NGA-LTER

Northern Gulf of Alaska Long-Term Ecological Research

Cruise Report July 2018

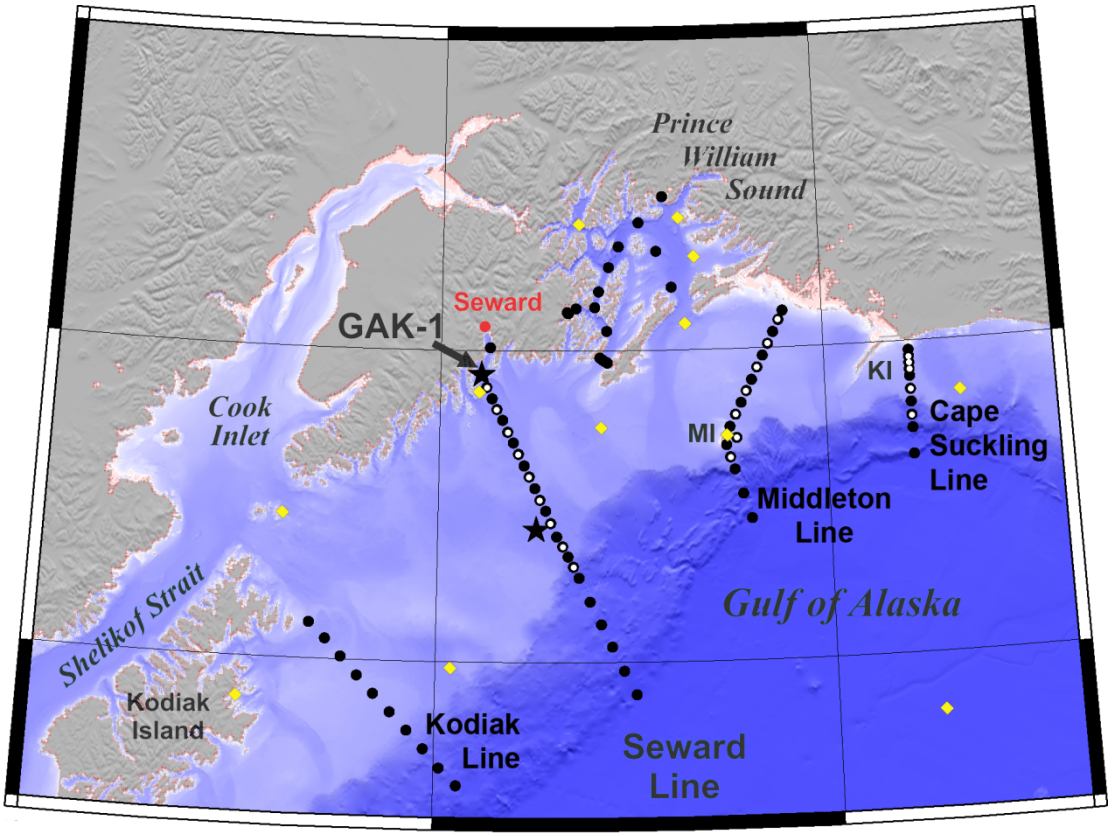
Cruise ID: WolJ2018

Funding Sources: NSF, NPRB, AOOS, EVOS/GWA

Purpose:

The NGA is a highly productive subarctic Pacific marine biome where intense environmental variability has profound impacts on lower trophic level organisms and community dynamics that, directly or indirectly, support the iconic fish, crabs, seabirds and marine mammals of Alaska. In the NGA, a pronounced spring bloom and regions of sustained summer production support a stable base of energy-rich zooplankton grazers that efficiently transfers primary production up the food chain and a substantial sinking flux of organic matter that exports carbon to the sea bottom communities. The LTER research cruises examine features, mechanisms and processes that drive this productivity and system-wide resilience to understand how short- and long-term climate variability propagates through the environment to influence organisms.

This cruise represents a continuation of sampling begun in fall 1997 under the NSF/NOAA NE Pacific GLOBEC program, and subsequently a consortium of the North Pacific Research Board (NPRB), the Alaska Ocean Observing System (AOOS), and the Exxon Valdez Oil Spill Trustee Council's (EVOSTC) Gulf Watch. This is the first cruise with expanded domain, measurements and investigators under the NSF's Northern Gulf of Alaska Long-term Ecological Program (NGA-LTER). This cruise marks the 21st consecutive spring cruise for the Seward Line in the NGA, including Prince William Sound (PWS), and the 48th year of observations at GAK1.



The LTER sampling stations. CTDs cast without water sampling as open symbols. Yellow diamonds represent locations of meteorological data from NOAA buoys or ground stations

Daily summary

July 2 – Mobilization proceeded slowly with this being our first usage of the Woldstad. Although our largest items (winch, CTD, Connex, freezer) had been preloaded, all other gear needed to be moved by cart ~200 m form the U-Haul down boat ramps to the ship, and space needed to be assigned. Labspace inside the vessel is generally suboptimal. Once fully positioned problems were encountered with the winch brake and that consumed considerable time trying to resolve. The run for feeding GPS data to/from the TSG is very long.

July 3 –Day 1. Much of the day is spent try to resolve winch issues. Ultimately, it was determined that the hydraulics were not connected properly and a third line was needed. We determined too late that more wire was required to run serial data up and down to the engine room for the TSG, and were forced to locate both the deck box and underway computer in the engine room. We finally got underway just after dinner, and headed to the CS line while still setting up some equipment inside the labs.

July 4 – Day 2. Most of the day was spend in transit; a test cast was run at ~20:00. Night work began at ~1:30 with Bongo nets at CS4 and worked inshore to CS1. The ship mistakenly stopped at CS3i rather than CS3 and samples taken. Methot nets were deployed on the forward port crane at CS1 and CS3i. Nightwork ended at ~9am.

July 5 – Day 3. Day sampling began at CS1 with a CTD cast at 9:20am, flowed by a Calvet then deployment of the iron-fish. CTD were conducted at CS1.25 and CS1i and then the Prodcast as CS2 began at ~14:00 – we continued working the Calvets and CTD' outward along the line finishing slightly past midnight Night work began at ~01:00 completing a Bongo and a Methot by 02:00 then transited over to the Middleton Line.

July 6 – Day 4. Day sampling began at 09:40 at MID1 with a CTD, Calvet and deployment of the iron-fish. A CTD was completed at MID1i, then the Prodcast began at MID2 at ~noon. We worked outward along the line, ending with MID6 at 22:30. Night work began immediately at MID6 and they worked in as far inward as MID2, conducting Methot trawls at MID6, MID4 and MID2. Night work ended at ~06:30. MID1 was not occupied largely due to its shallow depth, but also to get in an attempt to get day sampling back on track.

July 7 – Day 5. The morning's transit to MID5 ended with a CTD Prodcast at ~10 am. The regular CTD cast was also repeated at MID5 (but no repeated Calvet), then we headed to MID6i for a CTD and deployment of the iron-fish. We proceeded to MID7 and worked outward along the line, taking an extra Calvet at MID9 for genetics and to image *Neocalanus*, then completing MID10 at 23:00. Nightwork began immediately at MID10 with both Bongos and Methots run at all stations finally ending at MID7 at 06:00. We headed toward PWS to avoid an oncoming storm.

July 8 – Day 6. We reached the Montague Strait Line at ~1300, conducted CTD casts at all 4 stations but tripping bottles only at MS3 & MS2, and a Calvet at only MS2. The iron fish was deployed. A CTD cast at KIP0 at 17:30 ended day sampling. Although we tried to reach Icy Bay for sampling, we arrived too late, recovered the iron-fish, then transited to KIP2 for Night work. Night work began with a KIP2 multinet at ~22:00. Sampling continued northward doing PWS1, PWS2, and finally ending with PWS3 at 5:30

July 9 – Day 7. Day work began at ~8:00 at PWS3 with a Calvet and CTD then deployment of the iron-fish. We started the CTD Prodcast for PWS2 at ~10:40 followed by two Calvet hauls, a regular CTD, then both a deep and shallow vertical multinet. Stations PWS1 and KIP2 were sampled while on route to Icy Bay. CTDs and Calvets were conducted at IB1 and IB2, but ice prevented us going in further. Daywork ended at 23:30. Night work consisted of a single Methot at IB2, then we transited to GAK1.

July 10 – Day 8. Day work at Intensive Station GAK1 began with a regular CTD cast at 8:30, followed by at Calvet then the CTD Prodcast at 10:15. A second Calvet was taken for genetics, then a shallow multinet, followed by deployment of the iron-fish while leaving station at 12:20. We worked outward along the line, stopping for CTDs at "i" stations and finishing GAK4 at 21:00. We transited back to GAK1 to begin night work there at midnight. The first Multinet deployment let slack into the winch wraps, and the wire became snarled on the drum – several hours were required to work the wire off before it could be used. Ultimately, multinets were run out as far as GAK4, with Methots being completed at GAK1- GAK3, but night work did not end until 9:30 due to the lost time working on the winch.

July 11 – Day 9. Day work began with a prod cast at Intensive Station GAK5 at 11am. Sampling included 2 Calvets, a regular CTD and, a vertical multinet to the bottom, with the station completed by 13:00. With the iron-fish deployed, we worked southward ignoring the "i" stations as far as GAK8 where we ended at 19:40. We then transited back to GAK5 to begin nightwork there at 23:00 and ended at GAK9 at 07:00.

July 12 – Day 10. The day began with a 200m multinet at 08:00 for GAK9, followed by the CTD Prodcast, two Calvets and the regular CTD cast. *Neocalanus* were present and imaged. After deploying the iron-fish we did a CTD at GAK9i, then worked outward as far as GAK13 conducting casts to a maximum of 1000 m. Discrepancies appeared in first one and then both conductivity channels that were ultimately ascribed to Jellyfish tentacles in the conductivity cells. Daywork at GAK13 ended at 23:00 and the cells were flushed and filled to a dilute Trition solution overnight. Nightwork began immediately working inward to GAK10 doing both Multinets and Methots at all stations. Nightwork ended at 06:00, and the vessel transited out to GAK15.

July 13 – Day 11. We deployed the iron-fish enroute at ~9:00, and began intensive Station GAK15 at ~noon with the CTD Prodcast. We completed two CalVet hauls and a regular CTD, but weather had gotten rough while on station so the vertical multinets could not be deployed and the station ended at ~15:00. Ana and Suzanne were collected water for an iron fertilization experiment that due to the weather required we run within the seas. That transit did not end until we reached ~GAK13, at which point heading back into seas to reach GAK14 was no longer an option. We headed to the Kodiak Line hoping that weather would be better by the time we reached it.

July 14 – Day 12. We began Intensive Station KOD5 ~9:00am with a CTD prod cast followed by two Calvets and a regular CTD. We worked northward in marginal weather to KOD1, ending daywork at ~19:00. Nightwork began immediately with a Methot followed by Bongo nets beginning at 20:00 that worked southward as far as KOD7, with both nets collected at all stations except KOD5. Night work ended at 06:30 and then the vessel transited to KOD6.

July 15 – Day 13. We began at KOD6 with CTD and Calvets, in poor weather, deployed the iron-fish and worked outward to GAK8 before needing to shut-down to weather at 13:00. We repositioned to KOD10 and began nightwork there at 21:00, and working north to KOD8 with the Methot skipped at KOD9. The Bongo net and weights (but not the Fastcat) were lost at KOD8 at ~2:00 due to a carabiner failure. The vessel repositioned to KOD9.

July 16 – Day 14. We began daywork for KOD9 at 07:30 in better weather then contacted an Intensive Station at KOD10 with a prod cast, 2 Calvets and a regular CTD cast. Sufficient time remained that we could return to the Seward Line to sample the missing stations and repeat the casts with bad conductivity. We arrived at GAK 15 with much-improved weather at ~19:30, conducted at CTD to 1000m, a Calvet , then both a deep (1200m) and shallow (200m) multinet that ended at 22:40. Nightwork began immediately with Methots and Multinets that ended at GAK14 around 2:15.

July 17 – Day 15. CTDs began at GAK14 shortly before 7:00, followed by a Calvet. CTDs were recast to 1000m without tripping bottles for GAK13-11 with the last cast ending at 13:20. The vessel began the transit back to Homer.

July 18 – Day 16 – Demobilazation. We arrived in Homer around breakfast and spent most of the day offloading and repacking the U-haul to transport equipment back to SMC. The largest items (connex, winch, CTD, freezer) were stored for us by SVS until the fall cruise. We stayed on the vessel overnight and began the trip to Seward early on July 19.

Physics Report:

PI: Seth Danielson
Participant: Thilo Klenz

On this cruise we conducted 90 casts for water column hydrography at 69 stations (Figure 1) using a 24 x 10 liter bottle rosette. Bottle trips were made at standard levels: 0, 10, 20, 30, 40, 50, 75, 100, 125, 150, 200, 250, 500, 750, and 1000 m depths and within 5 m of the bottom when the bottom depth was less than 1500 m. The SBE9-11 CTD was outfitted with pressure, dual temperature, dual conductivity and dual oxygen sensors. Ancillary sensors included a WetLabs fluorometer, a WetLabs C-Star transmissometer, a Biospherical PAR sensor, and a Benthos altimeter. One channel was assigned to a self-logging Sequoia LISST particle size spectra instrument; one channel provided power to a self-logging SUNA nitrate sensor. A self-logging Underwater Vision Profiler (UVP) was also attached to the CTD rosette frame. The UVP instrument required a 30 meter soak depth so for profiles needing UVP data recording the CTD had an unusually deep soak that may have impacted the profiles' depiction of the near-surface stratification. Only one profile at each station required a UVP profile so stations with multiple casts had a combination of deep and shallow soak depths.

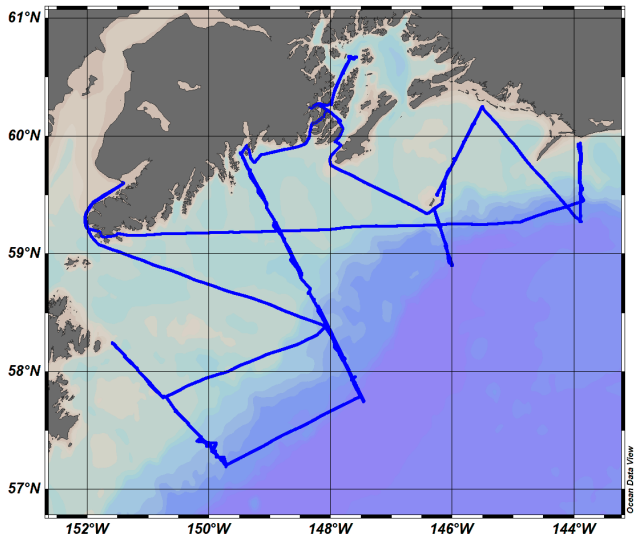


Figure 1. Cruise track for Woldstad from July 4-18, 2018 (WolJ2018)

The CTD stations were occupied on four shelf transects (Kodiak, Middleton, Cape Suckling and Seward Line; Fig. 2-5) plus stations in Prince William Sound, including stations across Montague Strait, in three fjords (Icy Bay, College Fjord and Columbia Glacier fjord), and along Knight Island Passage.

Our underway data-stream was limited from this vessel, and consisted only of records of the cruise track provided by the navigation software, and a SBE-45 Thermosalinograph. Due to the long-wire runs associated with connecting the TSG into the ship's GPS, we were forced to setup the computer logging this data in the engine room. This resulted in a number of problems that created periodic data corruption and computer reboots resulting in frequent losses of data. Early in the cruise the time-stamp became corrupted, forcing manual alignment of the CTD data with that from the bridge. We are hope that some of the gaps (Figure 6) can be filled in by during later processing.

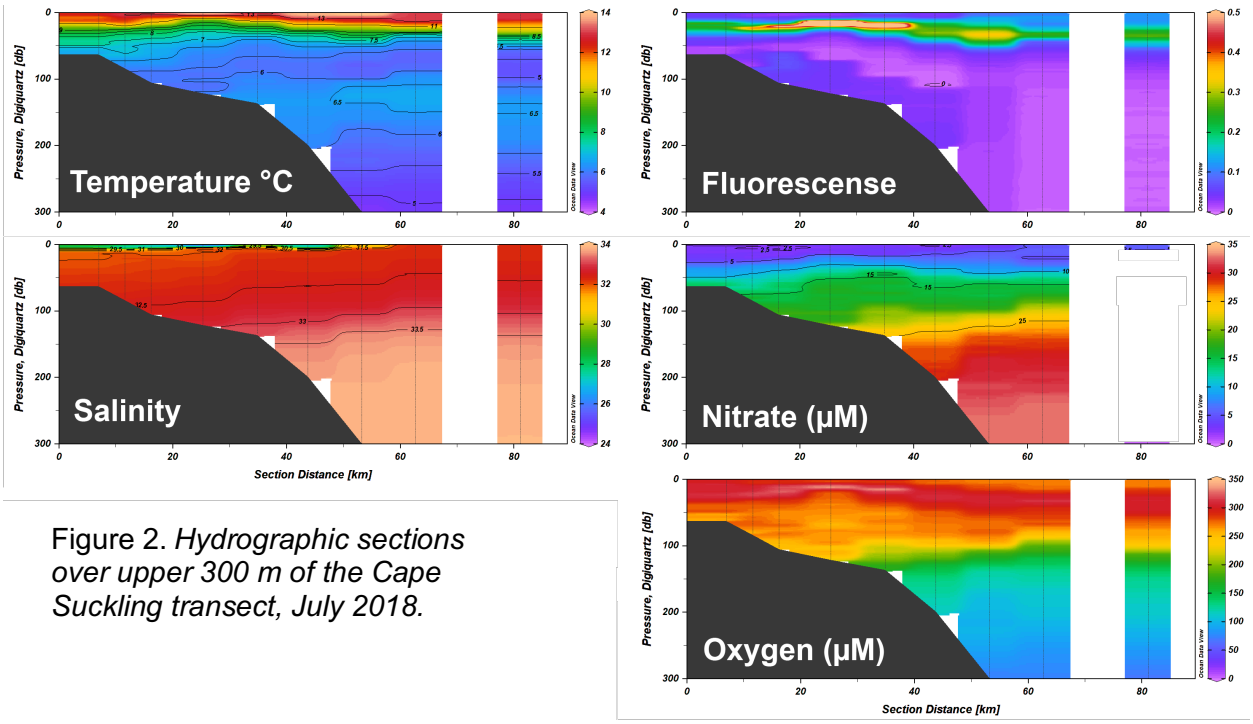


Figure 2. *Hydrographic sections over upper 300 m of the Cape Suckling transect, July 2018.*

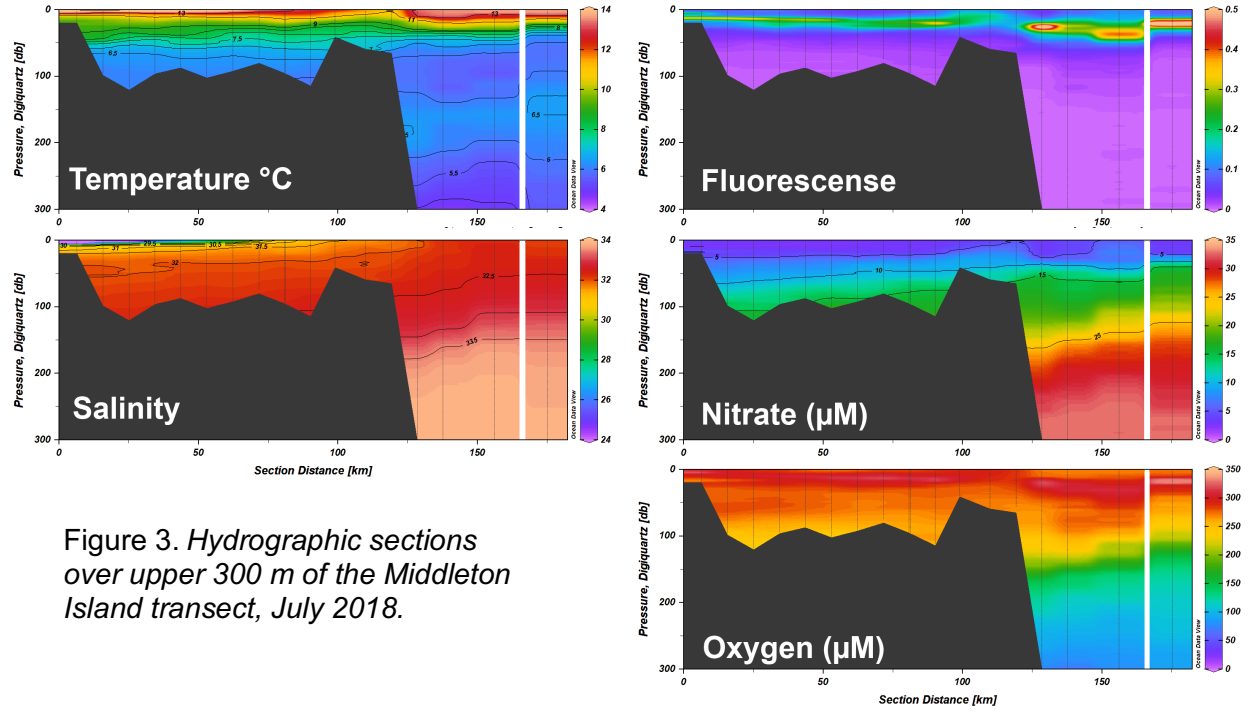


Figure 3. *Hydrographic sections over upper 300 m of the Middleton Island transect, July 2018.*

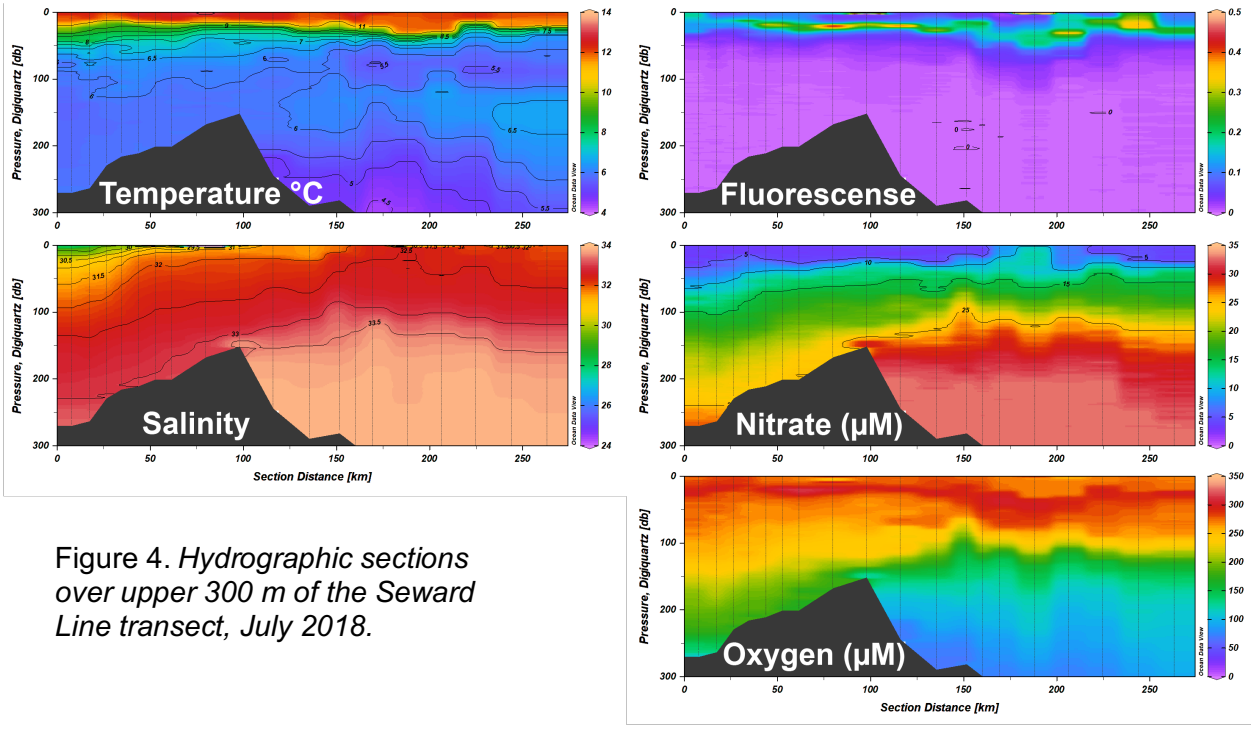


Figure 4. *Hydrographic sections over upper 300 m of the Seward Line transect, July 2018.*

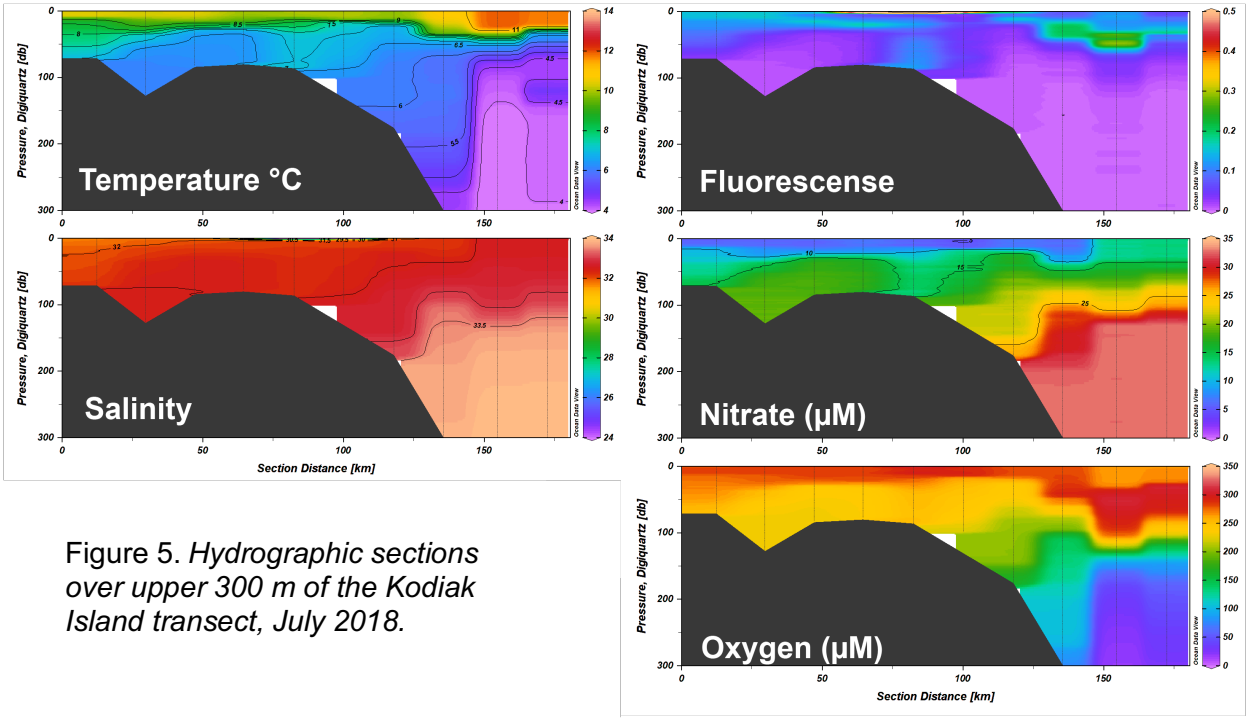


Figure 5. *Hydrographic sections over upper 300 m of the Kodiak Island transect, July 2018.*

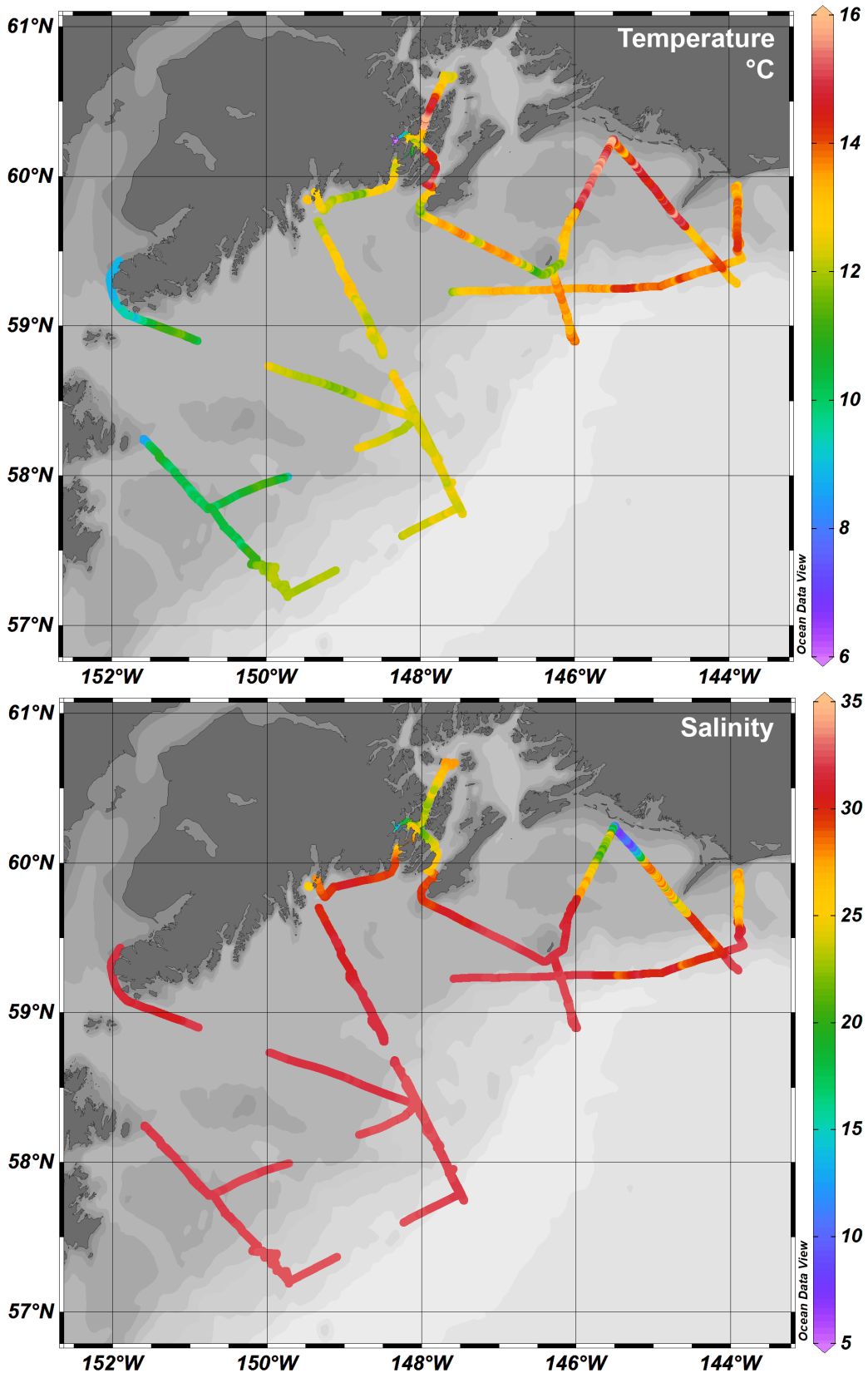


Figure 6. Underway data (~3 m depth) during July 2018 (WolJ18).

Macro- and Micronutrient sample collection and processing

PI: Ana M. Aguilar-Islas
Participants: Barkha Singh (under graduate student volunteer)

The goal of this field effort was to determine ambient distribution of dissolved inorganic macronutrients (nitrate, nitrite ammonium, phosphate and silicic acid) and the micronutrient iron. Nutrient distributions in conjunction with hydrography are used to determine resource variability to the phytoplankton community in space and time and to identify the relative importance of various processes in supplying nutrients to surface waters. This cruise also provided field research experience to an undergraduate student from UAF.

Sample collection and processing for macronutrient analysis:

Filtered seawater samples were collected from surface to a depth of 1000 m from 48 vertical profiles using the UAF CTD rosette bottles (see Table 1). Samples were filtered through 0.45 um cellulose acetate filter disks using a syringe, and were kept frozen (-40°C) following collection. Samples were also obtained from primary production casts (53 of samples), and from all replicates from an iron addition experiment (22 samples). Barkha Singh was responsible for most of the sampling with some help from Aguilar-Islas and members of the Strom team. In total 609 samples were collected for nutrient analysis.

Sample collection for iron analysis:

Surface seawater samples were collected underway in between stations (see Table 2). These samples were obtained from a custom-made surface sampler (FeFish) deployed from the port crane, and kept at a distance of ~ 5 m from the hull of the ship. Aguilar-Islas was involved in deck operations, with assistance from the crew. A total of 134 samples were collected for Fe analysis. Seawater was brought into a trace metal clean van outfitted with HEPA filtered air where collection took place.

Sample processing for iron analysis:

A small enclosure was built inside the van for sample processing. Samples were filtered in-line (Acropak 0.2 um cartridges) for the analysis of dissolved iron, iron-binding organic ligands, and soluble iron. Samples for soluble iron were further filtered through 0.02 um Anotop syringe filters. Unfiltered samples were collected for total dissolvable iron analysis, and for particulate iron analysis (through 0.2 um polycarbonate filter discs) (See Table 2). Aguilar-Islas was responsible for all sample collection and off-line filtration.

Seawater collection and processing for the iron addition experiment
An experiment was conducted in collaboration with the Strom Lab using unfiltered surface seawater from Station GAK 14 (targeting HNLC region) amended with filter surface seawater from Station CS1 (targeting river plume region) and with FeCl3 additions. Surface seawater was collected with the IronFish into 20L carboys, and when needed filtered inline through 0.2 um Acropak filter cartridges. Filtered seawater from Station CS1 was kept in the dark inside the walking freezer until the initiation of the experiment. Replicates of controls (1:1.56 mixture of filtered and unfiltered GAK14 surface water), + river water iron (1:1.56 mixture of unfiltered GAK

14 surface water and filtered CS1 surface water), and + FeCl3 (same as control, but with an added 3 nM Fe spike) were obtained from 4 time points for the analysis of nutrients, iron and biological parameters. Note: The low salinity of surface water at GAK 14 indicated coastal influence, but due to time constrains searching for HNLC water was not an option.

General Notes

DECK OPERATIONS: The use of the Woldstad for our LTER operations was adequate for the collection of trace-metal clean surface water and the collection of nutrient samples from the CTD. This was in part due to the relatively good weather during the cruise. However, CTD operations will be difficult under rougher conditions. Vertical sampling for iron work is not possible under the current configuration on the Woldstad. The deck crew provided excellent support; their help ensured the success of our FeFish deployments. The crew was helpful during offloading and always behaved in a professional manner.

LAB SPACE: Due to the lack of lab space on this ship, working vans were essential. The ship was able to provide electric power and fresh water to the vans, and compressed air for the FeFish pump. The location of the vans was adequate because of the relatively mild weather we had during the cruise. I can imagine that during storms, accessing to the vans in the forward deck could become a safety issue. Collecting the data from the underway flow through system was a challenge and will need to be restructured.

LIVING SPACES: The living spaces were not ideal. State rooms were too small for the number of people in each room, and in particular, having only one bathroom for all the science personnel and most of the crew was challenging. The food was adequate.

OTHER: Storage and transportation for the trace metal clean van in between summer and fall cruises was generously provided and coordinated by the Woldstad.

Table 1 Nutrient Sample Collection

Station	Date	# of samples	Station	Date	# of samples
CS 1	7/5/2018	7	GAK 4	7/10/2018	11
CS 2	7/5/2018	9	GAK 5	7/11/2018	11
CS 3	7/5/2018	11	GAK 6	7/11/2018	10
CS 4	7/5/2018	15	GAK 7	7/11/2018	12
CS 5	7/5/2018	15	GAK 8	7/11/2018	13
MID 1	7/6/2018	3	GAK 9	7/12/2018	13
MID 2	7/6/2018	10	GAK 10	7/12/2018	15
MID 3	7/6/2018	9	GAK 11	7/12/2018	15
MID 4	7/6/2018	8	GAK 12	7/12/2018	15
MID 5	7/6/2018	7	GAK 13	7/12/2018	15
MID 6	7/6/2018	5	GAK 15	7/13/2018	15
MID 5R	7/7/2018	9	GAK 14	7/17/2018	15
MID 7	7/7/2018	6	KOD 1	7/14/2018	7
MID 8	7/7/2018	14	KOD 2	7/14/2018	9
MID 9	7/7/2018	14	KOD 3	7/14/2018	7
MID 10	7/7/2018	14	KOD 4	7/14/2018	7
MS 3	7/8/2018	10	KOD 5	7/14/2018	8
MS 2	7/8/2018	10	KOD 6	7/15/2018	9
PWS 3	7/9/2018	13	KOD 7	7/15/2018	11
PWS 2	7/9/2018	14	KOD 8	7/15/2018	14
PWS 1	7/9/2018	12	KOD 9	7/16/2018	15
KIP 2	7/9/2018	14	KOD 10	7/16/2018	14
IB 1	7/9/2018	11			
GAK 1	7/10/2018	13	Total		534
GAK 2	7/10/2018	12			
GAK 3	7/10/2018	11			

Table 2. Samples for iron parameters

Line	Date	DFe	TDFe	SFe	Ligands	PFe
CS	7/5/2018	10	3	3	3	3
MID	7/6 – 7/7	19	4	4	3	4
PWS	7/8 – 7/9	4	1	1	1	2
GAK	7/10 – 7/17	28	4	4	4	4
KOD	7/14 – 7/16	18	4	4	4	4
Total		69	16	16	15	17

DFe = dissolved iron (< 0.2 um), TDFe = total dissolvable iron (unfiltered), SFe = soluble Fe (< 0.02 um), PFe = particulate iron (> 0.2 um)

Carbonate Chemistry

PI: Claudine Hauri

Samples for DIC analysis were collected at GAK1, GAK5, GAK9, GAK15 and PWS2 to be run at OSU by Burke Hales. An independent set of triplicate samples were collected from the surface and bottom bottles of GAK1 to be analyzed at UAF's OARC.

Particles

PI: Andrew McDonnell, Participant: Stephanie O'Daly

The LISST-Deep (Laser-in-situ-scattering-transmissivity rated to 3000m) and UVP5 (Underwater Vision Profiler 5) were mounted on the CTD rosette for all casts, and collected data at all stations. The UVP5 did not collect data during most productivity casts along the GAK and KOD lines, but did collect data during the full CTD profiles at each station.

The UVP did not collect surface data (<20 meters) at stations GAK3 & GAK4 for an unknown reason. The CTD was soaked at 30 meters and lowered at least 30 meters/min, which should have allowed ample time for the UVP to turn on and surface data to be collected. This appears to have happened at 6 stations during the cruise: GAK3, GAK7, GAK8, KOD4, KOD7, KOD10_prod. The LISST collected data whenever the CTD was powered, sampling at 1 second intervals. The LISST collected data at all stations and all CTD casts. A backscatter profile for the LISST was taken at the beginning of the cruise, and again at the end with distilled water. The LISST passed background backscatter tests both times.

Microbes

PI: Eric Collins. Participant: Madison Herron

Collins group uses genetic analyses to explore microbial communities within the Gulf of Alaska. At each station, seawater from the surface, chlorophyll maximum, and bottom was collected and filtered onto 0.2um Sterivex filters to retain bacteria, archaea, and protists. DNA will be extracted from the filters at UAF and the V4 region of the 16S rRNA gene (bacteria and archaea) and 18S rRNA gene (protists), along with the ITS1 region (fungi), will be sequenced on an Illumina MiSeq to an average depth of 10,000 reads per sample. These metabarcodes provide insight into the microbial communities that reside within the Gulf of Alaska, including primary producers, biogeochemical cycling bacteria and archaea, and harmful algal bloom forming taxa. During the July 2018 LTER cruise aboard R/V Sikuliaq, we collected 59 samples from 21 stations.

Microbial sample summary

Station	Depths
CS1	3
CS3	4
CS5	2
GAK1	3
GAK12	3
GAK14	3
GAK15	3
GAK5	3
GAK9	3
KIP2	3
KOD1	2
KOD10	1
KOD5	3
KOD6	3
KOD8	2
KOD9	3
MID1	3
MID3	3
MID5	4
MID7	2
MID9	3
TOTAL	**59**

Phytoplankton and Microzooplankton

PI: Suzanne Strom, Participants: Kelley Bright, Clayton Mazur, Garrett Michael (all WWU; GM part of SPMC's REU program)

Phytoplankton biomass and performance: Phytoplankton biomass was characterized by size-fractionated chlorophyll at all non-intermediate shelf stations and most PWS stations (total = 45 vertical profiles); only total chl (GFF) was measured in Icy Bay. Samples were analyzed fluorimetrically on board (6-7 depths per station depending on depth of CTD fluorescence profile). Samples for determination of photosynthetic efficiency (Fv/Fm, Walz WaterPAM) were also taken at all the above depths and stations except fjord stations heavily impacted by suspended particulates. Primary production estimates were made at most intensive stations (total = 10) using the 13-C method and 24-h deck incubations. 5-6 'light depths' were sampled per station based on the attenuation coefficient as estimated from the CTD PAR profile. Chlorophyll (GFF only) and nutrient samples were also taken from each of these productivity depths during experiment set-up.

Community characterization: Photosynthetic organisms and other protists were sampled at approximately every other shelf station, generally at 10 m depth only, as well as at selected stations in PWS. Samples were fixed in acid Lugol's for standard microzooplankton biomass and composition estimates, and in borate-buffered formalin for characterization of diatoms. Additional samples collected in conjunction with our mixotrophy project were i) fixed in glutaraldehyde, DAPI-stained, and made into slides for biomass and composition of nano- and picoplankton, and ii) fixed in HMTA-buffered formalin for inverted-epifluorescence microscopy to assess mixotrophy in ciliates and larger dinoflagellates. At intensive stations only, additional samples were taken from 10 and either 20 or 30 m for HPLC analysis of phytoplankton pigments (chemotaxonomy) and from 10 m only (in duplicate) for molecular characterization of the protist community. At intensive stations a 4-depth vertical profile of acid Lugol's samples was also collected.

Organic carbon characterization: Samples were filtered and frozen at approximately every other shelf station as well as one in PWS (total = 20) for DOC profiles; depths sampled were mainly 150 m and above, and corresponded to nutrient sampling depths. At intensive stations only (total = 10), a 4-depth vertical profile (0, 10, 20, 40 m) was sampled for POC and PIC.

Additional work for NPRB-funded mixotrophy project: Two prey addition experiments were conducted to assess the potential for mixotrophy in photosynthetic flagellates, including dinoflagellates. At PWS3 and GAK9i, water was collected from near the surface and amended (n=3) with the following cultured phytoplankton as exogenous prey: *Synechococcus* sp. RCC3010; *Synechococcus* sp. RCC 3011; *Rhodomonas* sp. 755; or no prey addition (controls). After ~24 h incubation, samples were fixed and slides prepared for epifluorescence microscopy determination of prey uptake by different flagellate groups.

Iron source experiment: A 4-d incubation experiment was conducted to investigate the effect of iron-rich water (collected on the inner CS line) and/or added FeCl3 on the offshore community. Unfortunately offshore waters appear to have been nitrogen-limited rather than HNLC, so that

Fe additions did not stimulate a bloom, as anticipated. Small scale internal community dynamics were evident over the 4-d time period in the incubation bottles.

Preliminary observations: The predominant water column structure on the shelf was highly temperature and variably salinity stratified, with a strong pycnocline at 20-30 m and a corresponding chlorophyll maximum layer. At most stations and depths, >95% of chl-a was in the <20 µm size fraction (Fig. 7). Exceptions (where >20 µm cells predominated) were seen in surface low salinity layers on the inner CS and MID lines, at GAK 10-13, and at most stations on the Kodiak line. True oceanic water with surface salinity = 32.6 and low total chlorophyll (<0.3 µg/liter) was only encountered on the outer Kodiak line. The outer Seward line may have been impacted by a mesoscale eddy. No meaningful on-board microscopy was possible on the Woldstad.

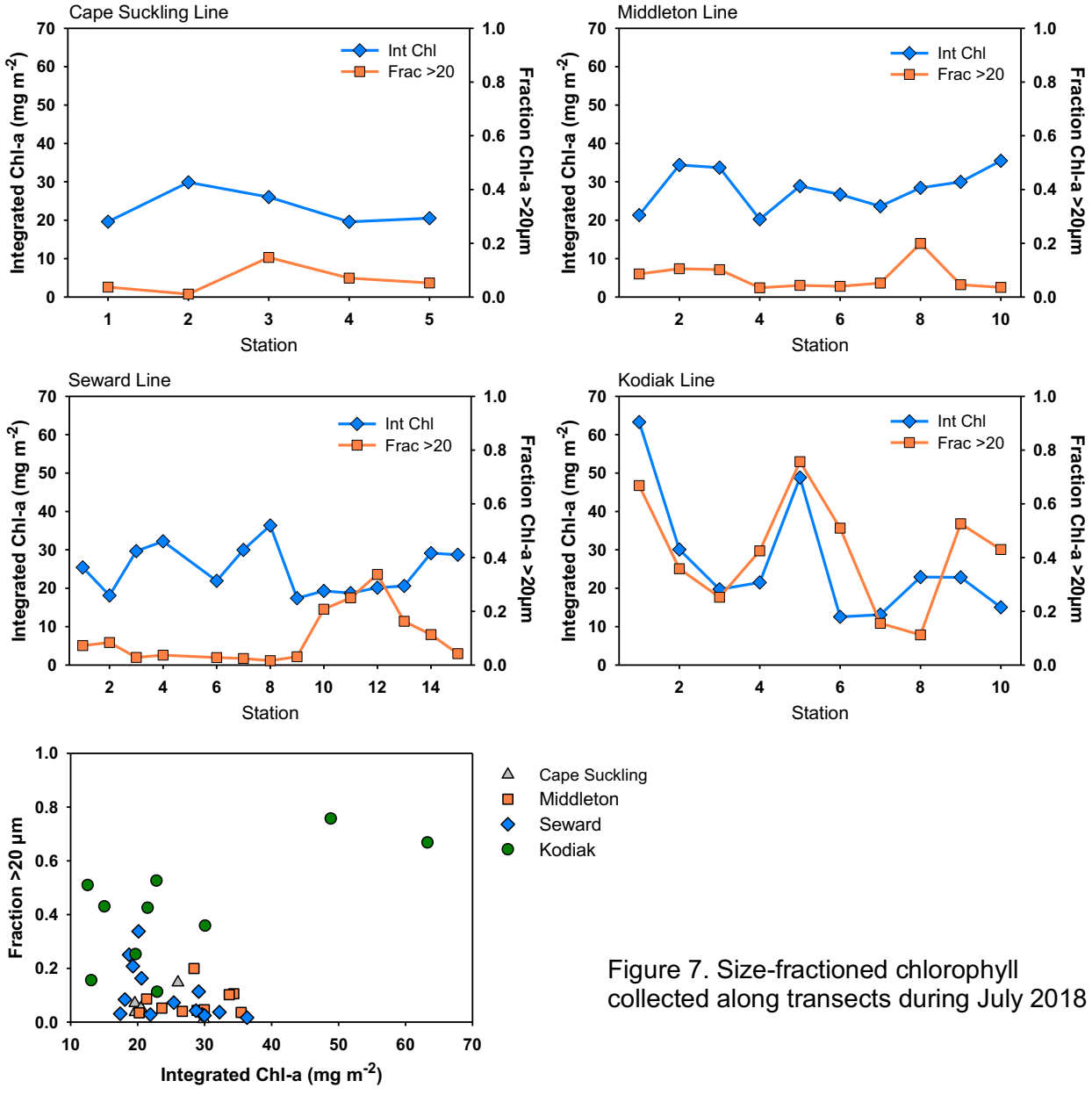


Figure 7. Size-fractioned chlorophyll collected along transects during July 2018

Table 3: Sampling effort for Strom component, by station. Intensive stations highlighted

Stn	SF Chl	Tot Chl	Lugol's µzoo	Diatom	Mixo	Nano/ pico	HPLC	Euk Mol	DOC	POC/ PIC	13C prod	Fv/Fm
Res 2.5	**x**											**x**
CS1	x		x	x	x	x	x					x
CS2	x		x	x	x	x	x	x	x	x	x	x
CS3	x		x	x								x
CS4	x		x	x	x	x	x	x	x	x		x
CS5	x		x	x								x
MID1	x		x	x	x	x	x					x
MID2	x		x	x	x	x	x	x	x	x	x	x
MID3	x		x	x	x	x	x					x
MID4	x		x	x	x	x						x
MID5	x		x	x	x	x	x	x	x	x	x	x
MID6	x		x	x			x					x
MID7	x		x	x	x	x	x					x
MID8	x											x
MID9	x		x	x	x	x	x					x
MID10	x											x
MS2	x		x	x								x
KIP2	x											x
PWS1	x											x
PWS2	x		x	x	x	x	x	x	x	x	x	x
PWS3	x											x
IB1		x										
IB2		x										
GAK1	x		x	x	x	x	x	x	x	x	x	x
GAK2	x											x
GAK3	x		x	x	x	x						x
GAK4	x											x
GAK5	x		x	x	x	x	x	x	x	x	x	x
GAK6	x											x
GAK7	x		x	x	x	x						x
GAK8	x											x
GAK9	x		x	x	x	x	x	x	x	x	x	x
GAK10	x											x
GAK11	x		x	x	x	x						x
GAK12	x											x
GAK13	x		x	x	x	x						x
GAK14	x											x
GAK15	x		x	x	x	x	x	x	x	x	x	x
KOD1	x		x	x	x	x	x					x
KOD2	x											x
KOD3	x		x	x	x	x	x					x
KOD4	x											x
KOD5	x		x	x	x	x	x	x	x	x	x	x
KOD6	x											x
KOD7	x						x					x
KOD8	x											x
KOD9	x											x
KOD10	x		x	x	x	x	x	x	x	x	x	x
Total	**45**	**2**	**27**	**27**	**23**	**23**	**20**	**11**	**11**	**11**	**10**	**45**

Meso/Macro Zooplankton

PI:Hopcroft, Participants: Ken Coyle, Jennifer Questel, Heidi Mendosa-Islas, Loring Schiable (volunteer), Per Fosstveit (teacher);

Zooplankton sampling operations were divided into distinct day and night activities. During daytime, Quadnets (Quad frame has 4 nets, 2 of 150µm mesh and 2 of 53µm mesh) casts were conducted at all stations (except "i" stations) to 100m depth, or within 5m of the bottom at shallower stations. At intensive stations, and additional Quadnet cast was taken, with the 150um net preserved in ethanol for molecular studies and the 53µm nets used for live sorting. Additionally, at intensive stations along the Seward Line and at PWS2, a multinet equipped with 150µm-mesh nets was deployed vertically to 200 m (shelf) with a second cast deployed to 750m (PWS2) or 1200m (GAK15) dividing strata at 600, 400, 300, 200,100, 60, 40, and 20 m. During night-time a Bongo net of 505µm mesh was towed obliquely to 200m depth (or 5 m above the bottom) at all shelf stations except for the Seward Line. Bongo depths were monitored using a Fastcat (SBE29) CTD mounted immediately above the nets. Along the Seward Line and within PWS, a multinet equipped with 505µm-mesh nets was towed obliquely to 200m depth (or 5 m above the bottom) dividing strata at 100, 60, 40, and 20 m. All standard gear was deployed without notable issues until the every last station Bongo station (KOD8) where failure of the Carabiner resulted in the loss of the Bongo nets and weights A redeployed with back-up nets was not attempted.

At most stations a Methot net was deployed to target large jellyfish. The net was fished from the forward crane and deployed just below the surface, typically rowing for 20 minutes at 2.5 knots. No depressor was rigged to the net to reduce slide-load on the crane.

Live sorting of epipelagic samples at intensive stations was challenging due to poor laboratory setup and the need to participate in CTD deployments. Nonetheless, samples were inspected routinely for *Neocalanus*. Both *N. plumchrus* and *N. cristatus* occurred at most offshore intensive stations, and up to 50 individuals of each species were imaged as available. It is notable that animals were collected in except condition and pigmentation was typically intense on *N. plumchus*, mover lipid storage between stations was surprisingly variable, with *N. cristatus* almost devoid of lipids at stations along the outer Kodiak and Seward Lines.

Marine bird and marine mammal surveys (USFWS)
PI: Kathy Kuletz, Participants: Dan Cushing, Toby Burke

Methods

A single observer conducted visual surveys during daylight hours while the vessel was underway. Two observers participated in the cruise, Toby Burke and Dan Cushing. Surveys were conducted from the bridge (platform height: 4.7 m), using a modified line-transect protocol. One observer searched an area within a 300-m, 90˚ arc from the bow to the beam, using hand-held 10x binoculars when necessary for species identification. Observations were recorded using four perpendicular distance bins: 0-50m, 51-100m, 101-200m, and 201-300m. Observations of rare birds or large flocks, or marine mammals observed outside of the sampling window were recorded as "off-transect". The behavior of each animal was recorded as flying, on water, on ice, or foraging. Birds and mammals on the water or ice, or actively foraging from the air, were recorded continuously. Flying birds were recorded using instantaneous scans (frequency based on ship speed, typically about 1 per minute), to minimize bias due to movement of flying birds. Observations were recorded directly into a laptop computer using software Dlogv3 (R.G. Ford Consulting, Portland, OR) which logged the geographic coordinates of each sighting, as well as the track line and environmental conditions (Beaufort Sea state, weather, glare, ice coverage) at 20 sec intervals. We encountered glacial ice in the vicinity of Icy Bay in PWS.

Preliminary Results

We conducted a total of 136 hours of surveys totaling 2217 linear km (Fig. 8). On-transect, we observed a total of 6658 individuals of 37 species of birds, with an additional 9 species observed off-transect during surveys or while at stations (Table 4). Compared to the April-May 2018 NGA LTER cruise, this represented a 160% increase in the number of birds per linear km surveyed, and a 18% reduction in the total number of species identified during the cruise. In general, compared to spring, there was an increase in numbers of birds encountered along the Kodiak Line, and decreases along the Cape Suckling line and on the inner shelf region of the Seward Line. Areas with relatively high densities during both seasons included Middleton Island, Cape Cleare, and, to a lesser extent, the shelf-break region along the Seward Line. Species diversity was likely higher in spring than in summer because spring is an active migratory period for many species. That said, we did witness the vanguard of early fall migrating species, including long-tailed jaegers, Sabine's gull, and red-necked phalarope.

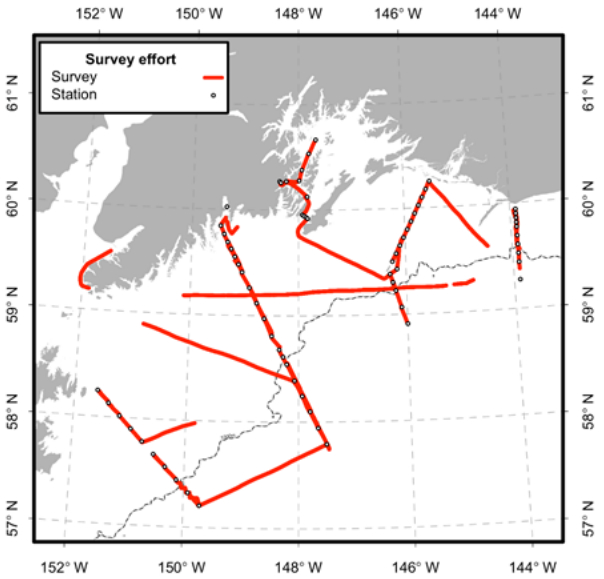


Figure 8. Locations of seabird and marine mammals transect during July 2018

The most abundant species of marine bird during July was the northern fulmar (29%; Table 4; Figure 3). Fulmars were also the dominant species during spring (23%). In July, however, the number of fulmars per linear km was twice as high as during spring. During both seasons, the spatial pattern of distribution was similar. Fulmars were widely distributed across the continental shelf and slope, with small numbers occurring within PWS, and higher concentrations near the shelf-break, with the highest densities occurring near Middleton Island, though fulmars are not known to nest at Middleton. The primary spatial difference between seasons was higher relative abundance of fulmars along the Kodiak line in summer than in spring.

Fork-tailed storm-petrel was the second most abundant species of marine bird during July (17%; Figure 9). Like northern fulmars, fork-tailed storm-petrels were about twice as numerous in summer as in spring, when it was also one of the dominant species of seabird (13%). During the July cruise, fork-tailed storm-petrels were distributed across the study area, absent only from a portion of the inner-shelf near the Copper River (Figure 9). The highest concentrations of fork-tailed storm-petrels occurred near the shelf-break, and the species was also abundant on a shoal (~150m depth) bordering Amatuli Trough to the north of Portlock Bank.

Also abundant were sooty and short-tailed shearwaters; these two species represented a combined total of 24% of marine bird observations, with 11% of the total number being sooty shearwaters, 10% short-tailed shearwaters, and 3% unidentified dark shearwaters (no other species of shearwater were identified). In addition, approximately 10,000 short-tailed shearwaters, along with an aggregation of at least 9 humpback whales, were observed in the vicinity of the vessel while occupying station KOD6 on the Kodiak Line. Abundance of shearwaters was approximately five times greater in summer than in spring. During July, the highest densities of sooty shearwaters occurred in the inner shelf, especially near Cape Cleare and Cape St. Elias, and south of Resurrection Bay (Figure 9). In contrast, short-tailed shearwaters were most abundant over Albatross Bank, east of Kodiak Island.

Black-footed albatross comprised 5% of the total number of birds observed. Black-footed albatross were most frequently encountered near the shelf-break and were also abundant at Albatross Bank and over the outer shelf along the Seward Line (Figure 9). Black-footed albatross were generally rare or absent within 25 km of shore and in the vicinity of the Copper River. During spring, Laysan albatross were abundant and widely distributed. In July, however, only 4 Laysan albatross were observed. A total of 5 short-tailed albatross were observed during the July cruise; all were immature individuals, and all occurred on the outer portions of the Seward and Kodiak lines.

Tufted puffins also comprised 5% of the total. Spatial distribution of tufted puffins showed small numbers widely dispersed over shelf and oceanic regions, with high concentrations within 50 km of breeding colonies at Middleton Island and at the Chiswell and Beehive Island groups near Resurrection Bay (Figure 9). Other species that showed spatial concentration near breeding colonies included glaucous-winged gulls near Middleton Island and the barrier islands of the Copper River (4% of total), and common murre (4%) near colonies at Middleton Island, Resurrection Bay, and Kachemak Bay.

Black-legged kittiwakes made up 3% of the total number of birds observed in July, and the number observed per linear km was only one fourth of that observed during spring, when

kittiwakes made up 18% of the total number of birds. The geographic distribution of kittiwakes was restricted to nearshore areas and the shelf between Middleton Island and the mainland (Figure 9). The highest numbers were observed near colonies at Middleton Island, Prince William Sound, Resurrection Bay, and Kachemak Bay. Unlike during spring, when they were widely distributed, no black-legged kittiwakes were observed offshore of the 1000m isobath in summer, suggesting that birds nesting at Middleton were foraging to the north of the island.

Of special note were several red-legged kittiwakes off the Kenai Peninsula and Kodiak Island (Figure 9). Red-legged kittiwakes breed at several islands in the Bering Sea, all located more than 1000 km from these sightings. Red-legged kittiwakes have a larger eye than black-legged kittiwakes, a possible adaptation to nocturnal foraging on myctophids and squid. On July 12, we observed, at close range, at least two different individuals 145 to 200 km southeast of Resurrection Bay (stations GAK9 to GAK12). One bird landed on the ship where it remained for several hours. This kittiwake appeared to have an infestation of ticks surrounding its eyes, which it repeatedly rubbed with its wing and scratched with its foot (Figure 9). On July 14, between 10 and 70 km south of Kodiak's Marmot Island (stations KOD1 to KOD5), we observed at least one individual that circled the ship several times and re-appeared around the ship during the day. In total, the observations were of at least three different individuals (possibly five but unlikely); two adults in alternate (breeding) plumage and one adult in basic (non-breeding) plumage.

Red-necked phalaropes also comprised 3% of the total number of birds; phalaropes, which are often associated with fronts, were most abundant near Cape Cleare and Middleton Island (Figure 9).

We observed a total of 9 species of marine mammals, the same number of species that was seen during spring (Table 5). The most abundant marine mammal was Dall's porpoise (96 total, including on- and off-transect observations). Dall's porpoise occurred widely in the eastern half of the study area, including PWS, the shelf-break near Middleton Island, and the shelf between Middleton and the Copper River (Figure 10). Groups were also frequently encountered near the outer stations of the Seward Line. A total of 30 humpback whales were identified on- and off-transect. The largest aggregation, of at least 9 whales, occurred at station KOD6, over Albatross Bank. A pod of at least 6 humpback whales was active along the shore of Latouche Island in PWS. Humpback whales were also observed near Cape Suckling, near Middleton Island, and along the outer Seward Line. In contrast, only 1 humpback whale was identified during the spring cruise. A total of 26 fin whales were identified; fin whales were widely distributed over the continental shelf and slope. Sperm whales (6 on- and 1 off-transect) were observed between Seward Line stations GAK11 and GAK12, and several solitary adult male killer whales were encountered during the cruise.

The most frequently encountered pinnepid was the harbor seal (20 total); harbor seals occurred in Icy Bay, near the Copper River, and at Cape Suckling (Figure 10). A total of 10 northern fur seals were observed during the cruise, an increase in numbers relative to spring. Most were observed over the shelf along the Seward Line. A single Steller sea lion was observed south of Cape Suckling. Sea otters were primarily observed in PWS and Kachemak Bay; however, a single individual was observed marooned on a kelp mat 97 km from the nearest shore.

Table 4. Marine birds observed during the July 2018 Gulf of Alaska Long-term Ecological Research cruise. Numbers include on-transect observations only. Species only observed off-transect during surveys or while at stations are indicated by an asterisk.

Common Name	Scientific Name	Number	% of total
Mallard	*Anas platyrhynchos*	1	< 0.1
Surf scoter	*Melanitta perspicillata*	*	0.0
White-winged scoter	*Melanitta fusca*	5	0.1
Hummingbird spp.	*Trochilidae* spp.	1	< 0.1
Black oystercatcher	*Haematopus bachmani*	6	0.1
Black turnstone	*Arenaria melanocephala*	11	0.2
Surfbird	*Calidris virgata*	*	0.0
Least sandpiper	*Calidris minutilla*	1	< 0.1
Dowitcher spp.	*Limnodromus* spp.	1	< 0.1
Red-necked phalarope	*Phalaropus lobatus*	223	3.3
Red phalarope	*Phalaropus fulicaria*	2	< 0.1
Phalarope spp.	*Phalaropus* spp.	2	< 0.1
Pomarine jaeger	*Stercorarius pomarinus*	4	0.1
Parasitic jaeger	*Stercorarius parasiticus*	6	0.1
Long-tailed jaeger	*Stercorarius longicaudus*	42	0.6
Common murre	*Uria aalge*	231	3.5
Thick-billed murre	*Uria lomvia*	*	0.0
Murre spp.	*Uria* spp.	2	< 0.1
Pigeon guillemot	*Cepphus columba*	4	0.1
Marbled murrelet	*Brachyramphus marmoratus*	35	0.5
Kittlitz's murrelet	*Brachyramphus brevirostris*	13	0.2
Marbled or Kittlitz's murrelet	*Brachyramphus* spp.	7	0.1
Ancient murrelet	*Synthliboramphus antiquus*	70	1.1
Cassin's auklet	*Ptychoramphus aleuticus*	13	0.2
Parakeet auklet	*Aethia psittacula*	14	0.2
Auklet spp.	*Aethia or Ptychoramphus* spp.	17	0.3
Rhinoceros auklet	*Cerorhinca monocerata*	53	0.8
Horned puffin	*Fratercula corniculata*	48	0.7
Tufted puffin	*Fratercula cirrhata*	334	5.0
Alcid spp.	*Alcidae* spp.	5	0.1
Black-legged kittiwake	*Rissa tridactyla*	193	2.9
Red-legged kittiwake	*Rissa brevirostris*	1	< 0.1
Sabine's gull	*Xema sabini*	3	< 0.1
Mew gull	*Larus canus*	*	0.0
Herring gull	*Larus argentatus*	8	0.1
Glaucous-winged gull	*Larus glaucescens*	237	3.6
Gull spp.	*Larus spp.*	3	< 0.1
Caspian tern	*Hydrpprogne caspia*	*	0.0
Arctic tern	*Sterna paradisaea*	7	0.1
Pacific loon	*Gavia pacifica*	3	< 0.1
Laysan albatross	*Phoebastria immutabilis*	1	< 0.1
Black-footed albatross	*Phoebastria nigripes*	343	5.2
Short-tailed albatross	*Phoebastria albatrus*	*	0.0
Northern fulmar	*Fulmarus glacialis*	1930	29.0
Short-tailed shearwater	*Ardenna tenuirostris*	694	10.4
Sooty shearwater	*Ardenna grisea*	760	11.4
Dark shearwater spp.	*Ardenna* spp.	174	2.6
Fork-tailed storm-petrel	*Oceanodroma furcata*	1096	16.5
Leach's storm-petrel	*Oceanodroma leucorhoa*	53	0.8
Red-faced cormorant	*Phalacrocorax urile*	1	< 0.1
Pelagic cormorant	*Phalacrocorax pelagicus*	*	0.0
Bald eagle	*Haliaeetus leucocephalus*	*	0.0
Passerine spp.	*Passeriformes* spp.	*	0.0
Total		6658	100.0

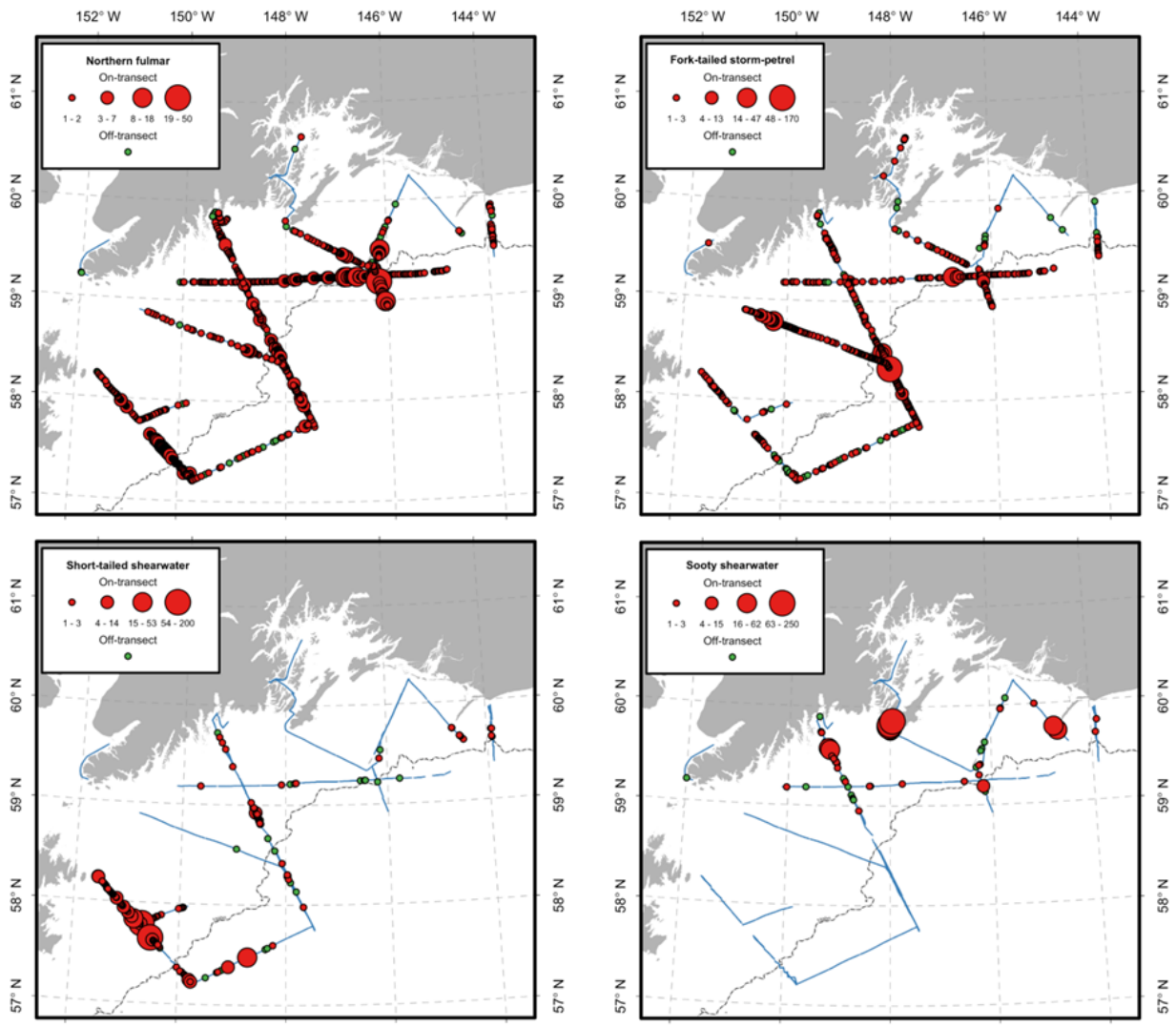


Figure 9. Seabirds observations during the July 2018 NGA-LTER

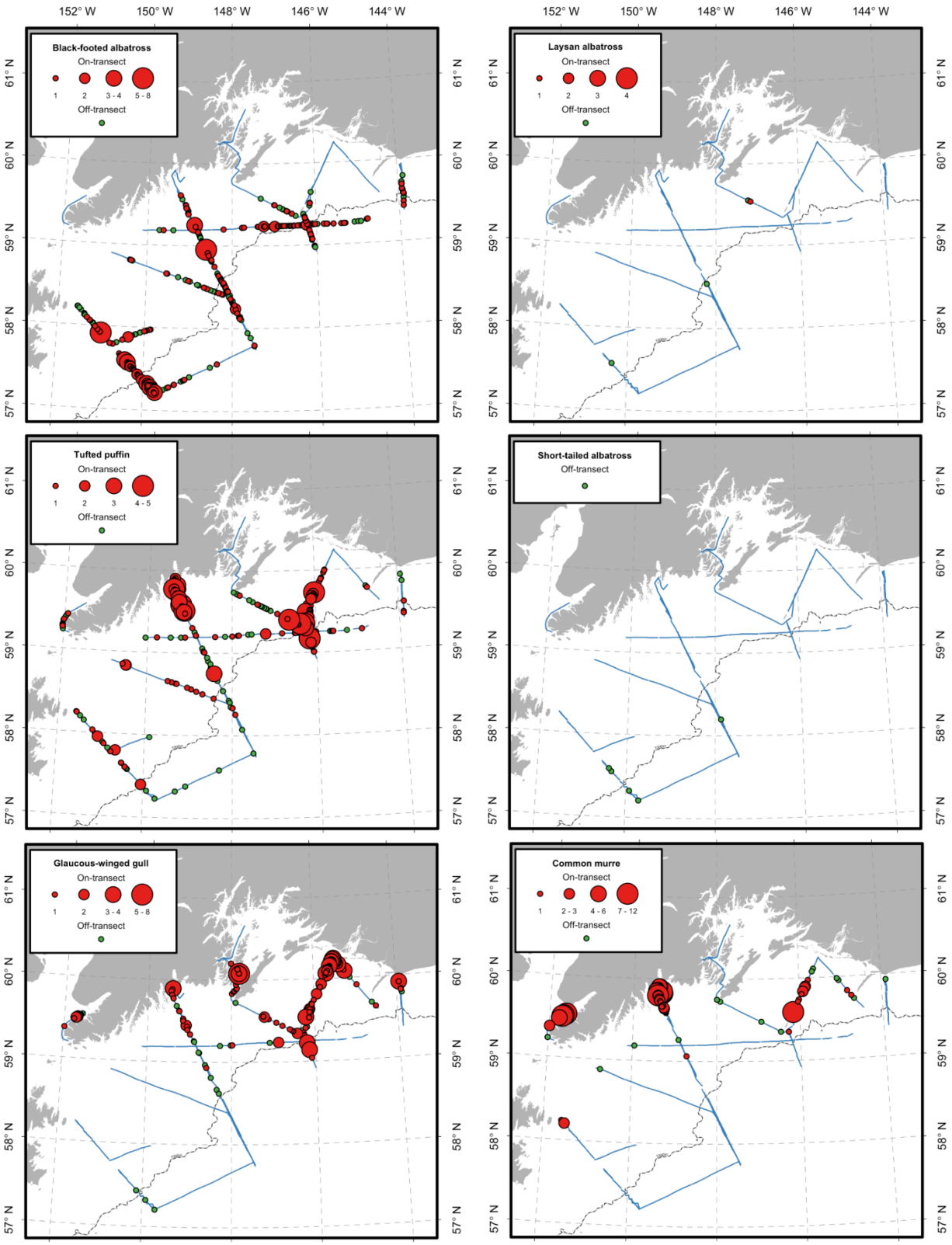


Figure 9 (cont). Seabirds observations during the July 2018 NGA-LTER

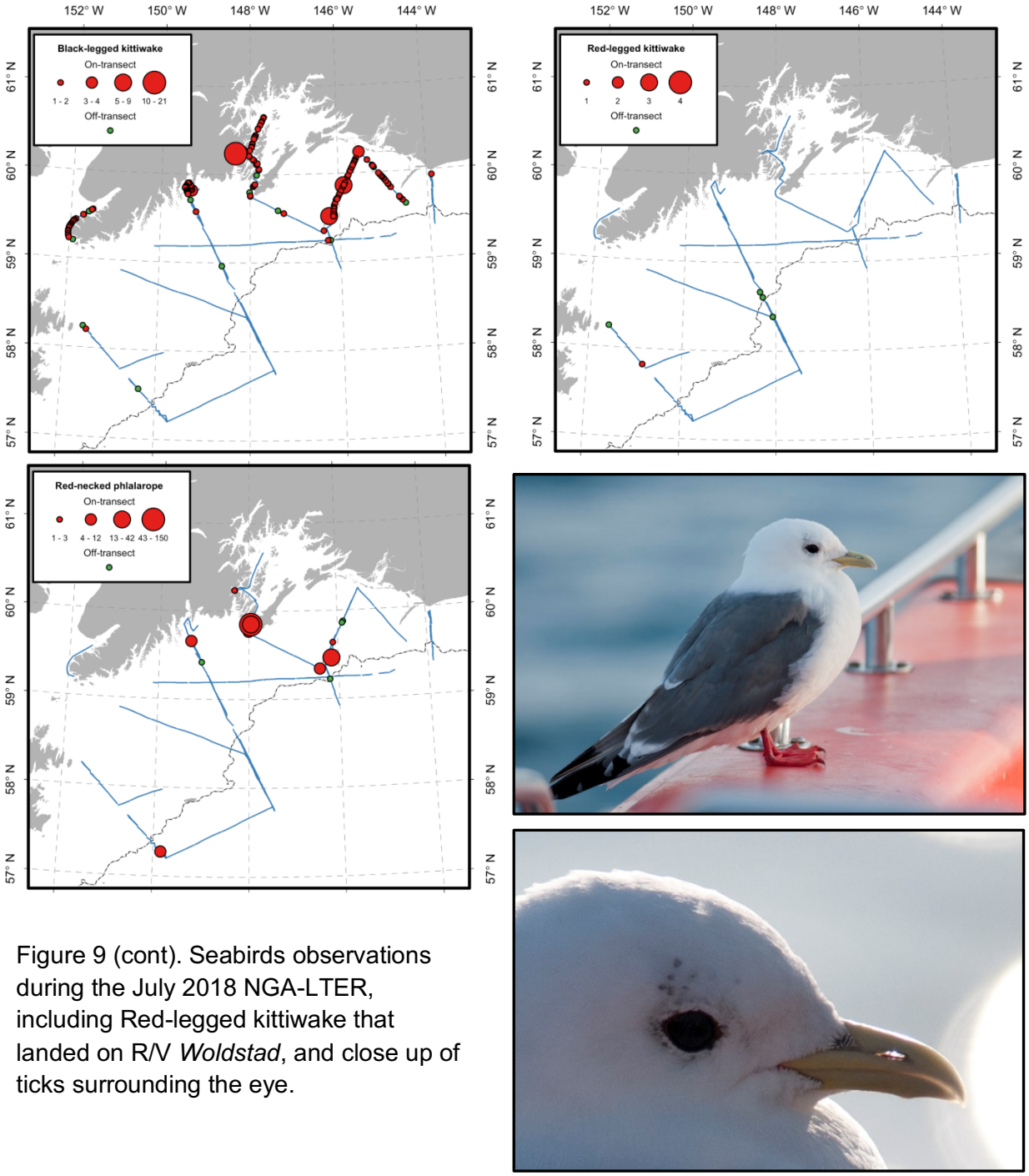


Figure 9 (cont). Seabirds observations during the July 2018 NGA-LTER, including Red-legged kittiwake that landed on R/V *Woldstad*, and close up of ticks surrounding the eye.

Table 5. Marine mammal species observed during the July 2018 Gulf of Alaska Long-term Ecological Research cruise. Numbers include on-transect observations only.

Common Name	Scientific Name	Number on-transect	Number off-transect
Fin whale	*Balaenoptera physalus*	5	21
Humpback whale	*Megaptera novaeangliae*	2	28
Sperm whale	*Physeter macrocephalus*	6	1
Killer whale	*Orcinus orca*	1	2
Whale spp.	*Cetacea* spp.	0	17
Dall's porpoise	*Phocoenoides dalli*	51	45
Steller sea lion	*Eumetopias jubatus*	1	0
Northern fur seal	*Callorhinus ursinus*	7	3
Harbor seal	*Phoca vitulina*	8	12
Sea otter	*Enhydra lutris*	11	6
Total		92	135

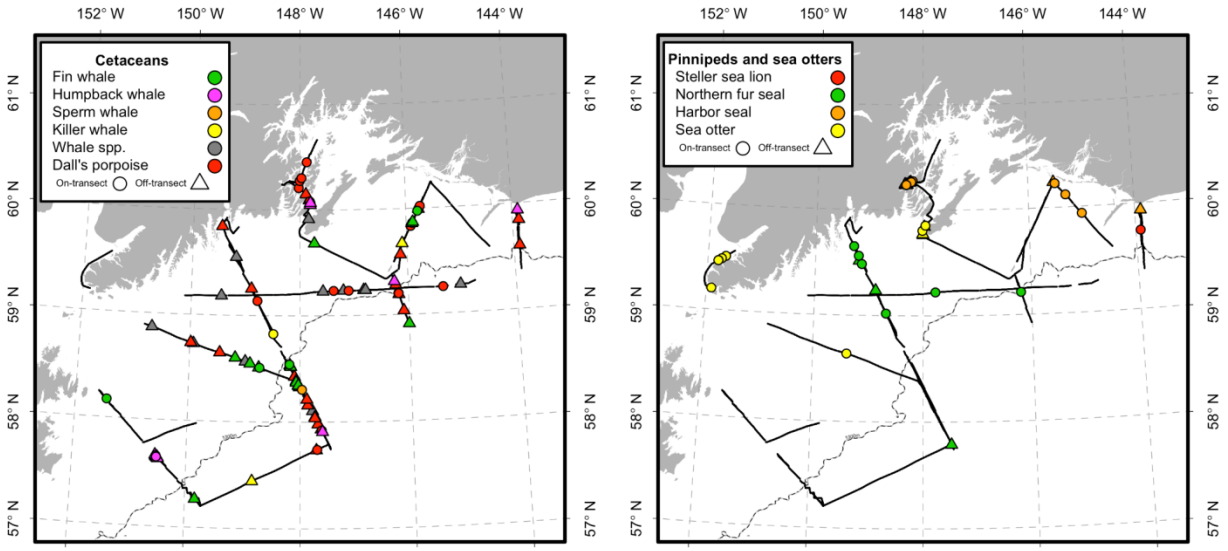


Figure 10. Cetaceans, pinnepeds and sea otters observations during the July 2018 NGA-LTER.

Outreach

Teacher-at-sea Per Fosstveit joined us from Monroe Woodbury Middle School located in Central Valley, New York. He participated in Seward Line sampling, especially net tows, and kept a log for his class back home. During opportunities with cellular coverage and/or at the end of the cruise he posted ~18 logs (roughly one per day) describing various aspects of the cruise and our daily adventures (see https://www.ateacherstrek.com/). Per made valuable contribution to the daytime activities helping with launch and recovery of the CTD, plus sampling with the Calvets nets.

Appendix. STANDARD STATIONS (intensive stations highlighted)

Latitude N (degrees, minutes)		Longitude W (degrees, minutes)		Station Name	Depth
Resurrection Bay Station					
60	1.5	149	21.5	RES2.5	298
Seward Line					
59	50.7	149	28	GAK1	269
59	46	149	23.8	GAK1I	
59	41.5	149	19.6	GAK2	228
59	37.6	149	15.5	GAK2I	
59	33.2	149	11.3	GAK3	213
59	28.9	149	7.1	GAK3I	
59	24.5	149	2.9	GAK4	201
59	20.1	148	58.7	GAK4I	
59	15.7	148	54.5	GAK5	167
59	11.4	148	50.3	GAK5I	
59	7	148	46.2	GAK6	151
59	2.7	148	42	GAK6I	
58	58.3	148	37.8	GAK7	243
58	52.9	148	33.6	GAK7I	
58	48.5	148	29.4	GAK8	288
58	44.6	148	25.2	GAK8I	
58	40.8	148	21	GAK9	276
58	36.7	148	16.7	GAK9I	
58	32.5	148	12.7	GAK10	1459
58	23.3	148	4.3	GAK11	1410
58	14.6	147	56	GAK12	2134
58	5.9	147	47.6	GAK13	2058
57	*56.6*	*147*	*39*	*GAK14*	*3518*
57	*47.5*	*147*	*30*	*GAK15*	*4543*
Prince William Sound Stations					
60	7.5	147	50	KIP0	
60	16.7	147	59.2	KIP2	588
60	22.78	147	56.17	PWS1	248
60	32.1	147	48.2	PWS2	798
60	40	147	40	PWS3	742
60	49..25	147	24	PWSA	472
60	45	147	14	PWSB	
60	38.1	147	10	PWSC	245
60	31.5	147	7.6	PWSD	
60	24.3	147	58.3	PWSE	291
60	24	146	45	PWSF	
Columbia Glacier					
61	7.4	147	3.8	CG0	
60	59.5	147	4.2	CG1	192
60	57.6	147	5.9	CG2	
Icy Bay					
60	16.3	148	21.7	IB0	
60	15.5	148	20.1	IB1	172
60	16.3	148	14	IB2	157
Montague Strait Line					
59	57.257	147	55.602	MS1	
59	56.6	147	53.7	MS2	194
59	55.9	147	51.4	MS3	169
59	55.2	147	49.7	MS4	119

Latitude N (degrees, minutes)		Longitude W (degrees, minutes)		Station Name	Depth
Kodiak Line					
58	14.7	151	35.4	KOD1	71
58	7.8	151	23.07	KOD2	127
58	0.9	151	10.74	KOD3	84
57	54	150	58.17	KOD4	78
57	47.1	150	45.6	KOD5	87
57	40.26	150	32.97	KOD6	102
57	33.42	150	20.34	KOD7	178
57	26.37	150	7.95	KOD8	708
57	19.32	149	55.56	KOD9	1310
57	12.27	149	43.17	KOD10	2503
Cape Suckling Line					
59	56.35	143	53.5	CS1	63
59	53.85	143	53.5	CS1.25	85
59	51.35	143	53.5	CS1i	104
59	48.85	143	53.5	CS1.75	116
59	46.35	143	53.5	CS2	124
59	41.35	143	53.5	CS2i	134
59	36.35	143	53.5	CS3	193
59	31.35	143	53.5	CS3i	1316
59	26.35	143	53.5	CS4	2010
59	16.35	143	53.5	CS5	2810
Middleton Island Line					
60	15	145	30	MID1	35
60	10.5	145	34.5	MID1i	100
60	6	145	39	MID2	116
60	1.5	145	43.5	MID2i	98
59	57	145	48	MID3	87
59	52.5	145	52.5	MID3i	100
59	48	145	57	MID4	90
59	43.5	146	1.5	MID4i	72
59	39	146	6	MID5	97
59	34.5	146	10.5	MID5i	114
59	30	146	15	MID6	41
59	25.7	146	10	MID6i	65
59	23	146	18	MID7	65
59	18.267	146	15	MID7i	420
59	13.534	146	12	MID8	611
59	4.067	146	6	MID9	2900
58	54.6	146	0	MID10	4444

Event	Description	Station	Local	GMT	Latitude	Longitude	Depth	Comments		Scientist
1	CTD 0 Start	test	7/4/2018 20:07	4:06:54 AM	59.25415	145.2632	222			Hopcroft
2	CTD 0 End	test	7/4/2018 20:29	4:29:09 AM	59.2551	145.2533	222			Hopcroft
3	Bongo 60 cm Start	CS4	7/5/2018 1:39	9:39:07 AM	59.43828	143.8948	1500			Hopcroft
4	Bongo 60 cm Bottom	CS4	7/5/2018 2:09	10:09:57 AM	59.44454	143.8644	1500			Hopcroft
5	Bongo 60 cm End	CS4	7/5/2018 2:31	10:31:01 AM	59.44927	143.8445	1500			Hopcroft
6	Bongo 60 cm Start	CS3	7/5/2018 3:16	11:16:46 AM	59.51638	143.9003	1400	Apparently stopped at CS3i instead of CS3		Hopcroft
7	Bongo 60 cm Bottom	CS3	7/5/2018 3:32	11:32:13 AM	59.52279	143.8912	1400	Apparently stopped at CS3i instead of CS3		Hopcroft
8	Bongo 60 cm End	CS3	7/5/2018 3:49	11:49:57 AM	59.53027	143.8838	1400	Apparently stopped at CS3i instead of CS3		Hopcroft
9	Methot Net Start	CS3	7/5/2018 4:22	12:22:50 PM	59.54428	143.8582	1400	Apparently stopped at CS3i instead of CS3		Hopcroft
10	Methot Net End	CS3	7/5/2018 4:42	12:42:31 PM	59.55476	143.8577	1400	Apparently stopped at CS3i instead of CS3		Hopcroft
11	Bongo 60 cm Start	CS2	7/5/2018 6:28	2:28:20 PM	59.77239	143.9004	121			Hopcroft
12	Bongo 60 cm Bottom	CS2	7/5/2018 6:36	2:36:55 PM	59.77474	143.892	121			Hopcroft
13	Bongo 60 cm End	CS2	7/5/2018 6:46	2:46:39 PM	59.77738	143.8834	121			Hopcroft
14	Bongo 60 cm Start	CS1	7/5/2018 8:01	4:01:15 PM	59.93975	143.8904	63			Hopcroft
15	Bongo 60 cm Bottom	CS1	7/5/2018 8:07	4:07:05 PM	59.93768	143.894	63			Hopcroft
16	Bongo 60 cm End	CS1	7/5/2018 8:13	4:13:36 PM	59.93463	143.8981	63			Hopcroft
17	Methot Net Start	CS1	7/5/2018 8:38	4:38:42 PM	59.92559	143.9083	63			Hopcroft
18	Methot Net End	CS1	7/5/2018 8:58	4:58:15 PM	59.93478	143.8974	63			Hopcroft
19	CTD 01 Start	CS1	7/5/2018 9:19	5:19:15 PM	59.9383	143.8929	63		1	Hopcroft
20	CTD 1 End	CS1	7/5/2018 9:39	5:39:44 PM	59.93931	143.8908	63			Hopcroft
21	CalVET Net Tow Start	CS1	7/5/2018 9:56	5:56:54 PM	59.93866	143.8935	63			Hopcroft
22	CalVET Net Tow End	CS1	7/5/2018 10:01	6:01:05 PM	59.93867	143.8944	63			Hopcroft
22.5	Fe Fish	CS1	7/5/2018 10:11	6:11:05 PM	59.93867	143.8944		Start of Transect CS		Aguilar-Islas
23	CTD 02 Start	CS1.25	7/5/2018 10:58	6:58:51 PM	59.89644	143.896	84			Hopcroft
24	CTD 02 End	CS1.25	7/5/2018 11:11	7:11:52 PM	59.89752	143.8965	84			Hopcroft
25	CTD 03 Start	CS1.5	7/5/2018 13:02	9:02:16 PM	59.85572	143.8901	105			Hopcroft
26	CTD 03 End	CS1.5	7/5/2018 13:13	9:13:18 PM	59.85739	143.8879	105			Hopcroft
27	CTD 04 Start	CS2	7/5/2018 14:07	10:07:22 PM	59.77468	143.8949	121	prod cast		Strom
28	CTD 04 End	CS2	7/5/2018 14:28	10:28:45 PM	59.77518	143.8878	121			Hopcroft
29	CalVET Net Tow Start	CS2	7/5/2018 14:40	10:40:11 PM	59.77415	143.8943	121			Hopcroft
30	CalVET Net Tow End	CS2	7/5/2018 14:44	10:44:13 PM	59.77452	143.8932	121			Hopcroft
31	CTD 05 abort	CS2	7/5/2018 15:04	11:04:13 PM	59.77388	143.8919	121	aborted -pump issues		Hopcroft
32	CTD 05 Start	CS2	7/5/2018 15:30	11:30:17 PM	59.77357	143.8931	121			Hopcroft
33	CTD 05 End	CS2	7/5/2018 15:52	11:52:33 PM	59.77322	143.8857	121			Hopcroft
34	CTD 06 Start	CS2i	7/5/2018 16:41	12:41:29 AM	59.68745	143.8948	136			Hopcroft
35	CTD 06 End	CS2i	7/5/2018 16:51	12:51:16 AM	59.68657	143.8935	136			Hopcroft
36	CTD 07 Start	CS3	7/5/2018 17:35	1:35:25 AM	59.60738	143.8929	198			Hopcroft
37	CTD 07 End	CS3	7/5/2018 18:03	2:03:08 AM	59.60534	143.8918	198			Hopcroft
38	CalVET Net Tow Start	CS3	7/5/2018 18:09	2:09:00 AM	59.60525	143.8921	198			Hopcroft
39	CalVET Net Tow End	CS3	7/5/2018 18:14	2:14:58 AM	59.60494	143.8917	198			Hopcroft
41	CTD 08 Start	CS3i	7/5/2018 19:02	3:02:51 AM	59.52192	143.8925	1316			Hopcroft
42	CTD 08 End	CS3i	7/5/2018 19:45	3:45:33 AM	59.52545	143.8871	1316			Hopcroft
43	CTD 09 Start	CS4	7/5/2018 20:38	4:38:40 AM	59.4378	143.8953	2010			Hopcroft
44	CTD 09 End	CS4	7/5/2018 21:36	5:36:32 AM	59.43721	143.8901	2010			Hopcroft
45	CalVET Net Tow Start	CS4	7/5/2018 21:45	5:45:33 AM	59.43731	143.891	2010			Hopcroft
46	CalVET Net Tow End	CS4	7/5/2018 21:52	5:52:17 AM	59.4379	143.8911	2010	30-40 angle		Hopcroft
47	CTD 10 Start	CS5	7/5/2018 23:19	7:19:22 AM	59.27116	143.8978	2810			Hopcroft
48	CTD 10 End	CS5	7/6/2018 0:18	8:18:11 AM	59.27102	143.8787	2810			Hopcroft
48.5	Fe Fish	CS5	7/6/2018 0:28	8:28:11 AM	59.27102	143.8787	2810			Aguilar-Islas

49	CalVET Net Tow Start	CS5	7/6/2018 0:40	8:40:45 AM	59.27306	143.8915	2810			Hopcroft
50	CalVET Net Tow End	CS5	7/6/2018 0:46	8:46:30 AM	59.27363	143.8927	2810			Hopcroft
51	Bongo 60 cm Start	CS5	7/6/2018 0:59	8:59:40 AM	59.27378	143.8945	2810			Hopcroft
52	Bongo 60 cm Bottom	CS5	7/6/2018 1:07	9:07:38 AM	59.273	143.8871	2810			Hopcroft
53	Bongo 60 cm End	CS5	7/6/2018 1:14	9:14:55 AM	59.27242	143.881	2810			Hopcroft
54	Methot Net Start	CS5	7/6/2018 1:40	9:40:02 AM	59.29814	143.9293	2810			Hopcroft
55	Methot Net End	CS5	7/6/2018 2:00	10:00:12 AM	59.30439	143.9522	2810			Hopcroft
56	CTD 11 Start	MID1	7/6/2018 9:41	5:41:11 PM	60.24975	145.4999	20			Hopcroft
57	CTD 11 End	MID1	7/6/2018 9:53	5:53:25 PM	60.24945	145.4992	20			Hopcroft
58	CalVET Net Tow Start	MID1	7/6/2018 10:00	6:00:02 PM	60.24956	145.5007	20			Hopcroft
60	CalVET Net Tow End	MID1	7/6/2018 10:01	6:01:39 PM	60.24942	145.5006	20			Hopcroft
60.5	Fe Fish	MID1	7/6/2018 10:08	6:08:39 PM	60.24942	145.5006	20			Aguilar-Islas
61	CTD 12 Start	MID1i	7/6/2018 10:56	6:56:06 PM	60.17508	145.5743	98			Hopcroft
62	CTD 12 End	MID1i	7/6/2018 11:08	7:08:10 PM	60.17538	145.5707	98			Hopcroft
63	CTD 13 Start	MID2	7/6/2018 11:58	7:58:00 PM	60.09995	145.6512	120		prod cast	Strom
64	CTD 13 End	MID2	7/6/2018 12:18	8:18:29 PM	60.0999	145.6481	120			Hopcroft
65	CalVET Net Tow Start	MID2	7/6/2018 12:25	8:25:01 PM	60.09877	145.6477	120			Hopcroft
66	CalVET Net Tow End	MID2	7/6/2018 12:29	8:29:47 PM	60.09857	145.648	120			Hopcroft
67	CTD 14 Start	MID2	7/6/2018 12:57	8:57:30 PM	60.09994	145.6514	120			Hopcroft
68	CTD 14 End	MID2	7/6/2018 13:22	9:22:42 PM	60.10036	145.6499	120			Hopcroft
69	CalVET Net Tow End	MID2	7/6/2018 13:28	9:28:35 PM	60.1002	145.65	120		ethanol	Hopcroft
70	CalVET Net Tow End	MID2	7/6/2018 13:33	9:33:37 PM	60.10001	145.6507	120			Hopcroft
71	CTD 15 Start	MID2i	7/6/2018 14:21	10:21:50 PM	60.02511	145.7276	96			Hopcroft
72	CTD 15 End	MID2i	7/6/2018 14:30	10:30:11 PM	60.02572	145.7282	96			Hopcroft
73	CTD 16 Start	MID3	7/6/2018 15:16	11:16:29 PM	59.95111	145.7994	87			Hopcroft
74	CTD 16 End	MID3	7/6/2018 15:35	11:35:16 PM	59.95467	145.8024	87			Hopcroft
75	CalVET Net Tow Start	MID3	7/6/2018 15:44	11:44:24 PM	59.95128	145.8013	87			Hopcroft
76	CalVET Net Tow End	MID3	7/6/2018 15:49	11:49:06 PM	59.95214	145.802	87			Hopcroft
77	CTD 17	MID3i	7/6/2018 16:37	12:37:21 AM	59.87523	145.8734	102			Hopcroft
78	CTD 17 End	MID3i	7/6/2018 16:46	12:46:27 AM	59.8774	145.8731	102			Hopcroft
79	CTD 18 Start	MID4	7/6/2018 17:36	1:36:53 AM	59.79926	145.9483	92			Hopcroft
80	CTD 18 End	MID4	7/6/2018 17:55	1:55:14 AM	59.80321	145.9439	92			Hopcroft
82	CalVET Net Tow Start	MID4	7/6/2018 18:03	2:03:32 AM	59.80141	145.9498	92			Hopcroft
83	CalVET Net Tow End	MID4	7/6/2018 18:07	2:07:47 AM	59.8022	145.9488	92			Hopcroft
84	CTD 19 Start	MID4i	7/6/2018 18:54	2:54:47 AM	59.72477	146.0248	80			Hopcroft
85	CTD 19 End	MID4i	7/6/2018 19:01	3:01:26 AM	59.72529	146.0247	80			Hopcroft
86	CTD 20 Start	MID5	7/6/2018 19:51	3:51:11 AM	59.65137	146.097	95			Hopcroft
87	CTD 20 End	MID5	7/6/2018 20:08	4:08:11 AM	59.65399	146.0962	95			Hopcroft
88	CalVET Net Tow Start	MID5	7/6/2018 20:13	4:13:42 AM	59.65358	146.0961	95			Hopcroft
89	CalVET Net Tow End	MID5	7/6/2018 20:18	4:18:07 AM	59.6531	146.0946	95			Hopcroft
90	CTD 21 Start	MID5i	7/6/2018 21:02	5:02:22 AM	59.57526	146.1711	114			Hopcroft
91	CTD 21 End	MID5i	7/6/2018 21:10	5:10:52 AM	59.57562	146.1687	114			Hopcroft
92	CalVET Net Tow Start	MID6	7/6/2018 22:02	6:02:31 AM	59.4977	146.2484	41			Hopcroft
93	CalVET Net Tow Start	MID6	7/6/2018 22:05	6:05:44 AM	59.49637	146.2461	41			Hopcroft
94	CalVET Net Tow End	MID6	7/6/2018 22:08	6:08:55 AM	59.49558	146.2438	41			Hopcroft
94.5	Fe Fish		7/7/2018 22:08	7:08:55 AM	59.49558	146.2438		41		Aguilar-Islas
95	CTD 22 Start	MID6	7/6/2018 22:18	6:18:40 AM	59.49872	146.2478	41			Hopcroft
96	CTD 22 End	MID6	7/6/2018 22:29	6:29:44 AM	59.4987	146.248		41		Hopcroft
98	Methot Net Start	MID6	7/6/2018 22:43	6:43:30 AM	59.49588	146.2462	41			Hopcroft
99	Methot Net End	MID6	7/6/2018 23:03	7:03:09 AM	59.50355	146.2613	41			Hopcroft

100	Bongo 60 cm Start	MID6	7/6/2018 23:18	7:18:03 AM	59.50012	146.2572	41			Hopcroft
101	Bongo 60 cm Bottom	MID6	7/6/2018 23:18	7:18:46 AM	59.50005	146.2578	41			Hopcroft
102	Bongo 60 cm End	MID6	7/6/2018 23:20	7:20:55 AM	59.49983	146.259	41			Hopcroft
103	Bongo 60 cm Start	MID5	7/7/2018 0:35	8:35:16 AM	59.65074	146.0978	95			Hopcroft
104	Bongo 60 cm Bottom	MID5	7/7/2018 0:42	8:42:09 AM	59.64888	146.1035	95			Hopcroft
105	Bongo 60 cm End	MID5	7/7/2018 0:48	8:48:50 AM	59.64744	146.1082	95			Hopcroft
106	Bongo 60 cm Start	MID4	7/7/2018 2:05	10:05:50 AM	59.80082	145.9506	83			Hopcroft
107	Bongo 60 cm Bottom	MID4	7/7/2018 2:14	10:14:32 AM	59.80215	145.961	83			Hopcroft
108	Bongo 60 cm End	MID4	7/7/2018 2:23	10:23:43 AM	59.80381	145.9711	83			Hopcroft
109	Methot Net Start	MID4	7/7/2018 2:46	10:46:52 AM	59.80671	145.9576	83			Hopcroft
110	Methot Net End	MID4	7/7/2018 3:06	11:06:05 AM	59.80134	145.9425	83			Hopcroft
111	Bongo 60 cm Start	MID3	7/7/2018 4:16	12:16:56 PM	59.95251	145.8148	88			Hopcroft
112	Bongo 60 cm Bottom	MID3	7/7/2018 4:22	12:22:21 PM	59.9529	145.8083	88			Hopcroft
113	Bongo 60 cm End	MID3	7/7/2018 4:28	12:28:08 PM	59.95303	145.8025	88			Hopcroft
114	Bongo 60 cm Start	MID2	7/7/2018 5:37	1:37:12 PM	60.09893	145.6566	120			Hopcroft
115	Bongo 60 cm Bottom	MID2	7/7/2018 5:45	1:45:02 PM	60.10069	145.646	120			Hopcroft
116	Bongo 60 cm End	MID2	7/7/2018 5:54	1:54:07 PM	60.10303	145.6348	120			Hopcroft
117	Methot Net Start	MID2	7/7/2018 6:03	2:03:24 PM	60.10681	145.6324	120			Hopcroft
118	Methot Net End	MID2	7/7/2018 6:23	2:23:14 PM	60.10194	145.6593	120			Hopcroft
119	CTD 23 Start	MID5	7/7/2018 9:51	5:51:19 PM	59.65137	146.1045	95		prod cast	Strom
120	CTD 23 End	MID5	7/7/2018 10:06	6:06:17 PM	59.65346	146.1076	95			Hopcroft
121	CTD 24 Start	MID5	7/7/2018 10:34	6:34:47 PM	59.64762	146.1015	95		intensive	Hopcroft
122	CTD 24 End	MID5	7/7/2018 10:58	6:58:48 PM	59.64616	146.108	95			Hopcroft
123	CTD 25 Start	MID6i	7/7/2018 12:28	8:28:52 PM	59.42715	146.168	59			Hopcroft
124	CTD 25 End	MID6i	7/7/2018 12:35	8:35:15 PM	59.42594	146.1694	59			Hopcroft
124.5	Fe Fish	MID6i	7/8/2018 12:45	9:55:15 PM	59.42594	146.1694		59	Deploy	Aguilar-Islas
125	CTD 26 Start	MID7	7/7/2018 13:32	9:32:29 PM	59.3827	146.3018	59			Hopcroft
126	CTD 26 End	MID7	7/7/2018 13:52	9:52:19 PM	59.38045	146.3099	59			Hopcroft
127	CalVET Net Tow Start	MID7	7/7/2018 14:03	10:03:00 PM	59.38223	146.303	59			Hopcroft
128	CalVET Net Tow End	MID7	7/7/2018 14:05	10:05:33 PM	59.38181	146.3043	59			Hopcroft
129	CTD 27 Start	MID7i	7/7/2018 14:53	10:53:05 PM	59.30458	146.2468		440		Hopcroft
130	CTD 27 End	MID7i	7/7/2018 15:17	11:17:02 PM	59.30352	146.2488	440			Hopcroft
131	CTD 28 Start	MID8	7/7/2018 16:03	12:03:28 AM	59.22535	146.1989		676		Hopcroft
132	CTD 28 End	MID8	7/7/2018 16:50	12:50:13 AM	59.22384	146.1956	676			Hopcroft
133	CalVET Net Tow Start	MID8	7/7/2018 16:57	12:57:26 AM	59.22534	146.1998	676			Hopcroft
134	CalVET Net Tow End	MID8	7/7/2018 17:01	1:01:09 AM	59.22507	146.2002	676			Hopcroft
135	CTD 29 Start	MID9	7/7/2018 18:20	2:20:52 AM	59.06833	146.1007	2900			Hopcroft
136	CTD 29 End	MID9	7/7/2018 19:19	3:19:36 AM	59.07051	146.102	2900			Hopcroft
137	CalVET Net Tow Start	MID9	7/7/2018 19:24	3:24:45 AM	59.07066	146.1027	2900			Hopcroft
138	CalVET Net Tow End	MID9	7/7/2018 19:30	3:30:40 AM	59.0701	146.1047	2900			Hopcroft
139	CalVET Net Tow Start	MID9	7/7/2018 19:42	3:42:22 AM	59.0693	146.1107	2900		genetics	Hopcroft
140	CalVET Net Tow End	MID9	7/7/2018 19:48	3:48:15 AM	59.06878	146.1126	2900			Hopcroft
141	CTD 30 Start	MID10	7/7/2018 21:44	5:44:20 AM	58.90431	146.0031	4400			Hopcroft
143	Fe fish End	MID10	7/7/2018 22:32	6:32:51 AM	58.91053	146.005	4400			Aguilar-Islas
144	CTD 30 End	MID10	7/7/2018 22:42	6:42:04 AM	58.9122	146.0061	4400			Hopcroft
145	CalVET Net Tow Start	MID10	7/7/2018 22:52	6:52:55 AM	58.91373	146.0026	4400			Hopcroft
146	CalVET Net Tow End	MID10	7/7/2018 22:59	6:59:07 AM	58.91434	146.0046	4400			Hopcroft
147	Methot Net Start	MID10	7/7/2018 23:08	7:08:18 AM	58.91155	146.002	4400			Hopcroft
148	Methot Net End	MID10	7/7/2018 23:28	7:28:09 AM	58.90027	145.9921	4400			Hopcroft
149	Bongo 60 cm Start	MID10	7/7/2018 23:45	7:45:45 AM	58.90697	145.9989	4400			Hopcroft

150	Bongo 60 cm Bottom	MID10	7/8/2018 0:02	8:02:10 AM	58.91224	146.015	4400			Hopcroft
151	Bongo 60 cm End	MID10	7/8/2018 0:17	8:17:11 AM	58.91765	146.0269	4400			Hopcroft
152	Bongo 60 cm Start	MID9	7/8/2018 1:14	9:14:28 AM	59.05895	146.0932	2900			Hopcroft
153	Bongo 60 cm Bottom	MID9	7/8/2018 1:30	9:30:13 AM	59.06858	146.0971	2900			Hopcroft
154	Bongo 60 cm End	MID9	7/8/2018 1:41	9:41:48 AM	59.0752	146.0996	2900			Hopcroft
155	Methot Net Start	MID9	7/8/2018 1:53	9:53:26 AM	59.073	146.0997	2900			Hopcroft
156	Methot Net End	MID9	7/8/2018 2:13	10:13:08 AM	59.06366	146.0932	2900			Hopcroft
157	Bongo 60 cm Start	MID8	7/8/2018 3:23	11:23:54 AM	59.22484	146.1982	676			Hopcroft
158	Bongo 60 cm Bottom	MID8	7/8/2018 3:34	11:34:15 AM	59.22815	146.1899	676			Hopcroft
159	Bongo 60 cm End	MID8	7/8/2018 3:45	11:45:38 AM	59.23143	146.1823	676			Hopcroft
160	Methot Net Start	MID8	7/8/2018 3:54	11:54:50 AM	59.23063	146.187	676			Hopcroft
161	Methot Net End	MID8	7/8/2018 4:14	12:14:16 PM	59.22279	146.2061	676			Hopcroft
162	Bongo 60 cm Start	MID7	7/8/2018 5:28	1:28:18 PM	59.38332	146.2964	64			Hopcroft
163	Bongo 60 cm Bottom	MID7	7/8/2018 5:35	1:35:13 PM	59.38311	146.2888		55		Hopcroft
164	Bongo 60 cm End	MID7	7/8/2018 5:44	1:44:04 PM	59.38255	146.2785	55			Hopcroft
165	Methot Net Start	MID7	7/8/2018 5:53	1:53:57 PM	59.38079	146.2868	55			Hopcroft
166	Methot Net End	MID7	7/8/2018 6:13	2:13:04 PM	59.37485	146.3084	55			Hopcroft
167	CTD 31 Start	MS4	7/8/2018 13:08	9:08:55 PM	59.92004	147.8324	106			Hopcroft
168	CTD 31 End	MS4	7/8/2018 13:17	9:17:57 PM	59.92221	147.8328	106			Hopcroft
169	CTD 32 Start	MS3	7/8/2018 13:29	9:29:23 PM	59.93102	147.856	162			Hopcroft
170	CTD 32 End	MS3	7/8/2018 13:56	9:56:49 PM	59.9344	147.8591	162			Hopcroft
171	CalVET Net Tow Start	MS2	7/8/2018 14:10	10:10:16 PM	59.94255	147.8932	186			Hopcroft
172	CalVET Net Tow End	MS2	7/8/2018 14:14	10:14:29 PM	59.94293	147.8927	186			Hopcroft
173	CTD 33 Start	MS2	7/8/2018 14:20	10:20:49 PM	59.94138	147.8929	186			Hopcroft
174	CTD 33 End	MS2	7/8/2018 14:48	10:48:35 PM	59.94278	147.8886	186			Hopcroft
175	CTD 34 Start	MS1	7/8/2018 15:08	11:08:42 PM	59.95361	147.9299		169		Hopcroft
177	CTD 34 End	MS1	7/8/2018 15:19	11:19:08 PM	59.95353	147.9317	169			Hopcroft
178	Fe Fish Start	MS1	7/8/2018 15:27	11:27:36 PM	59.95437	147.9272	169			Aguilar-Islas
179	CTD 35 Start	KIP0	7/8/2018 17:15	1:15:23 AM	60.12479	147.8318		290		Hopcroft
180	CTD 35 End	KIP0	7/8/2018 17:31	1:31:38 AM	60.12525	147.8327	290			Hopcroft
181	Fe Fish End	KIP0	7/8/2018 20:53	4:53:59 AM	60.27331	148.1776	290		Taken out before CTD	Aguilar-Islas
182	MultiNet Start	KIP2	7/8/2018 21:47	5:47:30 AM	60.28306	147.9886	520			Hopcroft
183	MultiNet End	KIP2	7/8/2018 22:26	6:26:41 AM	60.26286	147.9913	520			Hopcroft
184	Methot Net Start	KIP2	7/8/2018 22:41	6:41:55 AM	60.27084	147.987	520			Hopcroft
185	Methot Net End	KIP2	7/8/2018 23:01	7:01:29 AM	60.28474	147.9819	520			Hopcroft
186	MultiNet Start	PWS1	7/8/2018 23:47	7:47:59 AM	60.39108	147.9318		350		Hopcroft
187	MultiNet End	PWS1	7/9/2018 0:31	8:31:30 AM	60.36885	147.9418		350		Hopcroft
188	Methot Net Start	PWS1	7/9/2018 0:41	8:41:09 AM	60.36916	147.9406		328		Hopcroft
189	Methot Net End	PWS1	7/9/2018 1:01	9:01:24 AM	60.38263	147.9352	328			Hopcroft
190	MultiNet Start	PWS2	7/9/2018 2:11	10:11:16 AM	60.54177	147.8053	739			Hopcroft
191	MultiNet End	PWS2	7/9/2018 2:47	10:47:52 AM	60.5214	147.815	739			Hopcroft
192	Methot Net Start	PWS2	7/9/2018 2:55	10:55:23 AM	60.5219	147.8135	739			Hopcroft
193	Methot Net End	PWS2	7/9/2018 3:15	11:15:17 AM	60.53417	147.8087	739			Hopcroft
194	MultiNet Start	PWS3	7/9/2018 4:23	12:23:08 PM	60.67226	147.6906	732			Hopcroft
195	MultiNet End	PWS3	7/9/2018 4:55	12:55:49 PM	60.66164	147.6547	732			Hopcroft
196	Methot Net Start	PWS3	7/9/2018 5:02	1:02:45 PM	60.65915	147.6466	732			Hopcroft
197	Methot Net End	PWS3	7/9/2018 5:22	1:22:16 PM	60.65267	147.6225	732			Hopcroft
198	CTD 36 Start	PWS3	7/9/2018 8:14	4:14:59 PM	60.66827	147.6657	732			Hopcroft
199	CTD 36 End	PWS3	7/9/2018 9:05	5:05:47 PM	60.67491	147.699	732			Hopcroft
200	CalVET Net Tow Start	PWS3	7/9/2018 9:25	5:25:53 PM	60.66773	147.6664	732			Hopcroft

201	Calvet Net Tow End	PWS3	7/9/2018 9:30	5:30:00 PM	60.66772	147.6664	732			Hopcroft
202	CTD 37 Start	PWS2	7/9/2018 10:41	6:41:54 PM	60.53318	147.7986	798		prod cast	Strom
203	CTD 37 End	PWS2	7/9/2018 10:50	6:50:39 PM	60.53345	147.8025	798			Hopcroft
204	CalVET Net Tow Start	PWS2	7/9/2018 10:58	6:58:43 PM	60.53494	147.805	798			Hopcroft
205	CalVET Net Tow End	PWS2	7/9/2018 11:02	7:02:22 PM	60.53525	147.8048	798			Hopcroft
206	CTD 038 Start	PWS2	7/9/2018 11:26	7:26:44 PM	60.53112	147.8035	798			Hopcroft
207	CTD 038 End	PWS2	7/9/2018 12:13	8:13:56 PM	60.53534	147.8093	798			Hopcroft
208	CalVET Net Tow Start	PWS2	7/9/2018 12:28	8:28:18 PM	60.53251	147.798	798		ethanol	Hopcroft
209	CalVET Net Tow End	PWS2	7/9/2018 12:33	8:33:38 PM	60.53248	147.7986	798			Hopcroft
210	MultiNet Start	PWS2	7/9/2018 13:46	9:46:50 PM	60.53101	147.7988		740	deep vert 730 600 400 300 200	Hopcroft
210.5	MultiNet End	PWS2						726	hit bottom	
211	MultiNet Start	PWS2	7/9/2018 15:07	11:07:50 PM	60.53389	147.8043	730		shallow 200 100 60 40 20	Hopcroft
212	MultiNet End	PWS2	7/9/2018 15:19	11:19:06 PM	60.53462	147.8051	730			Hopcroft
213	CTD 39 Start	PWS1	7/9/2018 16:46	12:46:53 AM	60.37877	147.9343		325		Hopcroft
214	CTD 39 End	PWS1	7/9/2018 17:20	1:20:34 AM	60.3813	147.9296	325			Hopcroft
215	CalVET Net Tow Start	PWS1	7/9/2018 17:25	1:25:21 AM	60.38005	147.9354	325			Hopcroft
216	CalVET Net Tow End	PWS1	7/9/2018 17:32	1:32:21 AM	60.38005	147.9354	325			Hopcroft
217	CTD 40 Start	KIP2	7/9/2018 18:19	2:19:50 AM	60.27706	147.9865	590			Hopcroft
218	CTD 40 End	KIP2	7/9/2018 19:10	3:10:21 AM	60.28339	147.9768	590			Hopcroft
219	CalVET Net Tow Start	KIP2	7/9/2018 19:15	3:15:33 AM	60.28438	147.9767	590			Hopcroft
220	CalVET Net Tow End	KIP2	7/9/2018 19:21	3:21:23 AM	60.28424	147.9786	590			Hopcroft
222	CTD 41 Start	IB1	7/9/2018 21:29	5:29:29 AM	60.24321	148.3421	172			Hopcroft
223	CTD 41 End	IB1	7/9/2018 21:52	5:52:56 AM	60.24118	148.3413	172			Hopcroft
224	CalVET Net Tow Start	IB1	7/9/2018 22:00	6:00:58 AM	60.24049	148.3406	172			Hopcroft
225	CalVET Net Tow End	IB1	7/9/2018 22:06	6:06:41 AM	60.24012	148.34	172			Hopcroft
226	CTD 42 End	IB2	7/9/2018 22:52	6:52:25 AM	60.27167	148.2338		157		Hopcroft
227	CTD 42 End	IB2	7/9/2018 23:13	7:13:24 AM	60.27214	148.2329		157		Hopcroft
228	CalVET Net Tow Start	IB2	7/9/2018 23:25	7:25:28 AM	60.27125	148.234		157		Hopcroft
229	CalVET Net Tow End	IB2	7/9/2018 23:30	7:30:02 AM	60.27168	148.2337	157		High angle aft near end of tow	Hopcroft
230	Methot Net Start	IB2	7/9/2018 23:45	7:45:53 AM	60.26568	148.2015	157			Hopcroft
231	Methot Net End	IB2	7/10/2018 0:05	8:05:12 AM	60.25783	148.1815	157			Hopcroft
232	CTD 43 Start	GAK1	7/10/2018 8:29	4:29:26 PM	59.84484	149.4645		269		Hopcroft
233	CTD 43 End	GAK1	7/10/2018 9:12	5:12:26 PM	59.85052	149.4715	269			Hopcroft
234	CalVET Net Tow Start	GAK1	7/10/2018 9:41	5:41:03 PM	59.84476	149.467	269			Hopcroft
235	CalVET Net Tow End	GAK1	7/10/2018 9:45	5:45:43 PM	59.84491	149.4675	269			Hopcroft
236	CTD 44 Start	GAK1	7/10/2018 10:16	6:16:27 PM	59.84155	149.4656	269		prod cast	Strom
237	CTD 44 End	GAK1	7/10/2018 10:50	6:50:57 PM	59.84417	149.4713	269			Hopcroft
238	CalVET Net Tow End	GAK1	7/10/2018 11:03	7:03:36 PM	59.84482	149.4672	269			Hopcroft
239	CalVET Net Tow End	GAK1	7/10/2018 11:07	7:07:42 PM	59.84502	149.4679	269			Hopcroft
240	MultiNet Start	GAK1	7/10/2018 12:02	8:02:16 PM	59.84307	149.4624	269			Hopcroft
241	Multinet End	GAK1	7/10/2018 12:20	8:20:16 PM			269		200 100 60 40 20	Hopcroft
241.5	Fe Fish Start	GAK1	7/10/2018 12:20	8:20:16 PM	59.84307	149.4624				Aguilar-Islas
242	CTD 45 Start	GAK1i	7/10/2018 13:35	9:35:58 PM	59.76616	149.3941		260		Hopcroft
243	CTD 45 End	GAK1i	7/10/2018 13:51	9:51:28 PM	59.76591	149.3992	269			Hopcroft
244	CTD 46 Start	GAK2	7/10/2018 14:48	10:48:31 PM	59.69184	149.3274	228			Hopcroft
245	CTD 46 End	GAK2	7/10/2018 15:24	11:24:09 PM	59.6908	149.3269	228			Hopcroft
246	CalVET Net Tow Start	GAK2	7/10/2018 15:33	11:33:38 PM	59.69085	149.3275	228			Hopcroft
247	CalVET Net Tow End	GAK2	7/10/2018 15:37	11:37:57 PM	59.69039	149.3273	228			Hopcroft
248	CTD 47 Start	GAK2i	7/10/2018 16:24	12:24:26 AM	59.62751	149.2584	215			Hopcroft
249	CTD 47 End	GAK2i	7/10/2018 16:39	12:39:38 AM	59.62619	149.2602	215			Hopcroft

250	CTD 48 Start	GAK3	7/10/2018 17:32	1:32:20 AM	59.55389	149.1884		210		Hopcroft
251	CTD 48 End	GAK3	7/10/2018 17:59	1:59:23 AM	59.555	149.1894	210			Hopcroft
252	CalVET Net Tow Start	GAK3	7/10/2018 18:06	2:06:17 AM	59.55311	149.1891	210			Hopcroft
253	CalVET Net Tow End	GAK3	7/10/2018 18:12	2:12:17 AM	59.55318	149.1894	210			Hopcroft
254	CTD 49 Start	GAK3i	7/10/2018 18:55	2:55:24 AM	59.48051	149.1176	200			Hopcroft
255	CTD 49 End	GAK3i	7/10/2018 19:12	3:12:16 AM	59.48206	149.1186	200			Hopcroft
256	Fe Fish End	GAK4	7/10/2018 20:00	4:00:23 AM			200			Aguilar-Islas
257	CTD 50 Start	GAK4	7/10/2018 20:08	4:08:34 AM	59.41153	149.0448	200			Hopcroft
258	CTD 50 End	GAK4	7/10/2018 20:39	4:39:56 AM	59.41631	149.0415	200			Hopcroft
259	CalVET Net Tow Start	GAK4	7/10/2018 20:46	4:46:16 AM	59.41715	149.0421	200			Hopcroft
260	CalVET Net Tow End	GAK4	7/10/2018 20:54	4:54:19 AM	59.41625	149.0428	200			Hopcroft
261	Methot Net Start	GAK1	7/11/2018 0:06	8:06:12 AM	59.85424	149.4807	260			Hopcroft
262	Methot Net End	GAK1	7/11/2018 0:26	8:26:16 AM	59.84434	149.4712	260			Hopcroft
263	MultiNet Start	GAK1	7/11/2018 0:43	8:43:01 AM	59.84479	149.4639	260			Hopcroft
264	MultiNet End	GAK1	7/11/2018 1:26	9:26:57 AM	59.81855	149.4463	260		Winch problem, net1 is probably not good	Hopcroft
265	Methot Net Start	GAK2	7/11/2018 3:19	11:19:55 AM	59.69408	149.3296	230			Hopcroft
266	Methot Net End	GAK2	7/11/2018 3:39	11:39:10 AM	59.68229	149.3365	230			Hopcroft
267	MultiNet Start	GAK2	7/11/2018 5:15	1:15:43 PM	59.69195	149.3205	228			Hopcroft
268	MultiNet End	GAK2	7/11/2018 5:49	1:49:55 PM	59.66859	149.3263	228			Hopcroft
269	MultiNet Start	GAK3	7/11/2018 6:38	2:38:51 PM	59.55807	149.1897	210			Hopcroft
270	MultiNet End	GAK3	7/11/2018 7:17	3:17:04 PM	59.53579	149.1927	210			Hopcroft
271	Methot Net Start	GAK3	7/11/2018 7:26	3:26:16 PM	59.53076	149.1919	210			Hopcroft
272	Methot Net End	GAK3	7/11/2018 7:46	3:46:23 PM	59.51886	149.1905	210			Hopcroft
273	MultiNet Start	GAK4	7/11/2018 8:45	4:45:48 PM	59.41744	149.0518	200			Hopcroft
274	MultiNet End	GAK4	7/11/2018 9:32	5:32:34 PM	59.39757	149.0539	200			Hopcroft
275	CTD 51 Start	GAK5	7/11/2018 10:48	6:48:26 PM	59.25959	148.9057	167		prod cast	Strom
276	CTD 51 End	GAK5	7/11/2018 11:13	7:13:48 PM	59.2634	148.9017	167			Hopcroft
277	CalVET Net Tow Start	GAK5	7/11/2018 11:21	7:21:34 PM	59.26202	148.9086	167			Hopcroft
278	CalVET Net Tow End	GAK5	7/11/2018 11:27	7:27:01 PM	59.26215	148.9081	167			Hopcroft
279	CTD 52 Start	GAK5	7/11/2018 11:46	7:46:11 PM	59.25962	148.9114	167			Hopcroft
280	CTD 52 End	GAK5	7/11/2018 12:13	8:13:35 PM	59.26255	148.9036	167			Hopcroft
281	CalVET Net Tow Start	GAK5	7/11/2018 12:24	8:24:37 PM	59.26125	148.9082	167		genetics	Hopcroft
282	CalVET Net Tow End	GAK5	7/11/2018 12:30	8:30:17 PM	59.26141	148.9086	167		late - moving	Hopcroft
283	MultiNet Start	GAK5	7/11/2018 13:01	9:01:24 PM	59.2583	148.9084	167			Hopcroft
284	MultiNet End	GAK5	7/11/2018 13:10	9:10:20 PM	59.25923	148.9053	167			Hopcroft
285	Fe Fish Start	GAK5	7/11/2018 13:20	9:20:23 PM	59.26054	148.9026	167			Hopcroft
286	CTD 53 Start	GAK6	7/11/2018 14:45	10:45:16 PM	59.11474	148.772	151			Hopcroft
287	CTD 53 End	GAK6	7/11/2018 15:12	11:12:12 PM	59.11407	148.7598	151			Hopcroft
288	CalVET Net Tow Start	GAK6	7/11/2018 15:21	11:21:05 PM	59.11618	148.7677	151			Hopcroft
289	CalVET Net Tow End	GAK6	7/11/2018 15:26	11:26:30 PM	59.11591	148.7658	151			Hopcroft
290	CTD 54 Start	GAK7	7/11/2018 16:43	12:43:05 AM	58.96952	148.6324	243			Hopcroft
291	CTD 54 End	GAK7	7/11/2018 17:12	1:12:40 AM	58.96618	148.619	243			Hopcroft
292	CalVET Net Tow Start	GAK7	7/11/2018 17:24	1:24:32 AM	58.9704	148.6276	243			Hopcroft
293	CalVET Net Tow End	GAK7	7/11/2018 17:28	1:28:49 AM	58.96954	148.6262	243			Hopcroft
294	CTD 55 Start	GAK8	7/11/2018 18:50	2:50:13 AM	58.8089	148.4956	288			Hopcroft
295	CTD 55 End	GAK8	7/11/2018 19:20	3:20:56 AM	58.8102	148.4848	288			Hopcroft
296	CalVET Net Tow Start	GAK8	7/11/2018 19:30	3:30:11 AM	58.81088	148.4841	288			Hopcroft
297	CalVET Net Tow End	GAK8	7/11/2018 19:37	3:37:11 AM	58.81055	148.4863	288			Hopcroft
298	Fe Fish End	GAK8	7/11/2018 19:37	3:37:55 AM	58.81049	148.4863	288			Aguilar-Islas
299	MultiNet Start	GAK5	7/11/2018 23:00	7:00:40 AM	59.2676	148.9012	167			Hopcroft

300	MultiNet End	GAK5	7/11/2018 23:37	7:37:05 AM	59.25915	148.9355	167			Hopcroft
301	Methot Net Start	GAK5	7/11/2018 23:48	7:48:43 AM	59.24664	148.9341	167			Hopcroft
302	Methot Net End	GAK5	7/12/2018 0:08	8:08:11 AM	59.23606	148.9386	167			Hopcroft
303	MultiNet Start	GAK6	7/12/2018 1:10	9:10:19 AM	59.1249	148.7575	151			Hopcroft
304	MultiNet End	GAK6	7/12/2018 1:40	9:40:00 AM	59.10748	148.7652	151			Hopcroft
305	MultiNet Start	GAK7	7/12/2018 2:36	10:36:26 AM	58.97431	148.6254	243			Hopcroft
306	MultiNet End	GAK7	7/12/2018 3:08	11:08:13 AM	58.95864	148.6478	243			Hopcroft
307	Methot Net Start	GAK7	7/12/2018 3:15	11:15:43 AM	58.95449	148.6533	243			Hopcroft
309	Methot Net End	GAK7	7/12/2018 3:25	11:25:03 AM	58.94867	148.6566	243			Hopcroft
310	Methot Net Start	GAK8	7/12/2018 4:26	12:26:29 PM	58.832	148.4703	288			Hopcroft
311	Methot Net End	GAK8	7/12/2018 4:36	12:36:15 PM	58.82607	148.4706	288			Hopcroft
312	MultiNet Start	GAK8	7/12/2018 4:44	12:44:28 PM	58.81887	148.4764	288			Hopcroft
313	MultiNet End	GAK8	7/12/2018 5:13	1:13:14 PM	58.80043	148.4912	288			Hopcroft
314	Methot Net Start	GAK9	7/12/2018 6:00	2:00:25 PM	58.7051	148.336	280			Hopcroft
315	Methot Net End	GAK9	7/12/2018 6:20	2:20:05 PM	58.69256	148.3368	280			Hopcroft
316	MultiNet Start	GAK9	7/12/2018 6:28	2:28:28 PM	58.68773	148.341	280			Hopcroft
317	MultiNet End	GAK9	7/12/2018 6:59	2:59:56 PM	58.66986	148.3614	280			Hopcroft
318	MultiNet Start	GAK9	7/12/2018 8:10	4:10:48 PM	58.68083	148.3541	280		vertical 200 100 60 40 20	Hopcroft
319	MultiNet End	GAK9	7/12/2018 8:23	4:23:19 PM	58.67927	148.3538	280			Hopcroft
320	CTD 56 Start	GAK9	7/12/2018 9:03	5:03:05 PM	58.68064	148.3512	280		prod cast	Strom
321	CTD 56 End	GAK9	7/12/2018 9:30	5:30:20 PM	58.67722	148.3519	280			Hopcroft
322	CalVET Net Tow Start	GAK9	7/12/2018 9:38	5:38:36 PM	58.67947	148.3511	280			Hopcroft
323	CalVET Net Tow End	GAK9	7/12/2018 9:44	5:44:11 PM	58.67853	148.3517	280			Hopcroft
324	CTD 57 Start	GAK9	7/12/2018 10:04	6:04:11 PM	58.68222	148.353	280			Hopcroft
325	CTD 57 End	GAK9	7/12/2018 10:43	6:43:08 PM	58.67651	148.3564	280			Hopcroft
326	CalVET Net Tow Start	GAK9	7/12/2018 10:51	6:51:17 PM	58.67931	148.3512	280		genetics/live	Hopcroft
327	CalVET Net Tow End	GAK9	7/12/2018 10:56	6:56:11 PM	58.67826	148.3517	280			Hopcroft
327.5	Fe Fish start	GAK10	7/13/2018 10:56	7:56:11 PM	58.67826	148.3517		280		Aguilar-Islas
328	CTD 58 Start	GAK9i	7/12/2018 12:08	8:08:14 PM	58.61443	148.2822		620		Hopcroft
329	CTD 58 End	GAK9i	7/12/2018 12:36	8:36:46 PM	58.61451	148.293	620			Hopcroft
330	CTD 59 Start	GAK10	7/12/2018 13:28	9:28:58 PM	58.54313	148.2068	1459			Hopcroft
331	CTD 59 End	GAK10	7/12/2018 14:28	10:28:49 PM	58.55206	148.215	1459			Hopcroft
332	CalVET Net Tow Start	GAK10	7/12/2018 14:45	10:45:03 PM	58.54344	148.2136	1459			Hopcroft
333	CalVET Net Tow End	GAK10	7/12/2018 14:49	10:49:51 PM	58.54425	148.2137	1459			Hopcroft
334	CTD 60 Start	GAK11	7/12/2018 16:16	12:16:29 AM	58.38648	148.068		1410		Hopcroft
335	CTD 60 End	GAK11	7/12/2018 17:17	1:17:28 AM	58.39732	148.0593	1410			Hopcroft
336	CalVET Net Tow Start	GAK11	7/12/2018 17:29	1:29:34 AM	58.38996	148.0686	1410			Hopcroft
337	CalVET Net Tow End	GAK11	7/12/2018 17:34	1:34:07 AM	58.39082	148.068	1410		adjusted underway computer from EDT to ADT and	Hopcroft
338	CTD 61 Start	GAK12	7/12/2018 18:53	2:53:35 AM	58.24172	147.9362	2134			Hopcroft
339	CTD 61 End	GAK12	7/12/2018 19:54	3:54:37 AM	58.24895	147.9114	2134			Hopcroft
340	CalVET Net Tow Start	GAK12	7/12/2018 20:12	4:12:50 AM	58.24769	147.929	2134			Hopcroft
341	CalVET Net Tow End	GAK12	7/12/2018 20:18	4:18:48 AM	58.24794	147.9291	2134			Hopcroft
341.5	Fe fish recover	GAK13	7/12/2018 22:01	6:01:19 AM	58.09777	147.8007	2058			Aguilar-Islas
342	CalVET Net Tow Start	GAK13	7/12/2018 22:01	6:01:19 AM	58.09777	147.8007	2058			Hopcroft
343	CalVET Net Tow End	GAK13	7/12/2018 22:07	6:07:29 AM	58.09923	147.803	2058			Hopcroft
344	CTD 62 Start	GAK13	7/12/2018 22:16	6:16:52 AM	58.09847	147.7984	2058			Hopcroft
345	CTD 62 End	GAK13	7/12/2018 23:06	7:06:52 AM	58.10605	147.7868	2058			Hopcroft
346	Methot Net Start	GAK13	7/12/2018 23:14	7:14:10 AM	58.10614	147.7874	2058			Hopcroft
347	Methot Net End	GAK13	7/12/2018 23:34	7:34:26 AM	58.0967	147.8027	2058			Hopcroft
348	MultiNet Start	GAK13	7/12/2018 23:46	7:46:43 AM	58.09745	147.8006	2058			Hopcroft

349	MultiNet End	GAK13	7/13/2018 0:17	8:17:05 AM	58.10683	147.7648	2058		Hopcroft
350	Methot Net Start	GAK12	7/13/2018 1:15	9:15:53 AM	58.21214	147.9399	2123		Hopcroft
351	Methot Net End	GAK12	7/13/2018 1:35	9:35:25 AM	58.22557	147.9406	2123		Hopcroft
352	MultiNet Start	GAK12	7/13/2018 1:43	9:43:52 AM	58.22917	147.9398	2123		Hopcroft
353	MultiNet End	GAK12	7/13/2018 2:13	10:13:02 AM	58.24812	147.9328	2123		Hopcroft
354	Methot Net Start	GAK11	7/13/2018 3:07	11:07:25 AM	58.36913	148.074	1410		Hopcroft
355	Methot Net End	GAK11	7/13/2018 3:27	11:27:16 AM	58.38182	148.0742	1410		Hopcroft
356	MultiNet Start	GAK11	7/13/2018 3:36	11:36:11 AM	58.38641	148.0751	1410		Hopcroft
357	MultiNet End	GAK11	7/13/2018 4:06	12:06:42 PM	58.40762	148.0775	1410		Hopcroft
358	Methot Net Start	GAK10	7/13/2018 4:59	12:59:30 PM	58.5214	148.2131	1459		Hopcroft
359	Methot Net End	GAK10	7/13/2018 5:19	1:19:11 PM	58.53419	148.2126	1459		Hopcroft
360	MultiNet Start	GAK10	7/13/2018 5:27	1:27:24 PM	58.53771	148.212	1459		Hopcroft
361	MultiNet End	GAK10	7/13/2018 5:54	1:54:36 PM	58.55582	148.2106	1459		Hopcroft
362	Fe Fish Start	GAK13	7/13/2018 9:18	5:18:00 PM					Aguilar-Islas
363	CTD 63 Start	GAK15	7/13/2018 12:12	8:12:31 PM	57.78829	147.5004	4543	prod cast	Strom
364	CTD 63 End	GAK15	7/13/2018 12:35	8:35:55 PM	57.7994	147.5103	4543		Strom
365	CalVET Net Tow Start	GAK15	7/13/2018 12:49	8:49:17 PM	57.79434	147.5017	4543		Strom
366	CalVET Net Tow End	GAK15	7/13/2018 12:54	8:54:58 PM	57.79626	147.5031	4543		Strom
367	CTD 64 Start	GAK15	7/13/2018 13:11	9:11:49 PM	57.78431	147.4968	4543		Hopcroft
368	CTD 64 End	GAK15	7/13/2018 14:10	10:10:11 PM	57.81265	147.5197	4543		Hopcroft
369	CalVET Net Tow Start	GAK15	7/13/2018 14:43	10:43:13 PM	57.79399	147.5011	4543		Hopcroft
370	CalVET Net Tow End	GAK15	7/13/2018 14:48	10:48:30 PM	57.7958	147.5016	4543	too rough for vertical multinets	Hopcroft
370.5	Fe Fish End	GAK 13	?	?	?	?	?	Russ took fish out	Aguilar-Islas
371	CTD 65 Start	KOD5	7/14/2018 9:03	5:03:39 PM	57.78728	150.7605	86	prod cast	Hopcroft
372	CTD 65 End	KOD5	7/14/2018 9:24	5:24:34 PM	57.78197	150.7602	86		Hopcroft
374	CalVET Net Tow Start	KOD5	7/14/2018 9:38	5:38:03 PM	57.78345	150.7595	86		Hopcroft
375	CalVET Net Tow End	KOD5	7/14/2018 9:42	5:42:33 PM	57.78252	150.7602	86	nets fouled	Hopcroft
376	CalVET Net Tow End	KOD5	7/14/2018 9:53	5:53:44 PM	57.78658	150.7607	86	recast	Hopcroft
377	CalVET Net Tow End	KOD5	7/14/2018 9:57	5:57:31 PM	57.78533	150.761	86		Hopcroft
378	CTD 66 Start	KOD5	7/14/2018 10:16	6:16:37 PM	57.78637	150.7616	86		Hopcroft
379	CTD 66 End	KOD5	7/14/2018 10:34	6:34:46 PM	57.78368	150.7647	86		Hopcroft
380	CalVET Net Tow Start	KOD5	7/14/2018 10:42	6:42:48 PM	57.78391	150.7619	86		Hopcroft
381	CalVET Net Tow End	KOD5	7/14/2018 10:47	6:47:41 PM	57.78293	150.763	86	nets fouled	Hopcroft
382	CalVET Net Tow Start	KOD5	7/14/2018 11:01	7:01:04 PM	57.78656	150.7607	86	recast	Hopcroft
383	CalVET Net Tow Start	KOD5	7/14/2018 11:06	7:06:22 PM	57.78571	150.7627	86		Hopcroft
383.5	FeFish Deploy	KOD5	7/14/2018 11:20	7:20:22 PM	57.78571	150.7627	86		Aguilar-Islas
384	CTD 67 Start	KOD4	7/14/2018 12:29	8:29:39 PM	57.90434	150.9717	80		Hopcroft
385	CTD 67 End	KOD4	7/14/2018 12:44	8:44:31 PM	57.9072	150.9791	80		Hopcroft
386	CalVET Net Tow Start	KOD4	7/14/2018 12:55	8:55:38 PM	57.90222	150.9743	80		Hopcroft
387	CalVET Net Tow End	KOD4	7/14/2018 13:00	9:00:01 PM	57.90307	150.9762	80		Hopcroft
388	CTD 68 Start	KOD3	7/14/2018 14:19	10:19:18 PM	58.0155	151.1769	84		Hopcroft
389	CTD 68 End	KOD3	7/14/2018 14:36	10:36:02 PM	58.02573	151.1746	84		Hopcroft
390	CalVET Net Tow Start	KOD3	7/14/2018 14:54	10:54:06 PM	58.01733	151.178	84		Hopcroft
391	CalVET Net Tow End	KOD3	7/14/2018 14:57	10:57:47 PM	58.01876	151.1777	84		Hopcroft
392	CTD 69 Start	KOD2	7/14/2018 16:10	12:10:08 AM	58.12786	151.3868	127		Hopcroft
393	CTD 69 End	KOD2	7/14/2018 16:30	12:30:18 AM	58.1378	151.3872	127		Hopcroft
394	CalVET Net Tow Start	KOD2	7/14/2018 16:40	12:40:45 AM	58.13256	151.3867	127		Hopcroft
395	CalVET Net Tow End	KOD2	7/14/2018 16:46	12:46:53 AM	58.13402	151.3861	127		Hopcroft
396	CTD 70 Start	KOD1	7/14/2018 18:12	2:12:30 AM	58.24086	151.5889	71		Hopcroft
397	CTD 70 End	KOD1	7/14/2018 18:26	2:26:35 AM	58.24131	151.5848	71		Hopcroft

398	CalVET Net Tow Start	KOD1	7/14/2018 18:39	2:39:17 AM	58.24313	151.5893	71			Hopcroft
399	CalVET Net Tow End	KOD1	7/14/2018 18:43	2:43:53 AM	58.24031	151.5886	71			Hopcroft
400	Methot Net Start	KOD1	7/14/2018 19:14	3:14:10 AM	58.24086	151.5938	71			Hopcroft
401	Methot Net End	KOD1	7/14/2018 19:34	3:34:11 AM	58.24644	151.5875	71			Hopcroft
402	Bongo 60 cm Start	KOD1	7/14/2018 19:51	3:51:31 AM	58.23777	151.5862	71			Hopcroft
403	Bongo 60 cm Bottom	KOD1	7/14/2018 19:55	3:55:39 AM	58.23898	151.588	71			Hopcroft
404	Bongo 60 cm End	KOD1	7/14/2018 20:05	4:05:43 AM	58.2405	151.5924	71			Hopcroft
405	Methot Net Start	KOD2	7/14/2018 21:02	5:02:50 AM	58.13901	151.3885	127			Hopcroft
406	Methot Net End	KOD2	7/14/2018 21:21	5:21:17 AM	58.13246	151.3765	127			Hopcroft
407	Bongo 60 cm Start	KOD2	7/14/2018 21:30	5:30:30 AM	58.13066	151.3763	127			Hopcroft
408	Bongo 60 cm End	KOD2	7/14/2018 21:43	5:43:55 AM	58.12621	151.3871	127			Hopcroft
409	Methot Net Start	KOD3	7/14/2018 22:40	6:40:44 AM	58.02807	151.1917		84		Hopcroft
410	Methot Net End	KOD3	7/14/2018 23:01	7:01:05 AM	58.02151	151.1829	84			Hopcroft
411	Bongo 60 cm Start	KOD3	7/14/2018 23:10	7:10:00 AM	58.01804	151.1792	84			Hopcroft
412	Bongo 60 cm End	KOD3	7/14/2018 23:16	7:16:20 AM	58.0146	151.1748	84			Hopcroft
413	Methot Net Start	KOD4	7/15/2018 0:23	8:23:21 AM	57.89727	150.9765	80			Hopcroft
414	Methot Net End	KOD4	7/15/2018 0:43	8:43:18 AM	57.90132	150.9635	80			Hopcroft
415	Bongo 60 cm Start	KOD4	7/15/2018 0:52	8:52:03 AM	57.90091	150.9689	80			Hopcroft
416	Bongo 60 cm Bottom	KOD4	7/15/2018 0:57	8:57:38 AM	57.89859	150.974	80			Hopcroft
417	Bongo 60 cm End	KOD4	7/15/2018 1:04	9:04:52 AM	57.89569	150.9807	80			Hopcroft
418	Bongo 60 cm Start	KOD5	7/15/2018 2:24	10:24:25 AM	57.78529	150.7628	86			Hopcroft
419	Bongo 60 cm Bottom	KOD5	7/15/2018 2:29	10:29:54 AM	57.7846	150.7587	86			Hopcroft
420	Bongo 60 cm End	KOD5	7/15/2018 2:34	10:34:09 AM	57.78442	150.7562	86			Hopcroft
421	Bongo 60 cm Start	KOD6	7/15/2018 3:59	11:59:40 AM	57.67098	150.5572	102			Hopcroft
422	Bongo 60 cm Bottom	KOD6	7/15/2018 4:06	12:06:48 PM	57.6671	150.5558	102			Hopcroft
423	Bongo 60 cm End	KOD6	7/15/2018 4:14	12:14:00 PM	57.66336	150.5543	102			Hopcroft
424	Methot Net Start	KOD6	7/15/2018 4:24	12:24:00 PM	57.6659	150.5477	102			Hopcroft
425	Methot Net End	KOD6	7/15/2018 4:44	12:44:19 PM	57.67078	150.5453	102			Hopcroft
426	Methot Net Start	KOD7	7/15/2018 5:47	1:47:27 PM	57.55876	150.3463		179		Hopcroft
427	Methot Net End	KOD7	7/15/2018 6:07	2:07:09 PM	57.55574	150.3331	179			Hopcroft
428	Bongo 60 cm Start	KOD7	7/15/2018 6:15	2:15:05 PM	57.55376	150.332	179			Hopcroft
429	Bongo 60 cm Bottom	KOD7	7/15/2018 6:21	2:21:53 PM	57.55516	150.3349	179			Hopcroft
430	Bongo 60 cm End	KOD7	7/15/2018 6:28	2:28:13 PM	57.55617	150.338	179			Hopcroft
431	CTD 71 Start	KOD6	7/15/2018 8:02	4:02:20 PM	57.67496	150.5481		100	bird and whale hotspot	Hopcroft
432	CTD 71 End	KOD6	7/15/2018 8:18	4:18:17 PM	57.66477	150.5418		100		Hopcroft
433	CalVET Net Tow Start	KOD6	7/15/2018 8:30	4:30:12 PM	57.66857	150.5501		100		Hopcroft
434	CalVET Net Tow End	KOD6	7/15/2018 8:34	4:34:39 PM	57.66657	150.5499		100		Hopcroft
435	Fe Fish Start	KOD6	7/15/2018 8:35	4:35:11 PM	57.66638	150.5502		100	a few minutes early	Aguilar-Islas
436	CTD 72 Start	KOD7	7/15/2018 9:51	5:51:16 PM	57.55929	150.341	178			Hopcroft
437	CTD 72 End	KOD7	7/15/2018 10:16	6:16:25 PM	57.54487	150.33	178			Hopcroft
438	CalVET Net Tow Start	KOD7	7/15/2018 10:34	6:34:34 PM	57.55434	150.3401	178			Hopcroft
439	CalVET Net Tow End	KOD7	7/15/2018 10:39	6:39:53 PM	57.55234	150.3401	178			Hopcroft
440	CTD 73 Start	KOD8	7/15/2018 11:54	7:54:12 PM	57.44508	150.14	708			Hopcroft
441	CTD 73 End	KOD8	7/15/2018 12:45	8:45:46 PM	57.43322	150.1298	708			Hopcroft
442	CalVET Net Tow Start	KOD8	7/15/2018 12:55	8:55:18 PM	57.43676	150.1337	708			Hopcroft
443	CalVET Net Tow End	KOD8	7/15/2018 13:00	9:00:40 PM	57.43456	150.1353	708			Hopcroft
444	Fe Fish End	KOD10	7/15/2018 16:10	12:10:52 AM	57.20552	149.7194	2500			Aguilar-Islas
445	Methot Net Start	KOD10	7/15/2018 21:05	5:05:43 AM	57.20961	149.7065	2503			Hopcroft
446	Methot Net End	KOD10	7/15/2018 21:35	5:35:08 AM	57.20579	149.7212	2503			Hopcroft
447	Bongo 60 cm Start	KOD10	7/15/2018 21:45	5:45:22 AM	57.20439	149.7271	2503			Hopcroft

448	Bongo 60 cm Bottom	KOD10	7/15/2018 21:52	5:52:36 AM	57.20512	149.7191	2503			Hopcroft
449	Bongo 60 cm End	KOD10	7/15/2018 22:00	6:00:54 AM	57.20623	149.711	2503			Hopcroft
450	Methot Net Start	KOD9	7/15/2018 23:15	7:15:25 AM	57.31445	149.9291	1310			Hopcroft
451	Methot Net End	KOD9	7/15/2018 23:45	7:45:13 AM	57.31614	149.9005	1310			Hopcroft
452	Bongo 60 cm Start	KOD9	7/15/2018 23:56	7:56:50 AM	57.32146	149.9137	1310			Hopcroft
453	Bongo 60 cm Bottom	KOD9	7/16/2018 0:04	8:04:06 AM	57.32211	149.9211	1310			Hopcroft
454	Bongo 60 cm End	KOD9	7/16/2018 0:11	8:11:34 AM	57.32318	149.9297	1310			Hopcroft
455	Methot Net Start	KOD8	7/16/2018 1:20	9:20:28 AM	57.43659	150.1382	708			Hopcroft
456	Methot Net End	KOD8	7/16/2018 1:50	9:50:11 AM	57.44493	150.1259	708			Hopcroft
457	Bongo 60 cm Start	KOD8	7/16/2018 1:58	9:58:51 AM	57.44249	150.1293	708			Hopcroft
458	Bongo 60 cm Bottom	KOD8	7/16/2018 2:06	10:06:11 AM	57.43851	150.1368	708			Hopcroft
459	Bongo 60 cm End	KOD8	7/16/2018 2:13	10:13:33 AM	57.43456	150.1446	708		Bongo net was lost	Hopcroft
460	CTD 74 Start	KOD9	7/16/2018 6:44	2:44:14 PM	57.31971	149.9237	1310			Hopcroft
461	CTD 74 End	KOD9	7/16/2018 7:36	3:36:53 PM	57.32463	149.9234	1310			Hopcroft
462	CalVET Net Tow Start	KOD9	7/16/2018 7:44	3:44:30 PM	57.32288	149.925	1310			Hopcroft
463	CalVET Net Tow End	KOD9	7/16/2018 7:49	3:49:49 PM	57.3226	149.925	1310			Hopcroft
464	CTD 75 Start	KOD10	7/16/2018 9:03	5:03:03 PM	57.20157	149.7199	2503		prod cast	Hopcroft
465	CTD 75 End	KOD10	7/16/2018 9:27	5:27:41 PM	57.2033	149.7164	2503			Hopcroft
466	CalVET Net Tow Start	KOD10	7/16/2018 9:34	5:34:54 PM	57.20462	149.7193	2503			Hopcroft
467	CalVET Net Tow End	KOD10	7/16/2018 9:39	5:39:47 PM	57.20509	149.7193	2503			Hopcroft
468	CTD 76 Start	KOD10	7/16/2018 9:59	5:59:09 PM	57.20179	149.7237	2503			Hopcroft
469	CTD 76 End	KOD10	7/16/2018 10:59	6:59:00 PM	57.20504	149.7101	2503			Hopcroft
471	CalVET Net Tow Start	KOD10	7/16/2018 11:09	7:09:50 PM	57.20452	149.7175	2503		genetics	Hopcroft
472	CalVET Net Tow End	KOD10	7/16/2018 11:14	7:14:29 PM	57.20478	149.7168	2503			Hopcroft
473	CTD 77 Start	GAK15	7/16/2018 19:37	3:37:57 AM	57.78874	147.4976	4543		repeat after ~80 hrs	Hopcroft
474	CTD 77 End	GAK15	7/16/2018 20:20	4:20:22 AM	57.79453	147.5003	4543			Hopcroft
475	CalVET Net Tow Start	GAK15	7/16/2018 20:28	4:28:05 AM	57.79591	147.5019	4543			Hopcroft
476	CalVET Net Tow End	GAK15	7/16/2018 20:35	4:35:05 AM	57.79704	147.5036	4543		caught on ship - poor cast characteristics	Hopcroft
477	MultiNet Start	GAK15	7/16/2018 20:56	4:56:04 AM	57.78947	147.4979	4543		shallow 200 100 60 40 20	Hopcroft
478	MultiNet End	GAK15	7/16/2018 21:09	5:09:00 AM						Hopcroft
479	MultiNet Start	GAK15	17/16/2018 21:33	5:33:00 AM					Deep 1200 600 400 300 200	Hopcroft
480	MultiNet End	GAK15	7/16/2018 22:39	6:39:23 AM	57.79755	147.5	4543			Hopcroft
481	Methot Net Start	GAK15	7/16/2018 22:55	6:55:28 AM	57.79492	147.5011	4543			Hopcroft
482	Methot Net End	GAK15	7/16/2018 23:15	7:15:11 AM	57.78531	147.505	4543			Hopcroft
483	MultiNet Start	GAK15	7/16/2018 23:38	7:38:24 AM	57.79551	147.5023	4543			Hopcroft
484	MultiNet End	GAK15	7/17/2018 0:07	8:07:16 AM	57.77972	147.4867	4543			Hopcroft
485	Methot Net Start	GAK14	7/17/2018 1:19	9:19:53 AM	57.93686	147.6447	3518			Hopcroft
486	Methot Net End	GAK14	7/17/2018 1:29	9:29:31 AM	57.94189	147.6505	3518			Hopcroft
487	MultiNet Start	GAK14	7/17/2018 1:46	9:46:39 AM	57.94321	147.6542	3518			Hopcroft
488	MultiNet End	GAK14	7/17/2018 2:17	10:17:02 AM	57.94415	147.6161	3518			Hopcroft
489	CTD 78 Start	GAK14	7/17/2018 6:49	2:49:24 PM	57.94072	147.6477	3518			Hopcroft
490	CTD 78 End	GAK14	7/17/2018 7:41	3:41:05 PM	57.94311	147.6454	3518			Hopcroft
491	CalVET Net Tow Start	GAK14	7/17/2018 7:48	3:48:02 PM	57.9435	147.6488	3518			Hopcroft
492	CalVET Net Tow End	GAK14	7/17/2018 7:53	3:53:06 PM	57.94424	147.6479	3518			Hopcroft
493	CTD 79 Start	GAK13	7/17/2018 8:58	4:58:23 PM	58.09586	147.7925		2058	repeat phys only	Hopcroft
494	CTD 79 End	GAK13	7/17/2018 9:37	5:37:22 PM	58.10203	147.7917		2058		Hopcroft
495	CTD 80 Start	GAK12	7/17/2018 10:44	6:44:35 PM	58.24061	147.9366	2134			Hopcroft
496	CTD 80 End	GAK12	7/17/2018 11:26	7:26:34 PM	58.24232	147.9172	2134			Hopcroft
497	CTD 81 Start	GAK11	7/17/2018 12:38	8:38:34 PM	58.387	148.0773	1410			Hopcroft
498	CTD 81 End	GAK11	7/17/2018 13:21	9:21:59 PM	58.38272	148.0649	1410			Hopcroft