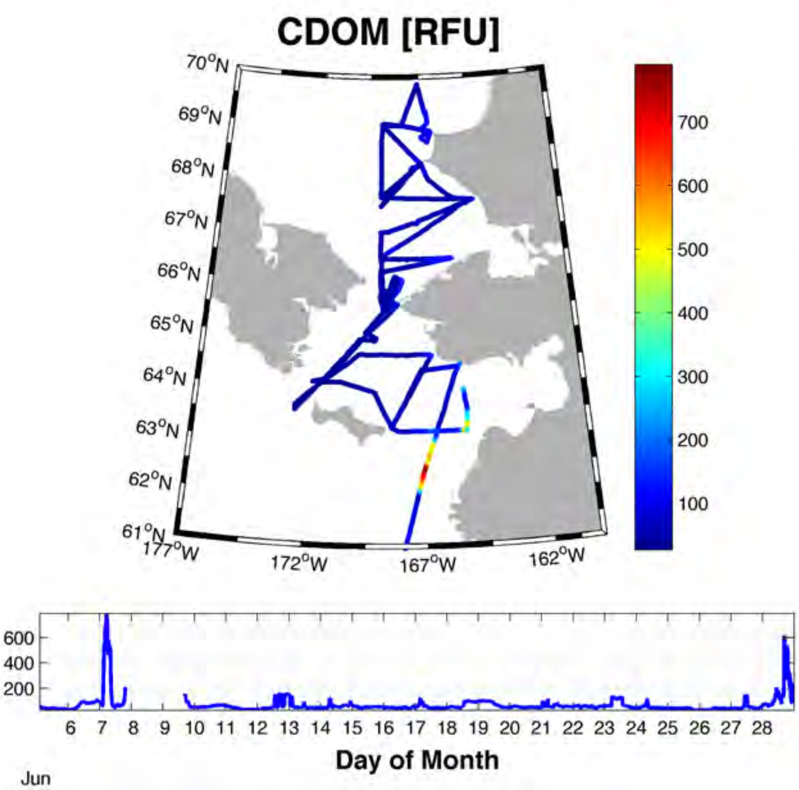

PAR [uE m-2 s-1]
70°N
69°N
68°N
67°N
66°N
65°N
64°N
63°N
62°N
61°N
177°W
172°W
167°W
162°W
2500
2000
1500
1000
500
2000
1000
0
6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
Day of Month
Jun

Appendix B: Underway Surface Oceanographic Measurements



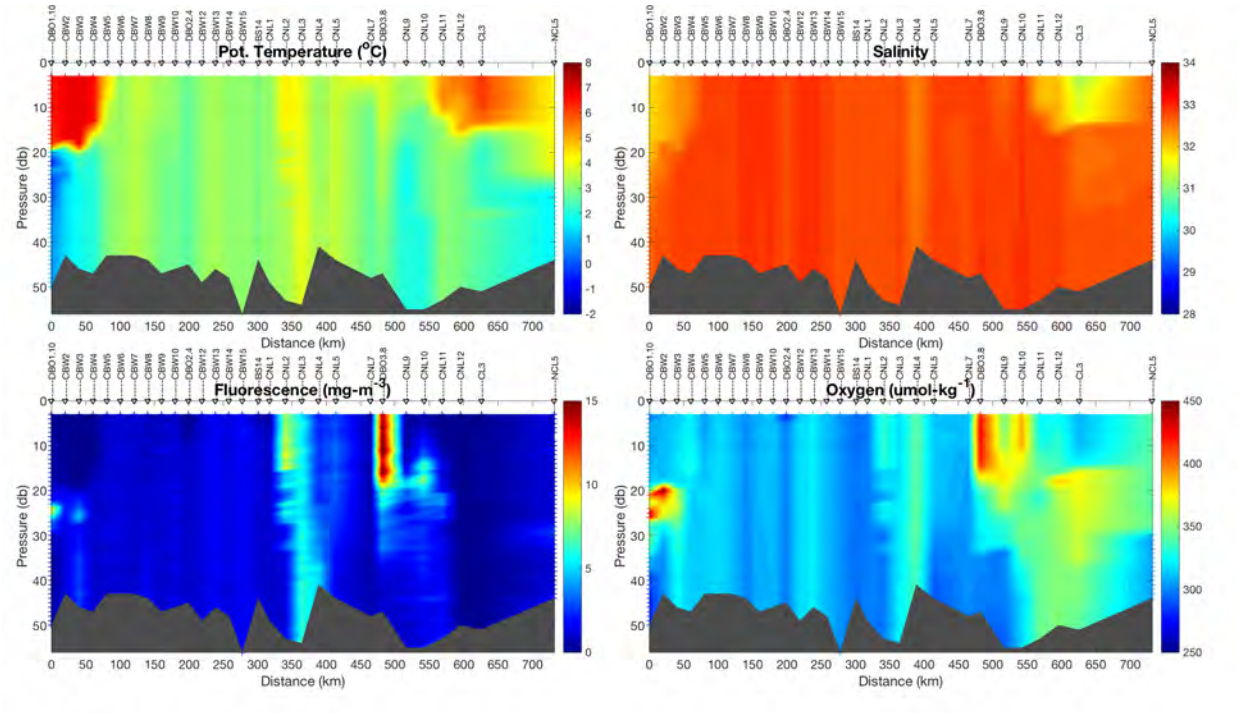



Surface Nitrate [uM]
70°N
69°N
68°N
67°N
66°N
65°N
64°N
63°N
62°N
61°N
177°W
172°W
167°W
162°W
0
5
10
15
20
Day of Month
6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28

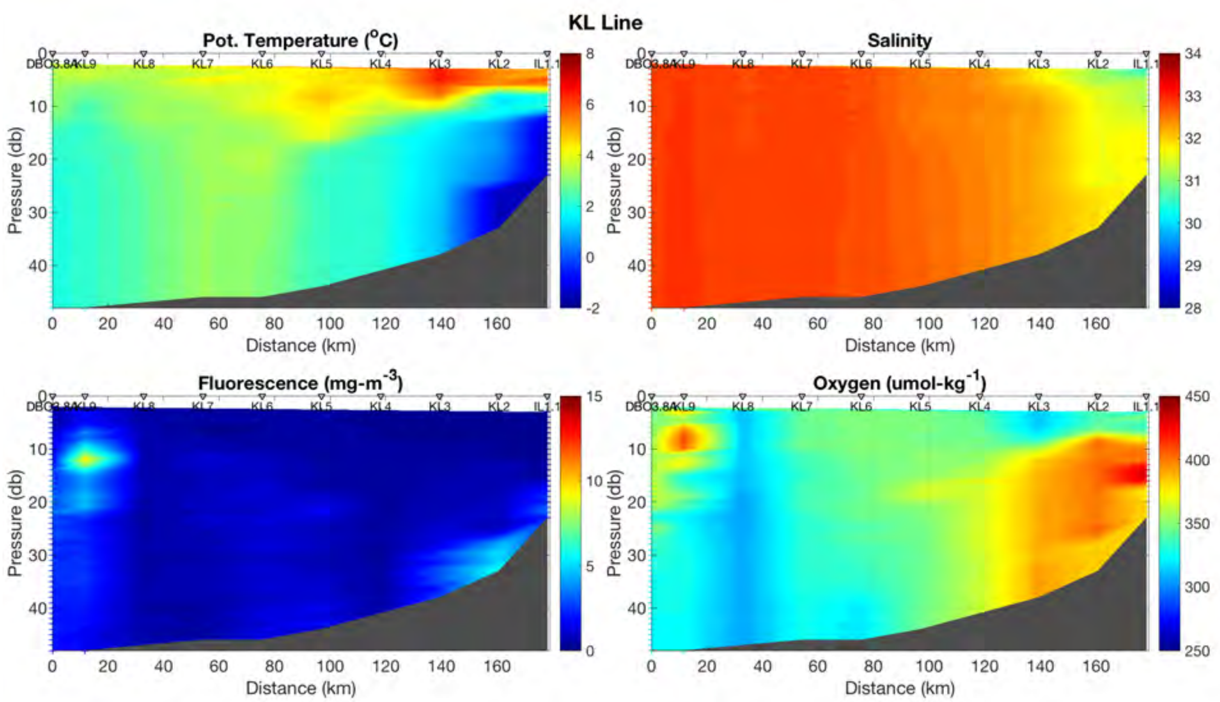

CDOM [RFU]
70°N
69°N
68°N
67°N
66°N
65°N
64°N
63°N
62°N
61°N
177°W
172°W
167°W
162°W
100
200
300
400
500
600
700
200
400
600
Day of Month
6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
Jun

Appendix C: Hydrographic Transects

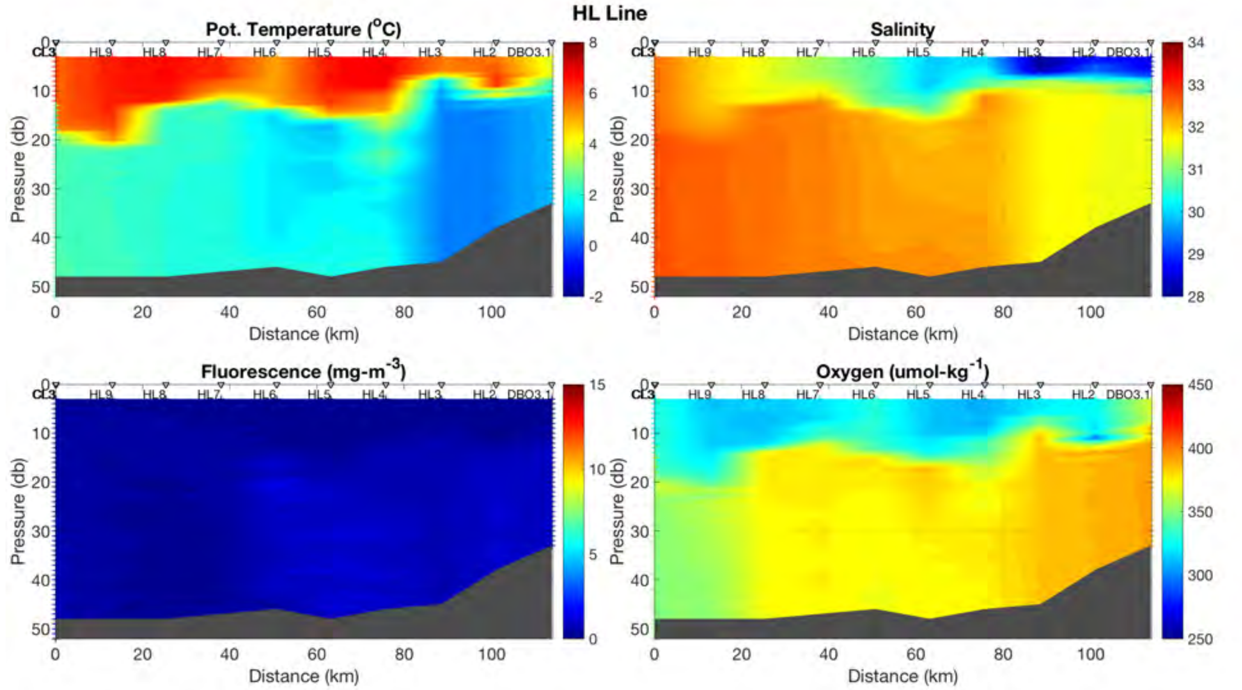
Offshore South-to-North Transect from 63N to 70N



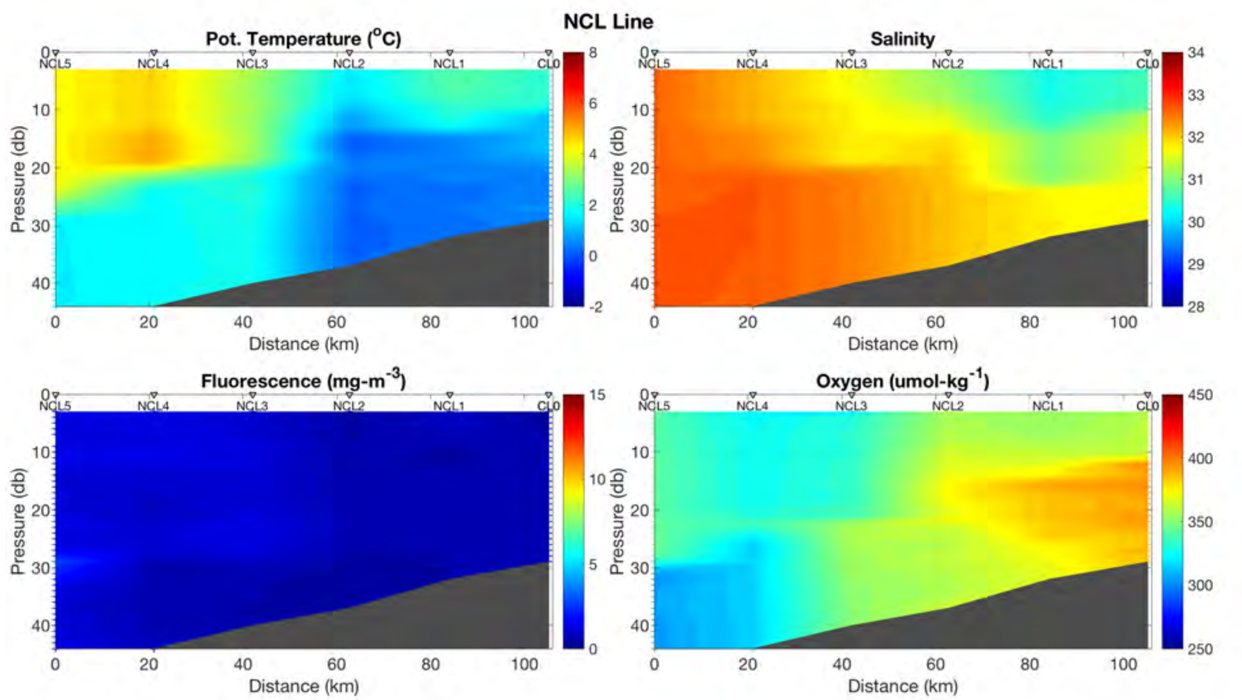
Kivalina transect (KL, 15 June)



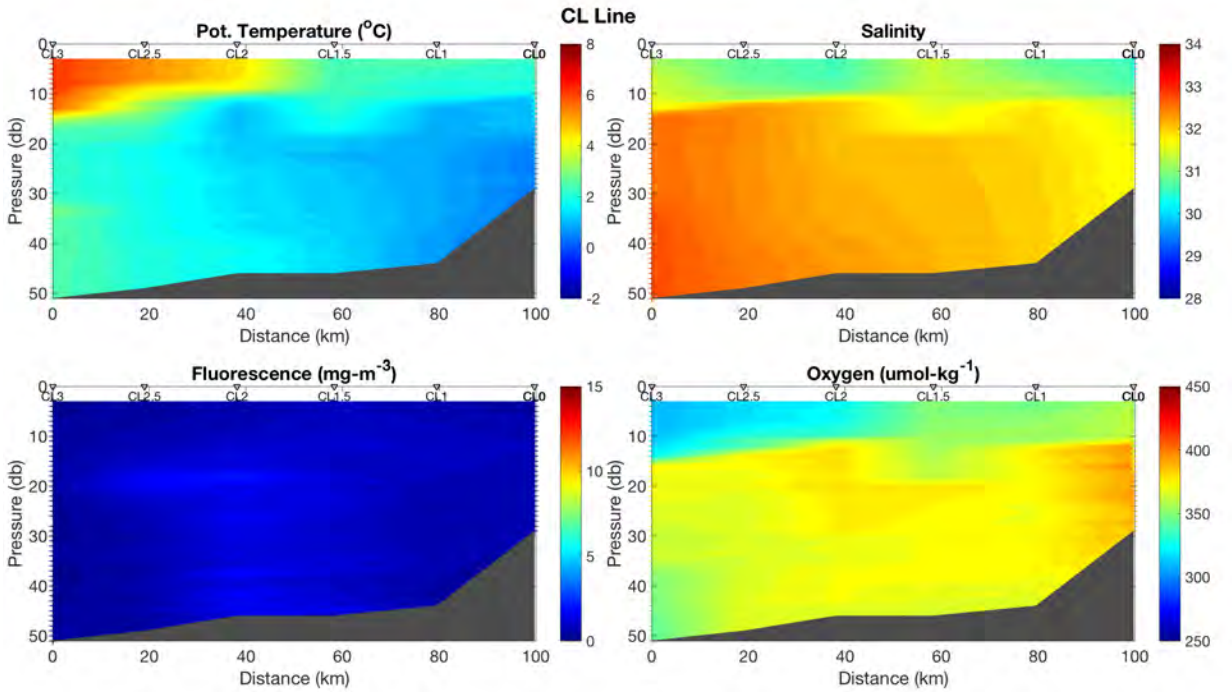
Point Hope transect (HL, 17 June)



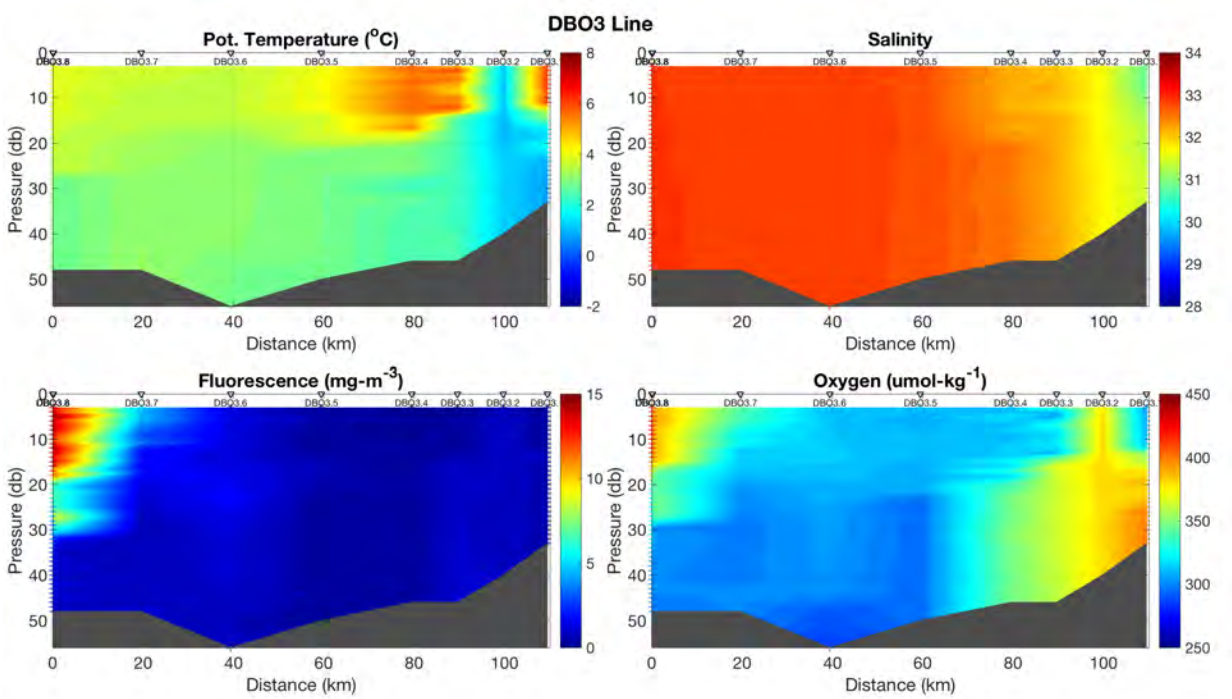
North of Cape Lisburne (NCL, 18 June)



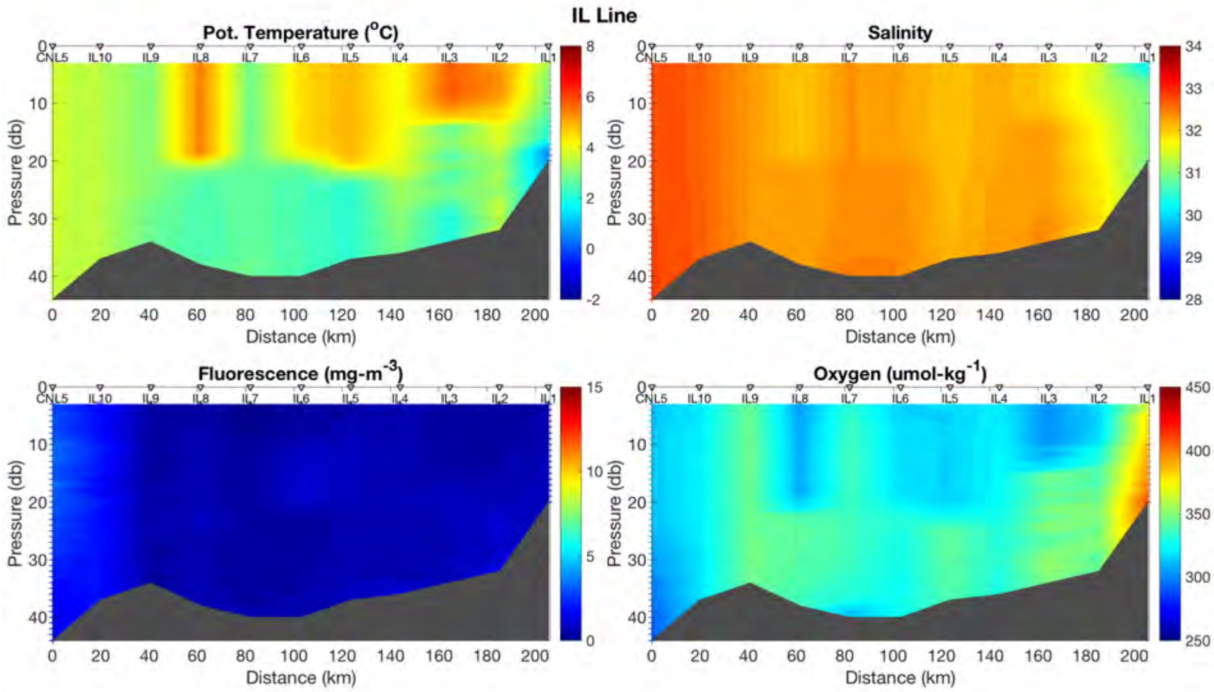
Cape Lisburne Transect (CL, 19 June)



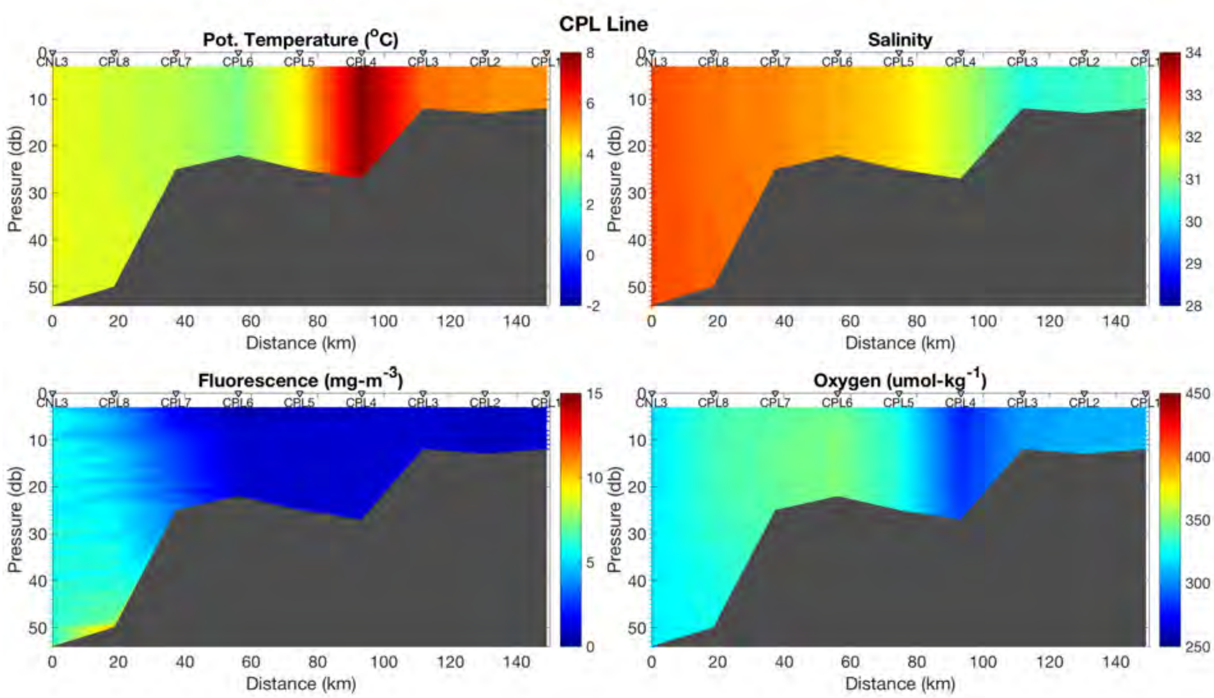
DBO3 transect (DBO3, 20 June)



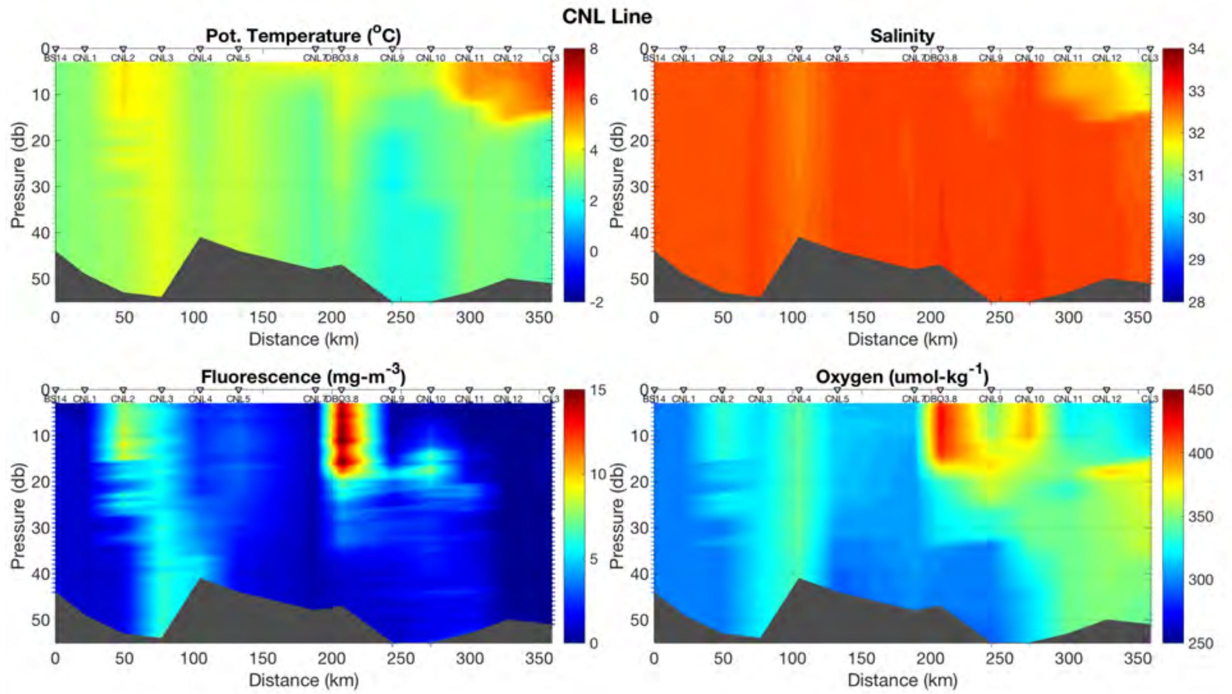
Isilivik Lagoon transect (IL, 21 June)



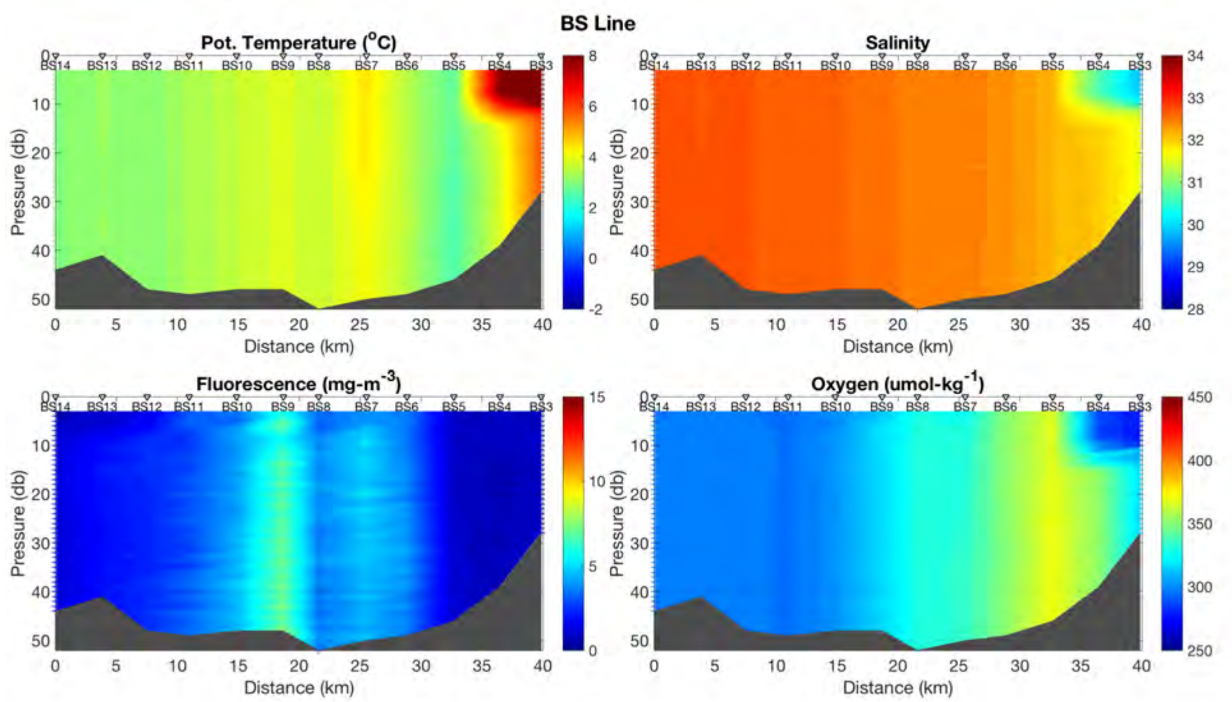
Cowpatch Lagoon transect (CPL, 22 June)



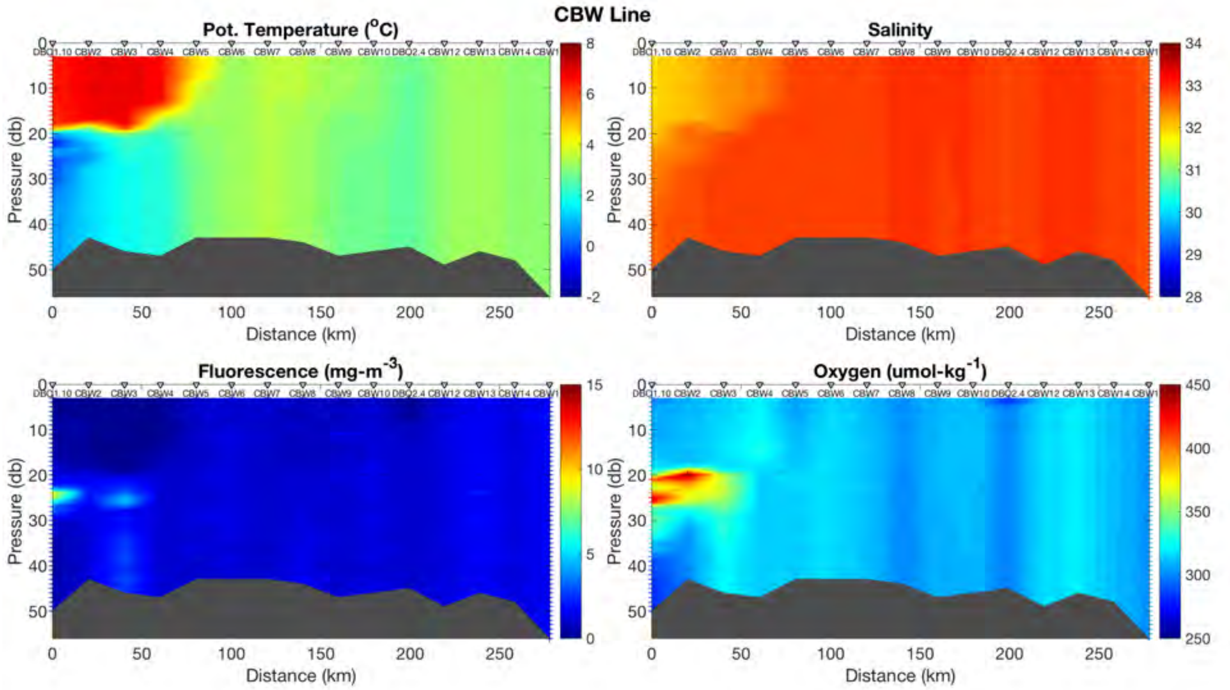
Convention Line transect (CNL, finish 23 June)



Bering Strait transect (BS, 24 June)

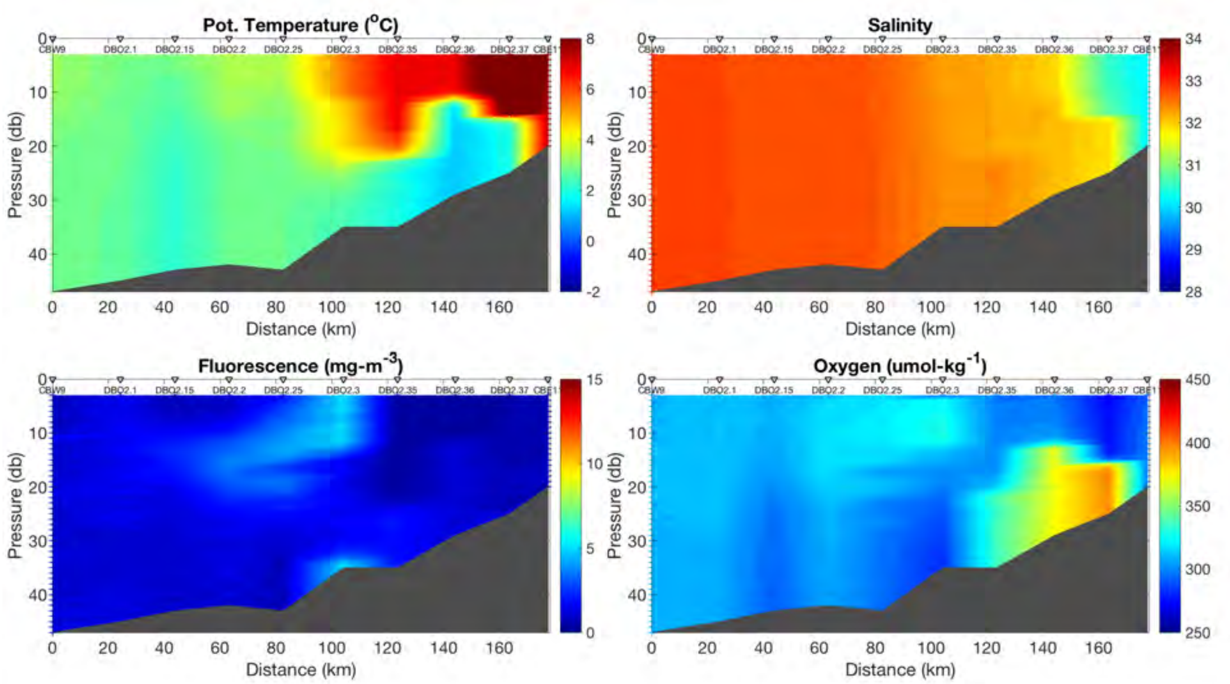


Chirikov Basin West transect (CBW, 25 June)

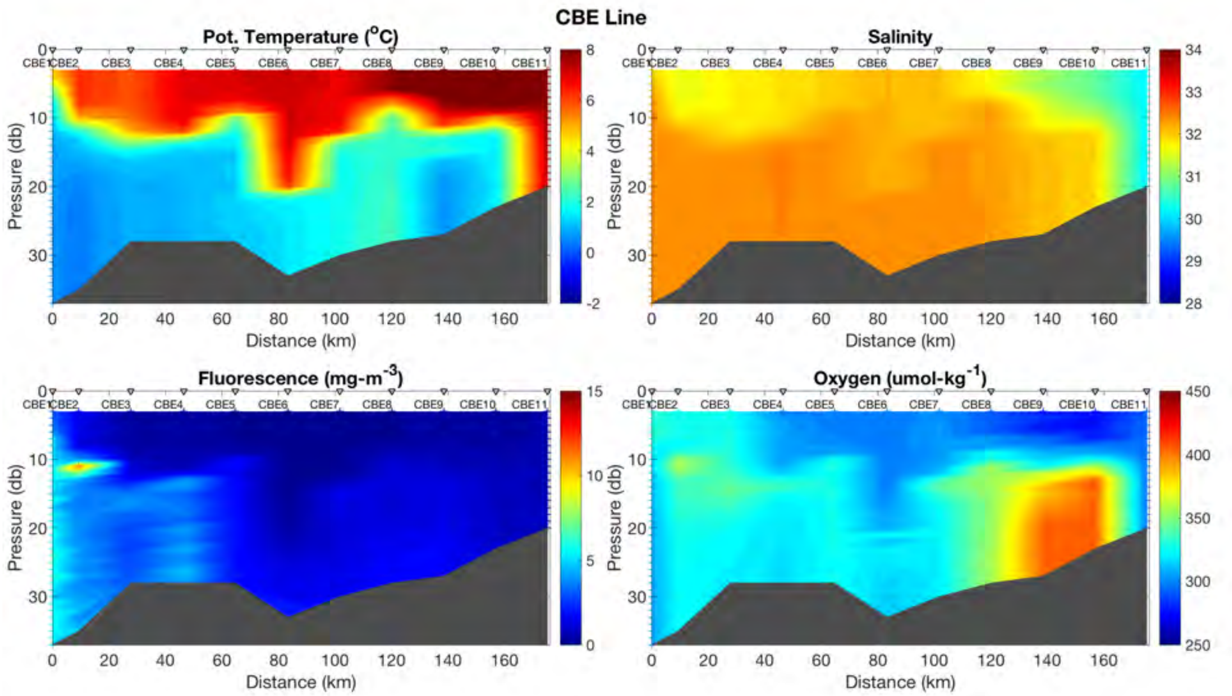


DBO-2 Transect (DBO2, 26 June)

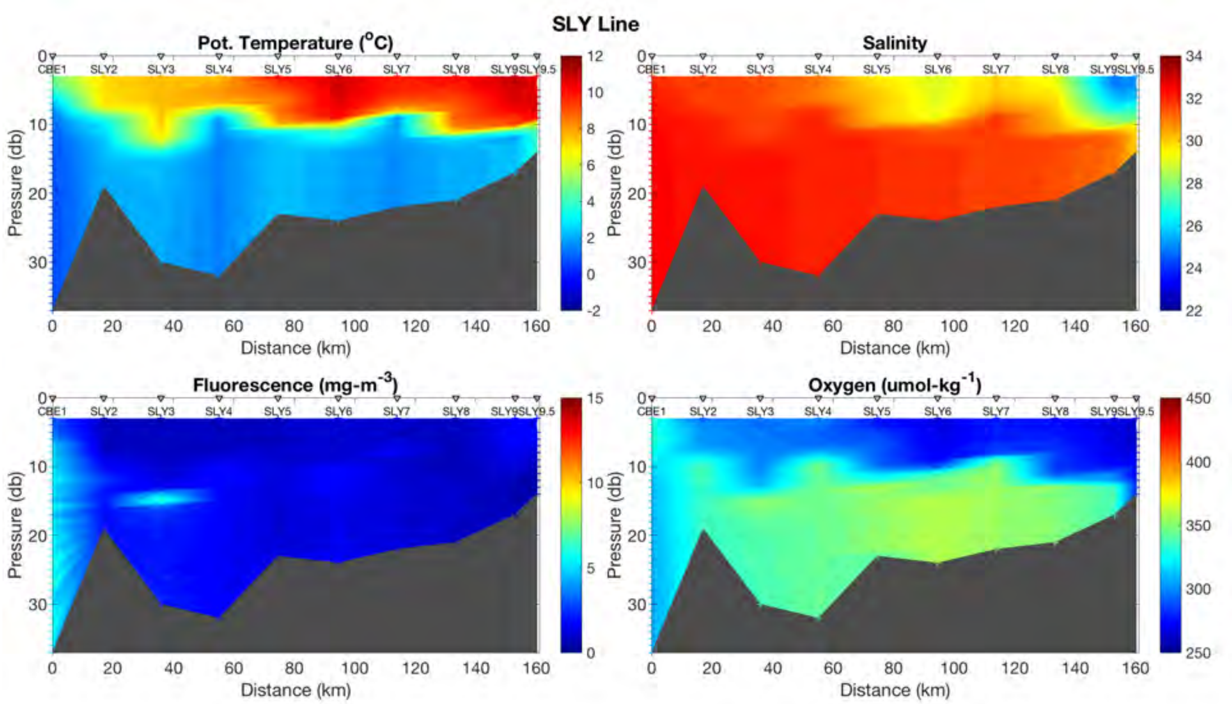
DBO2 Line



Chirkov Basin East transect (CBE, 27 June)



St. Lawrence to Yukon River transect (SLY, 28 June)



Appendix D: Event Activity Log

GPS_Time	Latitude	Longitude	Instrument	Action	Station	Cast	Depth	Author	Comment
6/9/17 16:07	64.4939	-165.438207	Ship	startCruise	NaN	NaN		eRoth1	Departing Nome, AK
6/9/17 16:52	64.443736	-165.637858	EM302	start	NaN	NaN		eRoth1	logging but sound speed is off
6/9/17 16:54	64.443151	-165.648752	EM710	start	NaN	NaN		eRoth1	logging but sound speed is off
6/9/17 16:57	64.442146	-165.666821	EK60	start	NaN	NaN		eRoth1	1.024 ms pulse duration, full power on all 5 freqs, logging
6/9/17 16:59	64.441338	-165.681165	OS150	start	NaN	NaN		eRoth1	logging, NB mode only, 25x 4 meter bins, external trigger [1,1]
6/9/17 17:01	64.440808	-165.691249	PS18	start	NaN	NaN		eRoth1	logging raw and sgy
6/9/17 17:01	64.440574	-165.696838	Underway Science seawater	start	NaN	NaN		eRoth1	
6/9/17 17:02	64.440471	-165.699156	PCO2	start	NaN	NaN		eRoth1	new filter on seawater equilibrator
6/9/17 21:57	64.380838	-167.070002	CTD911	deploy	CBE9	2	29.5	sDanielson1	ZOOP
6/9/17 22:27	64.380838	-167.070014	CTD911	deploy	CBE9	3	29.5	sDanielson1	
6/9/17 22:35	64.380839	-167.070013	CTD911	recover	CBE9	3	29.5	sDanielson1	
6/9/17 23:22	64.380841	-167.070009	CTD911	recover	CBE9	4	29.5	sDanielson1	PRIM PROD
6/9/17 23:33	64.380848	-167.070026	Vertical Net	deploy	CBE9	4	29.5	rHopcroft1	
6/9/17 23:43	64.381414	-167.070399	Vertical Net	recover	CSE9	4	29.5	rHopcroft1	PRESERVED
6/10/17 0:08	64.382266	-167.0681	Vertical Net	deploy	CBE9	4	29.5	rHopcroft1	LIVE
6/10/17 0:17	64.383029	-167.066925	Vertical Net	recover	CBE9	4		rHopcroft1	LIVE
6/10/17 0:51	64.383317	-167.066304	Multicorer	maxDepth	CBE9			sHardy	MC1
6/10/17 1:39	64.383307	-167.066294	Multicorer	maxDepth	CBE9	NaN	30.11	sHardy	MC2
6/10/17 2:12	64.388606	-167.059675	Bongo Net	deploy	CBE9	4	29	rHopcroft1	PRESERVED
6/10/17 2:14	64.390371	-167.058176	Bongo Net	recover	CBE9	4		rHopcroft1	BOTTOM
6/10/17 2:18	64.392579	-167.056318	Bongo Net	recover	CBE9	4		rHopcroft1	
6/10/17 2:55	64.389858	-167.086094	Mooring	deploy	CBE9	NaN		sDanielson1	MOORING N3
6/10/17 13:53	63.297434	-168.451579	BONGO 60CM	deploy	CBE1	NaN	40	rHopcroft1	
6/10/17 13:56	63.29837	-168.4536	Bongo Net	maxDepth	CBE1	NaN		rHopcroft1	
6/10/17 14:02	63.300557	-168.458324	BONGO 60CM	recover	CBE1	8	41,5	rHopcroft1	
6/10/17 14:30	63.296379	-168.44946	CTD911	deploy	CBE1	5		sDanielson1	
6/10/17 14:44	63.29637	-168.44946	CTD911	recover	CBE1	5		sDanielson1	
6/10/17 14:44	63.296369	-168.449466	CTD911	recover	CBE1	5		sDanielson1	
6/10/17 15:09	63.296375	-168.449454	CTD911	deploy	CBE1	6		sDanielson1	
6/10/17 15:15	63.296376	-168.449443	CTD911	recover	CBE1	6	39.4	sDanielson1	
6/10/17 15:29	63.296372	-168.449443	CTD911	deploy	CBE1	7	39.5	sDanielson1	
6/10/17 15:29	63.29638	-168.44944	CTD911	deploy	CBE1	7	39.5	sDanielson1	
6/10/17 15:36	63.296374	-168.449434	CTD911	recover	CBE1	7	40	sDanielson1	
6/10/17 15:54	63.296371	-168.449447	CTD911	deploy	CBE1	8	39.5	sDanielson1	
6/10/17 16:15	63.296372	-168.449436	CTD911	recover	CBE1	8	39.2	sDanielson1	
6/10/17 16:31	63.297923	-168.450056	Vertical Net	deploy	CBE1	NaN	42	rHopcroft1	PRESERVED
6/10/17 16:38	63.298943	-168.450461	Vertical Net	recover	CBE1	8	40	rHopcroft1	
6/10/17 16:51	63.300918	-168.451236	Vertical Net	deploy	CBE1	NaN	41	rHopcroft1	SECOND
6/10/17 16:57	63.301908	-168.451628	Vertical Net	recover	CBE1	NaN	41	rHopcroft1	SECOND
6/10/17 17:16	63.305202	-168.452915	Vertical Net	deploy	CBE1	NaN	41	rHopcroft1	THIRD
6/10/17 17:21	63.306062	-168.453244	Vertical Net	recover	CBE1	NaN	41	rHopcroft1	THIRD
6/10/17 17:37	63.307581	-168.454385	Vertical Net	deploy	CBE1	NaN	41	rHopcroft1	FORTH - RECAST
6/10/17 17:43	63.308546	-168.454956	Vertical Net	recover	CBE1	NaN	41	rHopcroft1	FOURTH
6/10/17 3:32	64.394516	-167.099278	PSBT	Surface	CBE9	1		anOther	60 m wire out
6/10/17 3:44	64.397898	-167.107362	PSBT	Surface	CBE9	1		anOther	
6/10/17 3:36	64.395579	-167.101872	PSBT	start	CBE9	1		anOther	60 m wire out, SIMRAD active
6/10/17 3:41	64.397039	-167.105276	PSBT	end	CBE9	1		anOther	
6/10/17 18:17	63.296729	-168.44992	Multicorer	maxDepth	CBE1	NaN	41.4	sHardy	MC3
6/10/17 18:55	63.296736	-168.449931	Multicorer	maxDepth	CBE1	NaN	39.5	sHardy	MC4
6/10/17 20:25	63.298049	-168.428598	Mooring	deploy	N1	8		sDanielson1	NEED 'TO FIX TIME & POSITIION

6/10/17 22:25	63.320803	-168.471693	Haps Corer	other	CBE1.5	NaN	41.36	sHardy	HAPS 1
6/10/17 23:00	63.316643	-168.467905	Haps Corer	other	CBE1.5	NaN	44.2	sHardy	HAPS 2
6/10/17 23:13	63.316645	-168.467908	Haps Corer	other	CBE1.5	NaN	44.3	sHardy	HAPS 3
6/10/17 23:47	63.316651	-168.467907	Multicorer	maxDepth	CBE1.5	NaN	44.7	sHardy	MC 5
6/10/17 21:16	63.300317	-168.452527	IKMT	Surface	CBE1	1		anOther	start tow
6/11/17 0:50	63.316658	-168.467918	Multicorer	maxDepth	CBE1.5	NaN	44.3	sHardy	MC 6
6/10/17 21:21	63.304534	-168.456468	IKMT	Surface	CBE1	1		anOther	middle of tow
6/10/17 21:25	63.307598	-168.459341	IKMT	Surface	CBE1	1		anOther	end of tow
6/10/17 21:50	63.314189	-168.465484	PSBT	Surface	CBE1	2		anOther	
6/10/17 21:54	63.315405	-168.466653	PSBT	start	CBE1	2		anOther	
6/10/17 21:01	63.296403	-168.44888	PSBT	end	CBE1	2		anOther	
6/10/17 22:04	63.319157	-168.470168	PSBT	Surface	CBE1	2		anOther	
6/11/17 2:11	63.316651	-168.467907	Multicorer	maxDepth	CBE1.5	NaN	44.24	sHardy	MC 7
6/11/17 2:55	63.321426	-168.472444	centerBoard	deploy	CBE1	42	42	eRoth1	
6/11/17 14:15	64.147507	-171.506855	BONGO 60CM	deploy	CBW5	12	45	rHopcroft1	
6/11/17 14:18	64.149142	-171.506844	BONGO 60CM	maxDepth	NaN	NaN	45	rHopcroft1	
6/11/17 14:23	64.151964	-171.506802	BONGO 60CM	recover	CBW5	12		rHopcroft1	53M WIRE
6/11/17 14:50	64.145964	-171.508691	CTD911	deploy	CBW5	9		sDanielson1	ZOOP & NUTS
6/11/17 15:08	64.145968	-171.508735	CTD911	recover	CBW5	9	45.5	sDanielson1	
6/11/17 15:29	64.145972	-171.508708	CTD911	deploy	CBW5	10	45	sDanielson1	
6/11/17 15:36	64.145969	-171.508716	CTD911	recover	CBW5	10		sDanielson1	
6/11/17 15:51	64.145969	-171.508707	CTD911	deploy	CBW5	11	45	sDanielson1	
6/11/17 15:57	64.14597	-171.508714	CTD911	recover	CBW5	11	45.5	sDanielson1	
6/11/17 16:45	64.145953	-171.508708	CTD911	recover	CBW5	12	45.5	sDanielson1	
6/11/17 16:45	64.145947	-171.508708	CTD911	recover	CBW5	12	45.5	sDanielson1	
6/11/17 16:55	64.146975	-171.509147	Vertical Net	deploy	CBW5	12	45.7	rHopcroft1	FIRST NO CTD
6/11/17 17:01	64.14781	-171.509062	Vertical Net	recover	NaN	NaN	45	rHopcroft1	ABORT
6/11/17 17:24	64.149236	-171.507795	Vertical Net	deploy	CBW5	12	45	rHopcroft1	FIRST
6/11/17 17:30	64.149235	-171.507817	Vertical Net	recover	CBW5	12	45	rHopcroft1	FIRST
6/11/17 17:44	64.149233	-171.507816	Vertical Net	deploy	CBW5	12		rHopcroft1	SECOND (no ctd)
6/11/17 17:51	64.149234	-171.507822	Vertical Net	recover	CBW5	12	45.5	rHopcroft1	
6/11/17 18:03	64.149237	-171.507805	Vertical Net	deploy	CBW5	12	45	rHopcroft1	THIRD (no ctd)
6/11/17 18:09	64.149231	-171.50782	Vertical Net	recover	CBW5	12	45	rHopcroft1	42 m wire
6/11/17 18:27	64.149231	-171.507808	Haps Corer	other	CBW5	NaN	47.38	anOther	HAPS 4
6/11/17 18:45	64.149234	-171.507799	Haps Corer	other	CBW5	NaN	45.65	anOther	HAPS 5
6/11/17 20:07	64.154298	-171.526649	Mooring	deploy	CEW5	NaN		sDanielson1	MOORING N2, BOTTOM DEPTH 45.6
6/11/17 20:55	64.158651	-171.522812	Vertical Net	deploy	CBW5	12	46	rHopcroft1	FOURTH
6/11/17 21:01	64.160678	-171.518911	Vertical Net	recover	CBW5	12	46	rHopcroft1	
6/12/17 0:14	64.147025	-171.850041	Underway Science seawater	service	NaN	NaN		eRoth1	
6/11/17 21:22	64.166452	-171.512134	IKMT	Surface	CBW5	2		anOther	
6/11/17 21:28	64.171365	-171.5078	IKMT	Surface	CBW5	2		anOther	
6/11/17 21:33	64.175366	-171.50429	IKMT	Surface	CBW5	2		anOther	
6/11/17 21:46	64.181495	-171.49512	PSBT	Surface	CBW5	3		anOther	
6/11/17 21:51	64.183204	-171.491219	PSBT	start	CBW5	3		anOther	
6/11/17 21:58	64.185606	-171.485718	PSBT	end	CBW5	3		anOther	
6/11/17 22:02	64.186712	-171.483183	PSBT	Surface	CBW5	3		anOther	
6/12/17 1:15	64.145421	-171.509566	CTD911	deploy	CBW5	14	45	sDanielson1	
6/12/17 1:30	64.145421	-171.5096	CTD911	recover	CBW5	14		sDanielson1	
6/12/17 16:14	65.910487	-168.230715	SVP drifter	deploy	NaN	NaN		sDanielson1	STABENO DRIFTER DEPLOY
6/12/17 20:41	65.846401	-168.245064	Underway Science seawater	service	NaN	NaN		eRoth1	switched to clean strainer
6/13/17 21:22	66.48483	-168.953021	BONGO 60CM	deploy	CNL3	18	56.6	rHopcroft1	
6/13/17 21:27	66.488863	-168.953562	BONGO 60CM	maxDepth	CNL3	NaN		rHopcroft1	
6/13/17 21:37	66.496272	-168.955005	BONGO 60CM	recover	CNL3	12	57	rHopcroft1	WIRE OUT 104M
6/13/17 21:56	66.50235	-168.958983	BONGO 60CM	deploy	CNL3	12	57	rHopcroft1	repeat cast

6/13/17 21:59	66.50447	-168.958957	BONGO 60CM	maxDepth	CNL3	NaN	57	rHopcroft1	
6/13/17 22:04	66.507963	-168.958963	BONGO 60CM	recover	CNL3	NaN	57	rHopcroft1	wire out 93m
6/13/17 22:42	66.501659	-168.961808	CTD911	deploy	CNL3	15	56	sDanielson1	
6/13/17 23:28	66.500074	-168.960271	CTD911	deploy	CNL3	16	56	sDanielson1	
6/13/17 23:53	66.500072	-168.960271	CTD911	deploy	CNL3	17	56	sDanielson1	
6/14/17 0:49	66.500072	-168.960267	CTD911	recover	CNL3	18	56	sDanielson1	
6/14/17 0:59	66.501463	-168.960402	Vertical Net	deploy	CNL3	18	56	rHopcroft1	FIRST
6/14/17 1:02	66.502063	-168.959995	Vertical Net	abort	CNL3	18		rHopcroft1	
6/14/17 1:09	66.503711	-168.960322	Vertical Net	deploy	CNL3	18	56	rHopcroft1	FIRST
6/14/17 1:13	66.50476	-168.961955	Vertical Net	recover	CNL3	18	57	rHopcroft1	52m
6/14/17 1:32	66.50153	-168.962485	Vertical Net	deploy	CNL3	18	56	rHopcroft1	SECOND
6/14/17 1:38	66.50291	-168.964498	Vertical Net	recover	CNL3	18	56	rHopcroft1	SECOND
NaN	NaN	NaN	Multicorer	maxDepth	CNL3	NaN	56.6	sHardy	MC 8
6/14/17 2:49	66.500593	-168.961573	Multicorer	maxDepth	CNL3	NaN	56.4	anOther	MC 9
6/14/17 3:10	66.501455	-168.963161	Vertical Net	deploy	CNL3	18	56	rHopcroft1	THIRD
6/14/17 3:15	66.502527	-168.965028	Vertical Net	recover	CNL3	NaN	56	rHopcroft1	THIRD
6/14/17 3:49	66.500441	-168.961245	Multicorer	maxDepth	CNL3	NaN	56.24	anOther	MC 10
6/14/17 4:19	66.504333	-168.96062	IKMT	Surface	CNL3	3		anOther	Start of trawl
6/14/17 4:28	66.512117	-168.959725	IKMT	Surface	CNL3	3		anOther	mid trawl
6/14/17 4:36	66.519373	-168.958997	IKMT	Surface	CNL3	3		anOther	
6/14/17 5:06	66.516978	-168.946679	PSBT	Surface	CNL3	4		anOther	
6/14/17 5:17	66.520815	-168.952729	PSBT	start	CNL3	4		anOther	
6/14/17 5:20	66.521869	-168.954365	PSBT	end	CNL3	4		anOther	
6/14/17 5:24	66.523272	-168.956559	PSBT	Surface	CNL3	4		anOther	
6/14/17 16:01	67.537914	-164.879109	BONGO 60CM	deploy	IL2	22	35	rHopcroft1	
6/14/17 16:04	67.536944	-164.876856	BONGO 60CM	maxDepth	IL2	22	35	rHopcroft1	
6/14/17 16:09	67.535317	-164.873097	BONGO 60CM	recover	IL2	22		rHopcroft1	wire out 50m
6/14/17 16:43	67.539061	-164.880111	CTD911	deploy	IL2	19	35.5	sDanielson1	
6/14/17 16:43	67.539061	-164.880113	CTD911	recover	IL2	19	35.5	sDanielson1	
6/14/17 16:59	67.539059	-164.880114	CTD911	deploy	IL2	20	36	sDanielson1	
6/14/17 17:08	67.539059	-164.880111	CTD911	recover	IL2	20	35.5	sDanielson1	
6/14/17 17:23	67.53906	-164.880109	CTD911	deploy	IL2	21	36	sDanielson1	
6/14/17 17:27	67.53906	-164.880111	CTD911	recover	IL2	21	36	sDanielson1	
6/14/17 17:40	67.539061	-164.880112	CTD911	deploy	IL2	22	35.5	sDanielson1	
6/14/17 18:02	67.539061	-164.880114	CTD911	recover	IL2	22	35.5	sDanielson1	
6/14/17 18:11	67.539427	-164.880408	Vertical Net	deploy	IL2	22	36	rHopcroft1	
6/14/17 18:14	67.539885	-164.88083	Vertical Net	recover	IL2	22	36	rHopcroft1	FIRST
6/14/17 18:27	67.540122	-164.881065	Vertical Net	deploy	IL2	22	36	rHopcroft1	SECOND
6/14/17 18:30	67.54044	-164.881363	Vertical Net	recover	IL2	22	36	rHopcroft1	SECOND
6/14/17 18:49	67.538904	-164.879899	Multicorer	maxDepth	IL2	NaN	35.2	sHardy	MC 11
6/14/17 19:15	67.538902	-164.879898	Multicorer	maxDepth	IL2	NaN	35.77	sHardy	MC 12
6/14/17 19:32	67.539574	-164.880493	Vertical Net	deploy	IL2	22	35	rHopcroft1	THIRD
6/14/17 19:34	67.539861	-164.880775	Vertical Net	recover	IL2	22	35	rHopcroft1	30m wire
6/14/17 20:28	67.53923	-164.880098	Multicorer	maxDepth	IL2	NaN	35.4	sHardy	MC 13
6/14/17 22:11	67.557627	-164.678991	Mooring	deploy	NaN	NaN		sDanielson1	N5, waterdepth 31 m, CTD cast at mooring site
6/14/17 22:24	67.558723	-164.67939	CTD911	deploy	N5	NaN	31	sDanielson1	
6/14/17 22:37	67.558727	-164.679396	CTD911	recover	N5	NaN	31	sDanielson1	
6/14/17 23:34	67.594584	-164.523686	CTD911	deploy	IL1.1	24	24	sDanielson1	
6/15/17 3:07	67.610895	-164.933764	CTD911	deploy	KL2	25	36	sDanielson1	KL (Kivalina Line) from coast to DBO3.8
6/15/17 1:36	67.544005	-164.883158	IKMT	Surface	IL2	4		anOther	Start
6/15/17 1:45	67.553616	-164.890907	IKMT	Surface	IL2	4		anOther	Mid
6/15/17 1:52	67.560104	-164.896563	IKMT	Surface	IL2	4		anOther	End
6/15/17 2:13	67.568544	-164.903804	PSBT	Surface	IL2	5		anOther	
6/15/17 2:16	67.569812	-164.905174	PSBT	start	IL2	5		anOther	
6/15/17 2:19	67.570903	-164.90649	PSBT	end	NaN	IL2		anOther	
6/15/17 2:23	67.572214	-164.908017	PSBT	Surface	IL2	5		anOther	
6/15/17 4:48	67.618005	-165.435753	CTD911	deploy	KL3	26	41	sDanielson1	

6/15/17 6:29	67.625235	-165.939234	CTD911	deploy	KL4	27	43	sDanielson1	
6/15/17 8:42	67.634081	-166.525417	CTD911	deploy	KL5	28	46	anOther	
6/15/17 8:43	67.634178	-166.531944	CTD911	recover	KL5	28	46	anOther	
6/15/17 9:49	67.640201	-166.946318	CTD911	deploy	KL6	29		anOther	
6/15/17 10:28	67.642371	-167.071789	CTD911	recover	KL6	29	50	anOther	
6/15/17 11:29	67.647671	-167.449494	CTD911	deploy	KL7	30	48.5	anOther	
6/15/17 11:46	67.647676	-167.44953	CTD911	recover	KL7	30	48.5	anOther	
6/15/17 13:10	67.655106	-167.953272	CTD911	deploy	KL8	31		anOther	
6/15/17 13:26	67.655081	-167.953245	CTD911	recover	KL8	31	49	anOther	
6/15/17 14:52	67.664903	-168.451836	CTD911	deploy	KL9	32	49	sDanielson1	
6/15/17 15:08	67.664905	-168.451841	CTD911	recover	KL9	32	49	sDanielson1	
6/15/17 16:45	67.669261	-168.955231	BONGO 60CM	deploy	DBO3.8	36	50	rHopcroft1	
6/15/17 16:48	67.668236	-168.955259	BONGO 60CM	maxDepth	BDO3.8	36	50	rHopcroft1	
6/15/17 16:51	67.666753	-168.955254	BONGO 60CM	recover	DBO3.8	36	50	rHopcroft1	
6/15/17 17:30	67.67046	-168.848973	Underway Science seawater	service	NaN	NaN		eRoth1	switched to clean strainer
6/15/17 17:56	67.670452	-168.729062	CTD911	deploy	DBO3.8A	33	50	sDanielson1	
6/15/17 18:34	67.670457	-168.72903	CTD911	deploy	DBO3.8A	34	50	sDanielson1	ZOOPS
6/15/17 18:53	67.670459	-168.729036	CTD911	deploy	DBO3.8A	35	50	sDanielson1	ZOOPS
6/15/17 19:20	67.670458	-168.729043	CTD911	deploy	DBO3.8A	36		sDanielson1	
6/15/17 19:44	67.67066	-168.72866	Vertical Net	deploy	DBO3.8A	36	50	rHopcroft1	FIRST
6/15/17 19:47	67.670871	-168.728216	Vertical Net	recover	BDO3.5A	36	50	rHopcroft1	FIRST
6/15/17 20:18	67.673034	-168.723342	Vertical Net	deploy	DBO3.6	36	50	rHopcroft1	SECOND
6/15/17 20:20	67.673226	-168.722894	Vertical Net	recover	DBO3.8A	36	50	rHopcroft1	SECOND
6/15/17 20:43	67.670797	-168.728012	Multicorer	maxDepth	DBO3.8A	NaN	49.44	sHardy	MC 14
6/15/17 21:20	67.670816	-168.728006	Multicorer	maxDepth	DBO3.8A	NaN	49.5	sHardy	MC 15 6 cores
6/15/17 21:42	67.671627	-168.726258	Vertical Net	deploy	DBO3.8A	36	50	rHopcroft1	THIRD
6/15/17 21:46	67.672143	-168.725159	Vertical Net	recover	DBO3.8A	NaN	50	rHopcroft1	THIRD
6/15/17 23:56	67.671682	-168.725997	Multicorer	maxDepth	DBO3.8A	NaN	50.8	sHardy	MC 16 6 cores
6/16/17 1:13	67.672011	-168.745713	CTD911	deploy	N6	37	50	sDanielson1	
6/15/17 22:14	67.677432	-168.71392	IKMT	Surface	DBO 3.8A	5		anOther	
6/15/17 22:22	67.682332	-168.703512	IKMT	Surface	DBO 3.8A	5		anOther	
6/15/17 22:29	67.686613	-168.694403	IKMT	Surface	DBO 3.8A	5		anOther	
6/15/17 22:43	67.692414	-168.682056	PSBT	Surface	DBO 3.8A	6		anOther	
6/15/17 22:47	67.693705	-168.679312	PSBT	start	DBO 3.8A	6		anOther	
6/15/17 22:52	67.695404	-168.675717	PSBT	end	DBO 3.8A	6		anOther	
6/15/17 22:56	67.696451	-168.673482	PSBT	Surface	DBO 3.8A	6		anOther	
6/16/17 3:26	67.897644	-168.240442	CTD911	deploy	DBO3.6	38	58	sDanielson1	ctd for trawl
6/16/17 3:58	67.893827	-168.236411	IKMT	Surface	DBO 3.6	6		anOther	start
6/16/17 4:08	67.885201	-168.22539	IKMT	Surface	DBO 3.6	6		anOther	mid
6/16/17 4:17	67.877876	-168.213906	IKMT	Surface	DBO 3.6	6		anOther	end
6/16/17 4:36	67.877952	-168.21098	PSBT	Surface	DBO 3.6	7		anOther	
6/16/17 4:41	67.880092	-168.213343	PSBT	start	DBO 3.6	7		anOther	
6/16/17 4:46	67.881994	-168.215495	PSBT	end	DBO 3.6	7		anOther	
6/16/17 4:50	67.883605	-168.217351	PSBT	Surface	DBO 3.6	7		anOther	
6/16/17 8:45	67.500037	-168.949484	CTD911	deploy	CNL7	39	49.5	anOther	
6/16/17 9:03	67.500039	-168.949492	CTD911	recover	CNL7	39	49.5	anOther	
6/16/17 16:10	68.187401	-167.317892	BONGO 60CM	deploy	DBO3.3	43	49	rHopcroft1	
6/16/17 16:11	68.186991	-167.316855	BONGO 60CM	maxDepth	DBO3.3	NaN		rHopcroft1	
6/16/17 16:14	68.186226	-167.314947	BONGO 60CM	recover	DBO3.8	43	49	rHopcroft1	56m wire out
6/16/17 16:27	68.184409	-167.309265	BONGO 60CM	deploy	DBO3.3	43	49	rHopcroft1	cast 2
6/16/17 16:30	68.183757	-167.307641	BONGO 60CM	maxDepth	DBO3.3	NaN	48	rHopcroft1	
6/16/17 16:33	68.182704	-167.304989	BONGO 60CM	recover	DBO3.3	43	48	rHopcroft1	65m wire out
6/16/17 16:52	68.184877	-167.309966	CTD911	deploy	DBO3.3	40	48	sDanielson1	
6/16/17 17:32	68.184865	-167.309966	CTD911	deploy	DBO3.3	41	48	sDanielson1	
6/16/17 17:57	68.184875	-167.309964	CTD911	deploy	DBO3.3*	42	48	sDanielson1	

6/16/17 18:18	68.184873	-167.309982	CTD911	deploy	DBO3.3	43	48	sDanielson1	
6/16/17 18:48	68.186055	-167.312613	Vertical Net	deploy	DBO3.3	43	49	rHopcroft1	FIRST
6/16/17 18:52	68.186604	-167.313716	Vertical Net	recover	DBO3.3	43	48	rHopcroft1	FIRST
6/16/17 19:05	68.18887	-167.318089	Vertical Net	deploy	DBO3.3	43		rHopcroft1	SECOND
6/16/17 19:08	68.18946	-167.319224	Vertical Net	recover	DBO3.3	43	48	rHopcroft1	SECOND
6/16/17 19:35	68.185605	-167.310702	Multicorer	maxDepth	DBO3.3	NaN	48	sHardy	MC 17
6/16/17 20:32	68.185606	-167.310689	Multicorer	maxDepth	DBO3.3	NaN	49.3	sHardy	MC 18 6 cores
6/16/17 20:52	68.186105	-167.311492	Vertical Net	deploy	DBO3.3	43	49	rHopcroft1	THIRD
6/16/17 20:56	68.186667	-167.312415	Vertical Net	recover	DBO3.3	43	48	rHopcroft1	THIRD
6/16/17 21:13	68.185771	-167.310416	Multicorer	maxDepth	DBO3.3	NaN	47.9	sHardy	MC 19
6/16/17 23:33	68.128469	-167.498702	CTD911	deploy	DBO3.4	44	49	sDanielson1	
6/17/17 3:23	68.300441	-166.94083	CTD911	deploy	DBO3.1	45	36	sDanielson1	
6/17/17 4:34	68.380436	-167.161462	CTD911	deploy	HL2	46	40	anOther	
6/16/17 21:37	68.188468	-167.313345	IKMT	Surface	DBO 3.3	7		anOther	Start
6/16/17 21:44	68.194983	-167.320959	IKMT	Surface	DBO 3.3	7		anOther	Middle
6/16/17 21:51	68.20136	-167.327304	IKMT	Surface	DBO 3.3	7		anOther	End
6/16/17 22:11	68.23017	-167.367032	PSBT	Surface	DBO 3.3	8		anOther	No SIMRAD
6/16/17 22:16	68.231752	-167.368809	PSBT	start	DBO 3.3	8		anOther	
6/17/17 5:04	68.421699	-167.26946	PSBT	end	DBO 3.3	8		anOther	
6/16/17 22:22	68.234266	-167.372343	PSBT	Surface	DBO 3.3	8		anOther	
6/17/17 0:01	68.125071	-167.489689	PSBT	Surface	DBO 3.4	9		anOther	Non Quantitative
6/17/17 0:11	68.121823	-167.482303	PSBT	start	DBO 3.4	9		anOther	Start time after wire let out to 120 m
6/17/17 0:14	68.120771	-167.479815	PSBT	end	DBO 3.4	9		anOther	
6/17/17 0:19	68.119369	-167.47645	PSBT	Surface	DBO 3.4	9		anOther	
6/17/17 0:54	68.159071	-167.422878	PSBT	Surface	DBO 3.4	10		anOther	
6/17/17 0:58	68.160179	-167.426805	PSBT	start	DBO 3.4	10		anOther	
6/17/17 1:01	68.161161	-167.428814	PSBT	end	DBO 3.4	10		anOther	
6/17/17 1:05	68.162318	-167.431885	PSBT	Surface	DBO 3.4	10		anOther	
6/17/17 1:17	68.16648	-167.442319	IKMT	Surface	DBO 3.4	8		anOther	
6/17/17 1:25	68.172644	-167.454694	IKMT	Surface	DBO 3.4	8		anOther	
6/17/17 1:33	68.178727	-167.467252	IKMT	Surface	DBO 3.4	8		anOther	
6/17/17 5:30	68.461527	-167.372176	CTD911	deploy	HL3	47	49	anOther	
6/17/17 6:40	68.542779	-167.594383	CTD911	deploy	HL4	48	50	anOther	
6/17/17 8:01	68.624358	-167.811305	CTD911	deploy	HL5	49	52	anOther	
6/17/17 9:09	68.706058	-168.02128	CTD911	deploy	HL6	50	50	anOther	
6/17/17 10:18	68.787177	-168.241392	CTD911	deploy	HL7	51	51	anOther	
6/17/17 11:32	68.868268	-168.461041	CTD911	deploy	HL8	52	51	anOther	
6/17/17 12:39	68.949209	-168.670638	CTD911	deploy	HL9	53	51	anOther	
6/17/17 13:54	69.034246	-168.891629	CTD911	deploy	CL3	54	52	anOther	
6/17/17 16:07	69.036822	-168.890392	BONGO 60CM	deploy	CL3	58	53	rHopcroft1	
6/17/17 16:16	69.040442	-168.877735	BONGO 60CM	recover	CL3	58	53	rHopcroft1	early deploy 94 out
6/17/17 16:47	69.034272	-168.891242	CTD911	deploy	CL3	55	53	sDanielson1	
6/17/17 17:30	69.032876	-168.885005	CTD911	deploy	CL3	56	53	sDanielson1	
6/17/17 17:50	69.033575	-168.889819	CTD911	deploy	CL3	57	53	sDanielson1	
6/17/17 18:08	69.034331	-168.894998	SVP drifter	deploy	cl3	58	53	sDanielson1	
6/17/17 18:42	69.035887	-168.902453	CTD911	recover	CL3	58	53	sDanielson1	
6/17/17 18:53	69.035518	-168.901714	Vertical Net	deploy	CL3	58	54	rHopcroft1	FIRST
6/17/17 18:56	69.035319	-168.901135	Vertical Net	abort	CL3	NaN	53	rHopcroft1	
6/17/17 19:16	69.036847	-168.905124	Vertical Net	deploy	CL3	58	54	rHopcroft1	FIRST slow tow
6/17/17 19:21	69.037778	-168.906103	Vertical Net	recover	CL3	58	53	rHopcroft1	FIRST slow tow
6/17/17 19:32	69.039911	-168.908277	Vertical Net	deploy	CL3	58	53	rHopcroft1	SECOND slow tow
6/17/17 19:36	69.040601	-168.908774	Vertical Net	recover	CL3	58	53	rHopcroft1	SECOND slow tow
6/17/17 20:41	69.034334	-168.891334	Multicorer	maxDepth	CL3	NaN	52.65	sHardy	MC 20
6/17/17 21:10	69.034332	-168.89133	Multicorer	maxDepth	CL3	NaN	52.19	sHardy	MC 21
6/17/17 21:27	69.034827	-168.892339	Vertical Net	deploy	CL3	58		rHopcroft1	THIRD slow tow
6/17/17 21:33	69.035596	-168.892736	Vertical Net	recover	CL3	58	54	rHopcroft1	THIRD slow tow
6/17/17 22:18	69.034191	-168.89203	Multicorer	maxDepth	CL3	NaN	53.74	sHardy	MC 22

6/17/17 22:40	69.036423	-168.887917	IKMT	Surface	CL3	9		anOther	Start
6/17/17 22:50	69.043247	-168.873699	IKMT	Surface	CL3	9		anOther	mid
6/17/17 22:59	69.04988	-168.860639	IKMT	Surface	CL3	9		anOther	end
6/17/17 23:15	69.055819	-168.856144	PSBT	Surface	CL3	11		anOther	
6/17/17 23:21	69.057248	-168.861877	PSBT	start	CL3	11		anOther	
6/17/17 23:23	69.057949	-168.864231	PSBT	end	CL3	11		anOther	
6/17/17 23:28	69.059208	-168.869686	PSBT	Surface	CL3	11		anOther	
6/18/17 2:12	69.028919	-167.931453	CTD911	deploy	CL2	59	51	sDanielson1	
6/18/17 2:39	69.03137	-167.935045	PSBT	Surface	CL2	12		anOther	
6/18/17 2:44	69.033422	-167.933897	PSBT	start	CL2	12		anOther	Non-Quantitative, problem with float
6/18/17 2:47	69.034392	-167.933273	PSBT	end	CL2	12		anOther	
6/18/17 2:51	69.036169	-167.932	PSBT	Surface	CL2	12		anOther	
6/18/17 3:12	69.043281	-167.925908	IKMT	Surface	CL2	10		anOther	
6/18/17 3:28	69.057464	-167.90773	IKMT	Surface	CL2	10		anOther	
6/18/17 8:45	69.816247	-167.069823	CTD911	deploy	NCL5	60	46	anOther	
6/18/17 9:09	69.811583	-167.066906	SVP drifter	deploy	NCL5	60		anOther	J06OJB SBD9602F02
6/18/17 9:11	69.81025	-167.066112	SVP drifter	deploy	NCL5	60		anOther	122541 Bouy & tether parts
6/18/17 9:12	69.808469	-167.065012	SVP drifter	deploy	NCL5	60		anOther	122542
6/18/17 10:30	69.633133	-166.940182	CTD911	deploy	NCL4	61	46	anOther	
6/18/17 12:03	69.449121	-166.810052	CTD911	deploy	NCL3	62	43	anOther	
6/18/17 13:42	69.269167	-166.682269	CTD911	deploy	NCL2	63	40	sDanielson1	
6/18/17 15:33	69.082829	-166.548298	CTD911	deploy	NCL1	64	35	sDanielson1	
6/18/17 17:14	68.950104	-166.906543	BONGO 60CM	deploy	CL1	68	47	rHopcroft1	
6/18/17 17:15	68.949445	-166.907064	BONGO 60CM	maxDepth	CL1	68	47	rHopcroft1	
6/18/17 17:18	68.948362	-166.907933	BONGO 60CM	recover	CL1	68	43 deep 57 wire out	rHopcroft1	
6/18/17 17:30	68.947971	-166.910145	CTD911	deploy	CL1	65	47	sDanielson1	
6/18/17 18:19	68.94797	-166.910142	SVP drifter	deploy	CL1		47	sDanielson1	J06NOM
6/18/17 18:29	68.94794	-166.90988	CTD911	deploy	CL1	67	47	sDanielson1	
6/18/17 18:50	68.947956	-166.910048	CTD911	deploy	CL1	68	47	sDanielson1	
6/18/17 19:19	68.948511	-166.909362	Vertical Net	deploy	CL1	68	47	rHopcroft1	FIRST
6/18/17 19:22	68.948841	-166.908737	Vertical Net	recover	CL1	68	47	rHopcroft1	FIRST
6/18/17 19:33	68.949835	-166.906788	Vertical Net	deploy	CL1	68	47	rHopcroft1	SECOND
6/18/17 19:36	68.950103	-166.906251	Vertical Net	recover	CL1	68	47	rHopcroft1	SECOND
6/18/17 20:21	68.94815	-166.909746	Haps Corer	start	CL1	NaN	47	sHardy	HAPs 6
6/18/17 20:43	68.94814	-166.909745	Multicorer	maxDepth	CL1	NaN	48.3	sHardy	MC 23
6/18/17 21:15	68.948154	-166.909742	Multicorer	maxDepth	CL1	NaN	47.4	sHardy	MC 24
6/18/17 21:48	68.948145	-166.909737	Multicorer	maxDepth	CL1	NaN	48.3	sHardy	MC 25
6/18/17 22:12	68.948563	-166.90898	Vertical Net	deploy	CL1	68	47	rHopcroft1	THIRD
6/18/17 22:16	68.948804	-166.908549	Vertical Net	recover	CL1	68	47	rHopcroft1	THIRD
6/18/17 22:32	68.952917	-166.902472	IKMT	Surface	CL1	11		anOther	
6/18/17 22:40	68.95841	-166.893655	IKMT	Surface	CL1	11		anOther	Middle
6/18/17 22:47	68.963845	-166.885325	IKMT	Surface	CL1	11		anOther	
6/18/17 23:00	68.970647	-166.875013	PSBT	Surface	CL1	13		anOther	
6/18/17 23:04	68.972256	-166.872463	PSBT	start	CL1	13		anOther	
6/19/17 0:43	68.898466	-166.420882	CTD911	deploy	CL0	69	31	sDanielson1	
6/18/17 23:08	68.97378	-166.870015	PSBT	end	CL1	13		anOther	
6/18/17 23:12	68.975333	-166.867545	PSBT	Surface	CL1	13		anOther	
6/19/17 1:13	68.899351	-166.423312	PSBT	Surface	CL0	14		anOther	Non-Quantitative, looking for Arctic Cod
6/19/17 1:15	68.900266	-166.424464	PSBT	start	CL0	NaN		anOther	
6/19/17 1:20	68.902105	-166.426758	PSBT	end	CL0	14		anOther	
6/19/17 1:23	68.903024	-166.427906	PSBT	Surface	CL0	14		anOther	
6/19/17 1:37	68.907517	-166.432559	IKMT	Surface	CL0	12		anOther	Looking for sign of Arctic Cod
6/19/17 1:42	68.912878	-166.437648	IKMT	Surface	CL0	12		anOther	

6/19/17 1:47	68.916886	-166.441507	IKMT	Surface	CL0	12		anOther	
6/19/17 7:56	68.898601	-166.419262	CTD911	deploy	CL0	70	31	anOther	
6/19/17 8:27	68.898752	-166.41954	Vertical Net	deploy	CL0	70	31	rHopcroft1	
6/19/17 8:30	68.89899	-166.419576	Vertical Net	recover	CL0	70	31	rHopcroft1	
6/19/17 8:40	68.900427	-166.419522	BONGO 60CM	deploy	CL0	70	31.2	rHopcroft1	
6/19/17 8:42	68.901473	-166.419449	BONGO 60CM	maxDepth	CL0	70		rHopcroft1	
6/19/17 8:46	68.903515	-166.419301	BONGO 60CM	recover	CL0	70	32.3	rHopcroft1	
6/19/17 10:13	68.947907	-166.909879	CTD911	deploy	CL1	71	46	anOther	
6/19/17 12:05	68.999582	-167.42526	Vertical Net	deploy	CL1.5	72	48	rHopcroft1	
6/19/17 12:10	68.999948	-167.424987	Vertical Net	recover	CL1.5	72	48	rHopcroft1	
6/19/17 12:22	68.999966	-167.428546	CTD911	deploy	CL1.5	72	48	sDanielson1	
6/19/17 12:44	68.999272	-167.429779	BONGO 60CM	deploy	CL1.5	72	48	rHopcroft1	
6/19/17 12:46	68.998675	-167.430993	BONGO 60CM	maxDepth	CL1.5	72		rHopcroft1	
6/19/17 12:49	68.997592	-167.433193	BONGO 60CM	recover	CL1.5	72	48	rHopcroft1	60m wire out
6/19/17 14:18	69.029603	-167.928248	Vertical Net	deploy	CL2	73	50	rHopcroft1	
6/19/17 14:22	69.029891	-167.927809	Vertical Net	recover	CL2	73	50	rHopcroft1	
6/19/17 14:33	69.029798	-167.929137	CTD911	deploy	CL2	73	50	sDanielson1	
6/19/17 14:57	69.030036	-167.924401	BONGO 60CM	deploy	CL2	73	50	rHopcroft1	
6/19/17 15:00	69.029752	-167.920915	BONGO 60CM	maxDepth	CL2	73	50	rHopcroft1	
6/19/17 15:03	69.029393	-167.916256	BONGO 60CM	recover	CL2	73	50	rHopcroft1	67m wire out
6/19/17 16:31	69.030204	-168.411053	Vertical Net	deploy	CL2.5	74	52.2	rHopcroft1	
6/19/17 16:35	69.030207	-168.411032	Vertical Net	recover	CL2.5	74	51.5	rHopcroft1	
6/19/17 16:44	69.030144	-168.410508	CTD911	deploy	CL2.5	74	51	sDanielson1	
6/19/17 17:07	69.02956	-168.408334	BONGO 60CM	deploy	CL2.5	74	52	rHopcroft1	previous vertical entry should be station CL2.5
6/19/17 17:10	69.028726	-168.405335	BONGO 60CM	maxDepth	CL2.5	74	51.6	rHopcroft1	72m wire
6/19/17 17:13	69.027746	-168.401733	BONGO 60CM	recover	CL2.5	74	51.4	rHopcroft1	
6/19/17 17:51	69.031901	-168.621552	OS150	service	NaN	NaN		eRoth1	switched to BB mode (80x 2m bins)
6/19/17 18:37	69.033065	-168.885106	Vertical Net	deploy	CL3	75	53	rHopcroft1	
6/19/17 18:40	69.033268	-168.885876	Vertical Net	recover	CL3	75	52.7	rHopcroft1	
6/19/17 18:50	69.033785	-168.889502	CTD911	deploy	CL3	75	53	sDanielson1	
6/19/17 19:18	69.03227	-168.891746	BONGO 60CM	deploy	CL3	75	54	rHopcroft1	
6/19/17 19:20	69.030828	-168.892284	BONGO 60CM	maxDepth	CL3	75	53	rHopcroft1	
NaN	NaN	NaN	BONGO 60CM	recover	CL3	75	53	rHopcroft1	
6/19/17 21:16	68.751623	-168.949743	CTD911	deploy	CNL12	76	52	anOther	
6/19/17 23:18	68.50095	-168.950292	Vertical Net	deploy	CNL11	77	56	rHopcroft1	
6/19/17 23:22	68.50114	-168.950019	Vertical Net	recover	CNL11	77	55	rHopcroft1	
6/19/17 23:31	68.501446	-168.950306	CTD911	deploy	CNL11	77	55	anOther	
6/19/17 23:58	68.499707	-168.951209	BONGO 60CM	deploy	CNL11	77	55	rHopcroft1	
6/20/17 0:00	68.499076	-168.952203	BONGO 60CM	maxDepth	CNL11	77	55	rHopcroft1	
6/20/17 0:03	68.497871	-168.952782	BONGO 60CM	recover	CNL11	77	55	rHopcroft1	
6/20/17 1:46	68.250675	-168.950739	CTD911	deploy	CNL10	78	56	anOther	
6/20/17 3:50	68.000376	-168.950476	Vertical Net	deploy	CNL9	79	59	rHopcroft1	
6/20/17 3:54	68.000531	-168.950526	Vertical Net	recover	CNL11	79	59	rHopcroft1	
6/20/17 4:01	68.000638	-168.950508	CTD911	deploy	CNL9	79	57	anOther	
6/20/17 4:27	67.998916	-168.949815	BONGO 60CM	deploy	CNL9	79	59	rHopcroft1	
6/20/17 4:30	67.997376	-168.949917	BONGO 60CM	maxDepth	CNL9	79	59	rHopcroft1	
6/20/17 4:34	67.995158	-168.949946	BONGO 60CM	recover	CNL9	79	59	rHopcroft1	88m wire out
6/20/17 6:47	67.670922	-168.960838	Vertical Net	deploy	DBO3.8	80	50	rHopcroft1	
6/20/17 6:50	67.671166	-168.960012	Vertical Net	recover	DBO3.8	80	50	rHopcroft1	
6/20/17 7:00	67.670964	-168.959952	CTD911	deploy	DBO3.8	80	50	anOther	
6/20/17 7:24	67.672832	-168.954524	BONGO 60CM	deploy	DBO3.8	80	50	rHopcroft1	
6/20/17 7:26	67.67375	-168.951987	BONGO 60CM	maxDepth	DBO3.8	80	51	rHopcroft1	
6/20/17 7:30	67.675285	-168.94773	BONGO 60CM	recover	DBO3.8	80	50	rHopcroft1	69m wire out
6/20/17 8:42	67.783177	-168.600603	Vertical Net	deploy	DBO3.7	81	51	rHopcroft1	
6/20/17 8:45	67.783427	-168.599842	Vertical Net	recover	DBO3.7	81	51	rHopcroft1	
6/20/17 8:57	67.783332	-168.599676	CTD911	deploy	DBO3.7	81	50	anOther	
6/20/17 9:22	67.782235	-168.60044	BONGO 60CM	deploy	DBO3.7	81	51	rHopcroft1	

6/20/17 9:27	67.780351	-168.601832	BONGO 60CM	recover	DBO3.7	81	50	rHopcroft1	61m wire out
6/20/17 10:51	67.898565	-168.239546	Vertical Net	deploy	DBO3.6	82	58	rHopcroft1	
6/20/17 10:55	67.898782	-168.239054	Vertical Net	recover	DBO3.6	82		rHopcroft1	
6/20/17 11:06	67.898133	-168.240106	CTD911	deploy	DBO3.6	82	58	anOther	
6/20/17 11:35	67.898115	-168.243395	BONGO 60CM	deploy	DBO3.6	82	58	rHopcroft1	
6/20/17 11:37	67.897457	-168.24547	BONGO 60CM	maxDepth	DBO3.6	82	58	rHopcroft1	
6/20/17 11:41	67.896391	-168.248829	BONGO 60CM	recover	DBO3.6	82	58	rHopcroft1	74m wire out
6/20/17 14:14	67.671648	-168.962586	CTD911	deploy	DBO3.8	83	51	sDanielson1	
6/20/17 17:01	67.898287	-168.239358	Multicorer	maxDepth	DBO3.6	NaN	58.3	sHardy	MC 26
6/20/17 17:28	67.898284	-168.239355	Multicorer	maxDepth	DBO3.6	NaN	59	sHardy	MC 27
6/20/17 18:23	67.898284	-168.239354	Multicorer	maxDepth	DBO3.6	NaN	59	sHardy	MC 28
6/20/17 18:42	67.90546	-168.219698	SVP drifter	deploy	NaN	NaN		sDanielson1	s/n 122357
6/20/17 20:01	68.013908	-167.874762	Vertical Net	deploy	DBO3.5	84	52.7	rHopcroft1	
6/20/17 20:05	68.014501	-167.875616	Vertical Net	recover	DBO3.5	84	52	rHopcroft1	
6/20/17 20:16	68.013363	-167.871357	CTD911	deploy	DBO3.5	84	53	sDanielson1	
6/20/17 20:38	68.015352	-167.869857	BONGO 60CM	deploy	DBO3.5	84	53	rHopcroft1	
6/20/17 20:41	68.016488	-167.867431	BONGO 60CM	maxDepth	DBO3.5	84	52	rHopcroft1	
6/20/17 20:44	68.018392	-167.864758	BONGO 60CM	recover	DBO3.5	84	52	rHopcroft1	
6/20/17 21:54	68.127913	-167.501924	Vertical Net	deploy	DBO 3.4	85	50	rHopcroft1	
6/20/17 21:57	68.12865	-167.502913	Vertical Net	recover	DBO3.4	85	50	rHopcroft1	
6/20/17 22:05	68.128284	-167.501119	CTD911	deploy	DBO3.4	85	49	anOther	
6/20/17 22:31	68.130368	-167.499044	BONGO 60CM	deploy	DBO3.4	85	49	rHopcroft1	
6/20/17 22:32	68.131279	-167.497493	BONGO 60CM	maxDepth	DBO3.4	85	49.6	rHopcroft1	
6/20/17 22:35	68.132892	-167.494916	BONGO 60CM	recover	DBO3.4	85	49.4	rHopcroft1	
6/20/17 23:17	68.185453	-167.312286	Vertical Net	deploy	DBO3.3	86	48.5	rHopcroft1	
6/20/17 23:21	68.186226	-167.313362	Vertical Net	recover	DBO3.3	86	48.6	rHopcroft1	
6/20/17 23:30	68.18556	-167.311123	CTD911	deploy	DBO3.3	86	48	anOther	
6/20/17 23:51	68.187946	-167.309457	BONGO 60CM	deploy	DBO3.3	86	48.9	rHopcroft1	
6/20/17 23:54	68.188987	-167.307965	BONGO 60CM	maxDepth	DBO3.3	86	48.1	rHopcroft1	
6/20/17 23:57	68.190412	-167.305388	BONGO 60CM	recover	DBO3.3	86	48.1	rHopcroft1	
6/21/17 0:40	68.2419	-167.120213	Vertical Net	deploy	DBO3.2	87	43.7	rHopcroft1	
6/21/17 0:43	68.24265	-167.120499	Vertical Net	recover	DBO3.2	87	43.4	rHopcroft1	
6/21/17 0:51	68.24241	-167.119869	CTD911	deploy	DBO3.2	87	43	anOther	
6/21/17 1:12	68.243907	-167.119728	BONGO 60CM	deploy	DBO3.2	87	43.6	rHopcroft1	
6/21/17 1:13	68.244654	-167.118089	BONGO 60CM	maxDepth	DBO3.2	87	43	rHopcroft1	
6/21/17 1:16	68.246031	-167.115101	BONGO 60CM	recover	DBO3.2	87	42.9	rHopcroft1	
6/21/17 2:24	68.301706	-166.942043	Vertical Net	deploy	DBO3.1	88	34	rHopcroft1	
6/21/17 2:27	68.302244	-166.943882	Vertical Net	recover	DBO3.1	88	35	rHopcroft1	
6/21/17 2:40	68.300311	-166.941156	CTD911	deploy	DBO3.1	88	35	anOther	
6/21/17 3:01	68.29899	-166.939549	BONGO 60CM	deploy	DBO3.1	88	35	rHopcroft1	
6/21/17 3:04	68.297598	-166.937938	BONGO 60CM	maxDepth	DBO3.1	88	35	rHopcroft1	
6/21/17 3:05	68.297284	-166.937625	BONGO 60CM	recover	DBO3.1	88	35	rHopcroft1	51m wire out
6/21/17 11:03	67.603851	-164.430689	Vertical Net	deploy	IL1	89	25	rHopcroft1	
6/21/17 11:05	67.603855	-164.430675	Vertical Net	recover	IL1	89	25	rHopcroft1	
6/21/17 11:15	67.603841	-164.430724	CTD911	deploy	IL1	89	23	anOther	
6/21/17 11:34	67.602897	-164.430908	BONGO 60CM	deploy	IL1	89	24	rHopcroft1	
6/21/17 11:36	67.602117	-164.431103	BONGO 60CM	maxDepth	IL1	89	24	rHopcroft1	
6/21/17 11:38	67.600794	-164.431408	BONGO 60CM	recover	IL1	89	24	rHopcroft1	28m wire out
6/21/17 13:10	67.539129	-164.879837	Vertical Net	deploy	IL2	90		rHopcroft1	slow tow
6/21/17 13:14	67.539159	-164.880049	Vertical Net	recover	IL2	90	35	rHopcroft1	
6/21/17 13:48	67.538794	-164.87787	CTD911	deploy	IL2	90	35	sDanielson1	
6/21/17 13:52	67.537902	-164.880158	BONGO 60CM	deploy	IL2	90	35.5	rHopcroft1	
6/21/17 13:55	67.536941	-164.882677	BONGO 60CM	maxDepth	IL2	90		rHopcroft1	20/10
6/21/17 14:00	67.535433	-164.886678	BONGO 60CM	recover	IL2	90	35	rHopcroft1	46m wire out
6/21/17 15:38	67.475304	-165.337958	CTD911	deploy	IL3	91	37	sDanielson1	
6/21/17 17:39	67.411185	-165.788483	Vertical Net	deploy	IL4	92	38.8	rHopcroft1	
6/21/17 17:43	67.411202	-165.788531	Vertical Net	recover	IL4	92	39.8	rHopcroft1	

6/21/17 17:58	67.411075	-165.788613	CTD911	deploy	IL4	92	38	sDanielson1	
6/21/17 18:43	67.411059	-165.789313	Multicorer	maxDepth	IL4	NaN	38.3	sHardy	MC 29
6/21/17 19:25	67.411048	-165.789321	Multicorer	maxDepth	IL4	NaN	39	sHardy	MC 30
6/21/17 19:51	67.410358	-165.791222	BONGO 60CM	deploy	IL4	92	38.1	rHopcroft1	
6/21/17 19:53	67.40951	-165.793525	BONGO 60CM	maxDepth	IL4	92	39	rHopcroft1	
6/21/17 19:57	67.408128	-165.797466	BONGO 60CM	recover	IL4	92	38.2	rHopcroft1	
6/21/17 21:49	67.347854	-166.239133	CTD911	deploy	IL5	93	41	anOther	
6/21/17 23:41	67.283779	-166.686789	Vertical Net	deploy	IL6	94	44.6	rHopcroft1	
6/21/17 23:47	67.284342	-166.686036	Vertical Net	recover	IL6	94	44.6	rHopcroft1	
6/21/17 23:58	67.283855	-166.687749	CTD911	deploy	IL6	94	44	anOther	
6/22/17 0:20	67.28208	-166.689431	BONGO 60CM	deploy	IL6	94	44.1	rHopcroft1	
6/22/17 0:22	67.281224	-166.690138	BONGO 60CM	maxDepth	IL6	94	44.5	rHopcroft1	
6/22/17 0:26	67.279548	-166.691319	BONGO 60CM	recover	IL6	94	44.2	rHopcroft1	
6/22/17 2:05	67.219784	-167.149603	CTD911	deploy	IL7	95	43	anOther	
6/22/17 2:36	67.214476	-167.154407	IKMT	Surface	IL7	13		anOther	
6/22/17 2:45	67.20625	-167.161604	IKMT	Surface	IL7	13		anOther	
6/22/17 2:52	67.19975	-167.167084	IKMT	Surface	IL7	13		anOther	
6/22/17 3:05	67.197239	-167.168944	PSBT	Surface	IL7	15		anOther	
6/22/17 3:15	67.193006	-167.173141	PSBT	start	IL7	15		anOther	
6/22/17 3:20	67.191049	-167.17522	PSBT	end	IL7	15		anOther	
6/22/17 3:25	67.18931	-167.177319	PSBT	Surface	IL7	15		anOther	
6/22/17 3:36	67.18465	-167.181877	PSBT	Surface	IL7	16		anOther	
6/22/17 3:45	67.180988	-167.185932	PSBT	start	IL7	16		anOther	
6/22/17 3:48	67.179652	-167.187748	PSBT	end	IL7	16		anOther	
6/22/17 3:53	67.178051	-167.189855	PSBT	Surface	IL7	16		anOther	
6/22/17 5:25	67.155538	-167.59731	Vertical Net	deploy	IL8	96	40	rHopcroft1	slow tow
6/22/17 5:29	67.155359	-167.59685	Vertical Net	recover	IL8	96	40	rHopcroft1	38m wire out
6/22/17 5:40	67.155413	-167.597866	CTD911	deploy	IL8	96	40	anOther	
6/22/17 6:00	67.153832	-167.594617	BONGO 60CM	deploy	IL8	NaN	40	rHopcroft1	
6/22/17 6:04	67.151804	-167.595321	BONGO 60CM	maxDepth	IL8	NaN	40	rHopcroft1	
6/22/17 6:06	67.150104	-167.596071	BONGO 60CM	recover	IL8	NaN	40	rHopcroft1	59m wire out
6/22/17 7:50	67.091365	-168.047907	CTD911	deploy	IL9	97	37	anOther	
6/22/17 9:54	67.027653	-168.506964	Vertical Net	deploy	IL10	98	40	rHopcroft1	slow tow
6/22/17 9:57	67.027838	-168.505657	Vertical Net	recover	IL10	98	40	rHopcroft1	
6/22/17 10:16	67.027044	-168.509676	CTD911	deploy	IL10	98	40	anOther	
6/22/17 10:42	67.026076	-168.505814	BONGO 60CM	deploy	IL10	98	40	rHopcroft1	
6/22/17 10:43	67.025696	-168.505738	BONGO 60CM	maxDepth	IL10	98		rHopcroft1	
6/22/17 10:46	67.024732	-168.505822	BONGO 60CM	recover	IL10	98	40	rHopcroft1	44m wire out
6/22/17 12:25	67.000161	-168.958499	CTD911	deploy	CNL5	99	48	sDanielson1	
6/22/17 14:35	66.750712	-168.960607	CTD911	deploy	CNL4	100	43	sDanielson1	
6/22/17 16:46	66.501225	-168.959067	Vertical Net	deploy	CNL3	101	56	rHopcroft1	
6/22/17 16:51	66.501758	-168.958819	Vertical Net	recover	CNL3	101	57	rHopcroft1	
6/22/17 17:04	66.500142	-168.959707	CTD911	deploy	CNL3	101	547	sDanielson1	
6/22/17 17:24	66.499431	-168.959855	BONGO 60CM	deploy	CNL3	101	56.6	rHopcroft1	
6/22/17 17:26	66.498112	-168.960115	BONGO 60CM	maxDepth	CNL3	101	57	rHopcroft1	
6/22/17 17:31	66.496571	-168.960934	BONGO 60CM	recover	CNL3	101	56	rHopcroft1	
6/22/17 18:59	66.500287	-168.54019	CTD911	deploy	cpl8	102	52	sDanielson1	
6/22/17 19:36	66.499843	-168.54024	Multicorer	maxDepth	CPL 8	NaN	52.6	sHardy	MC 31
6/22/17 20:46	66.499848	-168.540231	Multicorer	maxDepth	CPL	NaN	52.35	sHardy	MC 32
6/22/17 22:13	66.500021	-168.118903	Vertical Net	deploy	CPL7	103	28	rHopcroft1	
6/22/17 22:15	66.500225	-168.11904	Vertical Net	recover	CPL7	103	28	rHopcroft1	
6/22/17 22:27	66.500288	-168.119292	CTD911	deploy	CPL7	103	28	anOther	
6/22/17 22:46	66.498979	-168.119049	BONGO 60CM	deploy	CPL7	103	28.9	rHopcroft1	
6/22/17 22:48	66.497998	-168.119102	BONGO 60CM	maxDepth	CPL7	103	28	rHopcroft1	
6/22/17 22:51	66.496513	-168.119228	BONGO 60CM	recover	CPL7	103	29.3	rHopcroft1	
6/23/17 0:15	66.500479	-167.69735	CTD911	deploy	CPL6	104	25	anOther	
6/23/17 0:47	66.495672	-167.697793	IKMT	Surface	CPL6	14		anOther	

6/23/17 0:53	66.489836	-167.701741	IKMT	Surface	CPL6	14		anOther	mid
6/23/17 0:58	66.485452	-167.70463	IKMT	Surface	CPL6	14		anOther	
6/23/17 1:15	66.488289	-167.704038	PSBT	Surface	CPL6	17		anOther	
6/23/17 1:18	66.489455	-167.702917	PSBT	start	CPL6	17		anOther	
6/23/17 1:23	66.491352	-167.701363	PSBT	end	CPL6	17		anOther	
6/23/17 1:26	66.492658	-167.700107	PSBT	Surface	CPL6	17		anOther	
6/23/17 2:46	66.500646	-167.27922	Vertical Net	deploy	CPL5	105	29.9	rHopcroft1	
6/23/17 2:48	66.500573	-167.27903	Vertical Net	recover	CPL5	105	29.4	rHopcroft1	
6/23/17 2:56	66.500271	-167.279569	CTD911	deploy	CPL5	105	29	anOther	
6/23/17 3:16	66.49847	-167.27911	BONGO 60CM	deploy	CPL5	105	30	rHopcroft1	
6/23/17 3:18	66.497104	-167.279699	BONGO 60CM	maxDepth	CPL5	105	29.3	rHopcroft1	
6/23/17 3:22	66.495201	-167.280596	BONGO 60CM	recover	CPL5	105	29.4	rHopcroft1	
6/23/17 4:39	66.500392	-166.858657	CTD911	deploy	CPL4	106	30	anOther	
6/23/17 5:59	66.500495	-166.437812	Vertical Net	deploy	CPL3	107	16	rHopcroft1	slow tow 0.5 knts
6/23/17 6:02	66.500201	-166.437594	Vertical Net	recover	CPL3	107	16	rHopcroft1	
6/23/17 6:11	66.50038	-166.438465	CTD911	deploy	CPL3	107	16	anOther	
6/23/17 6:22	66.499678	-166.439506	BONGO 60CM	deploy	CPL3	107	16	rHopcroft1	
6/23/17 6:24	66.498816	-166.440749	BONGO 60CM	maxDepth	CPL3	107		rHopcroft1	
6/23/17 6:26	66.497837	-166.442237	BONGO 60CM	recover	CPL3	107	16	rHopcroft1	26m wire out 20/10
6/23/17 7:44	66.500414	-166.018297	CTD911	deploy	CPL2	108	18	anOther	
6/23/17 9:10	66.499836	-165.597555	Vertical Net	deploy	CPL1	109	16	rHopcroft1	slow tow 0.5 knts
6/23/17 9:11	66.499837	-165.59722	Vertical Net	recover	NaN	NaN		rHopcroft1	
6/23/17 9:25	66.499747	-165.599924	CTD911	deploy	CPL1	109	15	anOther	
6/23/17 9:40	66.499097	-165.600944	BONGO 60CM	deploy	CPL1	109	16	rHopcroft1	20/10
6/23/17 9:41	66.498681	-165.601581	BONGO 60CM	maxDepth	NaN	NaN		rHopcroft1	
6/23/17 9:43	66.498035	-165.602463	BONGO 60CM	recover	CPL1	109	16	rHopcroft1	20m wire out
6/23/17 20:12	66.250431	-168.958496	CTD911	deploy	CNL2	110	57	sDanielson1	
6/23/17 22:53	66.001171	-168.958104	CTD911	deploy	CNL1	111	52	anOther	
6/24/17 0:54	65.810121	-168.928823	CTD911	deploy	BS14	112	47	anOther	
6/24/17 1:38	65.790253	-168.858575	CTD911	deploy	BS13	113	46	anOther	
6/24/17 2:14	65.771307	-168.790574	CTD911	deploy	BS12	114	52	anOther	
6/24/17 2:48	65.761225	-168.718995	CTD911	deploy	BS11	115	53	anOther	
6/24/17 3:24	65.740056	-168.649795	CTD911	deploy	BS10	116	52	anOther	
6/24/17 3:57	65.720634	-168.580516	CTD911	deploy	BS9	117	51	anOther	
6/24/17 4:25	65.711105	-168.519761	CTD911	deploy	BS8	118	54	anOther	
6/24/17 4:44	65.709238	-168.520196	IKMT	Surface	BS8	15		anOther	
6/24/17 4:54	65.703272	-168.523299	IKMT	Surface	BS8	15		anOther	
6/24/17 5:03	65.698434	-168.52612	IKMT	Surface	BS8	15		anOther	
6/24/17 5:40	65.690435	-168.449803	CTD911	deploy	BS7	119	53	anOther	
6/24/17 6:08	65.679992	-168.381349	CTD911	deploy	BS6	120	52	anOther	
6/24/17 6:41	65.660004	-168.311529	CTD911	deploy	BS5	121	48	anOther	
6/24/17 7:21	65.640032	-168.242024	CTD911	deploy	BS4	122	41	anOther	
6/24/17 8:01	65.628493	-168.170885	CTD911	deploy	BS3	123	32	anOther	
6/24/17 10:34	65.502708	-168.810475	Vertical Net	deploy	CBW15	124	58	rHopcroft1	
6/24/17 10:37	65.503193	-168.810755	Vertical Net	abort	CBW15	124		rHopcroft1	
6/24/17 10:46	65.501516	-168.812614	Vertical Net	deploy	CBW15	124	38	rHopcroft1	
6/24/17 10:51	65.502261	-168.813013	Vertical Net	recover	CBW15	124		rHopcroft1	
6/24/17 11:07	65.501961	-168.809377	CTD911	deploy	CBW15	124	58	anOther	
6/24/17 11:29	65.50123	-168.808461	BONGO 60CM	deploy	CBW15	124	58	rHopcroft1	
6/24/17 11:31	65.500491	-168.808873	BONGO 60CM	maxDepth	CBW15	124	58	rHopcroft1	
6/24/17 11:35	65.499129	-168.809002	BONGO 60CM	recover	CBW15	124		jKrause2	80m wire out
6/24/17 13:08	65.367255	-169.079663	CTD911	deploy	CBW14	125	52	sDanielson1	
6/24/17 14:54	65.230812	-169.349133	Vertical Net	deploy	CBW13	126	50	rHopcroft1	
6/24/17 14:58	65.231322	-169.348462	Vertical Net	recover	CBW13	126	50	rHopcroft1	
6/24/17 15:07	65.231098	-169.348258	CTD911	deploy	CBW13	126	49	sDanielson1	
6/24/17 15:26	65.230661	-169.348378	BONGO 60CM	deploy	CBW13	126	50	rHopcroft1	
6/24/17 15:29	65.229678	-169.349337	BONGO 60CM	maxDepth	CBW13	126	50	rHopcroft1	

6/24/17 15:33	65.228182	-169.35055	BONGO 60CM	recover	CBW13	126	50	rHopcroft1	66m wire out
6/24/17 17:04	65.096026	-169.619589	CTD911	deploy	CBW12	127	52	sDanielson1	
6/24/17 18:56	64.990349	-169.138291	Vertical Net	deploy	DBO2.5	128	48.5	rHopcroft1	
6/24/17 19:00	64.990544	-169.13807	Vertical Net	recover	DBO2.5	128	49	rHopcroft1	
6/24/17 19:10	64.990323	-169.139843	CTD911	deploy	dbo2.5	128	48	sDanielson1	
6/24/17 19:27	64.988952	-169.141116	BONGO 60CM	deploy	DBO2.5	128	48.6	rHopcroft1	
6/24/17 19:29	64.98818	-169.141876	BONGO 60CM	maxDepth	DBO2.5	128	48.2	rHopcroft1	
6/24/17 19:32	64.986956	-169.143026	BONGO 60CM	recover	DBO2.5	128	48.3	rHopcroft1	
6/24/17 20:10	64.957238	-169.180423	IKMT	Surface	DBO2.5	16		anOther	
6/24/17 20:17	64.950797	-169.18539	IKMT	Surface	DBO2.5	16		anOther	
6/24/17 20:24	64.944956	-169.189884	IKMT	Surface	DBO2.5	16		anOther	
6/24/17 21:02	64.945134	-169.24594	PSBT	Surface	DBO2.5	18		anOther	
6/24/17 19:59	64.961559	-169.176286	PSBT	start	DBO2.5	18		anOther	
6/24/17 21:12	64.94959	-169.241671	PSBT	end	DBO2.5	18		anOther	
6/24/17 21:16	64.951692	-169.239787	PSBT	Surface	DBO2.5	18		anOther	
6/24/17 23:12	64.96015	-169.887904	BONGO 60CM	deploy	DBO2.4	129	49	rHopcroft1	
6/24/17 23:14	64.959294	-169.888845	BONGO 60CM	maxDepth	DBO2.4	129	48.2	rHopcroft1	
6/24/17 23:17	64.957998	-169.890459	BONGO 60CM	recover	DBO2.4	129	48.5	rHopcroft1	
6/24/17 23:26	64.960018	-169.890381	CTD911	deploy	DBO2.4	129	48	anOther	
6/24/17 23:53	64.960087	-169.890555	Vertical Net	deploy	DBO2.4	129	48.2	rHopcroft1	
6/24/17 23:57	64.95998	-169.891217	Vertical Net	recover	DBO2.4	129	48.3	rHopcroft1	
6/25/17 0:08	64.960018	-169.890198	Vertical Net	deploy	DBO2.4	129	48	rHopcroft1	VERTICAL 2
6/25/17 0:11	64.960179	-169.890335	Vertical Net	recover	DBO2.4	129	48	rHopcroft1	SECOND
6/25/17 0:30	64.960097	-169.891071	Multicorer	maxDepth	DBO2.4	NaN	48.2	sHardy	MC 33
6/25/17 1:05	64.960091	-169.89106	Multicorer	maxDepth	DBO2.4	NaN	48.17	sHardy	MC 34
6/25/17 1:21	64.960095	-169.891072	Multicorer	maxDepth	DBO2.4	NaN	48.17	sHardy	MC 35
6/25/17 2:09	64.960094	-169.891053	Multicorer	maxDepth	DBO2.4	NaN	48.2	sHardy	MC 36
6/25/17 2:58	64.917604	-169.97059	IKMT	Surface	DBO2.4	17		anOther	
6/25/17 3:06	64.910391	-169.978306	IKMT	Surface	DBO2.4	17		anOther	
6/25/17 3:14	64.903764	-169.985258	IKMT	Surface	DBO2.4	17		anOther	
6/25/17 4:38	64.92835	-169.91817	Mooring	deploy	N6	NaN	49.5	sDanielson1	
6/25/17 3:27	64.905875	-169.988178	PSBT	Surface	DBO2.4	19		anOther	
6/25/17 3:32	64.907996	-169.988804	PSBT	start	DBO2.4	19		anOther	
6/25/17 3:37	64.910068	-169.989399	PSBT	end	DBO2.4	19		anOther	
6/25/17 3:42	64.911872	-169.989914	PSBT	Surface	DBO2.4	19		anOther	
6/25/17 4:54	64.927466	-169.918552	CTD911	deploy	N4	130	49	anOther	
6/25/17 5:20	64.911957	-169.947485	Underway Science seawater	service	NaN	NaN		eRoth1	changed to clean strainer
6/25/17 6:11	64.823836	-170.159538	CTD911	deploy	CBW10	131	49	anOther	
6/25/17 7:35	64.689136	-170.429189	Vertical Net	deploy	CBW9	132	49	rHopcroft1	
6/25/17 7:39	64.689128	-170.42868	Vertical Net	recover	CBW9	132		rHopcroft1	
6/25/17 7:49	64.689122	-170.428535	Vertical Net	deploy	CBW9	132	50	rHopcroft1	SECOND
6/25/17 7:52	64.68912	-170.427912	Vertical Net	recover	CBW9	132	49	rHopcroft1	
6/25/17 8:10	64.689148	-170.429489	CTD911	deploy	CBW9	132	49	anOther	
6/25/17 8:32	64.68512	-170.426508	BONGO 60CM	deploy	CBW9	132	49	rHopcroft1	
6/25/17 8:34	64.684173	-170.425655	BONGO 60CM	maxDepth	CBW9	132	49	rHopcroft1	
6/25/17 8:37	64.682703	-170.424343	BONGO 60CM	recover	CBW9	132	49.5	rHopcroft1	64m wire out
6/25/17 10:00	64.553109	-170.699753	CTD911	deploy	CBW8	133	47	anOther	
6/25/17 11:34	64.417919	-170.969345	Vertical Net	deploy	CBW7	134	45	rHopcroft1	
6/25/17 11:38	64.418088	-170.968224	Vertical Net	recover	CBW7	134	45	rHopcroft1	
6/25/17 11:48	64.417991	-170.969742	CTD911	deploy	CBW7	134	45	anOther	
6/25/17 12:08	64.417649	-170.973297	BONGO 60CM	deploy	CBW7	134	45	rHopcroft1	
6/25/17 12:11	64.417373	-170.976281	BONGO 60CM	maxDepth	CBW7	134	45	rHopcroft1	
6/25/17 12:14	64.417083	-170.979658	BONGO 60CM	recover	CBW7	132	46	rHopcroft1	65m wire out
6/25/17 13:36	64.28254	-171.238534	CTD911	deploy	CBW6	135	45	sDanielson1	
6/25/17 15:11	64.146182	-171.507994	Vertical Net	deploy	CBW5	136	45	rHopcroft1	

6/25/17 15:16	64.146518	-171.505928	Vertical Net	recover	CBW5	136	46	rHopcroft1	
6/25/17 15:26	64.146556	-171.505227	Vertical Net	deploy	CBW5	136	46	rHopcroft1	SECOND
6/25/17 15:30	64.146817	-171.503673	Vertical Net	recover	CBW5	136	46	rHopcroft1	
6/25/17 15:40	64.146345	-171.509054	CTD911	deploy	CBW5	136	46	sDanielson1	
6/25/17 16:01	64.146177	-171.502316	BONGO 60CM	deploy	CBW5	136	45	rHopcroft1	
6/25/17 16:04	64.146166	-171.499375	BONGO 60CM	maxDepth	CBW5	136	46	rHopcroft1	
6/25/17 16:06	64.146265	-171.495808	BONGO 60CM	recover	CBW5	136	46	rHopcroft1	58m wire out
6/25/17 16:31	64.154951	-171.524074	CTD911	deploy	N2	137	46	sDanielson1	mooring
6/25/17 17:34	64.067345	-171.67972	Seapath	fault	NaN	NaN		eRoth1	lost GPS signal for several minutes
6/25/17 18:12	64.011742	-171.779093	CTD911	deploy	CBW4	138	51	sDanielson1	
6/25/17 19:47	63.875118	-172.049279	Vertical Net	deploy	CBW3	139	48	rHopcroft1	
6/25/17 19:50	63.875699	-172.048234	Vertical Net	recover	CBW3	139	48.6	rHopcroft1	
6/25/17 20:03	63.875261	-172.048467	CTD911	deploy	CBW3	139	47	anOther	
6/25/17 20:34	63.876559	-172.043217	BONGO 60CM	deploy	CBW3	139	47.7	rHopcroft1	
6/25/17 20:35	63.877394	-172.041068	BONGO 60CM	maxDepth	CBW3	139	44.1	rHopcroft1	
6/25/17 20:38	63.878847	-172.037699	BONGO 60CM	recover	CBW3	139	44.3	rHopcroft1	
6/25/17 22:06	63.739755	-172.319653	CTD911	deploy	CBW2	140		anOther	
6/25/17 23:36	63.610418	-172.577966	BONGO 60CM	deploy	DBO1.10	141	54.4	rHopcroft1	
6/25/17 23:38	63.609184	-172.580467	BONGO 60CM	maxDepth	DBO1.10	141	54.1	rHopcroft1	
6/25/17 23:42	63.607355	-172.584499	BONGO 60CM	recover	DBO1.10	141	54.1	rHopcroft1	
6/25/17 23:54	63.604759	-172.590174	CTD911	deploy	DBO1.10	141	54	anOther	
6/26/17 23:59	64.68166	-169.001707	Vertical Net	deploy	DBO1.1	141	53.6	rHopcroft1	
6/26/17 13:00	64.563881	-170.205149	Vertical Net	recover	DBO1.1	141	54	rHopcroft1	
6/26/17 13:00	64.563881	-170.205149	Vertical Net	deploy	DBO1.10	141	54	rHopcroft1	SECOND
6/26/17 13:00	64.563881	-170.205149	Vertical Net	recover	DBO1.1	141	54	rHopcroft1	SECOND
6/26/17 1:55	63.602938	-172.593063	Multicorer	maxDepth	DBO 1.10	NaN	53.7	sHardy	MC 37
NaN	NaN	NaN	Multicorer	maxDepth	DBO 1.10	NaN	53.7	sHardy	MC 39
NaN	NaN	NaN	IKMT	Surface	DBO1.10	18		anOther	4:02:34 UTC: 63.604316 N 172.591417766667 W
NaN	NaN	NaN	IKMT	Surface	DBO1.10	18		anOther	4:11:35 UTC 63.6042929166667 N 172.5914571 W
NaN	NaN	NaN	IKMT	Surface	DBO1.10	18		anOther	4:19:39 UTC 63.6042755166667 N 172.591491583333 W
NaN	NaN	NaN	PSBT	Surface	DB01.10	20		anOther	4:37:22 UTC 63.6749370833333 N 172.587482783333 W
NaN	NaN	NaN	PSBT	start	DBO1.10	20		anOther	4:42:09 UTC 63.677048 N 172.58875585 W
NaN	NaN	NaN	PSBT	end	DBO1.10	20		anOther	4:47:12 UTC 63.6790980333333 N 172.58999725 W
NaN	NaN	NaN	PSBT	Surface	DBO1.10	20		anOther	4:51:57 UTC 63.68106095 N 172.591183783333 W
NaN	NaN	NaN	PSBT	Surface	DBO1.10	21		anOther	4:58:39 UTC 63.6840878166667 N 172.59300065 W
NaN	NaN	NaN	PSBT	start	DBO1.10	21		anOther	5:03:45 UTC 63.6863146 N 172.594358533333 W
NaN	NaN	NaN	PSBT	end	DBO1.10	21		anOther	5:08:43 UTC 63.6883612666667 N 172.595592266667 W
NaN	NaN	NaN	PSBT	Surface	DBO1.10	21		anOther	5:13:30 UTC 63.6902985333333 N 172.596764783333 W
6/26/17 14:13	64.669777	-169.920136	Vertical Net	deploy	DBO2.1	142	48	rHopcroft1	
6/26/17 14:18	64.670019	-169.919181	Vertical Net	recover	DBO2.1	142	48	rHopcroft1	
6/26/17 14:29	64.670139	-169.9199	CTD911	deploy	DBO2.1	142	48	sDanielson1	
6/26/17 14:51	64.670246	-169.919493	Vertical Net	deploy	DBO2.1	142	48	rHopcroft1	
6/26/17 14:54	64.670618	-169.918054	Vertical Net	recover	DBO2.1	142	48	rHopcroft1	SECOND
6/26/17 15:05	64.671669	-169.913929	BONGO 60CM	deploy	DBO2.1	142	48	rHopcroft1	
6/26/17 15:07	64.672288	-169.911502	BONGO 60CM	maxDepth	DBO2.1	142	48	rHopcroft1	
6/26/17 15:10	64.673244	-169.907736	BONGO 60CM	recover	DBO2.1	142	48	rHopcroft1	67m wire out
6/26/17 15:52	64.670209	-169.919505	Haps Corer	other	DBO2.1	NaN	48	anOther	1
6/26/17 16:07	64.670211	-169.919504	Haps Corer	other	DBO2.1	NaN		anOther	HIT BOTTOM
6/26/17 16:15	64.670207	-169.919502	Haps Corer	other	DBO2.1	NaN	48	anOther	HIT BOTTOM

6/26/17 16:24	64.670209	-169.919499	Haps Corer	other	DBO2.1	NaN	48	anOther	HIT BOTTOM
6/26/17 16:30	64.670208	-169.919504	Haps Corer	other	DBO2.1	NaN	48	anOther	HIT BOTTOM
6/26/17 16:39	64.670209	-169.919498	Haps Corer	other	DBO2.1	NaN	48	anOther	HIT BOTTOM
6/26/17 16:47	64.67021	-169.919499	Haps Corer	other	DBO2.1	NaN		anOther	HIT BOTTOM
6/26/17 16:56	64.670209	-169.919504	Haps Corer	other	DBO2.1	NaN	48	anOther	HIT BOTTOM
6/26/17 17:05	64.670208	-169.9195	Haps Corer	other	DBO2.1	NaN		anOther	HIT BOTTOM
6/26/17 17:27	64.67097	-169.91705	SVP drifter	deploy	NaN	NaN		anOther	
6/26/17 19:28	64.669952	-169.510461	CTD911	deploy	DBO2.15	143	46	sDanielson1	
6/26/17 17:30	64.672179	-169.910997	IKMT	Surface	DBO2.1	19		anOther	
6/26/17 20:42	64.677619	-169.180315	IKMT	Surface	DBO2.1	19		anOther	6/26/17 17:40
6/26/17 17:47	64.678502	-169.879349	IKMT	Surface	DBO2.1	19		anOther	
6/26/17 18:15	64.683077	-169.795086	PSBT	Surface	DBO2.1	22		anOther	
6/26/17 18:20	64.684305	-169.790953	PSBT	start	DBO2.1	22		anOther	
6/26/17 18:25	64.685492	-169.787007	PSBT	end	DBO2.1	22		anOther	
6/26/17 18:29	64.686545	-169.783504	PSBT	Surface	DBO2.1	22		anOther	
6/26/17 21:06	64.680682	-169.100508	BONGO 60CM	deploy	DBO2.2	144	46.4	rHopcroft1	
6/26/17 21:07	64.680059	-169.099382	BONGO 60CM	maxDepth	DBO2.2	144	45.8	rHopcroft1	
6/26/17 21:10	64.679038	-169.097431	BONGO 60CM	recover	DBO2.2	144	46	rHopcroft1	
6/26/17 21:18	64.679876	-169.099566	CTD911	deploy	DBO2.2	144	46	anOther	
6/26/17 21:43	64.679562	-169.098961	Vertical Net	deploy	DBO2.2	144	46.2	rHopcroft1	
6/26/17 21:46	64.679104	-169.098139	Vertical Net	recover	DBO2.2	144	45.9	rHopcroft1	
6/26/17 22:06	64.6798	-169.099438	Multicorer	maxDepth	DBO 2.2	NaN	46.15	sHardy	MC 41
6/26/17 22:28	64.679802	-169.09943	Multicorer	maxDepth	DBO 2.2	NaN	46.2	sHardy	MC 42
6/26/17 23:09	64.679803	-169.099426	Multicorer	maxDepth	DBO 2.2	NaN	46.1	sHardy	MC 43
6/27/17 1:22	64.680029	-168.692068	CTD911	deploy	DBO2.25	145	45	anOther	
6/26/17 23:23	64.679646	-169.09885	IKMT	Surface	DBO2.2	20		anOther	
6/26/17 23:39	64.680518	-169.063185	IKMT	Surface	DB02.2	NaN		anOther	resurface1
6/26/17 23:59	64.68166	-169.001707	IKMT	Surface	DBO2.2	NaN		anOther	resurface2
6/27/17 0:18	64.682988	-168.968649	PSBT	end	DBO2.2	NaN		anOther	stopbottom
6/27/17 0:09	64.681988	-168.979221	PSBT	Surface	DBO2.2	NaN		anOther	startsurface
6/27/17 0:13	64.682432	-168.974113	PSBT	start	DBO2.2	NaN		anOther	startbottom
6/27/17 0:23	64.68325	-168.963913	PSBT	Surface	DBO2.2	NaN		anOther	resurface
6/27/17 3:11	64.670285	-168.240638	Vertical Net	deploy	DBO2.3	146	39	rHopcroft1	
6/27/17 3:14	64.670432	-168.240776	Vertical Net	recover	DBO2.3	146		rHopcroft1	
6/27/17 3:22	64.670509	-168.240933	CTD911	deploy	DBO2.3	146	38	anOther	
6/27/17 3:41	64.670058	-168.238202	BONGO 60CM	deploy	DBO2.3	146	39	rHopcroft1	
6/27/17 3:43	64.669742	-168.236414	BONGO 60CM	maxDepth	DBO2.3	146	39	rHopcroft1	
NaN	NaN	NaN	BONGO 60CM	recover	DBO2.3	146	39	rHopcroft1	48m wire out
6/27/17 4:04	64.670221	-168.239114	Multicorer	maxDepth	DBO 2.3	NaN	38.6	sHardy	MC 44
6/27/17 6:35	64.670477	-167.831498	CTD911	deploy	DBO2.35	147	37	anOther	
6/27/17 8:05	64.680682	-167.400117	Vertical Net	deploy	DBO2.36	148	31	rHopcroft1	
6/27/17 8:07	64.681059	-167.400106	Vertical Net	recover	DBO2.36	148	31	rHopcroft1	
6/27/17 8:18	64.680419	-167.39913	CTD911	deploy	DBO2.36	148	31	anOther	
6/27/17 8:35	64.680763	-167.393862	BONGO 60CM	deploy	DBO2.36	148	31	rHopcroft1	
NaN	NaN	NaN	BONGO 60CM	maxDepth	DBO2.36	148	31	rHopcroft1	
NaN	NaN	NaN	BONGO 60CM	recover	DBO2.36	148	31	rHopcroft1	41m wire out 20/10
6/27/17 9:52	64.680423	-166.989153	CTD911	deploy	DBO2.37	149	27	anOther	
6/27/17 11:03	64.670525	-166.700363	Vertical Net	deploy	CBE11	150	23	rHopcroft1	slow tow
6/27/17 11:05	64.670603	-166.699929	Vertical Net	recover	CBE11	150	23	rHopcroft1	
6/27/17 11:13	64.670387	-166.699683	CTD911	deploy	CBE11	150	22	anOther	
6/27/17 11:30	64.669507	-166.692176	BONGO 60CM	deploy	CBE11	150	23	rHopcroft1	
6/27/17 11:31	64.669308	-166.690038	BONGO 60CM	maxDepth	CBE11	NaN		rHopcroft1	
6/27/17 11:34	64.668934	-166.68605	BONGO 60CM	recover	CBE11	150	23	rHopcroft1	29m wire out 20/10
6/27/17 12:48	64.525138	-166.879615	CTD911	deploy	CBE10	151	27	sDanielson1	
6/27/17 14:09	64.381595	-167.069304	Vertical Net	deploy	CBE9	152	30	rHopcroft1	FIRST
6/27/17 14:11	64.381326	-167.069287	Vertical Net	recover	CBE9	152	30	rHopcroft1	
6/27/17 14:19	64.380631	-167.069285	Vertical Net	deploy	CBE9	152	30	rHopcroft1	SECOND

6/27/17 14:21	64.380519	-167.06927	Vertical Net	recover	CBE9	152	30	rHopcroft1	
6/27/17 14:29	64.38096	-167.069908	CTD911	deploy	CBE9	152	30	sDanielson1	
6/27/17 14:47	64.379207	-167.070231	BONGO 60CM	deploy	CBE9	152	30	rHopcroft1	
6/27/17 14:20	64.380558	-167.069276	BONGO 60CM	maxDepth	CBE9	152	30	rHopcroft1	
6/27/17 14:52	64.37676	-167.071006	BONGO 60CM	recover	CBE9	152	30	rHopcroft1	43m wire out 30/15
6/27/17 16:06	64.236203	-167.25033	CTD911	deploy	CBE8	153	31	sDanielson1	
6/27/17 17:34	64.092684	-167.440919	Vertical Net	deploy	CBE7	154	33.4	rHopcroft1	
6/27/17 17:36	64.092844	-167.441706	Vertical Net	recover	CBE7	154	33.4	rHopcroft1	
6/27/17 17:48	64.092132	-167.440396	CTD911	deploy	CBE7	154	33	sDanielson1	
6/27/17 18:06	64.091654	-167.437819	BONGO 60CM	deploy	CBE7	154	33.3	rHopcroft1	
6/27/17 18:07	64.091436	-167.436394	BONGO 60CM	maxDepth	CBE7	154	33.5	rHopcroft1	
6/27/17 18:10	64.091084	-167.434195	BONGO 60CM	recover	CBE7	154	33.3	rHopcroft1	
6/27/17 19:30	63.947378	-167.620444	CTD911	deploy	CBE6	36	36	sDanielson1	UVP taken off CTD prior to cast 155
6/27/17 20:55	63.80388	-167.810151	Vertical Net	deploy	CBE5	156	32.5	rHopcroft1	
6/27/17 20:57	63.803656	-167.810717	Vertical Net	recover	CBE5	156	32.5	rHopcroft1	
6/27/17 21:06	63.803086	-167.810915	CTD911	deploy	CBE5	156	32	anOther	
6/27/17 21:22	63.801833	-167.811188	BONGO 60CM	deploy	CBE5	156	32.5	rHopcroft1	
6/27/17 21:23	63.80098	-167.811351	BONGO 60CM	maxDepth	CBE5	156	32.3	rHopcroft1	
6/27/17 21:26	63.799821	-167.811671	BONGO 60CM	recover	CBE5	156	32.2	rHopcroft1	
NaN	NaN	NaN	IKMT	Surface	DBO2.3	21		anOther	4:23:23 64.6702942333333 N 168.217744216667 W
NaN	NaN	NaN	IKMT	Surface	DBO2.3	21		anOther	4:30:27 64.6702940833333 N 168.202637266667 W
NaN	NaN	NaN	IKMT	Surface	DBO2.3	21		anOther	4:36:55 64.6703151666667 N 168.188912833333 W
NaN	NaN	NaN	PSBT	Surface	DBO2.3	24		anOther	5:20:02 64.67488255 N 168.10698395 W
NaN	NaN	NaN	PSBT	start	DBO2.3	24		anOther	5:23:41 64.6760022 N 168.1095967 W
6/27/17 22:35	63.658231	-167.989209	CTD911	deploy	CBE4	157	32	anOther	
NaN	NaN	NaN	PSBT	end	DBO2.3	24		anOther	5:28:43 64.6775244666667 N 168.113148716667 W
NaN	NaN	NaN	PSBT	Surface	DBO2.3	24		anOther	5:32:14 64.67857965 N 168.115620433333 W
6/27/17 23:59	63.513533	-168.178602	Vertical Net	deploy	CBE3	158	32	rHopcroft1	
6/28/17 0:01	63.513281	-168.178813	Vertical Net	recover	CBE3	158	31.9	rHopcroft1	
6/28/17 0:14	63.513276	-168.179445	CTD911	deploy	CBE3	158	32	anOther	
6/28/17 0:32	63.512363	-168.181621	BONGO 60CM	deploy	CBE3	158	32	rHopcroft1	
6/28/17 0:33	63.511689	-168.182789	BONGO 60CM	maxDepth	CBE3	158	32	rHopcroft1	
6/28/17 0:36	63.510579	-168.184409	BONGO 60CM	recover	CBE3	158	32	rHopcroft1	
6/28/17 1:52	63.369084	-168.359618	CTD911	deploy	CBE2	159	39	anOther	
6/28/17 2:50	63.295239	-168.450485	Vertical Net	deploy	CBE1	160	40	rHopcroft1	
6/28/17 2:53	63.294937	-168.450477	Vertical Net	recover	CBE1	160	40	rHopcroft1	
6/28/17 3:06	63.295814	-168.45057	Vertical Net	deploy	CBE1	160	40	rHopcroft1	SECOND
6/28/17 3:09	63.295685	-168.450564	Vertical Net	recover	CBE1	160	40	rHopcroft1	SECOND
6/28/17 3:18	63.295545	-168.450555	CTD911	deploy	CBE1	160	40	anOther	
6/28/17 3:42	63.295522	-168.446699	BONGO 60CM	deploy	CBE1	160	40	rHopcroft1	
NaN	NaN	NaN	BONGO 60CM	maxDepth	CBE1	160	40	rHopcroft1	
NaN	NaN	NaN	BONGO 60CM	recover	CBE1	160	40	rHopcroft1	41m wire out 40/20
6/28/17 5:00	63.224193	-168.151088	Vertical Net	deploy	SLY2	161		rHopcroft1	slow tow 0.5 knts
6/28/17 5:02	63.224197	-168.151084	Vertical Net	recover	SLY2	161	22	rHopcroft1	
6/28/17 5:09	63.224185	-168.151087	CTD911	deploy	SLY2	161	22	anOther	
6/28/17 5:25	63.22427	-168.14717	BONGO 60CM	deploy	SLY2	161	23	rHopcroft1	
6/28/17 5:27	63.224273	-168.145572	BONGO 60CM	maxDepth	SLY2	NaN		rHopcroft1	
6/28/17 5:29	63.224282	-168.143445	BONGO 60CM	recover	SLY2	161	22.5	rHopcroft1	27m wire out 20/10
6/28/17 6:41	63.224461	-167.750749	CTD911	deploy	SLY3	162	33	anOther	
6/28/17 8:06	63.224851	-167.360916	Vertical Net	deploy	SLY4	163	34	rHopcroft1	
6/28/17 8:08	63.225191	-167.360662	Vertical Net	recover	NaN	NaN		rHopcroft1	
6/28/17 8:18	63.224406	-167.360612	CTD911	deploy	SLY4	163	34	anOther	
6/28/17 8:34	63.226168	-167.356764	BONGO 60CM	deploy	SLY4	163	34	rHopcroft1	
6/28/17 8:36	63.22621	-167.353966	BONGO 60CM	maxDepth	NaN	NaN		rHopcroft1	

6/28/17 8:38	63.226224	-167.351082	BONGO 60CM	recover	SLY4	163	34	rHopcroft1	45m wire out 40/20
6/28/17 9:48	63.22437	-166.969903	CTD911	deploy	SLY5	164	25	anOther	
6/28/17 11:17	63.224025	-166.568181	Vertical Net	deploy	SYL6	165	25	rHopcroft1	
6/28/17 11:19	63.224048	-166.567322	Vertical Net	recover	NaN	NaN		rHopcroft1	
6/28/17 11:19	63.224051	-166.567287	Vertical Net	recover	NaN	NaN		rHopcroft1	
6/28/17 11:28	63.223979	-166.568793	CTD911	deploy	SLY6	165	25	anOther	
6/28/17 11:43	63.223944	-166.571578	BONGO 60CM	deploy	SLY6	165	25	rHopcroft1	
6/28/17 11:15	63.223994	-166.569022	BONGO 60CM	maxDepth	SLY6	165	26	rHopcroft1	
6/28/17 11:48	63.223867	-166.576344	BONGO 60CM	recover	SLY6	165	26	rHopcroft1	33m wire out 20/10
6/28/17 13:05	63.223933	-166.180499	CTD911	deploy	SLY7	166	25	sDanielson1	
6/28/17 14:30	63.225419	-165.79045	Vertical Net	deploy	SLY8	167	25	rHopcroft1	
6/28/17 14:31	63.225544	-165.790228	Vertical Net	recover	NaN	NaN		rHopcroft1	
6/28/17 14:40	63.224773	-165.790085	CTD911	deploy	SLY8	167	24	sDanielson1	
6/28/17 14:56	63.224014	-165.790808	BONGO 60CM	deploy	SLY8	167	25	rHopcroft1	
6/28/17 14:58	63.223245	-165.791557	BONGO 60CM	maxDepth	SLY8	167	25	rHopcroft1	
6/28/17 15:01	63.22212	-165.792635	BONGO 60CM	recover	SLY8	167	25	rHopcroft1	37m wire out 20/10
6/28/17 16:28	63.224215	-165.399686	CTD911	deploy	SLY9	168	20	sDanielson1	
6/28/17 17:11	63.223946	-165.253693	Vertical Net	deploy	SLY9.5	169	16	rHopcroft1	slow tow 0.5 knts
6/28/17 17:13	63.22443	-165.252998	Vertical Net	recover	SLY9.5	NaN	16	rHopcroft1	
6/28/17 17:22	63.223585	-165.253736	CTD911	deploy	SLY9.5	169	24	sDanielson1	
6/28/17 17:38	63.224143	-165.253288	Vertical Net	deploy	SLY9.5	169	16	rHopcroft1	RECAST
6/28/17 17:41	63.224426	-165.252855	Vertical Net	recover	SLY9.5	169	16	rHopcroft1	slow tow 0.5 knts
6/28/17 20:17	63.606924	-165.204118	Vertical Net	deploy	NSA	170	18	rHopcroft1	
6/28/17 20:19	63.606878	-165.203459	Vertical Net	recover	NSA	170	18	rHopcroft1	
6/28/17 20:28	63.6073	-165.206314	CTD911	deploy	NSA	170	19	anOther	
6/28/17 20:44	63.606694	-165.204849	BONGO 60CM	deploy	NSA	170	19	rHopcroft1	
6/28/17 20:45	63.60626	-165.204735	BONGO 60CM	maxDepth	NSA	170	19	rHopcroft1	22m wire out 20/10
6/28/17 20:47	63.605376	-165.204746	BONGO 60CM	recover	NSA	170	18	rHopcroft1	
6/28/17 23:28	64.000272	-165.335136	Vertical Net	deploy	NSB	171	19	rHopcroft1	slow tow 0.5 knts
6/28/17 23:31	64.000285	-165.335193	Vertical Net	recover	NSB	171	19	rHopcroft1	
6/28/17 23:36	64.000258	-165.335045	CTD911	deploy	NSB	171	19	anOther	
6/28/17 23:52	63.999687	-165.332242	BONGO 60CM	deploy	NSB	171	19	rHopcroft1	
6/28/17 23:23	63.999792	-165.333728	BONGO 60CM	maxDepth	NSB	171	19	rHopcroft1	
6/28/17 23:35	64.000256	-165.335039	BONGO 60CM	recover	NSB	171	19	rHopcroft1	21m wire out 20/10
6/29/17 2:10	64.374548	-165.426065	Vertical Net	deploy	NSC	172	32	rHopcroft1	
6/29/17 2:12	64.374668	-165.427151	Vertical Net	recover	NSC	172	32	rHopcroft1	
6/29/17 2:21	64.37427	-165.423985	CTD911	deploy	NSC	172	32	anOther	
6/29/17 2:38	64.374523	-165.424637	BONGO 60CM	deploy	NSC	172	32	rHopcroft1	
6/29/17 2:39	64.374246	-165.423779	BONGO 60CM	maxDepth	NSC	172	32	rHopcroft1	
6/29/17 2:42	64.373582	-165.422527	BONGO 60CM	recover	NSC	172	32	rHopcroft1	48m wire out 30/15
6/29/17 2:52	64.373725	-165.424117	centerBoard	recover	NaN	NaN		eRoth1	flush position
6/29/17 3:20	64.416951	-165.452205	Underway Science seawater	stop	NaN	NaN		eRoth1	
6/29/17 3:24	64.427617	-165.454177	OS150	stop	NaN	NaN		eRoth1	
6/29/17 3:24	64.428515	-165.454311	PS18	stop	NaN	NaN		eRoth1	
6/29/17 3:26	64.432619	-165.455127	EK60	stop	NaN	NaN		eRoth1	
6/29/17 3:26	64.434528	-165.455492	EM710	stop	NaN	NaN		eRoth1	
6/29/17 3:27	64.437096	-165.455967	EM302	stop	NaN	NaN		eRoth1	
6/29/17 3:47	64.484836	-165.445091	PCO2	stop	NaN	NaN		eRoth1	
6/29/17 3:52	64.492118	-165.43817	Ship	endCruise	NaN	NaN		eRoth1	arriving in Nome, AK