NGA-LTER

Northern Gulf of Alaska Long-Term Ecological Research

Cruise Report September 2019

Cruise ID: TxF19 (TGXF19, TGX201909)

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 second year with expanded domain, measurements and investigators under the NSF's Northern Gulf of Alaska Long-term Ecological Program (NGA-LTER). This cruise marks the 23nd consecutive fall cruise for the Seward Line in the NGA, including Prince William Sound (PWS), and the 49th year of observations at GAK1.

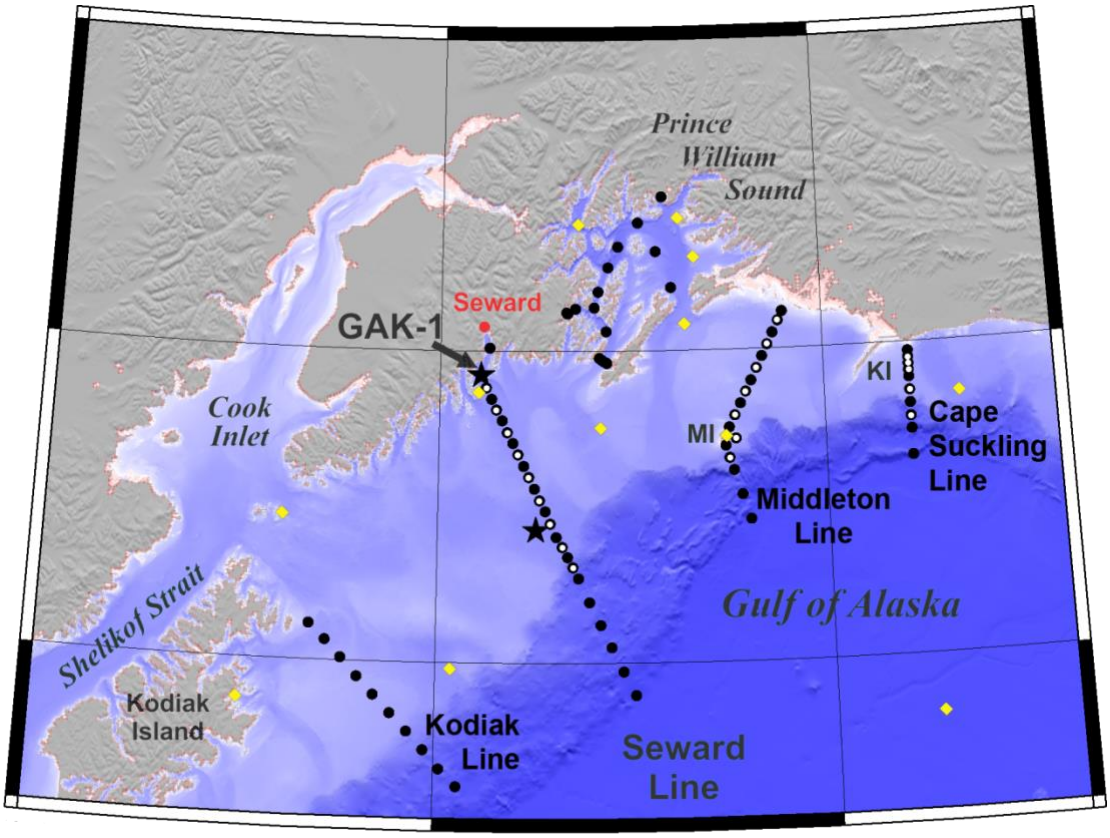


Figure 1. The LTER sampling stations. CTD casts without water sampling as open symbols. Yellow diamonds represent locations of meteorological data from NOAA buoys or ground stations. Star shows position of LTER mooring. Cape Suckling is low priority.

Daily summary

Sept 10th - Day 0 – Science team arrived Seward and organized equipment in warehouse & laboratory.

Sept 11th – Day 1. *Tiglax* arrived SMC at ~8:30 and we loaded most gear from warehouse before ship needed to move to railway dock at ~10:00 to load large items (Conex, CTD winch) while setup of labs and meteorological package began. We returned from Railway dock to SMC ~11:30 to complete loading and continue setup. The TSG was successfully reinstalled after repair from the Spring cruise. Aside from general setup, problem remained from spring to resolve with wiring Conex to ship, ultimately traced to a miswired breaker panel. Marine Tech Ethan Roth successfully installed the deck units for a Simrad EK60 acoustics system, and a line- monitoring system for the main winch. During installation of the winch monitor, we discovered bolts had worked their way out of the winch motor, and hydraulic fluid had leaked into the winches control housing. Resolving these issues delayed final setup until ~until 22:00. The CTD test-cast at Res2.5 commenced at ~23:00 and we headed directly to PWS to avoid an incoming storm (no night work).

Sept 12th – Day 2. We began day operations with a CTD at KIP2 ~07:30 followed by a Calvet and iron-fish deployment, then worked our way northward beginning intensive station PWS2 at ~12:30 with a primary production cast. In total, 3 CTD cats, 2 Calvets and 2 Vertical Multinets were completed at ~17:00. Then we moved to PWS3 to conduct a CTD and Calvet ending at ~20:00. Winds were too strong to sample the eastern sound, and a weather window opening suggested the best plan was to head south through Knight Island Passage for night work, then head to the Middleton Line before the next storm hit. Night sampling began at 21:30 at PWS3 and ended with the 4th Multinet at KIP2 at ~05:00 – a Methot was only executed at KIP2 due to a combination of weather and gear issues, consistent with first-night learning curves.

Sept 13th – Day 3. After short sightseeing approach to the Chenega Glacier, Day Work began at ~8:00 with a CTD cast at IB0, followed by 2 Calvets. We sampled IB1 and IB2 on our way toward the Pleiades. We made a deep Vertical multinet to ~600m just north of the Pleiades to recollect diapausing *Neocalanus* due to the poor condition of specimens sampled at PWS2 the prior day. We then completed the 4 stations along the Montague Strait Line ending at ~1700 (bottle and Calvet collections were only undertaken at MS2) then transited toward Middleton Island. Strong currents delayed arrival to MID5 until ~0100, but then Bongo and Methot nets were worked shoreward ending at MID2 at 08:00.

Sept 14th – Day 4. Daywork began at with a CTD at MID1 at ~09:30; due to the shallow depth (15m) Calvets nets were not completed. The Iron Fish was deployed and had initial problems getting it primed due to an air leak. Station MID2 began with a production CTD cast at 11:45. The full suite of sampling was completed by 13:00. We worked outward through to MID6, ending daytime activities by 21:00. The leak on the Iron Fish was fixed (~Station MID1), and the Fish was deployed throughout the day. Night activities began at MID6 at 21:30, working Bongo and Methot nets out to MID10 and ending at 05:00. *Tiglax* transited toward MID5

Sept 15th – Day 5. Day work began at Intensive Station MID5 early at 10:00 with a prod CTD followed by two Calvets and a second CTD. We headed to MID6i for a CTD, then worked outward along the line ending MID10 at 21:30 after nightfall as winds began to build. The Iron Fish was deployed throughout the day collecting samples from MID5 to MID 10. The night was spend transiting toward GAK1 with winds building to 30 knots then quickly subsiding.

Sept 16th – Day 6. Day work began at GAK1 began with the prod CTD, then was followed by 2 Calvets, 2 additional CTD cast and a Vertical Multinet. We worked outward along the line, ending GAK4 at 20:30. The Iron Fish was deployed throughout the day collecting samples from GAK 1 to GAK 4. We began night work by 21:00 and worked towed Multinets and Methots from GAK4 to GAK1 ending at 05:30, then transited back to GAK 4i to begin CTDs.

Sept 17th – Day 7. Day-work began at 09:30 with a bottleless CTD at GAK4i, then began Intensive Station GAK5 with a prod CTD at 10:30, a vertical multinet at Intensive station GAK5, followed by 2 Calvets, a second CTD, and finally a vertical Multinet. We worked southward along the line ending at GAK8 at 22:00. The Iron Fish was deployed throughout the day collecting samples from GAK 4i to GAK 8. We transited out to GAK9 where the night team began Mutinelts and Methots at 21:00. They completed GAK8, but then had an unsuccessful Multinet at GAK7 before being shut-down by weather at 2:00. The *Tiglax* transited toward Resurrection Bay for shelter.

Sept 18th – Day 8. We spent the day in Resurrection Bay, sampled RES2.5 late morning, and then went ashore for a hike. We got underway at 18:00 with lower winds but still large swell and choppy seas. There was no Iron Fish deployment. Nightwork began at GAK5 at 21:30, followed by samples at GAK6 and resampling of GAK7. Issues with the forward crane hydraulics prevented a Methot tow at GAK7.

Sept 19th – Day 9. Day-work began at 6:00 with a bottleless CTD cast near the GEO mooring, then again at GAK8i at 8:30. Intensive Station GAK9 began with a Prod CTD at 09:30, followed 2 Calvets, the standard CTD, and finally a vertical Multinet ending at 11:30. We worked outward along the line conducting CTDs to 1000m as far as GAK13 where we stopped at 21:45 because the winds had built to unworkable strength. The Iron Fish was deployed throughout the day collecting samples from GAK 8i to GAK 13. Night work started immediately with a Multinet cast under strong winds that ended at 22:40. Remaining issues with the forward crane precluded any Methot deployment, as did the 30 knot winds that were still building. We ended operations and headed to Kodiak to ride out the storm.

Sept 20th – Day 10. The day was spent mostly in transit, reaching the Kodiak dock at ~1800. During transit, winds had gusted as high as 50 kts. There was no night work. The forward crane was repaired while in port.

Sept 21st – Day 11. We continued to ride out the winds. With access to weather models for planning, we got underway at 16:00 to position ourselves for night-work amid what would be marginal sea state. Night-work began at 20:40 with a Methot at KOD1, followed by a Bongo. Sampling proceeded southward with weather too rough for a Methot at KOD5. Night sampling worked out to KOD6 ending there at 06:40 with a Methot trawl.

Sept 22nd – Day 12. We began our fist CTD at KOD6 at 07:15, and began our Intensive Station at KOD5 at 09:00 finishing it by 10:15. We worked northward to KOD1 finishing our Calvet at ~17:00. The Iron Fish was deployed throughout the day collecting samples from KOD5 to to KOD 1. Given the weather forecast, we headed back to Kodiak Harbor while a gale moved past the island.

Sept 23rd – Day 13. We spent the day tied up in Kodiak hoping the weather would improve.

Sept 24th – Day 14. We got underway at 06:00 hoping the weather was better than forecasted. Seas were better than expected in the lee of Kodiak Island so we headed toward KOD6 to pick up where we had left off 2 days prior. By the time we reached KOD, seas had built and become

confused over a high swell. The Iron fish was deployed and we transited toward KOD7. Sea state at KOD7 was marginal as we completed a CTD and a Calvet. With winds still building, we called off sampling and headed for Seward.

Sept 25th – Day 15. We reached Seward at ~10:00 and began to offload at SMC. We moved to offloaded larger items at the railway dock at ~1500, and waited over an hour for the crane to arrive. During that time, loading of the UHaul began. *Tiglax* returned to SMC to complete offload at ~17:30, with packing of the UHaul completed by ~19:30. Scripps graciously allowed us to stay on board overnight after our charter had officially ended at 16:00

Sept 26th – Day 16. We began disembarked *Tiglax* at 08:00, and were on the road north by 09:30.

General Comment: *the weather this cruise was among the worst experienced during the time-series. Six storms occurred during the cruise, with only 1-2 workable days between each. As during spring, PWS was reduced to one day to maximize probability of the shelf lines being completed.*

Physics Report:

PI: Seth Danielson, Participant: Rachel Potter

On this cruise we conducted 71 casts for water column hydrography at 58 stations (Fig. 1,2) using a 15 x 6 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 1000 m. The SBE9-11 CTD was outfitted with pressure, dual temperature, dual conductivity and (for this cruise) a single oxygen sensor. 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. Only one cast at each station required a UVP profile so stations with multiple casts may have had a combination of deep and shallow soak depths.

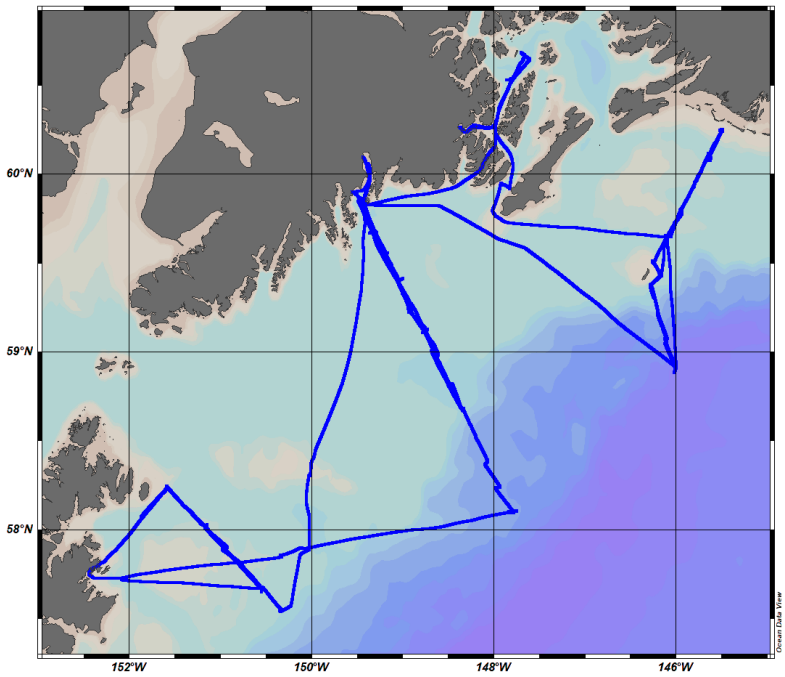


Figure 2. Cruise track for Tiglax from Sept 11-25, 2019 (TxF19)

The CTD stations were occupied on three shelf transects

(Kodiak, Middleton, and Seward Line; Fig. 3-6) plus stations in Prince William Sound, including stations across Montague Strait, the Icy Bay fjord, and along Knight Island Passage.

Underway data from this vessel consisted of records of the cruise track and an SBE-21 Thermo-salinograph, and an EK60 acoustics system operating at 38 and 120 Hz. Logging occurs in the bridge's computer room. There were relatively few data gaps in the record, with the exception of gaps when we were getting underway from port (Fig. 7).

Hydrographic data showed very intense thermal stratification on the Middleton and Seward Line transects but much weaker over the Kodiak Station until KOD7 (Fig. 3-5). Salinity showed a freshened layer from the Copper River to well past the shelf break on the Middleton Line, a coastally trapped ACC on the Seward Line that weakly extended to mid-shelf, and a reduced salinity all the way across the Kodiak Line until KOD7. Nitrate was virtually absent from surface waters along the Middleton and Seward Line, but probably non-limiting along the Kodiak Line as far as sampling occurred. Correspondingly, the Middleton and Seward Lines showed a weak subsurface maximum, while chlorophyll fluorescence was more broadly distributed within the upper 50m along the Kodiak Line. Dissolved oxygen appeared to decline rapidly below 100m in oceanic waters.

Underway data shows sea surface temperature generally between 12 and 16°C, and the depression of salinity within Prince William Sound and the ACC, particularly near the Copper River and within Icy Bay (Fig. 7). Air temperatures were typically between 10 and 15 °C during the cruise and there were multiple instances of winds that exceeded 20 m/s (Fig. 8). Compared to the 22-year record along the Seward Line, temperatures averaged across the upper 100m of the line were only 0.22 °C above the mean (Fig. 9), being slightly cooler than normal over the shelf, but over 2 °C above the mean at GAK13.

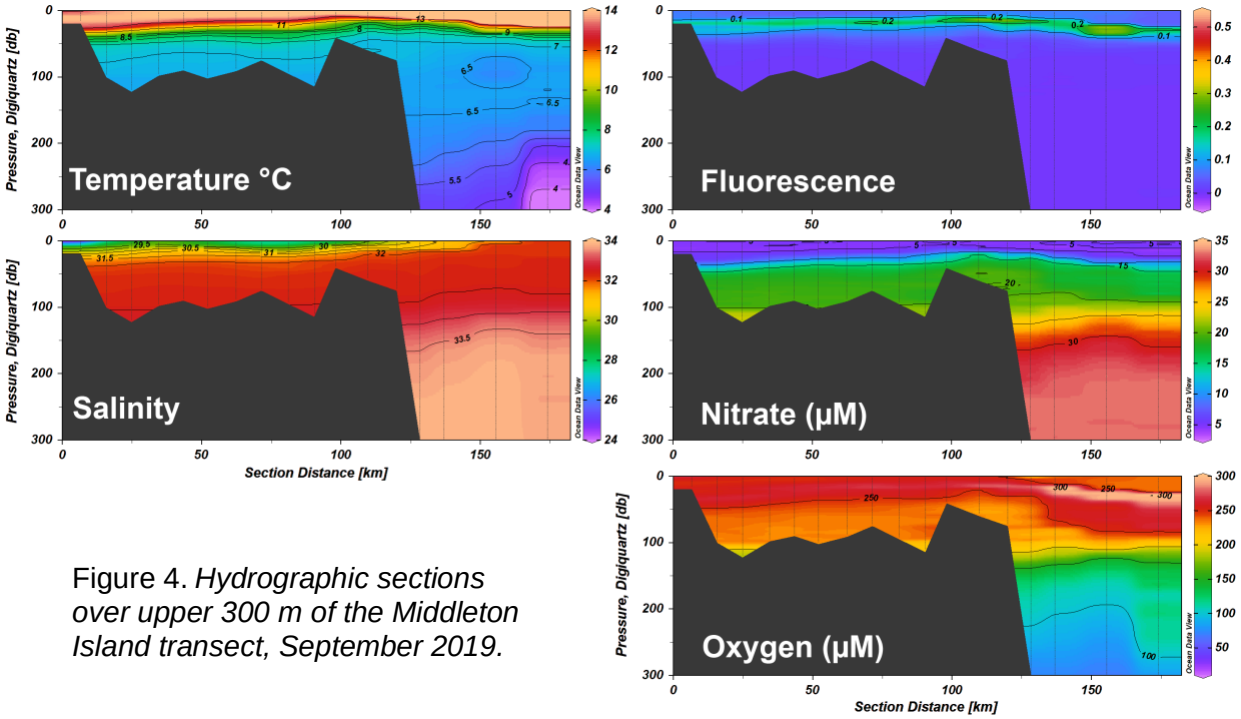


Figure 4. *Hydrographic sections over upper 300 m of the Middleton Island transect, September 2019.*

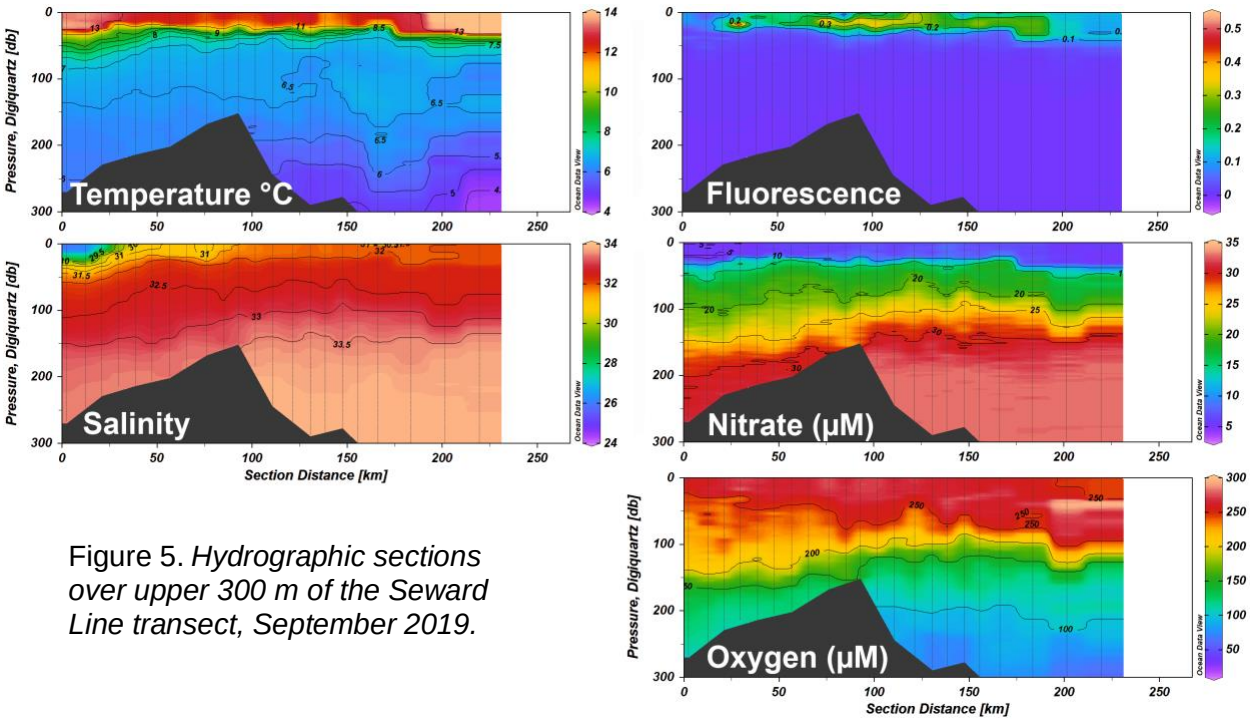


Figure 5. *Hydrographic sections over upper 300 m of the Seward Line transect, September 2019.*

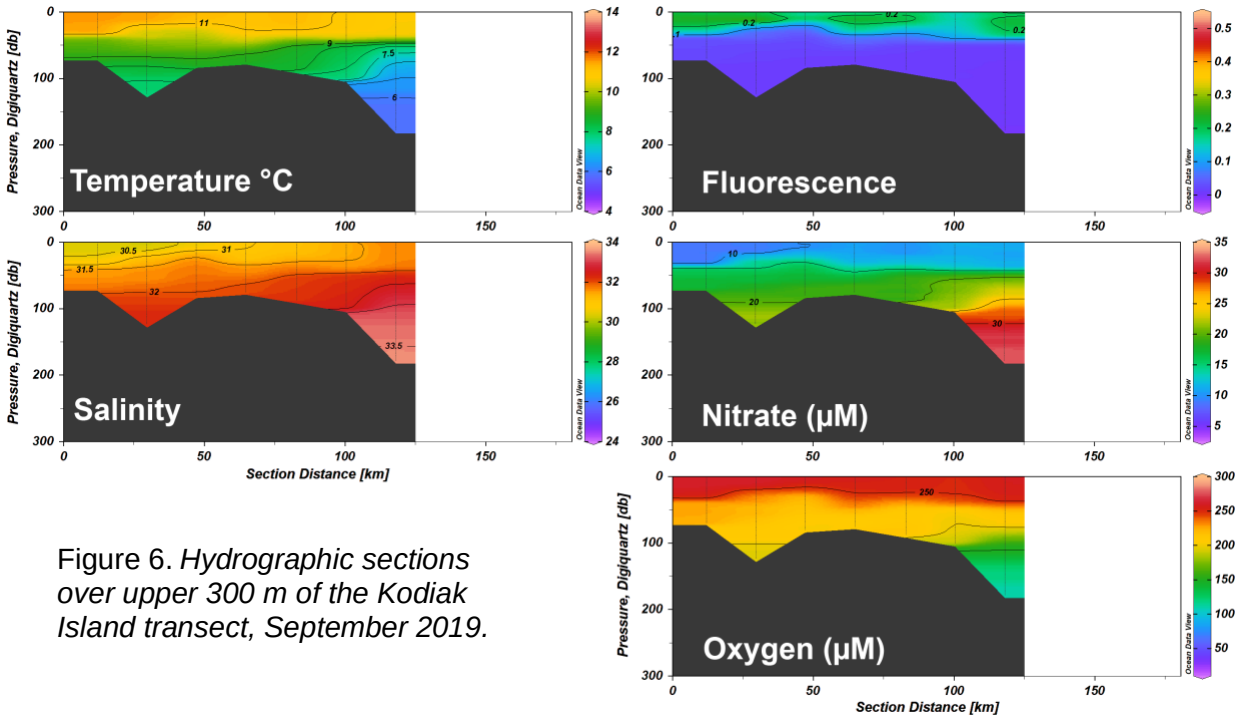
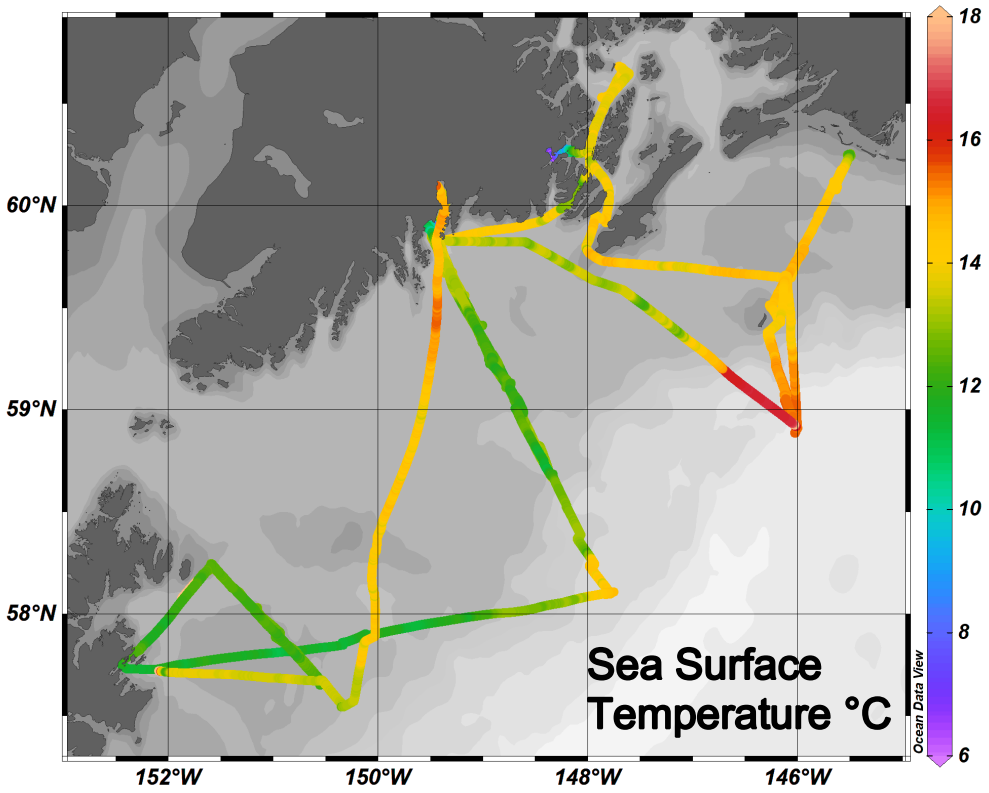


Figure 6. *Hydrographic sections over upper 300 m of the Kodiak Island transect, September 2019.*



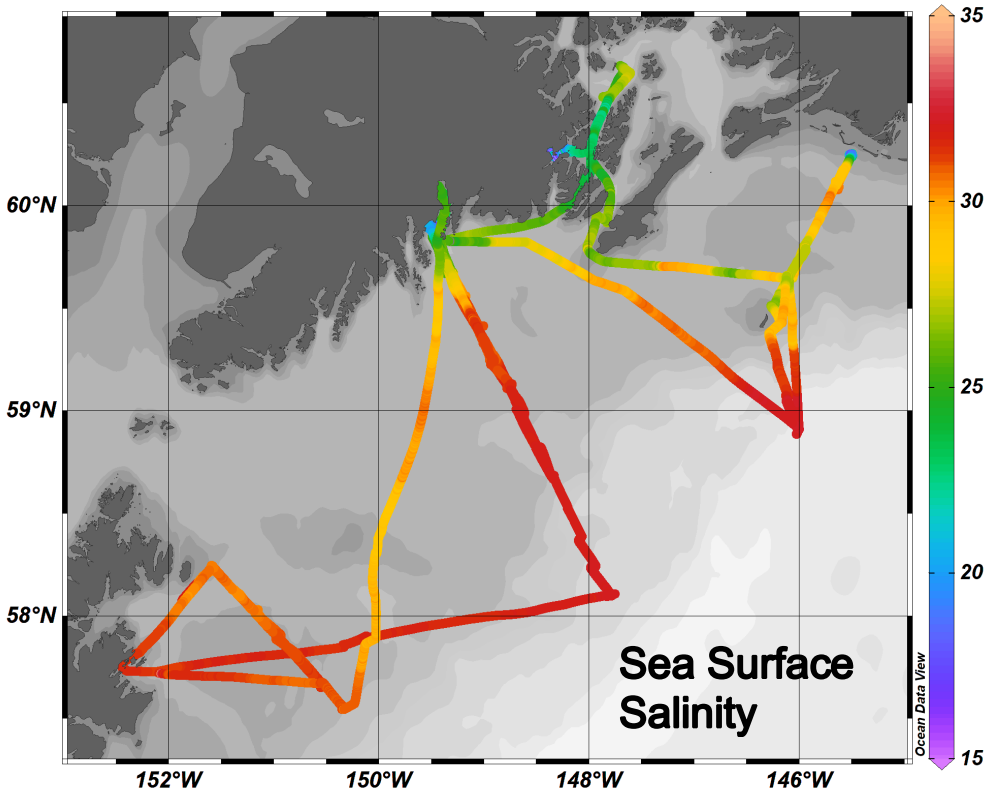


Figure 7. Underway data (~3 m depth) during September 2019 (TxF19).

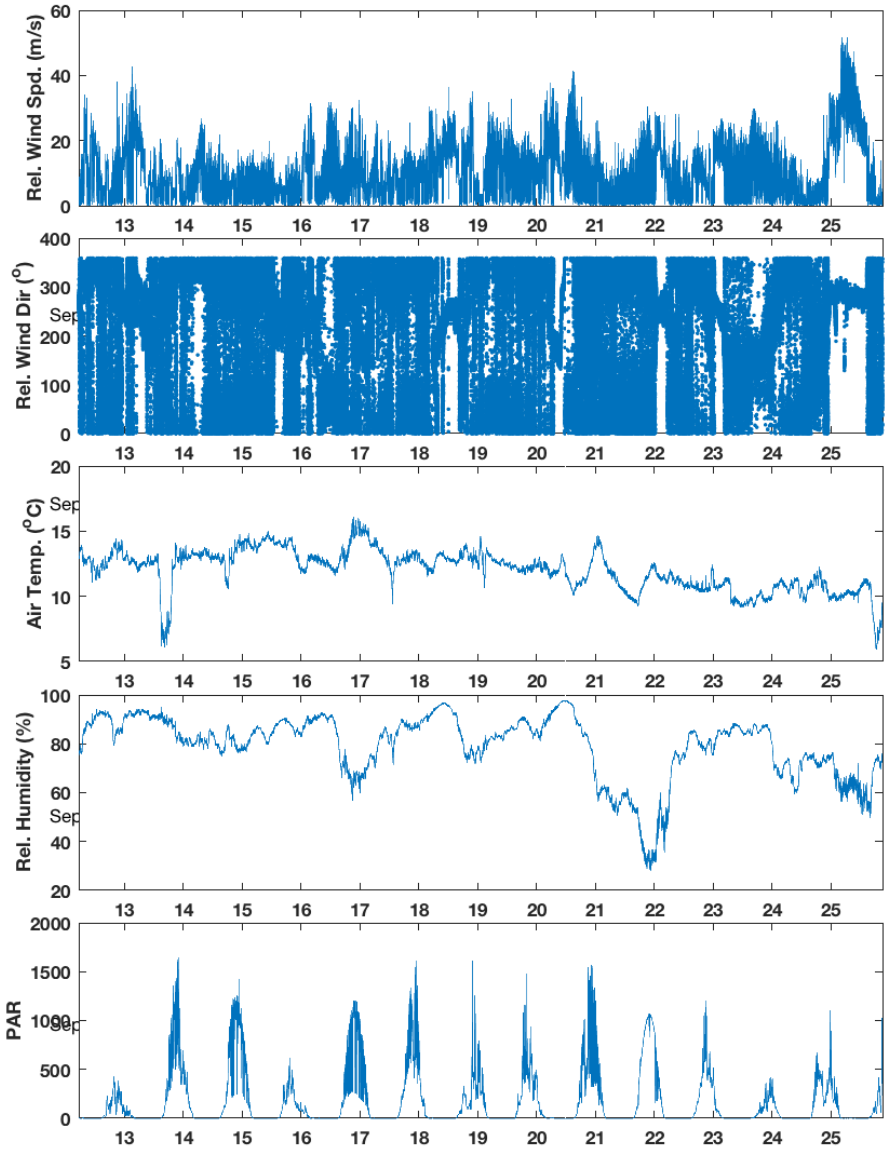


Figure 8. Underway relative wind speed/direction, Air temperature, relative humidity and PAR.

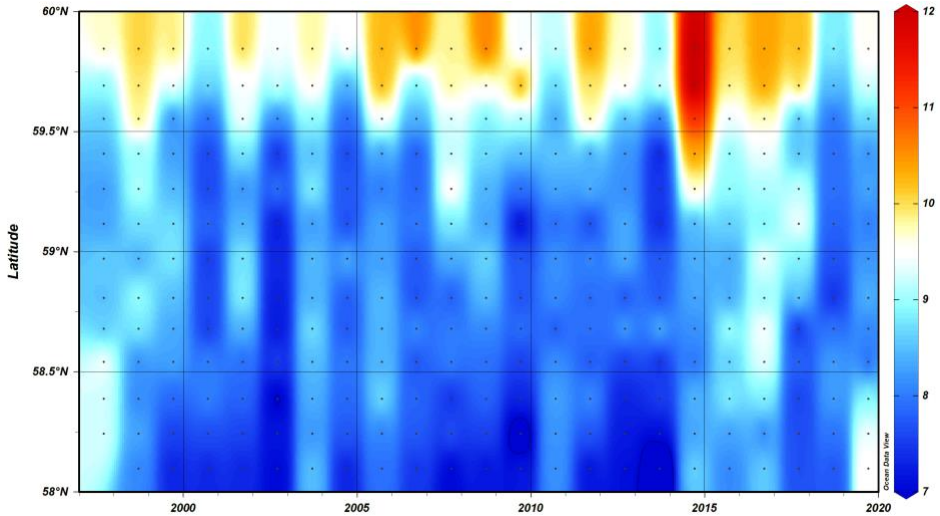


Figure 9. Temperature average of the upper 100m along the Seward Line during September.

Macro- and Micronutrient sample collection and processing

PI: Ana M. Aguilar-Islas
Participants: Mette Kaufman (Res.Tech.), Emily Ortega (MS student), and Annie Kandel (MS student)

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 chemical oceanography graduate students from UAF.

Sample collection and processing for macronutrient analysis:

Filtered seawater samples were collected from surface to a depth of 1000 m from 43 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 $_{o}$C) following collection. Samples were also obtained from primary production casts (42 samples), and from the surface FeFish (41 samples). Mette Kaufman was responsible for sampling and logging. In total, 504 samples were collected for nutrient analysis.

Table 1 Nutrient Sample Collection

Date	Stations	# of samples
9/12	KIP2, PWS1-3	48
9/13	IB0-2, MS2	44
9/14	MID1-6	41
9/15	MID7-10	51
9/16	GAK1-4	48
9/17	GAK5-8	46
9/18	RES2.5	13
9/19	GAK9-13	73
9/22	KOD1-6	46
9/24	KOD7	11
Total	**39 Stations**	**421 samples**
Primary Production	PWS2, MID2, MID5, GAK1, GAK5, GAK9, KOD5	42
Extra Surface FeFish	All lines	41
GRAND TOTAL		**504**

Sample collection for iron analysis:

The *M/V Tiglax* is an adequate platform for collecting surface samples for Fe analysis, but under current configurations vertical sampling is not possible. Surface seawater samples were collected underway in between stations (see Table 2). These samples were obtained from a custom-made surface sampler (Iron Fish) deployed from the starboard crane, and kept at a distance of ~ 5 m from the hull of the ship. Kandel and Kaufman were involved in deck operations with assistance from the crew. A total of 148 samples (Table 2) were collected for analysis of Fe parameters. Seawater was brought into a trace metal clean van outfitted with HEPA filtered air that provides positive pressure where sample collection takes 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 µm cartridges) for the analysis of dissolved iron, iron-binding organic ligands, and nutrients. Unfiltered samples were collected for total dissolvable iron analysis and for particulate iron analysis (through 0.2 µm polycarbonate filter discs). Kandel was responsible for all sample collection and off-line filtration.

Table 2. Samples for iron parameters

Line	Date	DFe	Nutrients	Ligands	TDFe	PFe	Total Samples
PWS	9/12,9/13	8	6	1	5	5	25
MID	9/14-9/15	19	10	3	10	10	52
GAK	9/16-9/19	25	16	6	13	13	73
KOD	9/22,9/24	13	9	3	7	7	39
Total		**65**	**41**	**13**	**35**	**35**	**189**

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

General Notes about the use of the *Tiglax*

DECK OPERATIONS: The use of the *Tiglax* for our LTER operations was adequate for the collection of trace-metal clean surface water and the collection of nutrient samples from the CTD. The deck crew provided excellent support; their help ensured the success of our FeFish deployments. A member of Aguilar-Islas' team was always in charge of FeFish deployment and recovery. The crew was also helpful during loading/offloading and always behaved in a professional manner.

LAB SPACE: Due to limited lab space on this ship, a working van is essential for Fe work. The ship was able to provide electric power to the van, but there were issues with the ground, that need to be addressed before the next cruise. The ship provided compressed air to run the IronFish pump. The location of the van is adequate during calm conditions, but access to the van becomes a safety issue during rough weather.

ISSUES DURING CRUISE: Weather prevented sampling from GAK14 and GAK15 and KOD8-KOD10. The most significant issue we ran into was the tubing for the FeFish. The inside is coated with Teflon and is vulnerable to cracks if the tubing is bent or stepped on, which have the potential to lead to sample contamination. Throughout repeated deployment and recovery the tubing was kinked multiple times and in different places. The kinks were fixed when possible either by adjusting the way the tubing was connected to the line or using makeshift splints of zip ties and electrical tape, but on 9/14 there was a crack that was deep enough to let air in and cause the pump to stop. This was fixed using a putty-like tape from Dr. Hopcroft but is a potential source of contamination to samples taken shortly afterwards, as the supplies used to fix it were not trace metal clean.

Carbonate Chemistry

PI: Claudine Hauri, Participant: None

Pre-filtered DIC samples were taken from Core Intensive stations Along the Seward Line as well as PWS2. Samples were filtered with a 0.45 micron membrane filter using a peristaltic pump to

remove PIC. Triplicates were taken for a single depth at most station. During productivity casts if the light level depths were within +/- 2 meters of a DIC depth we adjusted the DIC depth so these overlapped. In total 80 samples were collected. An independent set of triplicate samples were collected from the surface and bottom bottles of GAK1 to be analyzed at UAF's OARC.

Station	Number of samples
GAK1	12
GAK4	8
GAK5	11
GAK9	13

Station	Number of samples
PWS2	15
KOD5	7
KOD1	6
KOD2	8

Particles

PI: Andrew McDonnell, Participant: None

The LISST collected particle size and abundance data for all CTD casts. The UVP continues to be temperamental. The UVP appears to have collected data during the cruise, but we have been unable to download it. The instrument has been shipped back to the manufacturer to retrieve the information.

Phytoplankton and Microzooplankton

PI: Suzanne Strom
Participants: Kerri Fredrickson, Hana Busse, Jake Lawlor (all WWU)

Phytoplankton biomass: Phytoplankton biomass was characterized by size-fractionated chlorophyll at all non-intermediate shelf stations and most PWS stations (total = 37 vertical profiles); only total chl (GFF) was measured in Icy Bay. Samples were analyzed fluorimetrically on board (7 depths per station). Primary production estimates were made at all intensive stations sampled (total = 7) using the 13-C method and 24-h deck incubations. 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. At intensive stations only, additional samples were taken from 10 and either 0, 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 microzooplankton samples was also collected.

Mixotrophy: Surface and/or 10 m samples were taken at intensive stations as well as KOD-3, PWS-1, and PWS-3 for identification of autotrophic flagellates with ingested *Synechococcus*, and other evidence of mixotrophic potential or activity. These samples were fixed in glutaraldehyde, DAPI-stained, and separate subvolumes filtered onto 10 and 1.2 µm pore size filters, which were slide-mounted and frozen.

Organic carbon characterization: For DOC profiles, samples were filtered and frozen from each inner, outer and intensive station (total = 10); depths sampled were mainly 150 m and above, and corresponded to nutrient sampling depths. At intensive stations only (total =7), a 4-depth vertical profile (0, 10, 20, 40 m) was sampled for POC and PIC.

Preliminary observations: Despite persistently stormy weather, integrated chlorophyll remained fairly consistent along each sampling line (Fig.10). A 20-30 m sub-surface chlorophyll maximum was observed across most of the MID line, but elsewhere the SCM was not evident and highest chlorophyll concentrations were distributed throughout the upper 20 m of the water column (upper 40 m at the outer ends (as sampled) of GAK and KOD lines). This likely represents the onset of fall mixing in response to the high winds. Most stations were dominated by small (<20 µm) cells, exceptions being the inner portion of the GAK line and around Middleton Island. Storms and high seas prevented sampling of GAK 14-15 and KOD 8-10.

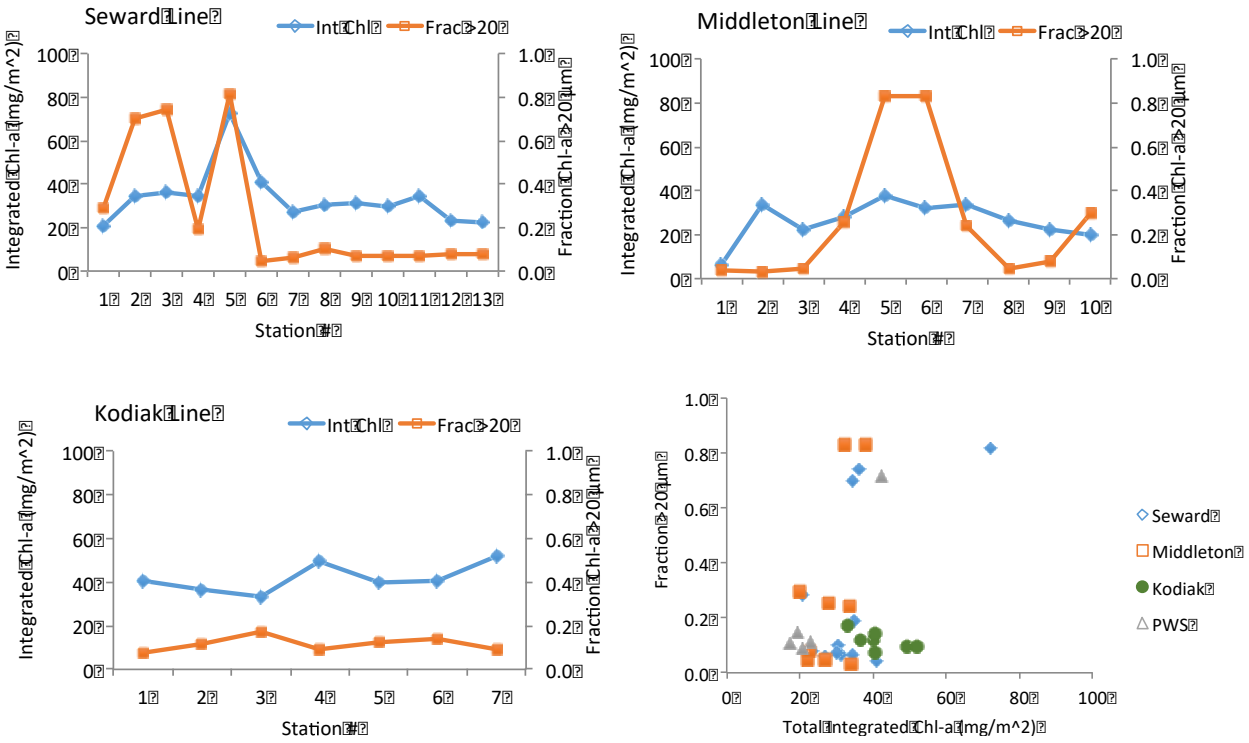


Figure 10. Size-fractioned chlorophyll collected along transects during September 2019

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

Station	Chl SF	Chl Tot	Lugols uzoo Prof	Lugols uzoo 10m	Diatom	Mixo	Nano	DOC	HPLC	Molecular TAR	Molecular JG	POC/PIC	Prod
RES2.5	x												
GAK1	x		x		x	x	x	x	x	x			
GAK2	x											x	x
GAK3	x			x	x								
GAK4	x												
GAK5	x		x		x	x	x	x	x	x			
GAK6	x												
GAK7	x			x	x								
GAK8	x												
GAK9	x		x		x	x	x	x	x	x			
GAK10	x											x	x
GAK11	x			x	x								
GAK12	x												
GAK13	x			x	x								
KOD7	x												
KOD6	x										x	x	x
KOD5	x		x		x	x	x	x	x	x			
KOD4	x												
KOD3	x			x	x								
KOD2	x										x	x	x
KOD1	x			x	x	x							
MID1	x			x	x	x					x		
MID2	x		x		x	x	x	x	x	x			
MID3	x			x	x						x	x	x
MID4	x			x	x								
MID5	x										x		
MID6	x			x	x								
MID5	x		x		x	x	x	x	x	x	x		
MID7	x			x	x								
MID8	x										x	x	x
MID9	x			x	x								
MID10	x			x	x	x							
PWS3	x											x	x
PWS2	x		x		x	x	x	x	x	x			
PWS1	x												
KIP2	x												
IB1		x											
MS2	x			x	x								
TOTAL	**37**	**1**	**7**	**14**	**21**	**10**	**7**	**7**	**7**	**7**	**7**	**7**	**7**

Table Key:

SF Chl: size-fractionated chlorophyll-a; water sample filtered in series through a 20 µm pre-size filter followed by a glass fiber filter (effective pore size 0.7 µm)

Tot Chl: total chlorophyll-a; water sample filtered through glass fiber filter only

Lugol's 10m: water sample preserved in acid Lugol's iodine solution (final concentration 5%) for microscopy analysis of size and composition of ciliate and dinoflagellate microzooplankton (cells ≥15 µm). Sample collected from 10 m.

Lugol's profile: Same as above but samples collected from 4 depths to yield a vertical profile.

Diatom: water sample preserved in borate-buffered formalin (final concentration 2%) for microscopy analysis of diatom community.

HPLC: water sample filtered (glass fiber, 0.7 µm) and frozen in liquid N2 for HPLC analysis of phytoplankton pigments (chemotaxonomy).

Mol: water sample filtered (0.2 µm) and frozen in liquid N2 for molecular analysis of eukaryotic microbial community composition. TAR: samples for Tatiana Rynearson (URI); JG: samples for Jeanette Gann (NOAA AFSC)

DOC: water sample filtered directly from Niskin through in-line pre-combusted glass fiber filter and filtrate stored frozen for analysis of dissolved organic carbon concentration.

POC/PIC: Paired samples from a single Niskin filtered through pre-combusted glass fiber filters and filters stored frozen for analysis of particulate organic and particulate inorganic carbon. Filtered volume was increased on this cruise to 2.3 L per sample for all but high chlorophyll depths/stations.

Prod: Water column primary productivity measured via 24-h incubation of samples from different depths with 13C-labeled sodium bicarbonate.

Meso/Macro Zooplankton

PI:Hopcroft, Participants: Jennifer Questel, Emily Stidham, Heidi Mendoza-Islas, Kira Monell, Cara Nelson (teacher);

Zooplankton sampling operations were divided into distinct day and night activities. During daytime, Quadnets (Quad frame has 4 nets, 2 of 150 µm mesh and 2 of 53 µm mesh) casts were conducted at all stations (except "i" stations) to 100 m depth, or within 5 m of the bottom at shallower stations. At intensive stations, and additional Quadnet cast was taken, with the 150 µm 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 150 µm mesh nets was deployed vertically to 200 m (shelf) with a second cast deployed to 750 m (PWS2) dividing strata at 600, 400, 300, 200,100, 60, 40, and 20 m (a vertical multinet could not be completed on the outer Seward Line due to weather). During night-time a Bongo net of 505 µm mesh was towed obliquely to 200 m depth (or 5 m above the bottom) at all shelf stations except for the Seward Line. Bongo depths were monitored using a Fastcat (SBE49) CTD mounted immediately above the nets. Along the Seward Line and within PWS, a multinet equipped with 505 µm-mesh nets was towed obliquely to 200 m depth (or 5 m above the bottom) dividing strata at 100, 60, 40, and 20 m. Poor weather prevented any sampling at GAK14 and GAK16, as well as KOD8-10, and prevented Multinet deployments at GAK8-12 and Bongo deployment at KOD7. Methot nets were collected at night concurrent with most Multinets or Bongos.

Table 4. Sampling effort for Zooplankton. Intensive stations highlighted. *samples taken for bulk genetics, sorting or imaging.

Station	Calvet-Quad	Multi Vert.	Multi Tow	Bongo	Methot
RES2.5	x				
GAK1	X*	x	x		x
GAK2	x		x		x
GAK3	x		x		x
GAK4	x		x		x
GAK5	X*	x	x		x
GAK6	x		x		X
GAK7	x		x		
GAK8	x		x		x
GAK9	X*	x	x		x
GAK10	x				
GAK11	x				
GAK12	x				
GAK13	x		x		
GAK14					
GAK15					
KOD1	x			X	x
KOD2	x			X	x
KOD3	x			X	x
KOD4	x			X	x
KOD5	x			X	
KOD6	x			X	x
KOD7	x				
KOD8					
KOD9					
KOD10					
MID1	x				
MID2	x			X	X
MID3	x			X	X
MID4	x			X	X
MID5	x			X	X
MID6	x			X	X
MID7	x			X	X
MID8	x			X	X
MID9	x			X	X
MID10	x			X	X
MS2	x		x		
KIP0					
KIP2	X*		x		x
PWS1	x		x		
PWS2	X*	x	x		
PWS3	x				
PWSA					
IB0	x				
IB1	x				
IB2	x				
CG0					
CG1					
CG2					
TOTAL	**39**	**4**	**14**	**15**	**23**

PI: Petra H. Lenz & Russ Hopcroft. Participant: Kira Monell

Project Goals: *Neocalanus* emergence from diapause (NSF project - UHM & UAF; PIs: Lenz, Hopcroft, Christie and Hartline) – transcriptional profiling of individuals in the genus *Neocalanus* in the adult stage. 2019 marks the 5th year of fall collection of Neocalanus flemingeri from our PWS2 station.

Research Activities:

- Deep collections were taken with MultiNet (150 µm mesh nets) towed vertically from depth (PWS2: 750 m) for samples to enumerate diapausing individuals (no aggregations of Neocalanus found above 300 m).
- Participated in obtaining images of *N. flemingeri*, *N. plumchrus* and *N. cristatus* from PWS2 400-500 m starta for prosome length & width and lipid sac volume (up to 50 per species) prior to preservation. A separate subset of *N. flemingeri* were sorted for cell-division experiments and RNA sequencing
- Cell division: termination of diapause and early oogenesis cell division was tracked using EdU in females collected from a deep vertical multinet tow. Sample site was the Pleiades in PWS, samples were taken from 500-400 m strata. Experiments lasted over a 3 week period with females either being given EdU and fixed immediately or given EdU and returned to flask to track movement of cells.
- RT-qPCR: to correspond with the cell division experiment, 6-8 individuals were placed in RNAlater for RT-qPCR at each of the cell division experimental time points.
- Additional individuals were preserved for *in situ* hybridization, individuals were only preserved for one time point (3 weeks) to fill a gap in the summer cruise samples.
- Images of experimental individuals were taken at three time points (24 hr, 72 hr, and 1 wk) to track how lipid sac volume changes as days since collection increases.

Marine bird and marine mammal surveys (USFWS)

PI: Dr. Kathy Kuletz, U.S. Fish and Wildlife Service
Dan Cushing, Pole Star Ecological Research LLC, onboard observer and report author

Background

We conducted marine bird and marine mammal surveys in the Northern Gulf of Alaska (NGA), September 10 to 28, 2019, aboard the 37-m R/V *Tiglax*, as a component of the NGA Long-term Ecological Research (NGA-LTER) cruise led by chief scientist Russell Hopcroft of the University of Alaska Fairbanks. Immediately following the NGA-LTER cruise, we conducted additional surveys in the study area during an acoustic mooring recovery led by chief scientist Bruce Thayre of Scripps Institute of Oceanography. Seabird and marine mammal surveys were conducted when the vessel was underway, including transits between sampling stations, sampling lines, and the ports of Homer, Seward, and Kodiak. Weather conditions during the September 2019 cruise were unusually poor. Six storms occurred during the cruise, requiring station sampling to be called off on multiple occasions, and as a result, the outer stations of the Seward and Kodiak lines were not sampled. In addition, high sea state precluded visual surveys during some transits.

Methods

Observer D. Cushing conducted visual surveys during daylight hours while the vessel was underway. Surveys were conducted from the flying bridge using a modified line-transect

protocol. The 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: 0-50 m, 51-100 m, 101-200 m, and 201-300 m. 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. Following completion of the cruise, survey transects were subdivided into 3 km segments, and density values (birds km^{-2}) were calculated for each taxon in each transect segment.

Preliminary results

We conducted 1452 linear km of surveys during the September 2019 cruise (Figure 11). On-transect, we observed a total of 6269 individuals of 38 species of birds, with an additional 14 species observed off-transect during surveys or while at stations (Table 5). Averaged across all 3 km transect segments, the mean density (all bird species combined) was 15.0 birds km^{-2}. This is higher than the 8.5 birds km^{-2} observed during both the April-May and July 2019 cruises, and is also higher than the 13.0 birds km^{-2} observed during September 2018.

The majority (43%; Table 5) of the birds observed during the cruise were sooty shearwaters. Sooty shearwaters were especially abundant over Albatross Bank east of Kodiak Island; near station KOD 4, an estimated 3000 sooty shearwaters foraged in dense flocks near humpback and fin whales. Sooty shearwaters were also abundant at lower Cook Inlet and Cape Cleare (Figure 12), with flocks also occurring within Prince William Sound, in Montague Strait.

The second most abundant species of seabird during the fall 2019 cruise was the northern fulmar, which made up 13% of bird observations. Fulmars were widely distributed, with the exception of inshore waters (Figure 13). The highest concentrations of fulmars were observed over banks along the Kodiak and Seward lines.

Common murres comprised 12% of total birds. Common murres were widely distributed over the inner shelf and over banks. The largest concentrations of occurred over Albatross Bank, and also along the inner portion of the Middleton Line, where murres were associated with fronts in the Copper River plume (Figure 14).

Black-legged kittiwakes species made 7% of total birds. While kittiwakes were widely distributed, the highest concentrations occurred along the coastline, including Kodiak Island, the Kenai Peninsula, Prince William Sound, and Middleton Island (Figure 15).

Four different species each individually made up 3% of total birds; glaucous-winged gull, Buller's shearwater, black-footed albatross, and fork-tailed storm-petrel (Table 5). Like kittiwakes, glaucous-winged gulls were most abundant near the coast (Figure 16), and also between Middleton Island and the mouth of the Copper River (both of which are locations of breeding sites). Buller's shearwater, a seasonal fall visitor to the northern Gulf of Alaska, was especially abundant in 2019, with a total of 463 observed both on- and off-transect (Figure 17).

Table 5. Marine birds observed during the September 2019 NGA-LTER cruise. Numbers include on-transect observations only. Species only observed off-transect are indicated by an asterisk.

Common name	Scientific name	Number	% of total
American wigeon	*Mareca americana*	3	< 0.1
Northern pintail	*Anas acuta*	*	-
Greater scaup	*Aythya marila*	1	< 0.1
Lesser scaup	*Aythia affinis*	*	-
Common eider	*Somateria mollissima*	1	< 0.1
Surf scoter	*Melanitta perspicillata*	1	< 0.1
White-winged scoter	*Melanitta fusca*	4	0.1
Goldeneye spp.	*Bucephala* spp.	*	-
Red-necked grebe	*Podiceps grisegena*	*	-
Sandhill crane	*Antigone canadensis*	*	-
Red-necked phalarope	*Phalaropus lobatus*	*	-
Red phalarope	*Phalaropus fulicaria*	22	0.4
Phalarope spp.	*Phalaropus* spp.	27	0.4
South polar skua	*Stercorarius maccormicki*	3	< 0.1
Pomarine jaeger	*Stercorarius pomarinus*	10	0.2
Parasitic jaeger	*Stercorarius parasiticus*	8	0.1
Jaeger spp.	*Stercorarius* spp.	2	< 0.1
Common murre	*Uria aalge*	751	12.0
Thick-billed murre	*Uria lomvia*	1	< 0.1
Murre spp.	*Uria* spp.	9	0.1
Pigeon guillemot	*Cepphus columba*	1	< 0.1
Marbled murrelet	*Brachyramphus marmoratus*	5	0.1
Brachyramphus murrelet spp.	*Brachyramphus* spp.	1	< 0.1
Ancient murrelet	*Synthliboramphus antiquus*	1	< 0.1
Cassin's auklet	*Ptychoramphus aleuticus*	2	< 0.1
Parakeet auklet	*Aethia psittacula*	5	0.1
Rhinoceros auklet	*Cerorhinca monocerata*	15	0.2
Horned puffin	*Fratercula corniculata*	108	1.7
Tufted puffin	*Fratercula cirrhata*	95	1.5
Alcid spp.	*Alcidae* spp.	2	< 0.1
Black-legged kittiwake	*Rissa tridactyla*	490	7.8
Mew gull	*Larus canus*	6	0.1
Herring gull	*Larus argentatus*	62	1.0
Glaucous-winged gull	*Larus glaucescens*	215	3.4
Arctic tern	*Sterna paradisaea*	*	-
Pacific loon	*Gavia pacifica*	1	< 0.1
Common loon	*Gavia immer*	*	-
Laysan albatross	*Phoebastria immutabilis*	4	0.1
Black-footed albatross	*Phoebastria nigripes*	207	3.3
Short-tailed albatross	*Phoebastria albatrus*	*	-
Fork-tailed storm-petrel	*Oceanodroma furcata*	168	2.7
Leach's storm-petrel	*Oceanodroma leucorhoa*	1	< 0.1
Northern fulmar	*Fulmarus glacialis*	809	12.9
Buller's shearwater	*Ardenna bulleri*	211	3.4
Short-tailed shearwater	*Ardenna tenuirostris*	149	2.4
Sooty shearwater	*Ardenna grisea*	2711	43.2
Flesh-footed shearwater	*Ardenna carneipes*	9	0.1
Dark shearwater spp.	*Ardenna* spp.	127	2.0
Manx shearwater	*Puffinus puffinus*	*	-
Red-footed booby	*Sula sula*	*	-
Double-crested cormorant	*Phalacrocorax auritus*	3	< 0.1
Red-faced cormorant	*Phalacrocorax urile*	5	0.1
Pelagic cormorant	*Phalacrocorax pelagicus*	11	0.2
Pelagic or red-faced cormorant	*Phalacrocorax pelagicus or urile*	1	< 0.1
Great blue heron	*Ardea herodias*	*	-
Northern harrier	*Circus hudsonius*	*	-
Bald eagle	*Haliaeetus leucocephalus*	1	< 0.1
Merlin	*Falco columbarius*	*	-
Grey-crowned rosy-finch	*Leucosticte tephrocotis*	*	-
Total		**6269**	**100**

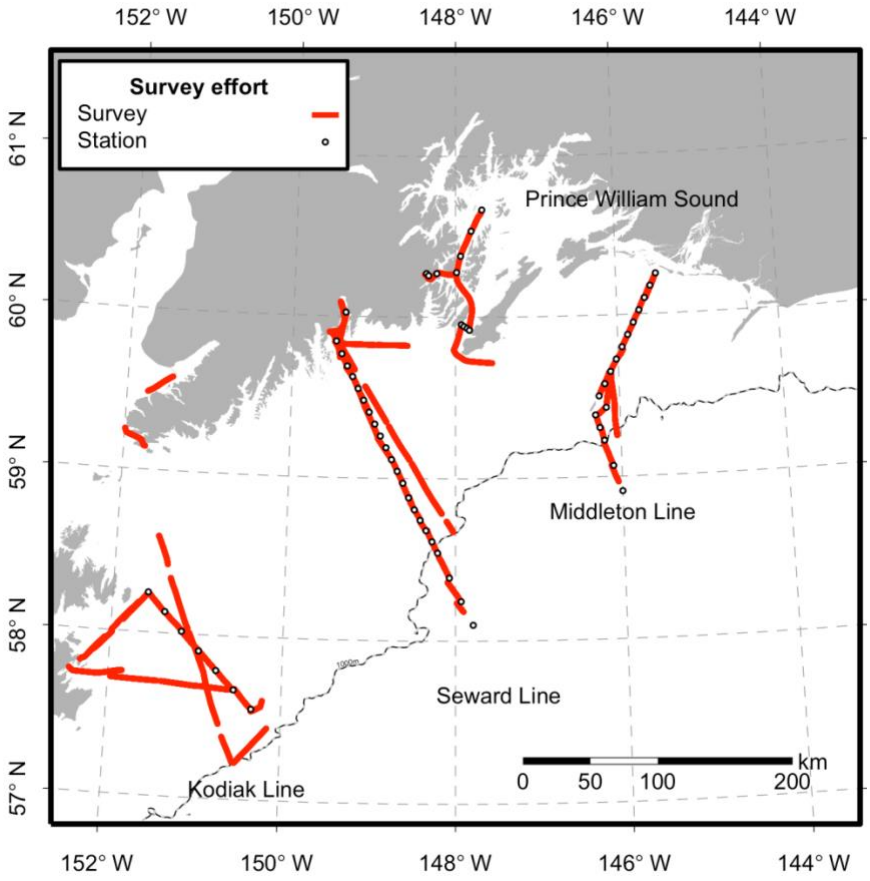


Figure 11. Location of seabird and marine mammal surveys (red) during the September 2019 NGA-LTER cruise.

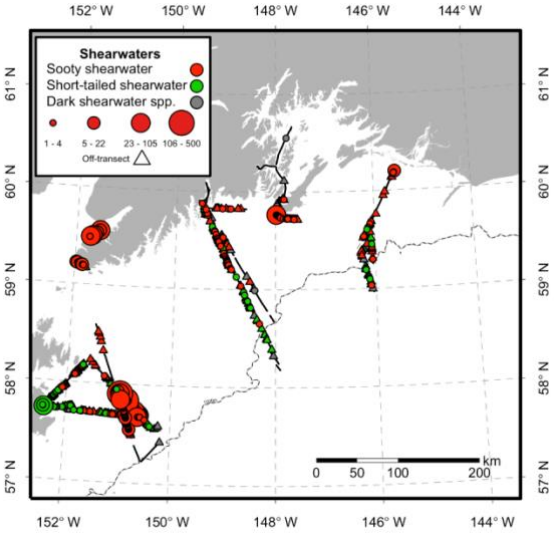


Figure 12. Sooty and short-tailed shearwater.

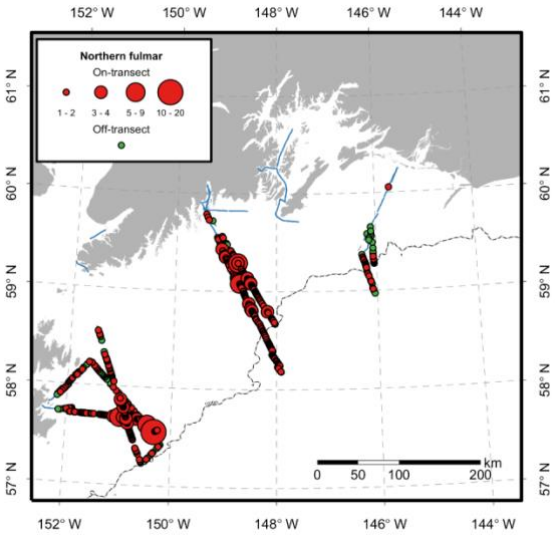


Figure 13. Northern fulmar.

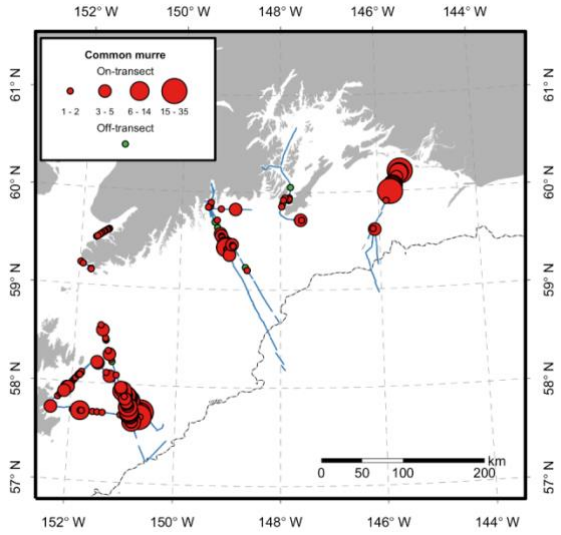


Figure 14. Common murre.

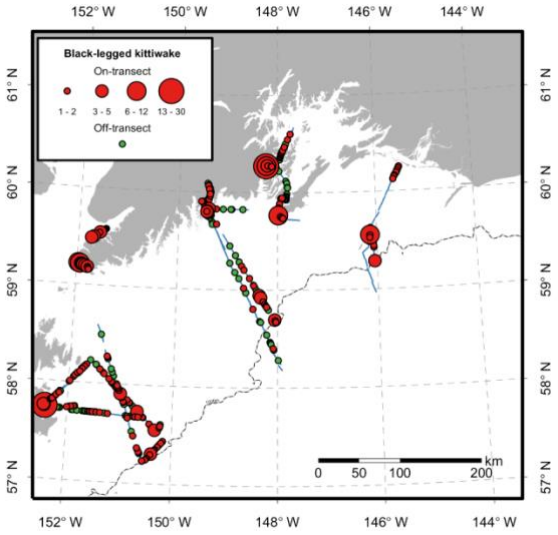


Figure 15. Black-legged kittiwake.

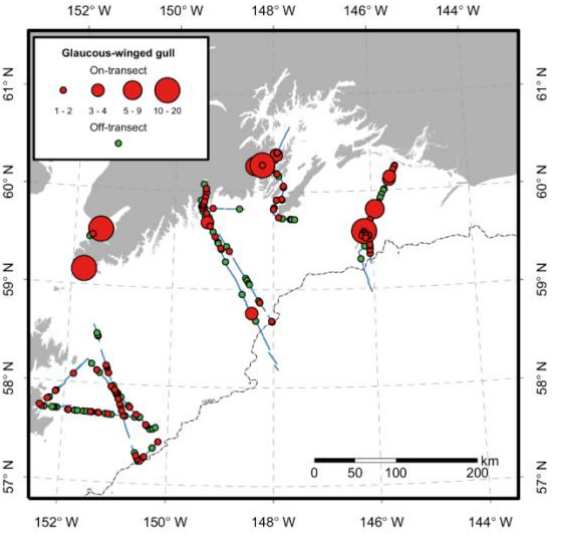


Figure 16. Glaucous-winged gull.

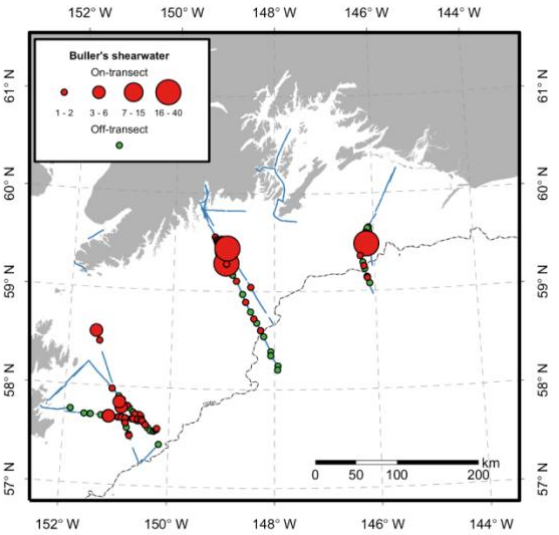


Figure 17. Buller's shearwater.

Buller's shearwaters were more abundant over the inner shelf region than during any previous September cruises. The Gulf of Alaska is this species' northernmost range, and it is more typically found in Pacific temperate and tropical waters. Black-footed-albatross (Figure 18) were most abundant near the shelf-break, with flocks of up to 250 occurring at stations just beyond the shelf-break along the Seward Line. Fork-tailed storm-petrels were distributed from inshore (e.g., Prince William Sound, Resurrection Bay) to the most offshore waters sampled (Figure 19). Storm-petrels were most abundant near the shelf-break south of Middleton Island.

During the fall 2019 cruise, we were fortunate to observe several rare seabirds. On September 13, 2019, we observed a Manx shearwater at Cape Cleare (Figure 20). Manx shearwater is primarily an Atlantic species. First observed in the Pacific Ocean in the 1970's, sightings along the Pacific coast of North America have been increasing in number since the 1990's but remain rare (annual or possibly annual in small numbers). Breeding sites in the Pacific remain unknown

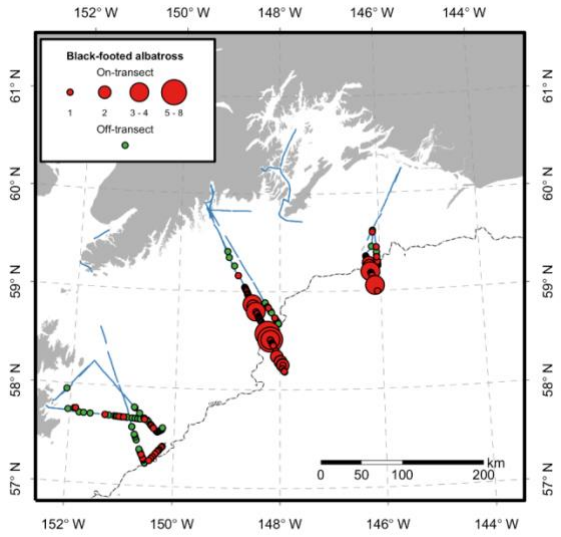


Figure 18. Black-footed albatross.

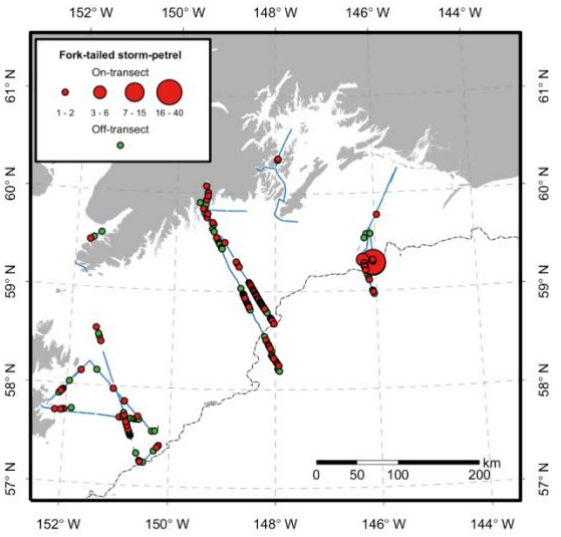


Figure 19. Fork-tailed storm-petrel.

Figure 20. Manx shearwater at Cape Cleare on September 13, 2019.

(Howell 2012). Multiple birds together have been reported at Middleton Island (Gibson et al., 2008, DeCicco et al., 2017).

A juvenile red-footed booby flew by the bridge of the ship while 8 miles east of Middleton Island (Figure 21). The red-footed booby is a pantropical seabird species, with the closest breeding locations in the Hawaiian Islands and Islas Revillagigedo, Mexico (CBRC 2007). To our knowledge, this is the fourth record of a red-footed booby in Alaska (and the second from *Tiglax*!), with two sightings in the Gulf of Alaska in August and September 2015 (Gibson et al., 2018), and one off of Agattu Island in the Aleutians in 2018.

South polar skuas are considered causal in Alaska (not annual but reoccur in irregular intervals; Gibson and Winthrow 2015). During the fall 2019 cruise, including observations during surveys and while at stations, we had a total of 11 sightings of south-polar skuas, all over the shelf. We observed 23 flesh-footed shearwaters (annual to semi-annual in Alaska; Gibson and Winthrow 2015). Most flesh-footed shearwaters occurred near Middleton Island. We had 15 observations of short-tailed albatross (total world population 4000), all of which were seen on the Seward Line. All but one short-tailed albatross were juveniles in plumage stage 1 (ages 1-2; Howell

Figure 21. Juvenile red-footed booby 8 miles east of Middleton Island on September 15, 2019.

2012), with one stage 3 juvenile (ages 4-6+). In our experience, short-tailed albatrosses are attracted to ships, and it is likely that some of these sightings were repeat observations of the same individuals. However, four short-tailed albatrosses occurred simultaneously at station GAK 9, and three occurred simultaneously at station GAK 11.

We observed a total of seven dead birds during the cruise. These included three rhinoceros auklets, one horned puffin (apparently a juvenile), one unidentified gull, and two unidentified birds. In comparison, no dead birds were observed during the spring or summer 2019 cruises. Seven dead birds were also observed during the fall 2018 cruise, and this number was also higher than spring or summer 2018 (three and zero dead birds, respectively). Mortality of recently fledged young is one possible hypothesis for the higher incidence of dead seabirds during fall.

We observed nine species of marine mammal (Table 6), with 59 individuals on-transect and 160 off-transect. The most abundant toothed whale (odontocete) species observed was the Dall's porpoise. Most Dall's porpoises were observed near the coast, with offshore sightings near Middleton Island (Figure 22). A total of 22 killer whales were encountered over the inner shelf, middle shelf, and in Prince William Sound. Harbor porpoises were observed in Kachemak Bay.

The most abundant baleen whale (mysticete) species was the fin whale. Fin whales occurred near the shelf-break, and also over Albatross Bank, and in coastal waters near Kodiak Island and Resurrection Bay (Figure 23). Humpback whales were observed in Kachemak Bay, over Albatross Bank (together with fin whales and huge flocks of shearwaters), and near Middleton Island.

Harbor seals occurred in Prince William Sound, and a single individual was observed over the middle shelf, hauled out on a log (Figure 24). One northern fur seal was observed in oceanic waters. Steller Sea lions were observed in Prince William Sound, and one was also observed on the outer shelf. Sea otters were observed in coastal areas.

Table 6. Marine mammal species observed during the September 2019 NGA-LTER cruise.

Common name	*Scientific name*	Number on-transect	Number off-transect
Fin whale	*Balaenoptera physalus*	5	21
Humpback whale	*Megaptera novaeangliae*	2	13
Killer whale	*Orcinus orca*	4	18
Whale spp.	*Cetacea* spp.	0	16
Dall's porpoise	*Phocoenoides dalli*	13	18
Harbor porpoise	*Phocoena phocoena*	0	2
Steller sea lion	*Eumetopias jubatus*	1	4
Northern fur seal	*Callorhinus ursinus*	1	0
Harbor seal	*Phoca vitulina*	4	46
Sea otter	*Enhydra lutris*	29	21
Total		**59**	**160**

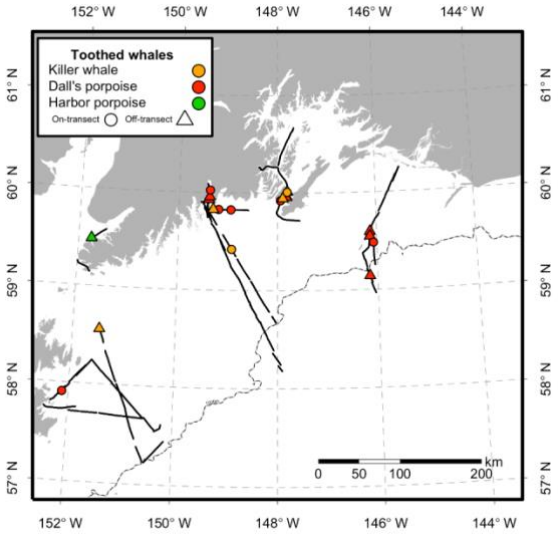


Figure 12. Toothed whales.

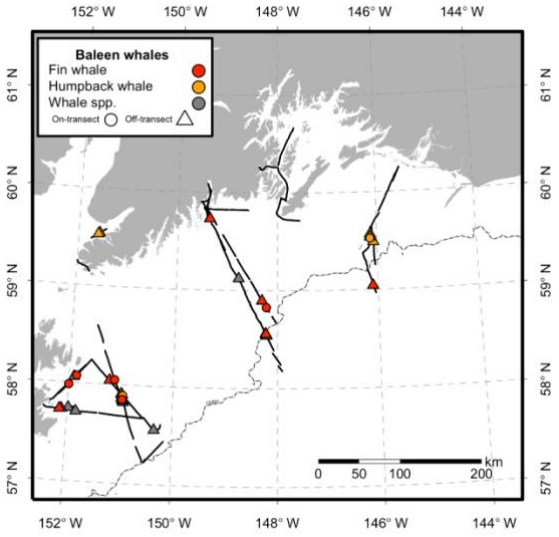


Figure 23. Baleen whales.

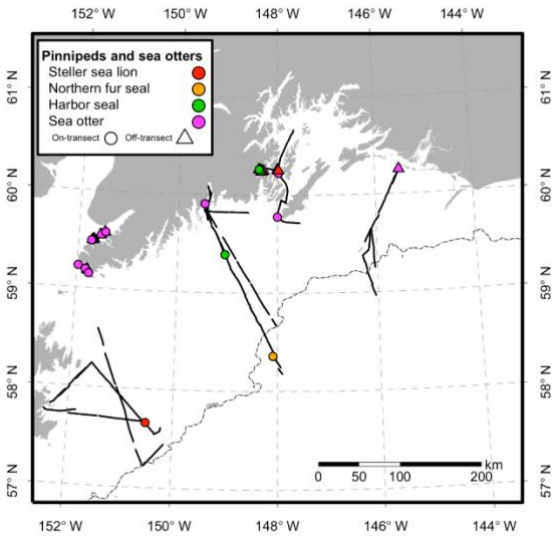


Figure 24. Pinnipeds and sea otters.

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Outreach

Teacher-at-sea Cara Nelson joined us from Bartlett High School in Alaska. She participated in Seward Line net sampling on night shift, and kept a log for her class back home. At the end of the cruise she produced 8 blogs describing various aspects of the cruise and our daily adventures (see https://noaateacheratsea.blog/?s=Cara+Nelson).

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 01 Start	Res2.5	9/11/2019 23:08	7:08:20 AM	60.02819	149.3534	300	Secondary sensors not valid	Hopcroft	due to missing hose
2	CTD 01 End	Res2.5	9/11/2019 23:23	7:23:39 AM	60.03091	149.3522	300		Hopcroft	
3	CTD 02 Start	KIP2	9/12/2019 7:18	3:18:17 PM	60.27833	147.9873	586	Had to bring back on deck,	Hopcroft	cable disconnected from CTD
4	CTD 02 Start	KIP2	9/12/2019 7:48						Hopcroft	
5	CTD 02 End	KIP2	9/12/2019 8:23						Hopcroft	
6	CalVET Net Tow Start	KIP2	9/12/2019 8:30	4:30:33 PM	60.27757	147.9885	583	1	Hopcroft	
7	CalVET Net Tow End	KIP2	9/12/2019 8:37	4:37:24 PM	60.27728	147.9899	583	1	Hopcroft	
8	Fe Fish Start	KIP2	9/12/2019 8:53	4:53:43 PM	60.28457	147.9827	583		Aguilar-Islas	
9	CTD03 Start	PWS1	9/12/2019 9:39	5:39:11 PM	60.37397	147.9417	338		Hopcroft	
10	CTD03 Start	PWS1	9/12/2019 9:48	5:48:15 PM	60.37396	147.9421	338		Hopcroft	
11	CTD03 Start	PWS1	9/12/2019 9:49	5:49:02 PM	60.37391	147.9421	338	Bottles 1 and 2 blew	Hopcroft	
12	CTD03 End	PWS1	9/12/2019 10:09	6:09:34 PM	60.37271	147.9426	338		Hopcroft	
13	CalVET Net Tow Start	PWS1	9/12/2019 10:18	6:18:34 PM	60.37197	147.9429	338	2	Hopcroft	
14	CalVET Net Tow End	PWS1	9/12/2019 10:25	6:25:05 PM	60.37165	147.9433	338	2	Hopcroft	
15	CTD04 Start	PWS1	9/12/2019 10:39	6:39:47 PM	60.37109	147.9447	338	Recast	Hopcroft	
16	CTD04 End	PWS1	9/12/2019 11:05	7:05:18 PM	60.37395	147.9463	338	Recast	Hopcroft	
17	Fe Fish End	PWS2	9/12/2019 12:20	8:20:14 PM	60.53463	147.8037	338		Aguilar-Islas	
18	CTD05 Start	PWS2	9/12/2019 12:24	8:24:46 PM	60.5361	147.8028	736	prod	Hopcroft	
19	CTD 05 End	PWS2	9/12/2019 12:42	8:42:00 PM	60.5366	147.8111	736	prod	Strom	
20	CalVET Net Tow Start	PWS2	9/12/2019 12:46	8:46:43 PM	60.53702	147.8132	736	3	Hopcroft	
21	CalVET Net Tow End	PWS2	9/12/2019 12:52	8:52:56 PM	60.53814	147.8149	736	3	Hopcroft	
22	CalVET Net Tow Start	PWS2	9/12/2019 13:13	9:13:03 PM	60.53498	147.7996	736	3A	Hopcroft	
23	CalVET Net Tow End	PWS2	9/12/2019 13:18	9:18:36 PM	60.53584	147.8006	736	3A	Hopcroft	
24	CTD 06 Start	PWS2	9/12/2019 13:28	9:28:40 PM	60.53504	147.7959	732	Intensive Shallow	Hopcroft	
25	CTD 06 End	PWS2	9/12/2019 13:49	9:49:02 PM	60.53537	147.807	732	Intensive Shallow	Hopcroft	
26	CTD 07 Start	PWS2	9/12/2019 14:24	10:24:58 PM	60.5362	147.8054	731		Hopcroft	
27	CTD 07 End	PWS2	9/12/2019 15:07	11:07:18 PM	60.53563	147.8255	731		Hopcroft	
28	MultiNet Vertical Start	PWS2	9/12/2019 15:34	11:34:07 PM	60.53466	147.8087	731	shallow	Hopcroft	
29	MultiNet End	PWS2	9/12/2019 16:00	12:00:45 AM	60.53363	147.8237	731		Hopcroft	
30	MultiNet Vertical Start	PWS2	9/12/2019 16:19	12:19:52 AM	60.53359	147.8355	731	Cast 2	Hopcroft	
31	MultiNet End	PWS2	9/12/2019 17:09	1:09:06 AM	60.53139	147.8657	731		Hopcroft	
32	Fe Fish Start	PWS2	9/12/2019 17:23	1:23:44 AM	60.53518	147.8066	731		Aguilar-Islas	
33	Fe Fish End	PWS3	9/12/2019 18:48	2:48:53 AM	60.65495	147.6758			Hopcroft	
34	CTD 08 Start	PWS3	9/12/2019 18:57	2:57:36 AM	60.67059	147.6672			Hopcroft	
35	CTD 08 End	PWS3	9/12/2019 19:37	3:37:06 AM	60.67165	147.6649	750		Hopcroft	

Event #	Description	Station	Local	GMT	Latitude	Longitude	Depth	Comments		Scientist	
36	CalVET Net Tow Start	PWS3	9/12/2019 19:40	3:40:06 AM	60.67219	147.6655	750		4	Hopcroft	
37	CalVET Net Tow End	PWS3	9/12/2019 19:46	3:46:03 AM	60.67266	147.667	750		4	Hopcroft	
38	MultiNet Start	PWS3	9/12/2019 21:36	5:36:02 AM	60.66936	147.6658	750			Hopcroft	
39	MultiNet End	PWS3	9/12/2019 22:39	6:39:11 AM	60.64927	147.6083	750			Hopcroft	calibration 5.77 to 8.444
40	MultiNet Start	PWS2	9/12/2019 23:30	7:30:48 AM	60.53352	147.7961	736			Hopcroft	late log- lat long off
41	MultiNet End	PWS2	9/13/2019 0:06	8:06:02 AM	60.53339	147.7961	736			Hopcroft	
42	MultiNet Start	PWS1	9/13/2019 1:35	9:35:25 AM	60.39012	147.9269	338			Hopcroft	
43	MultiNet End	PWS1	9/13/2019 2:10	10:10:04 AM	60.3698	147.9426	338			Hopcroft	
44	MultiNet Start	KIP2	9/13/2019 3:30	11:30:12 AM	60.29825	147.9755				Hopcroft	
45	MultiNet End	KIP2	9/13/2019 3:59	11:59:04 AM	60.27776	147.9847				Hopcroft	
46	Methot Net Start	KIP2	9/13/2019 4:41	12:41:53 PM	60.2944	147.979				Hopcroft	
47	Methot Net End	KIP2	9/13/2019 5:07	1:07:47 PM	60.30461	147.9758				Hopcroft	
48	CTD 09 Start	IB0	9/13/2019 8:08	4:08:52 PM	60.26363	148.3649	328			Hopcroft	
49	CTD 09 End	IB0	9/13/2019 8:38	4:38:10 PM	60.26015	148.3584	328			Hopcroft	
50	CalVET Net Tow Start	IB0	9/13/2019 8:45	4:45:01 PM	60.26516	148.3655	328		5	Hopcroft	
51	CalVET Net Tow End	IB0	9/13/2019 8:50	4:50:56 PM	60.2644	148.3647	328		5	Hopcroft	
52	CalVET Net Tow Start	IB0	9/13/2019 9:02	5:02:15 PM	60.26324	148.3625	328	5A		Hopcroft	
53	CalVET Net Tow End	IB0	9/13/2019 9:08	5:08:08 PM	60.26263	148.3613	328	5A		Hopcroft	
54	CTD 10 Start	IB1	9/13/2019 9:21	5:21:00 PM	60.24257	148.3328	146			Hopcroft	
55	CTD 10 End	IB1	9/13/2019 9:38	5:38:59 PM	60.24237	148.3318	146			Hopcroft	
56	CalVET Net Tow Start	IB1	9/13/2019 9:41	5:41:51 PM	60.2418	148.3326	146		6	Hopcroft	
57	CalVET Net Tow End	IB1	9/13/2019 9:53	5:53:16 PM			146		6	Hopcroft	
58	CTD 11 Start	IB2	9/13/2019 10:23	6:23:35 PM	60.27601	148.2298	157			Hopcroft	
59	CTD 11 End	IB2	9/13/2019 10:41	6:41:35 PM	60.27851	148.2252	157			Hopcroft	
60	CalVET Net Tow Start	IB2	9/13/2019 10:44	6:44:44 PM	60.27888	148.2245	157		7	Hopcroft	
61	CalVET Net Tow End	IB2	9/13/2019 10:50	6:50:39 PM	60.27958	148.2231	157		7	Hopcroft	
62	Fe Fish Start	IB2	9/13/2019 10:58	6:58:46 PM	60.27954	148.2195	157			Aguilar-Islas	
63	Fe Fish End	Pleiadies	9/13/2019 11:47	7:47:00 PM	60.26318	147.9894	600			Aguilar-Islas	
64	MultiNet Start	Pleidies	9/13/2019 11:54	7:54:06 PM	60.2628	147.9877	600	live net		Hopcroft	
65	MultiNet End	Pleidies	9/13/2019 12:39	8:39:11 PM	60.25995	147.9851	600			Hopcroft	
66	Fe Fish Start	Pleidies	9/13/2019 12:39	8:39:57 PM	60.25986	147.9851	600			Aguilar-Islas	
67	Fe Fish End	MS4	9/13/2019 15:09	11:09:05 PM	59.92096	147.8289				Aguilar-Islas	
68	CTD 12 Start	MS4	9/13/2019 15:15	11:15:38 PM	59.92054	147.8281	112			Hopcroft	
69	CTD 12 End	MS4	9/13/2019 15:28	11:28:37 PM	59.92115	147.8227	112			Hopcroft	
70	CTD 13 Start	MS3	9/13/2019 15:42	11:42:04 PM	59.93167	147.8546	165			Hopcroft	
71	CTD 13 End	MS3	9/13/2019 15:53	11:53:12 PM	59.93174	147.8504	165			Hopcroft	
72	CTD 14 Start	MS2	9/13/2019 16:11	12:11:16 AM	59.94399	147.8957	193			Hopcroft	
73	CTD 14 End	MS2	9/13/2019 16:37	12:37:47 AM	59.94094	147.8928	193			Hopcroft	

Event #	Description	Station	Local	GMT	Latitude	Longitude	Depth	Comments		Scientist
74	CalVET Net Tow Start	MS2	9/13/2019 16:44	12:44:14 AM	59.93999	147.8924	193		8	Hopcroft
75	CalVET Net Tow End	MS2	9/13/2019 16:50	12:50:20 AM	59.93909	147.8926	193		8	Hopcroft
76	CTD 15 Start	MS1	9/13/2019 17:05	1:05:45 AM	59.95315	147.9277				Hopcroft
78	CTD 15 End	MS1	9/13/2019 17:17	1:17:47 AM	59.9519	147.9293	168			Hopcroft
79	Bongo 60 cm Start	MID5	9/14/2019 0:59	8:59:42 AM	59.65025	146.1368	93			Hopcroft
80	Bongo 60 cm End	MID5	9/14/2019 1:14	9:14:57 AM	59.65129	146.1176	93			Hopcroft
81	Methot Net Start	MID5	9/14/2019 1:37	9:37:48 AM	59.65291	146.0932	93			Hopcroft
82	Methot Net End	MID5	9/14/2019 1:57	9:57:09 AM	59.64977	146.0691	surface			Hopcroft
83	Bongo 60 cm Start	MID4	9/14/2019 3:11	11:11:32 AM	59.78825	145.954				Hopcroft
85	Bongo 60 cm End	MID4	9/14/2019 3:26	11:26:08 AM	59.78037	145.9416			90	Hopcroft
86	Methot Net Start	MID4	9/14/2019 3:46	11:46:09 AM	59.78817	145.9525	0			Hopcroft
87	Methot Net End	MID4	9/14/2019 4:05	12:05:35 PM	59.79574	145.9604	0			Hopcroft
88	Bongo 60 cm Start	MID3	9/14/2019 5:22	1:22:55 PM	59.93957	145.8021	83			Hopcroft
89	Bongo 60 cm End	MID3	9/14/2019 5:39	1:39:17 PM	59.95135	145.8027	83			Hopcroft
90	Methot Net Start	MID3	9/14/2019 5:48	1:48:42 PM	59.9561	145.7978	83			Hopcroft
91	Methot Net End	MID3	9/14/2019 6:09	2:09:13 PM	59.96469	145.7792	83			Hopcroft
92	Bongo 60 cm Start	MID2	9/14/2019 7:09	3:09:57 PM	60.09408	145.6598	105			Hopcroft
93	Bongo 60 cm End	MID2	9/14/2019 7:38	3:38:01 PM	60.07989	145.6322	105			Hopcroft
94	Methot Net Start	MID2	9/14/2019 7:48	3:48:40 PM	60.09354	145.6234	105			Hopcroft
95	Methot Net End	MID2	9/14/2019 8:07	4:07:54 PM	60.09996	145.6302	105			Hopcroft
97	CTD 16 Start	MID1	9/14/2019 9:20	5:20:27 PM	60.24974	145.5072	16			Hopcroft
98	CTD 16 End	MID1	9/14/2019 9:24	5:24:04 PM	60.25084	145.5091	16			Hopcroft
99	Fe Fish Start	MID1	9/14/2019 10:05	6:05:13 PM	60.25117	145.5098	16			Aguilar-Islas
101	CTD 17 Start	MID1i	9/14/2019 10:53	6:53:59 PM	60.17587	145.5766	95			Hopcroft
102	CTD 17 End	MID1i	9/14/2019 11:00	7:00:35 PM	60.17704	145.5793	95			Hopcroft
103	Fe Fish End	MID2	9/14/2019 11:44	7:44:09 PM	60.10077	145.6494				Aguilar-Islas
104	CTD 18 Start	MID2	9/14/2019 11:46	7:46:01 PM	60.10137	145.6491	118	Prod		Hopcroft
105	CTD 18 End	MID2	9/14/2019 12:02	8:02:18 PM	60.10711	145.6507	118	Prod		Hopcroft
106	CalVET Net Tow Start	MID2	9/14/2019 12:05	8:05:42 PM	60.10837	145.6513	118		9	Hopcroft
107	CalVET Net Tow End	MID2	9/14/2019 12:11	8:11:38 PM	60.1106	145.6519	118		9	Hopcroft
108	CalVET Net Tow Start	MID2	9/14/2019 12:26	8:26:32 PM	60.11603	145.6529	118	9A		Hopcroft
109	CalVET Net Tow End	MID2	9/14/2019 12:32	8:32:19 PM	60.11799	145.6535	118	9A		Hopcroft
110	CTD 19 Start	MID2	9/14/2019 12:43	8:43:42 PM	60.10154	145.6487	118	Intensive		Hopcroft
111	CTD 19 End	MID2	9/14/2019 13:02	9:02:58 PM	60.10717	145.6501	118			Hopcroft
112	Fe Fish Start	MID2	9/14/2019 13:06	9:06:11 PM	60.10761	145.6508	118			Aguilar-Islas
113	CTD 20 Start	MID2i	9/14/2019 13:48	9:48:01 PM	60.02465	145.727	96			Hopcroft
114	CTD 20 End	MID2i	9/14/2019 13:56	9:56:19 PM	60.02451	145.7265	96			Hopcroft
115	CTD 21 Start	MID3	9/14/2019 14:36	10:36:19 PM	59.95287	145.7994	86			Hopcroft

Event #	Description	Station	Local	GMT	Latitude	Longitude	Depth	Comments		Scientist	
116	CTD 21 End	MID3	9/14/2019 14:55	10:55:58 PM	59.95095	145.7983	86			Hopcroft	
117	CalVET Net Tow Start	MID3	9/14/2019 14:58	10:58:45 PM	59.95076	145.7977	86		10	Hopcroft	
118	CalVET Net Tow End	MID3	9/14/2019 15:03	11:03:50 PM	59.9508	145.7966	86		10	Hopcroft	
119	Fe Fish Start	MID3	9/14/2019 15:15	11:15:06 PM	59.94312	145.8032	86			Aguilar-Islas	
120	CTD 22 Start	MID3i	9/14/2019 15:46	11:46:25 PM	59.88184	145.8662	99			Hopcroft	
121	CTD 22 End	MID3i	9/14/2019 15:55	11:55:57 PM	59.88208	145.8623	99			Hopcroft	
122	CTD 23 Start	MID4	9/14/2019 16:39	12:39:50 AM	59.79983	145.9501	90			Hopcroft	
123	CTD 23 End	MID4	9/14/2019 16:59	12:59:26 AM	59.79206	145.9401	90			Hopcroft	
124	CalVET Net Tow Start	MID4	9/14/2019 17:02	1:02:42 AM	59.79091	145.9388	90		11	Hopcroft	
125	CalVET Net Tow End	MID4	9/14/2019 17:07	1:07:44 AM	59.78918	145.937	90		11	Hopcroft	
126	Fe Fish Start	MID4	9/14/2019 17:13	1:13:30 AM	59.78627	145.9355	90			Aguilar-Islas	
127	CTD 24 Start	MID4i	9/14/2019 17:49	1:49:32 AM	59.72684	146.0202	70			Hopcroft	
128	CTD 24 End	MID4i	9/14/2019 17:57	1:57:35 AM	59.72478	146.0223	70			Hopcroft	
129	Fe Fish End	MID5	9/14/2019 18:34	2:34:40 AM	59.65001	146.1015				Aguilar-Islas	
130	CTD 25 Start	MID5	9/14/2019 18:35	2:35:39 AM	59.64967	146.1017	92			Hopcroft	
131	CTD 25 End	MID5	9/14/2019 18:49	2:49:55 AM	59.6466	146.1068	92			Hopcroft	
132	CalVET Net Tow Start	MID5	9/14/2019 18:51	2:51:56 AM	59.6462	146.1077	92		12	Hopcroft	
133	CalVET Net Tow End	MID5	9/14/2019 18:57	2:57:18 AM	59.64516	146.1099	92		12	Hopcroft	
134	Fe Fish Start	MID5	9/14/2019 19:02	3:02:09 AM	59.64397	146.1117	92			Aguilar-Islas	
135	Fe Fish End	MID5i	9/14/2019 19:33	3:33:28 AM	59.57635	146.177				Aguilar-Islas	
136	CTD 26 Start	MID5i	9/14/2019 19:36	3:36:13 AM	59.57544	146.1785	110			Hopcroft	
137	CTD 26 End	MID5i	9/14/2019 19:44	3:44:54 AM	59.57495	146.1822	110			Hopcroft	
138	Fe Fish Start	MID5i	9/14/2019 19:47	3:47:44 AM	59.57476	146.1836				Aguilar-Islas	
139	Fe Fish End	MID6	9/14/2019 20:22	4:22:24 AM	59.50042	146.2514				Aguilar-Islas	
140	CalVET Net Tow Start	MID6	9/14/2019 20:24	4:24:47 AM	59.50143	146.253			13	Hopcroft	bad cast
141	CalVET Net Tow End	MID6	9/14/2019 20:28	4:28:50 AM	59.50304	146.2547			13	Hopcroft	
142	CTD 27 Start	MID6	9/14/2019 20:32	4:32:22 AM	59.5049	146.2565	37			Hopcroft	
143	CTD 27 End	MID6	9/14/2019 20:40	4:40:57 AM	59.50771	146.2616	37	23 recast		Hopcroft	
144	CalVET Net Tow Start	MID6	9/14/2019 20:45	4:45:14 AM			37			Hopcroft	
144.5	CalVET Net Tow End	MID6	9/14/2019 20:51	4:51:14 AM							
145	Methot Net Start	MID6	9/14/2019 21:01	5:01:06 AM	59.51428	146.2679	37			Hopcroft	
146	Methot Net End	MID6	9/14/2019 21:20	5:20:39 AM	59.50787	146.2606	37			Hopcroft	
147	Bongo 60 cm Start	MID6	9/14/2019 21:31	5:31:36 AM	59.50616	146.2588	37			Hopcroft	
148	Bongo 60 cm End	MID6	9/14/2019 21:38	5:38:50 AM	59.50277	146.254	37			Hopcroft	
149	Bongo 60 cm Start	MID7	9/14/2019 22:48	6:48:35 AM	59.38195	146.2796	68			Hopcroft	
150	Bongo 60 cm End	MID7	9/14/2019 22:58	6:58:10 AM	59.37568	146.2767	68-75			Hopcroft	
151	Methot Net Start	MID7	9/14/2019 23:11	7:11:39 AM	59.36806	146.2722	68-75			Hopcroft	
152	Methot Net End	MID7	9/14/2019 23:31	7:31:59 AM	59.35696	146.2602	68-75			Hopcroft	

Event #	Description	Station	Local	GMT	Latitude	Longitude	Depth	Comments		Scientist
153	Bongo 60 cm Start	MID8	9/15/2019 0:28	8:28:57 AM	59.23425	146.2034	580			Hopcroft
154	Bongo 60 cm End	MID8	9/15/2019 0:46	8:46:00 AM	59.22279	146.1997	580			Hopcroft
155	Methot Net Start	MID8	9/15/2019 0:56	8:56:44 AM	59.21331	146.1951	580			Hopcroft
156	Methot Net End	MID8	9/15/2019 1:17	9:17:13 AM	59.19859	146.1881	580			Hopcroft
157	Bongo 60 cm Start	MID9	9/15/2019 2:11	10:11:08 AM	59.07925	146.1028				Hopcroft
158	Bongo 60 cm End	MID9	9/15/2019 2:25	10:25:20 AM	59.07028	146.102				Hopcroft
159	Methot Net Start	MID9	9/15/2019 2:34	10:34:33 AM	59.06365	146.1071				Hopcroft
160	Methot Net End	MID9	9/15/2019 2:54	10:54:57 AM	59.04982	146.1209				Hopcroft
161	Bongo 60 cm Start	MID10	9/15/2019 3:59	11:59:17 AM	58.92121	146.0115				Hopcroft
162	Bongo 60 cm End	MID10	9/15/2019 4:17	12:17:59 PM	58.90877	146.0095				Hopcroft
163	Methot Net Start	MID10	9/15/2019 4:26	12:26:57 PM	58.90118	146.0125				Hopcroft
164	Methot Net End	MID10	9/15/2019 4:46	12:46:55 PM	58.88868	146.023				Hopcroft
165	CTD 28 Start	MID5	9/15/2019 9:52	5:52:10 PM	59.65209	146.1004	92	Prod		Hopcroft
166	CTD 28 End	MID5	9/15/2019 10:06	6:06:40 PM	59.65372	146.1048	92	Prod		Hopcroft
167	CalVET Net Tow Start	MID5	9/15/2019 10:09	6:09:02 PM	59.65402	146.1054	92		14	Hopcroft
168	CalVET Net Tow End	MID5	9/15/2019 10:14	6:14:49 PM	59.65501	146.1082	92		14	Hopcroft
169	CalVET Net Tow Start	MID5	9/15/2019 10:26	6:26:44 PM	59.65684	146.1115	92	14A		Hopcroft
170	CalVET Net Tow End	MID5	9/15/2019 10:31	6:31:46 PM	59.65727	146.1124	92	14A		Hopcroft
171	CTD 29 Start	MID5	9/15/2019 10:35	6:35:19 PM	59.6578	146.1133	92	Intensive		Hopcroft
172	CTD 29 End	MID5	9/15/2019 10:50	6:50:32 PM	59.65953	146.1179	92	Intensive		Hopcroft
173	Fe Fish Start	MID5	9/15/2019 10:53	6:53:25 PM	59.65937	146.1182	92			Aguilar-Islas
174	CTD 30 Start	MID6i	9/15/2019 12:41	8:41:39 PM	59.4294	146.1667	57			Hopcroft
175	CTD 30 End	MID6i	9/15/2019 12:47	8:47:37 PM	59.43137	146.1645	57			Hopcroft
176	Fe Fish End	MID7	9/15/2019 13:29	9:29:34 PM	59.37763	146.2886				Aguilar-Islas
177	CTD 31 Start	MID7	9/15/2019 13:33	9:33:09 PM	59.37789	146.2885	73			Hopcroft
178	CTD 31 End	MID7	9/15/2019 13:45	9:45:45 PM	59.3809	146.2826	73			Hopcroft
179	CalVET Net Tow Start	MID7	9/15/2019 13:51	9:51:57 PM	59.37718	146.2885	73		15	Hopcroft
180	CalVET Net Tow End	MID7	9/15/2019 13:56	9:56:25 PM	59.37713	146.2888	73		15	Hopcroft
181	Fe Fish Start	MID7	9/15/2019 13:59	9:59:56 PM	59.37796	146.2883	73			Aguilar-Islas
182	CTD 32 Start	MID7i	9/15/2019 14:32	10:32:39 PM	59.30564	146.2507	439			Hopcroft
183	CTD 32 End	MID7i	9/15/2019 14:57	10:57:31 PM	59.30725	146.2402	439			Hopcroft
184	Fe Fish End	MID8	9/15/2019 15:33	11:33:02 PM	59.2322	146.2063				Aguilar-Islas
185	CTD 33 Start	MID8	9/15/2019 15:35	11:35:28 PM	59.23131	146.2087	533			Hopcroft
186	CTD 33 End	MID8	9/15/2019 16:15	12:15:30 AM	59.22665	146.2067	533			Hopcroft
187	CalVET Net Tow Start	MID8	9/15/2019 16:18	12:18:15 AM	59.22631	146.2065	533		16	Hopcroft
188	CalVET Net Tow End	MID8	9/15/2019 16:24	12:24:12 AM	59.22583	146.206	533		16	Hopcroft
189	Fe Fish Start	MID8	9/15/2019 16:28	12:28:47 AM	59.22263	146.2088	533			Aguilar-Islas
190	Fe Fish End	MID9	9/15/2019 17:46	1:46:17 AM	59.07434	146.1056				Aguilar-Islas

Event #	Description	Station	Local	GMT	Latitude	Longitude	Depth	Comments		Scientist
191	CTD 34 Start	MID9	9/15/2019 17:49	1:49:33 AM	59.07279	146.1045	2800			Hopcroft
192	CTD 34 End	MID9	9/15/2019 18:46	2:46:02 AM	59.07448	146.1266	2800			Hopcroft
193	CalVET Net Tow Start	MID9	9/15/2019 18:48	2:48:35 AM	59.07482	146.1281	2800		17	Hopcroft
194	CalVET Net Tow End	MID9	9/15/2019 18:54	2:54:33 AM	59.07589	146.1276	2800		17	Hopcroft
195	Fe Fish Start	MID9	9/15/2019 18:57	2:57:48 AM	59.07634	146.1282	2800			Aguilar-Islas
196	Fe Fish End	MID10	9/15/2019 20:20	4:20:16 AM	58.91103	146.0007				Aguilar-Islas
197	CalVET Net Tow Start	MID10	9/15/2019 20:25	4:25:17 AM	58.91113	146.0004			18	Hopcroft
198	CalVET Net Tow End	MID10	9/15/2019 20:31	4:31:12 AM	58.91251	146.0015			18	Hopcroft
199	CTD 35 Start	MID10	9/15/2019 20:37	4:37:24 AM	58.91399	146.0011	4443			Hopcroft
200	CTD 35 End	MID10	9/15/2019 21:28	5:28:09 AM	58.92455	146.0235	4443			Hopcroft
201	CTD 36 Start	GAK1	9/16/2019 10:27	6:27:15 PM	59.84798	149.4798	268	Prod		Hopcroft
202	CTD 36 End	GAK1	9/16/2019 10:45	6:45:15 PM	59.84582	149.4864	268	Prod		Hopcroft
203	CalVET Net Tow Start	GAK1	9/16/2019 10:49	6:49:01 PM	59.84581	149.4876	268		19	Hopcroft
204	CalVET Net Tow End	GAK1	9/16/2019 10:55	6:55:03 PM	59.84691	149.4882	268		19	Hopcroft
205	CalVET Net Tow Start	GAK1	9/16/2019 11:04	7:04:54 PM	59.84573	149.4845	268	19A		Hopcroft
206	CalVET Net Tow End	GAK1	9/16/2019 11:11	7:11:14 PM	59.84606	149.4848	268	19A		Hopcroft
207	CTD 37 Start	GAK1	9/16/2019 11:19	7:19:48 PM	59.84576	149.4838	271			Hopcroft
208	CTD 37 End	GAK1	9/16/2019 11:37	7:37:09 PM	59.84592	149.485	271			Hopcroft
209	MultiNet Start	GAK1	9/16/2019 12:06	8:06:03 PM	59.84518	149.4837	271			Hopcroft
210	MultiNet End	GAK1	9/16/2019 12:19	8:19:03 PM	59.84507	149.4829	271			Hopcroft
211	CTD 38 Start	GAK1	9/16/2019 12:33	8:33:46 PM	59.84409	149.4834	271			Hopcroft
212	CTD 38 End	GAK1	9/16/2019 12:55	8:55:12 PM	59.84284	149.4863	271			Hopcroft
213	Fe Fish Start	GAK1	9/16/2019 13:06	9:06:09 PM	59.84901	149.4929	271			Aguilar-Islas
214	CTD 39 Start	GAK1i	9/16/2019 14:10	10:10:46 PM	59.76559	149.3987	261			Hopcroft
215	CTD 39 End	GAK1i	9/16/2019 14:25	10:25:41 PM	59.76486	149.4028	261			Hopcroft
216	Fe Fish End	GAK2	9/16/2019 15:01	11:01:29 PM	59.69611	149.3338				Aguilar-Islas
217	CTD 40 Start	GAK2	9/16/2019 15:03	11:03:38 PM	59.69621	149.3337	233			Hopcroft
218	CTD 40 End	GAK2	9/16/2019 15:35	11:35:59 PM	59.68779	149.3497	233			Hopcroft
219	CalVET Net Tow Start	GAK2	9/16/2019 15:48	11:48:44 PM	59.69155	149.3346	233	miscast		Hopcroft
220	CalVET Net Tow End	GAK2	9/16/2019 15:56	11:56:38 PM	59.69022	149.3363	233	miscast		Hopcroft
221	CalVET Net Tow Start	GAK2	9/16/2019 16:07	12:07:04 AM	59.68918	149.3456	233		20	Hopcroft
222	CalVET Net Tow End	GAK2	9/16/2019 16:13	12:13:09 AM	59.6885	149.3504	233		20	Hopcroft
223	CTD 41 Start	GAK2i	9/16/2019 16:53	12:53:35 AM	59.62688	149.2625	215			Hopcroft
224	CTD 41 End	GAK2i	9/16/2019 17:04	1:04:37 AM	59.62793	149.2636	215			Hopcroft
225	Fe Fish End	GAK3	9/16/2019 17:41	1:41:53 AM	59.55489	149.1902				Aguilar-Islas
226	CTD 42 Start	GAK3	9/16/2019 17:43	1:43:33 AM	59.55492	149.1915	214			Hopcroft
227	CTD 42 End	GAK3	9/16/2019 18:19	2:19:00 AM	59.55795	149.1944	214			Hopcroft
228	CalVET Net Tow Start	GAK3	9/16/2019 18:22	2:22:20 AM	59.55796	149.1944	214		21	Hopcroft

Event #	Description	Station	Local	GMT	Latitude	Longitude	Depth	Comments		Scientist	
229	CalVET Net Tow End	GAK3	9/16/2019 18:30	2:30:01 AM	59.55782	149.1939	214		21	Hopcroft	
230	Fe Fish Start	GAK3	9/16/2019 18:35	2:35:29 AM	59.48486	149.121	214			Aguilar-Islas	
231	CTD 43 Start	GAK3i	9/16/2019 19:09	3:09:35 AM	59.48417	149.1195	203			Hopcroft	
232	CTD 43 End	GAK3i	9/16/2019 19:19	3:19:57 AM	59.48361	149.1227	203			Hopcroft	
233	Fe Fish End	GAK4	9/16/2019 19:58	3:58:55 AM	59.40968	149.0498				Aguilar-Islas	
234	CalVET Net Tow Start	GAK4	9/16/2019 20:02	4:02:07 AM	59.40868	149.0497		miscast		Hopcroft	
235	CalVET Net Tow End	GAK4	9/16/2019 20:05	4:05:22 AM	59.40876	149.0504		miscast		Hopcroft	
236	CalVET Net Tow Start	GAK4	9/16/2019 20:17	4:17:10 AM	59.40918	149.046	199		22	Hopcroft	
237	CalVET Net Tow End	GAK4	9/16/2019 20:23	4:23:05 AM	59.40934	149.0447	199		22	Hopcroft	
239	CTD 44 Start	GAK4	9/16/2019 20:26	4:26:26 AM	59.40955	149.0439	198			Hopcroft	
240	CTD 44 End	GAK4	9/16/2019 20:48	4:48:42 AM	59.41013	149.0395	198			Hopcroft	
241	Methot Net Start	GAK4	9/16/2019 20:59	4:59:10 AM	59.4114	149.0305	198			Hopcroft	
242	Methot Net End	GAK4	9/16/2019 21:19	5:19:01 AM	59.41402	149.0073	198			Hopcroft	
243	MultiNet Start	GAK4	9/16/2019 21:40	5:40:53 AM	59.40686	149.0468	198			Hopcroft	
244	MultiNet End	GAK4	9/16/2019 22:23	6:23:20 AM	59.42339	149.0858	198			Hopcroft	
245	MultiNet Start	GAK3	9/16/2019 23:21	7:21:52 AM	59.55171	149.2099	212			Hopcroft	
246	MultiNet End	GAK3	9/16/2019 23:56	7:56:45 AM	59.56157	149.1727	212			Hopcroft	
247	Methot Net Start	GAK3	9/17/2019 0:03	8:03:25 AM	59.55877	149.1817	212			Hopcroft	
248	Methot Net End	GAK3	9/17/2019 0:23	8:23:23 AM	59.55951	149.2081	212			Hopcroft	
249	MultiNet Start	GAK2	9/17/2019 1:25	9:25:59 AM	59.69035	149.3273	228			Hopcroft	BAD
250	MultiNet End	GAK2	9/17/2019 2:11	10:11:55 AM	59.67509	149.2977	228			Hopcroft	
251	MultiNet Start	GAK2	9/17/2019 2:18	10:18:00 AM	59.67733	149.3043	228			Hopcroft	
252	MultiNet End	GAK2	9/17/2019 2:58	10:58:29 AM	59.67181	149.3672	228			Hopcroft	
253	Methot Net Start	GAK2	9/17/2019 3:02	11:02:35 AM	59.67282	149.3621	228			Hopcroft	
254	Methot Net End	GAK2	9/17/2019 3:23	11:23:14 AM	59.67548	149.3423	228			Hopcroft	
255	MultiNet Start	GAK1	9/17/2019 4:37	12:37:19 PM	59.83036	149.4689	277			Hopcroft	
256	MultiNet End	GAK1	9/17/2019 5:06	1:06:49 PM	59.84855	149.4876	277			Hopcroft	
257	Methot Net Start	GAK1	9/17/2019 5:17	1:17:25 PM	59.85485	149.4841	277			Hopcroft	
258	Methot Net End	GAK1	9/17/2019 5:37	1:37:07 PM	59.86747	149.4732	277			Hopcroft	
259	CTD 45 Start	GAK4i	9/17/2019 9:23	5:23:29 PM	59.33182	149.0014	190			Hopcroft	
260	CTD 45 End	GAK4i	9/17/2019 9:34	5:34:28 PM	59.33104	149.0058	190			Hopcroft	
261	Fe Fish Start	GAK4i	9/17/2019 9:37	5:37:37 PM	59.33102	149.0072	190			Aguilar-Islas	
262	Fe Fish End	GAK5	9/17/2019 10:32	6:32:39 PM	59.24442	148.9324				Aguilar-Islas	
263	CTD 46 Start	GAK5	9/17/2019 10:36	6:36:43 PM	59.2437	148.9339	168	Prod		Hopcroft	
264	CTD 46 End	GAK5	9/17/2019 10:52	6:52:50 PM	59.24499	148.9424	168	Prod		Hopcroft	
265	CalVET Net Tow Start	GAK5	9/17/2019 10:57	6:57:31 PM	59.24572	148.9457	168		23	Hopcroft	
266	CalVET Net Tow End	GAK5	9/17/2019 11:03	7:03:33 PM	59.24566	148.9474	168		23	Hopcroft	
267	CalVET Net Tow Start	GAK5	9/17/2019 11:17	7:17:07 PM	59.24335	148.9258	168	23A		Hopcroft	

Event #	Description	Station	Local	GMT	Latitude	Longitude	Depth	Comments	Scientist
268	CalVET Net Tow End	GAK5	9/17/2019 11:22	7:22:46 PM	59.2438	148.9262	168	23A	Hopcroft
269	CTD 47 Start	GAK5	9/17/2019 11:29	7:29:48 PM	59.24501	148.9264	169	Intensive	Hopcroft
270	CTD 47 End	GAK5	9/17/2019 11:49	7:49:30 PM	59.24924	148.9345	169	Intensaive	Hopcroft
271	MultiNet Start	GAK5	9/17/2019 12:09	8:09:35 PM	59.24623	148.9305	169		Hopcroft
272	MultiNet End	GAK5	9/17/2019 12:22	8:22:24 PM	59.25017	148.9354	169		Hopcroft
273	Fe Fish Start	GAK5	9/17/2019 12:26	8:26:55 PM	59.25136	148.9353	169		Aguilar-Islas
274	CTD 48 Start	GAK5i	9/17/2019 13:20	9:20:06 PM	59.17469	148.8461	174		Hopcroft
275	CTD 48 End	GAK5i	9/17/2019 13:29	9:29:50 PM	59.17736	148.8468	174		Hopcroft
276	Fe Fish End	GAK6	9/17/2019 14:06	10:06:45 PM	59.11794	148.7679			Aguilar-Islas
277	CTD 49 Start	GAK6	9/17/2019 14:08	10:08:34 PM	59.11816	148.7691	150		Hopcroft
278	CTD 49 End	GAK6	9/17/2019 14:32	10:32:21 PM	59.12416	148.7719	150		Hopcroft
279	CalVET Net Tow Start	GAK6	9/17/2019 14:36	10:36:33 PM	59.1254	148.7723	150	24	Hopcroft
280	CalVET Net Tow End	GAK6	9/17/2019 14:42	10:42:40 PM	59.12665	148.7737	150	24	Hopcroft
281	Fe Fish Start	GAK6	9/17/2019 14:47	10:47:15 PM	59.12571	148.774	150		Aguilar-Islas
282	CTD 50 Start	GAK6i	9/17/2019 15:30	11:30:27 PM	59.0468	148.7016	189		Hopcroft
283	CTD 50 End	GAK6i	9/17/2019 15:41	11:41:17 PM	59.04858	148.7059	189		Hopcroft
284	Fe Fish End	GAK7	9/17/2019 16:24	12:24:21 AM	58.97356	148.6319			Aguilar-Islas
285	CTD 51 Start	GAK7	9/17/2019 16:27	12:27:14 AM	58.97315	148.6338	244		Hopcroft
286	CTD 51 End	GAK7	9/17/2019 17:03	1:03:02 AM	58.98132	148.6488	244		Hopcroft
287	CalVET Net Tow Start	GAK7	9/17/2019 17:07	1:07:26 AM	58.98229	148.6495	244	25	Hopcroft
288	CalVET Net Tow End	GAK7	9/17/2019 17:13	1:13:48 AM	58.98413	148.6493	244	25	Hopcroft
289	Fe Fish Start	GAK7	9/17/2019 17:17	1:17:29 AM	58.98332	148.6473	244		Aguilar-Islas
290	CTD 52 Start	GAK7i	9/17/2019 18:10	2:10:03 AM	58.88468	148.5631	299		Hopcroft
291	CTD 52 End	GAK7i	9/17/2019 18:23	2:23:19 AM	58.88999	148.5645	299		Hopcroft
292	Fe Fish End	GAK8	9/17/2019 19:09	3:09:05 AM	58.81045	148.4967			Aguilar-Islas
293	CalVET Net Tow Start	GAK8	9/17/2019 19:13	3:13:00 AM	58.80948	148.4937		26	Hopcroft
294	CalVET Net Tow End	GAK8	9/17/2019 19:19	3:19:01 AM	58.80959	148.4911		26	Hopcroft
295	CTD 53 Start	GAK8	9/17/2019 19:23	3:23:08 AM	58.81024	148.4884	290		Hopcroft
296	CTD 53 End	GAK8	9/17/2019 19:54	3:54:44 AM	58.82253	148.467	290		Hopcroft
297	MultiNet Start	GAK9	9/17/2019 20:58	4:58:31 AM	58.68813	148.3613	280		Hopcroft
298	MultiNet End	GAK9	9/17/2019 21:36	5:36:25 AM	58.66814	148.3405	280		Hopcroft
299	Methot Net Start	GAK9	9/17/2019 21:40	5:40:30 AM	58.66907	148.341	280		Hopcroft
300	Methot Net End	GAK9	9/17/2019 22:00	6:00:56 AM	58.6807	148.3521	280		Hopcroft
301	MultiNet Start	GAK8	9/17/2019 23:16	7:16:07 AM	58.81504	148.5013	294		Hopcroft
302	MultiNet End	GAK8	9/17/2019 23:52	7:52:24 AM	58.79803	148.4665	294		Hopcroft
303	Methot Start	GAK8	9/18/2019 0:00	8:00:34 AM	58.80495	148.4745	294		Hopcroft
304	Methot End	GAK8	9/18/2019 0:20	8:20:15 AM	58.81712	148.4869	294		Hopcroft
305	MultiNet Start	GAK7	9/18/2019 1:40	9:40:02 AM	58.97806	148.6414	260		Hopcroft

Event #	Description	Station	Local	GMT	Latitude	Longitude	Depth	Comments		Scientist
306	MultiNet End	GAK7	9/18/2019 2:10	10:10:05 AM	58.98405	148.6181	260	aborted at 30m		Hopcroft
307	CTD 54 Start	RES2.5	9/18/2019 9:42	5:42:09 PM	60.02048	149.3559	293			Hopcroft
308	CTD 54 End	RES2.5	9/18/2019 10:06	6:06:46 PM	60.02093	149.3642	293			Hopcroft
309	CalVET Net Tow Start	RES2.5	9/18/2019 10:15	6:15:40 PM	60.02175	149.3534	293		27	Hopcroft
310	CalVET Net Tow End	RES2.5	9/18/2019 10:21	6:21:21 PM	60.02328	149.3543	293		27	Hopcroft
312	MultiNet Start	GAK5	9/18/2019 23:29	7:29:53 AM	59.24964	148.9243	171			Hopcroft
314	MultiNet End	GAK5	9/19/2019 0:03	8:03:59 AM	59.22757	148.9342	171			Hopcroft
315	Methot Net Start	GAK5	9/19/2019 0:13	8:13:08 AM	59.23164	148.9339	171			Hopcroft
316	Methot Net End	GAK5	9/19/2019 0:33	8:33:12 AM	59.24452	148.9273	171			Hopcroft
317	MultiNet Start	GAK6	9/19/2019 2:06	10:06:10 AM	59.12467	148.7483	150			Hopcroft
318	MultiNet End	GAK6	9/19/2019 2:39	10:39:35 AM	59.11088	148.7823	150			Hopcroft
319	Methot Net Start	GAK6	9/19/2019 2:47	10:47:15 AM	59.11619	148.7761	150			Hopcroft
320	Methot Net End	GAK6	9/19/2019 3:07	11:07:18 AM	59.12473	148.752	150			Hopcroft
321	MultiNet Start	GAK7	9/19/2019 4:41	12:41:52 PM	58.98443	148.6174	241			Hopcroft
322	MultiNet End	GAK7	9/19/2019 5:15	1:15:48 PM	58.97493	148.6583	241			Hopcroft
323	CTD 55 Start	GEO	9/19/2019 6:11	2:11:41 PM	59.00713	148.6938	243			Hopcroft
324	CTD 55 End	GEO	9/19/2019 6:24	2:24:10 PM	59.0078	148.6927	243			Hopcroft
325	CTD 56 Start	GAK8i	9/19/2019 8:41	4:41:55 PM	58.7492	148.4232	287			Hopcroft
326	CTD 56 End	GAK8i	9/19/2019 8:55	4:55:19 PM	58.75156	148.4216	287			Hopcroft
327	Fe Fish Start	GAK8i	9/19/2019 9:06	5:06:28 PM	58.75206	148.4186	287			Aguilar-Islas
328	Fe Fish End	GAK9	9/19/2019 9:45	5:45:06 PM	58.67729	148.3492				Aguilar-Islas
329	CTD 57 Start	GAK9	9/19/2019 9:48	5:48:25 PM	58.6779	148.3491	280	Prod		Hopcroft
330	CTD 57 End	GAK9	9/19/2019 10:05	6:05:31 PM	58.68073	148.3462	280	Prod		Hopcroft
331	CalVET Net Tow Start	GAK9	9/19/2019 10:11	6:11:51 PM	58.68243	148.3433	280		28	Hopcroft
332	CalVET Net Tow End	GAK9	9/19/2019 10:17	6:17:45 PM	58.6833	148.3412	280		28	Hopcroft
333	CalVET Net Tow Start	GAK9	9/19/2019 10:27	6:27:38 PM	58.67548	148.3488	280	28A		Hopcroft
334	CalVET Net Tow End	GAK9	9/19/2019 10:33	6:33:26 PM	58.67589	148.3476	280	28A		Hopcroft
335	CTD 58 Start	GAK9	9/19/2019 10:40	6:40:24 PM	58.67762	148.3444	280	Intensive		Hopcroft
336	CTD 58 End	GAK9	9/19/2019 11:03	7:03:51 PM	58.67968	148.3399	280	Intensive		Hopcroft
337	MultiNet Start	GAK9	9/19/2019 11:16	7:16:20 PM	58.68178	148.3352	280			Hopcroft
338	MultiNet End	GAK9	9/19/2019 11:34	7:34:13 PM	58.68444	148.3323	280			Hopcroft
339	Fe Fish Start	GAK9	9/19/2019 11:39	7:39:45 PM	58.68441	148.3326	280			Aguilar-Islas
340	CTD 59 Start	GAK9i	9/19/2019 12:16	8:16:49 PM	58.61256	148.2793	670			Hopcroft
341	CTD 59 End	GAK9i	9/19/2019 12:42	8:42:08 PM	58.61144	148.2754	670			Hopcroft
342	Fe Fish End	GAK10	9/19/2019 13:23	9:23:06 PM	58.52946	148.2018				Aguilar-Islas
343	CTD 60 Start	GAK10	9/19/2019 13:26	9:26:28 PM	58.52914	148.2022	1459			Hopcroft
344	CTD 60 End	GAK10	9/19/2019 14:15	10:15:28 PM	58.52593	148.2042	1459			Hopcroft
345	CalVET Net Tow Start	GAK10	9/19/2019 14:19	10:19:05 PM	58.52581	148.2047	1459		29	Hopcroft

Event #	Description	Station	Local	GMT	Latitude	Longitude	Depth	Comments	Scientist
346	CalVET Net Tow End	GAK10	9/19/2019 14:25	10:25:38 PM	58.52594	148.2046	1459	29	Hopcroft
347	Fe Fish End	GAK11	9/19/2019 15:36	11:36:37 PM	58.38976	148.07	1443		Aguilar-Islas
348	CTD 61 Start	GAK11	9/19/2019 15:40	11:40:30 PM	58.38702	148.0696	1443		Hopcroft
349	CTD 61 End	GAK11	9/19/2019 16:42	12:42:44 AM	58.37006	148.0996	1443		Hopcroft
350	CalVET Net Tow Start	GAK11	9/19/2019 16:47	12:47:16 AM	58.36966	148.1006	1443	30	Hopcroft
351	CalVET Net Tow End	GAK11	9/19/2019 16:53	12:53:32 AM	58.36915	148.1016	1443	30	Hopcroft
352	Fe Fish Start	GAK11	9/19/2019 16:58	12:58:20 AM	58.36705	148.1015	1443		Aguilar-Islas
353	Fe Fish End	GAK12	9/19/2019 18:09	2:09:03 AM	58.24272	147.9353	2179		Aguilar-Islas
354	CTD 62 Start	GAK12	9/19/2019 18:09	2:09:20 AM	58.24262	147.9357	2179		Hopcroft
355	CTD 62 End	GAK12	9/19/2019 19:02	3:02:24 AM	58.23888	147.977	2179		Hopcroft
356	CalVET Net Tow Start	GAK12	9/19/2019 19:06	3:06:12 AM	58.23954	147.9796	2179	31	Hopcroft
357	CalVET Net Tow End	GAK12	9/19/2019 19:11	3:11:52 AM	58.23988	147.9833	2179	31	Hopcroft
358	Fe Fish Start	GAK12	9/19/2019 19:17	3:17:35 AM	58.23808	147.9871	2179		Aguilar-Islas
359	Fe Fish End	GAK13	9/19/2019 20:39	4:39:00 AM	58.09875	147.7863	2059		Aguilar-Islas
360	CalVET Net Tow Start	GAK13	9/19/2019 20:42	4:42:44 AM	58.09904	147.7883	2059	32	Hopcroft
361	CalVET Net Tow End	GAK13	9/19/2019 20:48	4:48:36 AM	58.09941	147.7897	2059	32	Hopcroft
362	CTD 63 Start	GAK13	9/19/2019 20:51	4:51:50 AM	58.10001	147.7916	2059		Hopcroft
363	CTD 63 End	GAK13	9/19/2019 21:44	5:44:47 AM	58.10306	147.8331	2059		Hopcroft
364	MultiNet Start	GAK13	9/19/2019 21:56	5:56:29 AM	58.09645	147.8327	2059		Hopcroft
365	MultiNet End	GAK13	9/19/2019 22:36	6:36:07 AM	58.10313	147.7957	2059		Hopcroft
366	Methot Net Start	KOD1	9/21/2019 20:40	4:40:27 AM	58.21924	151.611			Hopcroft
367	Methot Net End	KOD1	9/21/2019 21:00	5:00:43 AM	58.23068	151.6015			Hopcroft
368	Bongo 60 cm Start	KOD1	9/21/2019 21:15	5:15:08 AM	58.24024	151.597	69		Hopcroft
369	Bongo 60 cm End	KOD1	9/21/2019 21:26	5:26:37 AM	58.247	151.5948	69		Hopcroft
370	Methot Net Start	KOD2	9/21/2019 22:17	6:17:43 AM	58.15231	151.4309	129		Hopcroft
371	Methot Net End	KOD2	9/21/2019 22:38	6:38:12 AM	58.13809	151.4066	129		Hopcroft
372	Bongo 60 cm Start	KOD2	9/21/2019 22:48	6:48:44 AM	58.13152	151.3921	129		Hopcroft
373	Bongo 60 cm End	KOD2	9/21/2019 23:20	7:20:54 AM	58.10903	151.3347	129		Hopcroft
374	Methot Net Start	KOD3	9/22/2019 0:08	8:08:15 AM	58.02965	151.1974			Hopcroft
375	Methot Net End	KOD3	9/22/2019 0:28	8:28:07 AM	58.02825	151.162			Hopcroft
376	Bongo 60 cm Start	KOD3	9/22/2019 0:39	8:39:37 AM	58.02908	151.1575	82		Hopcroft
377	Bongo 60 cm End	KOD3	9/22/2019 0:51	8:51:23 AM	58.0285	151.1721	82		Hopcroft
378	Methot Net Start	KOD4	9/22/2019 2:05	10:05:47 AM	57.90202	150.9415			Hopcroft
379	Methot Net End	KOD4	9/22/2019 2:15	10:15:27 AM	57.90238	150.9538			Hopcroft
380	Bongo 60 cm Start	KOD4	9/22/2019 2:29	10:29:29 AM	57.89973	150.969	74		Hopcroft
381	Bongo 60 cm End	KOD4	9/22/2019 2:37	10:37:49 AM	57.89646	150.9786	74		Hopcroft
382	Bongo 60 cm Start	KOD5	9/22/2019 3:52	11:52:22 AM	57.78976	150.7481	87		Hopcroft
383	Bongo 60 cm End	KOD5	9/22/2019 4:04	12:04:40 PM	57.79648	150.7587	87		Hopcroft

Event #	Description	Station	Local	GMT	Latitude	Longitude	Depth	Comments		Scientist
384	Bongo 60 cm Start	KOD6	9/22/2019 5:33	1:33:50 PM	57.67262	150.5521	99			Hopcroft
385	Bongo 60 cm End	KOD6	9/22/2019 5:49	1:49:20 PM	57.6818	150.5658	99			Hopcroft
386	Methot Net Start	KOD6	9/22/2019 6:21	2:21:11 PM	57.66626	150.5561	99			Hopcroft
387	Methot Net End	KOD6	9/22/2019 6:41	2:41:31 PM	57.65277	150.5552	99			Hopcroft
388	CTD 64 Start	KOD6	9/22/2019 7:25	3:25:13 PM	57.67106	150.5496	99			Hopcroft
389	CTD 64 End	KOD6	9/22/2019 7:39	3:39:39 PM	57.66978	150.5504	99			Hopcroft
390	CalVET Net Tow Start	KOD6	9/22/2019 7:43	3:43:35 PM	57.66958	150.5506	99		33	Hopcroft
391	CalVET Net Tow End	KOD6	9/22/2019 7:50	3:50:15 PM	57.66967	150.5496	99		33	Hopcroft
392	Fe Fish Start	KOD6	9/22/2019 7:58	3:58:15 PM	57.68031	150.5718	99			Aguilar-Islas
393	Fe Fish End	KOD5	9/22/2019 9:03	5:03:09 PM	57.78351	150.7579				Aguilar-Islas
395	CTD 65 Start	KOD5	9/22/2019 9:05	5:05:03 PM	57.78332	150.7584	87	Prod		Hopcroft
396	CTD 65 End	KOD5	9/22/2019 9:23	5:23:53 PM	57.78323	150.7533	87	Prod		Hopcroft
397	CalVET Net Tow Start	KOD5	9/22/2019 9:27	5:27:27 PM	57.78289	150.7523	87		34	Hopcroft
398	CalVET Net Tow End	KOD5	9/22/2019 9:32	5:32:07 PM	57.78279	150.7516	87		34	Hopcroft
399	CalVET Net Tow Start	KOD5	9/22/2019 9:42	5:42:39 PM	57.78313	150.7497	87	34A		Hopcroft
400	CalVET Net Tow End	KOD5	9/22/2019 9:47	5:47:14 PM	57.78312	150.7489	87	34A		Hopcroft
401	CTD 66 Start	KOD5	9/22/2019 9:58	5:58:12 PM	57.78337	150.7593	87	Intensive		Hopcroft
402	CTD 66 End	KOD5	9/22/2019 10:10	6:10:49 PM	57.78417	150.7564	87	Intensive		Hopcroft
403	Fe Fish Start	KOD5	9/22/2019 10:13	6:13:38 PM	57.7847	150.7573	87			Aguilar-Islas
404	Fe Fish End	KOD4	9/22/2019 11:21	7:21:21 PM	57.90015	150.9694				Aguilar-Islas
405	CTD 67 Start	KOD4	9/22/2019 11:24	7:24:06 PM	57.90036	150.9693	75			Hopcroft
406	CTD 67 End	KOD4	9/22/2019 11:35	7:35:03 PM	57.90163	150.9658	75			Hopcroft
407	CalVET Net Tow Start	KOD4	9/22/2019 11:37	7:37:46 PM	57.902	150.9651	75		35	Hopcroft
408	CalVET Net Tow End	KOD4	9/22/2019 11:41	7:41:39 PM	57.90241	150.9637	75		35	Hopcroft
409	Fe Fish Start	KOD4	9/22/2019 11:44	7:44:53 PM	57.90324	150.9625	75			Aguilar-Islas
410	Fe Fish End	KOD3	9/22/2019 12:52	8:52:23 PM	58.01516	151.1787	75			Aguilar-Islas
411	CTD 68 Start	KOD3	9/22/2019 12:55	8:55:04 PM	58.01519	151.1789	79			Hopcroft
412	CTD 68 End	KOD3	9/22/2019 13:08	9:08:05 PM	58.01548	151.1727	79			Hopcroft
413	CalVET Net Tow Start	KOD3	9/22/2019 13:10	9:10:40 PM	58.01597	151.1714	79		36	Hopcroft
414	CalVET Net Tow End	KOD3	9/22/2019 13:14	9:14:32 PM	58.01548	151.1695	79		36	Hopcroft
415	Fe Fish Start	KOD3	9/22/2019 13:19	9:19:08 PM	58.01679	151.1693	79			Aguilar-Islas
416	Fe Fish End	KOD2	9/22/2019 14:24	10:24:42 PM	58.12966	151.3829				Aguilar-Islas
417	CTD 69 Start	KOD2	9/22/2019 14:27	10:27:58 PM	58.12962	151.3828	124			Hopcroft
418	CTD 69 End	KOD2	9/22/2019 14:48	10:48:56 PM	58.12518	151.3819	124			Hopcroft
419	CalVET Net Tow Start	KOD2	9/22/2019 14:53	10:53:53 PM	58.12471	151.3821	124		37	Hopcroft
420	CalVET Net Tow End	KOD2	9/22/2019 14:59	10:59:09 PM	58.12479	151.3826	124		37	Hopcroft
421	Fe Fish Start	KOD2	9/22/2019 15:03	11:03:44 PM	58.12597	151.3856	124			Aguilar-Islas
422	Fe Fish End	KOD1	9/22/2019 16:11	12:11:49 AM	58.24375	151.5879				Aguilar-Islas

Event #	Description	Station	Local	GMT	Latitude	Longitude	Depth	Comments	Scientist
423	CTD 70 Start	KOD1	9/22/2019 16:15	12:15:10 AM	58.24505	151.589	68		Hopcroft
424	CTD 70 End	KOD1	9/22/2019 16:31	12:31:32 AM	58.24203	151.589	68		Hopcroft
425	CalVET Net Tow Start	KOD1	9/22/2019 16:36	12:36:14 AM	58.24171	151.5907	68	38	Hopcroft
426	CalVET Net Tow End	KOD1	9/22/2019 16:39	12:39:57 AM	58.24198	151.5915	68	38	Hopcroft
427	Fe Fish Start	KOD6	9/24/2019 13:08	9:08:48 PM	57.67341	150.5549	99		Aguilar-Islas
428	Fe Fish End	KOD7	9/24/2019 14:20	10:20:19 PM	57.55691	150.3408			Aguilar-Islas
429	CTD 71 Start	KOD7	9/24/2019 14:23	10:23:40 PM	57.55659	150.3422	178		Hopcroft
430	CTD 71 End	KOD7	9/24/2019 14:47	10:47:43 PM	57.54951	150.3518	178		Hopcroft
431	CalVET Net Tow Start	KOD7	9/24/2019 14:50	10:50:25 PM	57.54835	150.3534	178	39	Hopcroft
432	CalVET Net Tow End	KOD7	9/24/2019 14:57	10:57:25 PM	57.54629	150.3535	178	39	Hopcroft