NGA-LTER

Northern Gulf of Alaska Long-Term Ecological Research

Cruise Report September 2021

Cruise ID: TGX2021-09 (TXF21)

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 fourth 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 25th fall cruise for the Seward Line in the NGA, including Prince William Sound (PWS), and the 50th year of observations at GAK1.

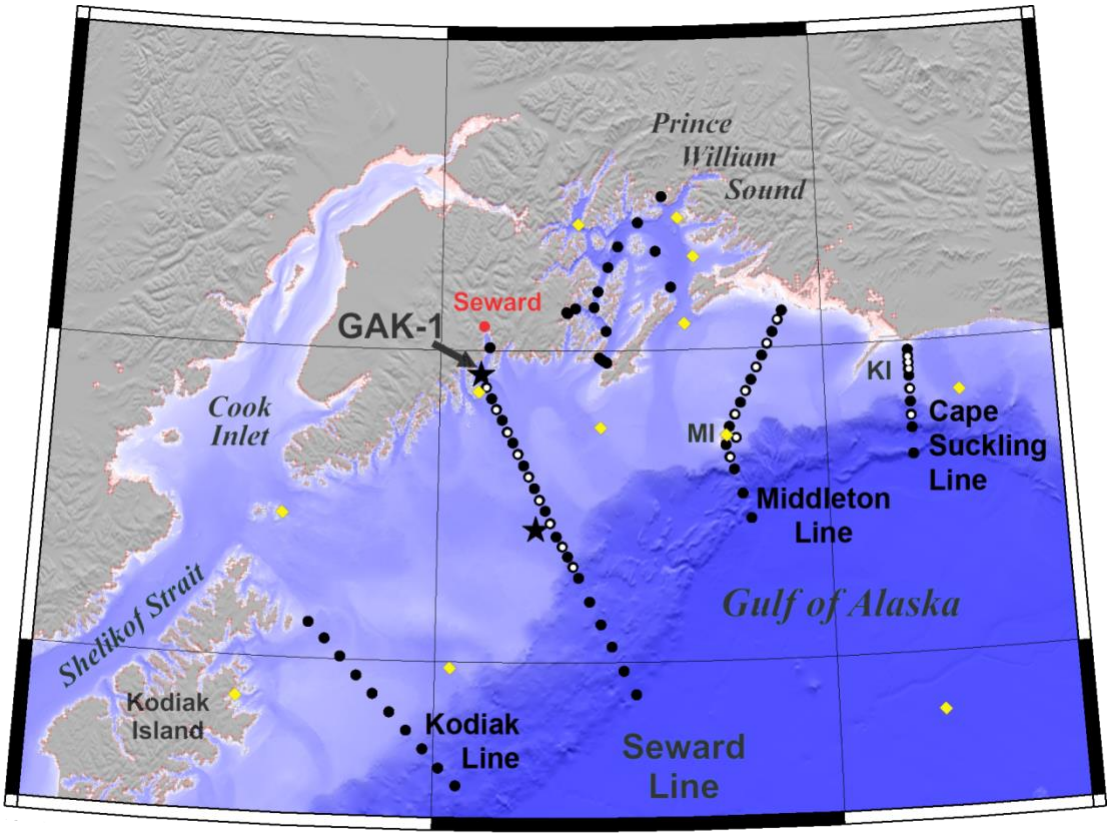


Figure 1. The LTER sampling stations. CTD casts without water sampling as open symbols. Yellow diamonds represent locations of meteorological data from NOAA buoys or ground stations. Star shows position of LTER mooring. Cape Suckling is low priority.

Scientific Personnel:

1	Russ Hopcroft (LTER Lead PI)	Zooplankton (days), UAF, Chief Scientist
2	Hannah Kepner	Zooplankton (nights), prospective student
3	Emily Stidham	Zooplankton (nights), UAF
4	Delaney Coleman	Zooplankton (nights), UAF
5	Bette Smith	Zooplankton (nights), UAF
6	Tom Kelly	Particle flux (days), UAF
7	Kerri Fredrickson	Phytoplankton/Microzoop, WWU
8	Megan O'Hara	Phytoplankton/Microzoop, WWU
9	Jake Cohen	Phytoplankton/Microzoop, UAF
10	Addie Norgaard	Chemistry (Gases), UAF
11	Mette Kaufman	Chemistry (Nutrients, Iron), UAF
12	Emily Ortega	Chemistry (Nutrients, Iron, DIC), UAF
13	Isaac Reister	Physics (CTD), UAF
14	Daniel Cushing	Seabirds/Mammals, FWS

TGX2021-09 was conducted during the time of the COVID19 global pandemic. Mitigation measures were taken to reduce the risk of disease transmission following UNOLS' recommendations.

Cruise Overview:

Station Transects: Most of the cruise was dedicated to transect station work, theoretically split as roughly 2 days on the Kodiak Line, 2 on the Middleton Island Line, 2 in Prince William Sound, and 5 on the Seward line. Poor weather precluded sampling of the Kodiak lIne and required the Seward Line cut into 3 separate occupations. As per standard design while occupying our transect lines, operations were generally divided into distinct day and night tasks, thus requiring each station to be occupied twice. This structure requires some back-tracking but avoids each discipline needing to supply 2 shifts of scientists and ensures all organisms – especially larger diel-migrating zooplankton – are captured with minimal time-of-day bias. During each morning we typically occupied an established "intensive" station for experimental work. Intensive stations involve a greater number and range of collections than other stations occupied that day. Stations profiles were supplemented by underway measurements. The Fe-Fish was deployed in between all stations, there were no trace-metal casts. Bird and mammal observations were conducted continuously during daylight hours while the ship was underway.

Sediment Traps: This cruise involved the deployment of drifting sediment traps with subsequent-day recovery. The reoccupation of stations as characteristic of our normal sampling design greatly facilitated the integration of sediment traps into the cruise logistics, but overall success was greatly limited by weather.

Moorings: This cruise recovered the Gulf of Alaska Ecosystem Observatory (GEO) mooring GEO3.

Daily summary

Sept 10 – Day0 – science party all arrived in Seward and boarded Tiglax for the evening. Winch and Conex were loaded at railway dock late afternoon.

Sept 11 – Day1 – mobilization and loading of vessel. Most of day is spent adding larger instruments to CTD and terminating the hydrographic wire. Connectivity issues with CTD were discovered early evening and troubleshooting continued to 4am, including wire retermination.

Sept 12 – Day2 – Troubleshooting of CTD continued, several issues were likely occurring concurrently hampering the process. Most other teams completed their setup. Weather in the Gulf was unworkable, so spending time at dock was less consequential.

Sept 13 – Day 3 - Eventually we implicated noise on the cable shield, and re-terminated cable to use internal conductors for both signal and ground. We cast off late afternoon. We sampled RES2.5 ~19:00, followed by a short test deployment of the iron-fish, then headed for Middleton Line were weather was projected to be better.

Sept 14 – Day 4 – Drifting Trap deployed at MID10 ~11:00, then began Intensive station MID10 with production cast at 11:30 followed by 2 Quad nets and the full CTD to 1000 m. The iron-fish was deployed then we head north completing Quad Calvets and CTDs to MID6 ending at 21:00. Nights worked south beginning at 22:00. A hydraulic leak after the first Methot precluded their deployment for the rest of the night. Nights completed two multinet collections at MID10 at ~5:30. Sea-state made for a challenging evening.

Sept 15 – Day 5 – The day began with sediment trap retrieval ~5nm south of MID10 at 07:00. CTDs began at MID6i at 11:30. The iron-fish was deployed and we sampled MID6 and MID5i before beginning Intensive station MID5 with a production cast at 14:15. We worked north toward MID1 ending there at 23:30. Night work began at MID2 at ~00:45. Although hydraulics had been repaired it was too rough for Methots, and weather shut down Bongo operations at 01:00 after completing the single station MID2, We headed for the protection of PWS.

Sept 16 – Day6 – Day work began at PWS3 at ~8:14 with a Calvet and CTD. We set a drifting Sediment trap just north of PWS2, then began intensive sampling there at 11:42 with a production cast. Two Calvets, 2 more CTD casts and a pair of vertical multinets followed, wrapping up activities at ~16:00. We sampled south hitting PWS1 and KIP2, ending there at 19:30. Night work sampled these same 4 stations heading north with Multinets and Methots ending at ~5:30.

Sept 17 – Day 7 – We retrieved the sediment traps near PWS2 at ~7:30, then headed out of the Sound hoping conditions would be workable by evening. A sediment trap was deployed at 20:30, then night work began at GAK9 at ~21:00. Night work continues south with Multinets and Methots stopping after GAK12 at 06:15, then transiting back to GAK9.

Sept 18 – Day8 – Intensive station Gak9 began at 10:00 with a vertical multinet, the production cast, 2 Quad Calvets and the full CTD cast wrapping up at ~12:00. We sampled GAK9i and GAK10 then proceeded ~7 nm west to retrieve the sediment trap, retuning back to the line thereafter to resume the transect. We sampled GAK11 & Gak12 before handing off to the night

shift at 21:30. Nights worked south with Multinets and Methots, ending at ~6:00 at GAK15, with seas laying down as the night progressed.

Sept 19 – Day 9 – The morning began early at Intensive station GAK15, switching over to a pair (deep and shallow) of vertical multinets that were in the water at 6:40. This was followed by the Production cast (at 8:30), two Quad Calvets, and the deep CTD cast that ended at ~10:30. We worked north with Calvets and CTDs to GAK13, then pulled the iron fish near Gak12 at 16:30. Nights began at GAK 8 at 21:00 and worked the Multinets and Methots in as far as GAK5, ending at 06:45. A sediment trap was set just before starting the last station (~04:30). Weather was picking up as night shift ended

Sept 20 – Day 10 – We began intensive station GAK5 with a vertical multinet at 8:00, followed by a production CTD, a Calvet and the main CTD ending at 10:00. Weather picked up very quickly during his station and had become unworkable. We retrieved the drifting trap at 11:30 then made our way into PWS for anchorage by dusk.

Sept 21 – Day 11 – Weather outside the sound was unworkable, so we took a few hours to hike near Chenega Glacier. Sampling began at IB0 ~12:45 and we worked outward with Calvets and CTD through IB2 then onto the MS line, completing sampling there at 19:45. The forecast had improved, and we headed to the Seward Line in hope that night work would be possible. Conditions were initially unworkable but has subsided somewhat by 02:00 when we began a Multinet at GAK3, early in the upcast the wire jumped the drum (due to sea-state) but only took a half hour to resolve. The samples were preserved, but the cast would need to be repeated again due to low volumes sampled. Conditions had improved greatly by 05:00 and both a multinet and Methot were completed at GAK4 by ~06:20

Sept 22 – Day 12 – We started day work with a CTD at 06:30 followed by a Calvet, then worked out with Calvets and CTDs to close the bird transect at GAK9 by 1700. All “intermediate” stations were samples as waterless CTDs. Weather continued to improve over the course of the day. We retrieved GEO2 mooring, and did a calibration CTD there during our return trip north at 19:30-21:00. Winds had built to 40 knots by when we reached GAK3 at 00:30, and we continued northward for calm anchorage inside Resurrection Bay.

Sept 23 – Day 13 – Storm force winds throughout the day precluded sampling.

Sept 24 – Day 14 – Winds remain unworkable for remaining Seward Line daywork stations. We got underway at 9:30 and conducted a vertical multinet to the bottom at RES2.5 at 9:30 to 10:00, then headed to Aialic Bay for glacier viewing. Winds began subsiding late evening, and nights worked Multinets and Methots at GAK1-GAK3 from 00:00 to 05:00, then repositioned to GAK1 for daywork.

Sept 25 – Day 15 – Intensive station GAK1 began at ~8:00 with a vertical multinet followed by the Prod CTD, 2 Calvets, 2 regular CTDs and then ended with the deployment of the Ironfish at ~11:00. We worked south to GAK4 closing the bird transect, then a waterless CTD cast was conducted, ending our day at ~17:00. All “intermediate” stations were samples as waterless CTDs.

Sept 26 – Day 16 – The day was spent offloading Tiglax, loading the UHaul, and organizing those items left to overwinter in the SMC warehouse.

Sept 27 – Day 18 – The science party disembarked Tiglax after breakfast, and she moved to the Railway dock to offload the winch and Connex. Final packing of UHaul was completed and the science party was underway for Fairbanks (or Anchorage) by noon

General Comment: *This cruise has some of the most unworkable weather encountered during the time series, with only brief periods of workable weather in between storm passages.*

Physics Report:

PI: Seth Danielson, Participant: Isaac Reister

On this cruise we conducted 65 casts for water column hydrography at 54 stations (Figure 1) 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.

The CTD stations were occupied on two shelf transects: the Seward Line (Figure 2) and the Middleton Island Line (Figure 3) plus additional stations in Prince William Sound and Resurrection Bay.

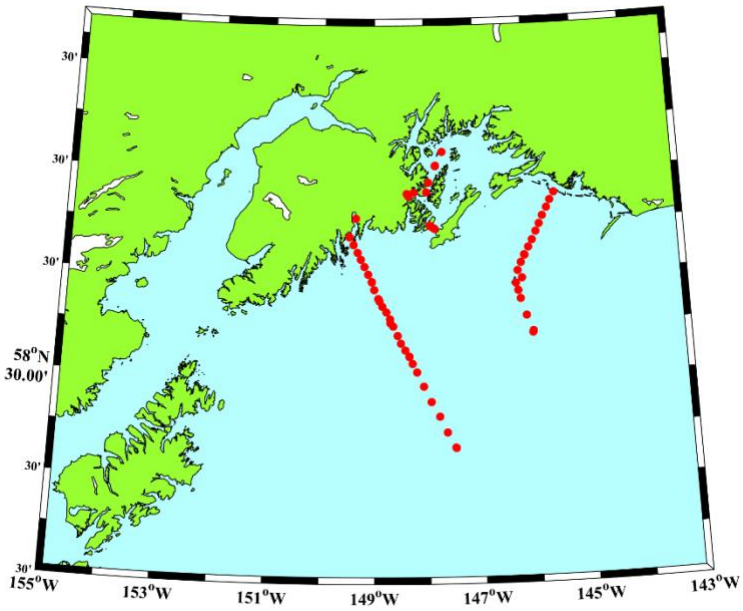


Figure 2. TGXF21 CTD Stations

Underway data from this cruise were collected by a SBE-21 thermosalinograph (temperature, salinity and chlorophyll a fluorescence) and a portable meteorological datalogger that recorded wind speed and direction (relative to the ship), air temperature, air pressure and air humidity, and solar radiation. Logging occurs in the bridge's computer room.

The Seward Line was cool in comparison to the past 25 years of observations by 0.41 degree, although the warmer water observed over the Middleton Line suggested heat was likely being lost during the stormy conditions encountered as the cruise progressed. Underway data (Fig. 3) revealed surface waters were much fresher in PWS and within the ACC (as is typical for September). The hydrographic section along the Seward Line (Fig, 4) showed a well-developed ACC with surface waters below a salinity of 32 extending nearly to the shelf break. Stratification (driven by temperature) was most intense offshore and likely contributed to the subsurface chlorophyll maximum observed in offshore waters. In contrast, the Middleton Line (Fig. 5) had warmer, low-salinity (>29.5) water that stretched along most of its length in its surface waters. Middleton also showed a subsurface chlorophyll maximum in the most offshore stations where salinity again suggested more oceanic waters were present. Satellite data (Fig. 6) showed there was a weak cyclonic eddy just east of the Middleton Line and that chlorophyll was low to moderate (1-2 mg m^{-3}) over much of the LTER sampling domain. SST cooled considerably during the cruise (Fig. 6B).

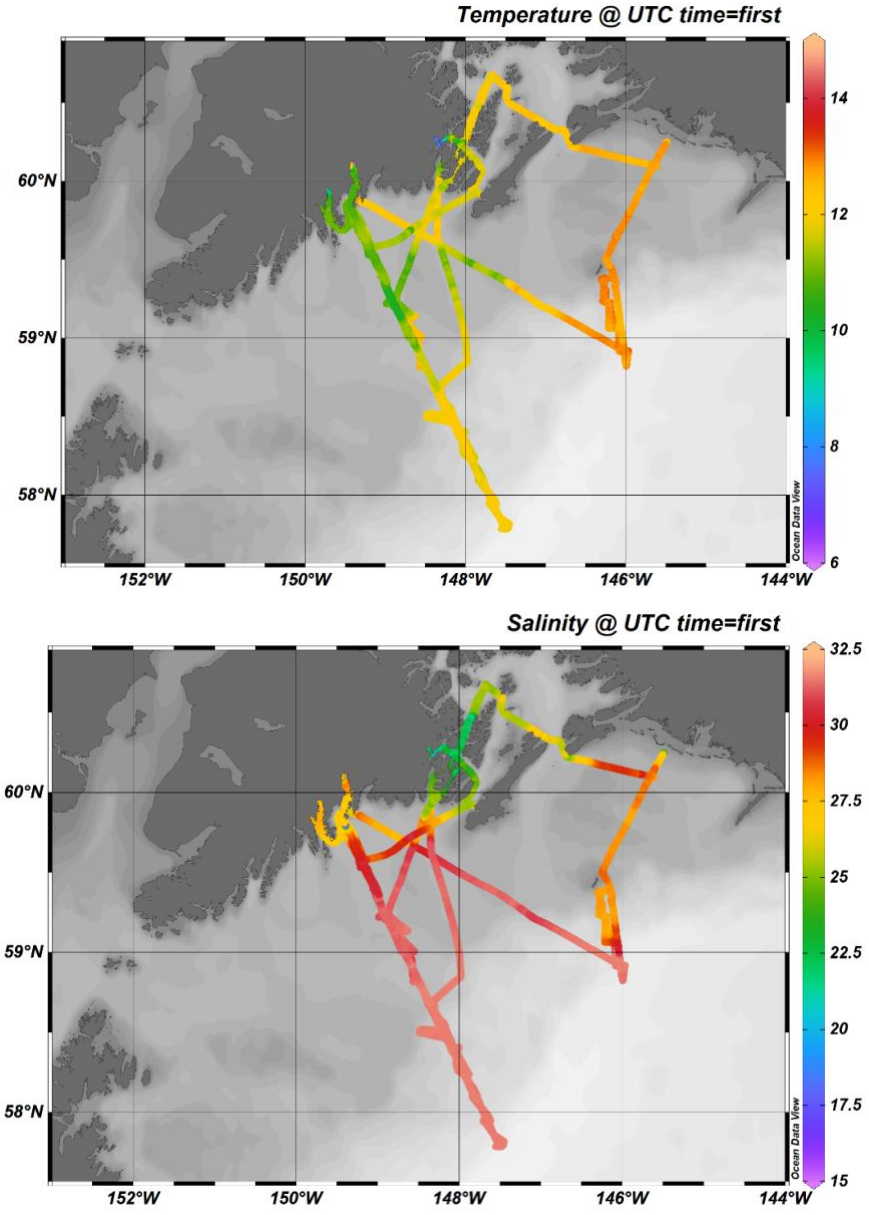


Fig. 3. Underway temperature and salinity from Fall 2012 (TGX2021-09)

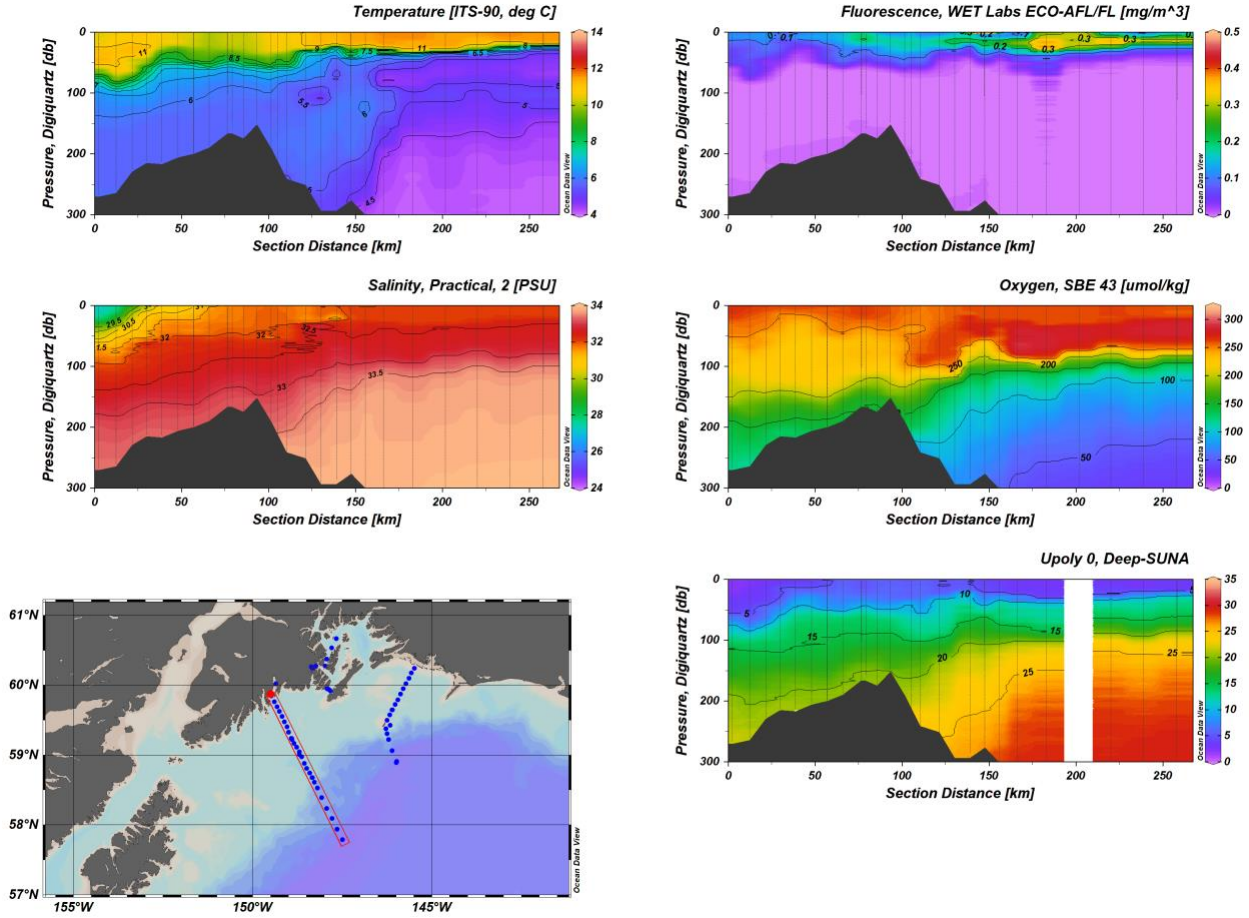


Fig. 4 Seward Line transect physical hydrography from TGX2021-09.

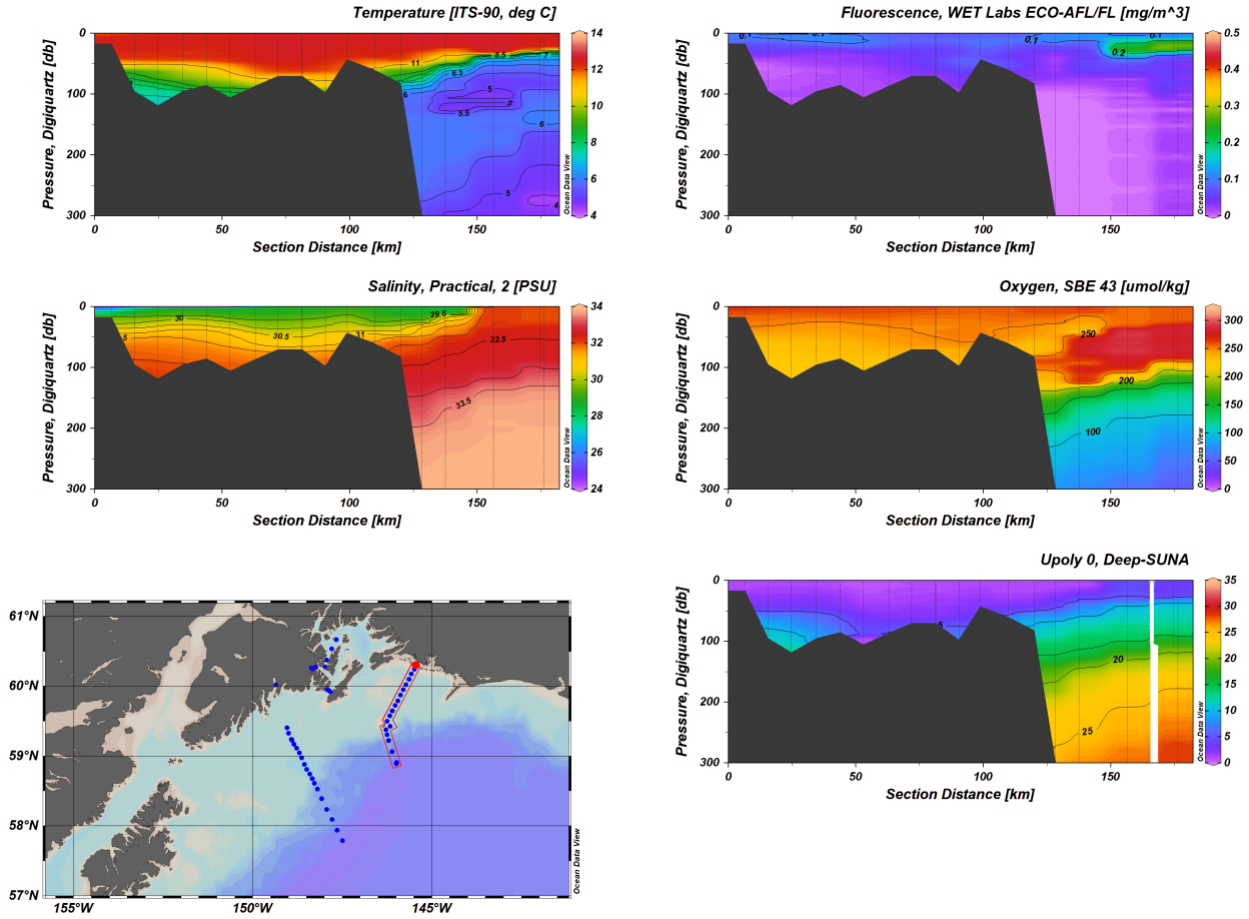


Fig. 5 Middleton Line transect physical hydrography from TGX2021-09.

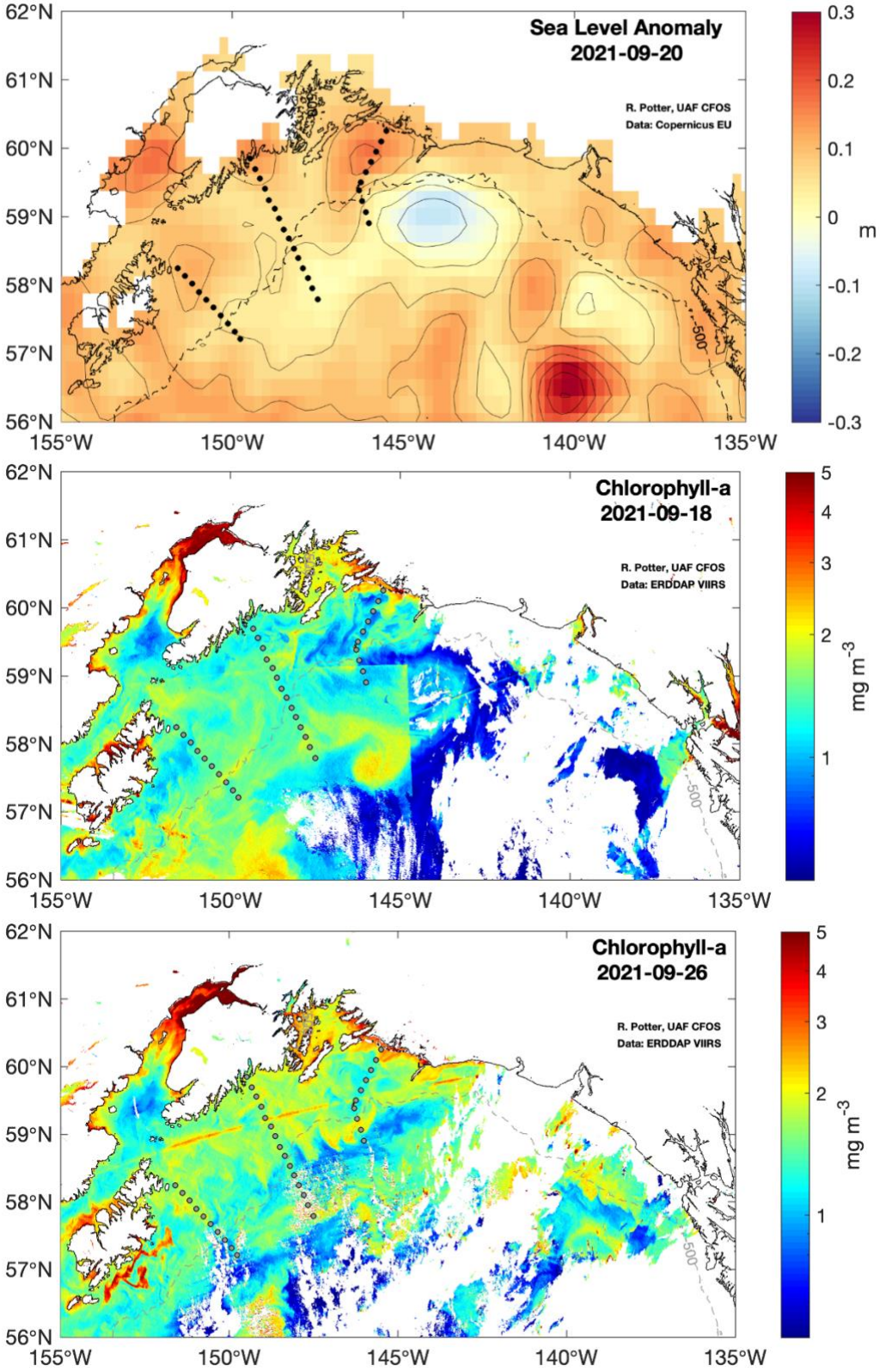
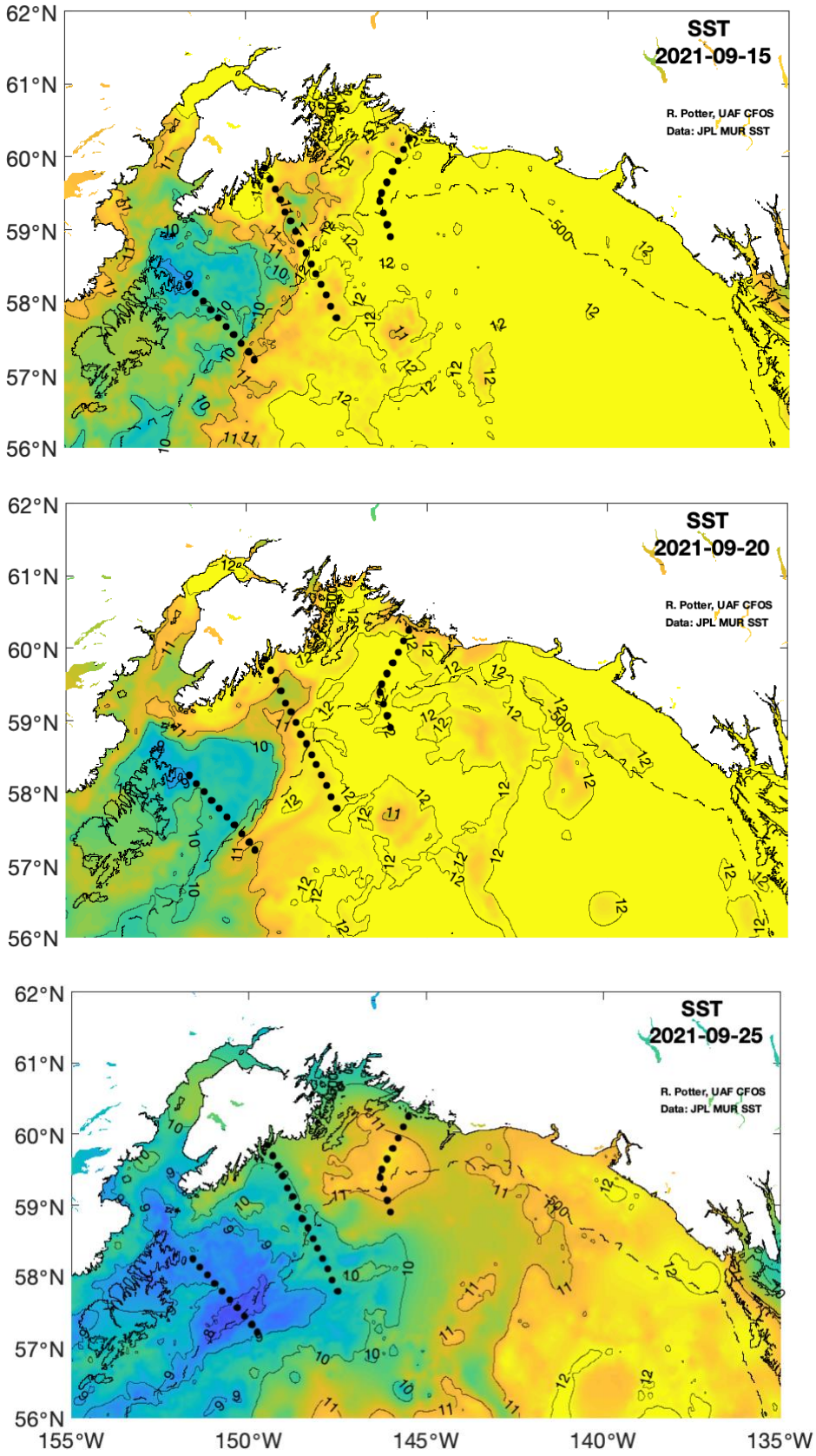


Fig. 6. Satellite images from mid-cruise.



Fig, 6B. Satellite derived sea-surface temperature during the cruise period.

Macro- and Micronutrient sample collection and processing

PI: Ana M. Aguilar-Islas
Participants: Emily Ortega, Mette Kaufman

During this field effort our goal was to determine ambient distribution of dissolved inorganic macronutrients (nitrate, nitrite, ammonium, phosphate and silicic acid) and the micronutrient iron across the three main NGA LTER lines (KOD, GAK, MID) and Prince William Sound. 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. A secondary aim was to assess the deployment suitability of a new tubing for the surface trace metal sampler, the "Iron-fish".

Table 1. Samples collected for Nutrient Analysis
Intensive stations are in bold. Additional samples collected from primary production (PP) casts and surface transects are under "OTHER"

Station	Date	# samples	Station	Date	# samples
Res 2.5	9/14/2021	13	GAK12	9/18/2021	15
MID10	**9/14/2021**	**15**	**GAK15**	**9/19/2021**	**15**
MID9	9/14/2021	15	GAK14	9/19/2021	15
MID8	9/14/2021	14	GAK13	9/19/2021	15
MID7	9/14/2021	7	**GAK5**	**9/20/2021**	**11**
MID6	9/15/2021	5	IB0	9/21/2021	13
MID5	**9/15/2021**	**8**	IB1	9/21/2021	10
MID4	9/15/2021	8	IB2	9/21/2021	11
MID3	9/15/2021	8	MS2	9/21/2021	11
MID2	9/15/2021	9	GAK4	9/22/2021	11
MID10*	9/15/2021	3	GAK5*	9/22/2021	11
PWS3	9/16/2021	14	GAK6	9/22/2021	10
PWS2	**9/16/2021**	**14**	GAK7	9/22/2021	12
PWS1	9/16/2021	13	GAK8	9/22/2021	13
KIP2	9/16/2021	14	GEO	9/22/2021	10
GAK9	**9/18/2021**	**13**	**GAK1**	**9/25/2021**	**13**
GAK10	9/18/2021	15	GAK2	9/25/2021	12
GAK11	9/18/2021	15	GAK3	9/25/2021	12
			Fe Fish		22
			Prod		43
				Total	**488**

Filtered seawater samples were collected from 36 vertical profiles from surface to 1000 m from the CTD rosette bottles (see Table 1). Samples were filtered through Whatman GF/F filter disks using a syringe, and were frozen (-80 ^{o}C) following collection. Samples were also obtained from the surface in between stations (22 samples) from the "iron fish" along with samples for micronutrient analysis. Mette Kaufman was responsible for most of the sampling with some help with Emily Ortega. In addition, the Strom lab took nutrient samples from primary production CTD casts (43 samples). In total, **488** samples were collected for nutrient analysis.

Sample collection and processing for macronutrient analysis:

Filtered seawater samples were collected from 36 vertical profiles from surface to 1000 m from the CTD rosette bottles (see Table 1). Samples were filtered through Whatman GF/F filter disks using a syringe, and were frozen (-80 ^{o}C) following collection. Samples were also obtained from the surface in between stations (22 samples) from the “iron fish” along with samples for micronutrient analysis. Mette Kaufman was responsible for most of the sampling with some help with Emily Ortega. In addition, the Strom lab took nutrient samples from primary production CTD casts (43 samples). In total, **488** samples were collected for nutrient analysis.

Sample processing for iron analysis:
A positive-pressure, plastic enclosure supplied with HEPA filtered air (the “bubble”) was constructed in the analytical lab to house the Nisking bottles, IronFish sampling spigots and filtration rigs. Immediately after collection Niskin bottles were transferred to the bubble for subsampling. Filtered (through 0.2 µm Acropak capsules) subsamples for dissolved Fe analysis were processed from all casts at all depths, and from all IronFish samples. Filtered subsamples for the analysis of iron-binding organic ligands, unfiltered samples for total dissolvable iron analysis, and filters for particulate iron analysis were obtained from a subset of samples (see Table 2). Replicates of particulate samples for use in dissolution experiments were obtained from KOD5 (bottom water collected with Niskins) and from MID1 (surface water collected with the Fe-Fish). These samples were filtered through 0.2 um polycarbonate filter discs (Nuclepore) using trace metal clean techniques. Filters and organic iron-binding ligand samples were stored frozen. Ortega and Aguilar-Islas were responsible for subsampling and filtration. In total there were 169 DFe samples, 143 TDFe samples, 32 Ligand samples, and 29 particulate samples taken during the cruise.

Sample processing for iron analysis:

All samples for iron parameters were collected inside a trace metal clean “van” on the ship’s deck that was supplied with HEPA filtered air. In general, collection took place as the ship arrived on station and in between stations. Filtration took place on-line for subsamples for the analysis of dissolved iron and iron-binding organic ligands. Off-line filtration was done for subsamples for soluble iron (through 0.02 um Anotop syringe filters) analysis, and for particulate iron (through 0.2 um polycarbonate filter discs (Nuclepore)) analysis. Unfiltered samples were also collected for total dissolvable iron analysis. See Table 2 for location of sample collection. Emily Ortega was responsible for all sample filtration.

General Notes

The deck crew provided excellent support, and their help contributed to the success of our iron fish deployments. In general, the crew was helpful responding promptly to changes in sampling needs and/or weather conditions. Communication via handheld radio was essential to the trace metal sampling effort. The trace metal clean van is an essential facility for trace metal work. The rough weather impacted the ‘iron-fish” sample collection to a lesser degree than other times because of the new tubing configuration. The ship’s deck gear was in good working condition. Other ship’s facilities were adequate. Meals provided by the ship’s cook were delicious including a number of fantastic desserts. We would also like to thank the Seward Marine Center, especially Brian Mullaly and Gillian Braver for their hard work and above-and-beyond assistance including forklifting the trace metal van.

Table 2. Samples for iron parameters

Station	Date	DFe	TDFe	SFe	Ligands	PFe	Notes
MID9	9/14/2021	1	1		1		
MID8	9/14/2021	1	1		1		
MID7	9/14/2021	1	1		1		
MID10	9/15/2021	1	1		1		
MID6	9/15/2021	1	1		1		
MID5	9/15/2021	1	1		1		
MID4	9/15/2021	1	1		1		
MID3	9/15/2021	1	1		1		
MID2	9/15/2021	1	1		1		
MID1	9/15/2021	1	1		1		
PWS2	9/16/2021	1	1	1	1		
GAK9	9/18/2021	1	1		1		
GAK10	9/18/2021	1	1		1		
GAK11	9/18/2021	1	1		1		
GAK12	9/18/2021	1	1		1		
GAK15	9/19/2021	1	1		1		
GAK14	9/19/2021	1	1		1		
GAK13	9/19/2021	1	1		1		
GAK5	9/20/2021	1	1		1		
GAK4	9/22/2021	1	1		1		
GAK5*	9/22/2021	1	1		1		
GAK6	9/22/2021	1	1		1		
GAK7	9/22/2021	1	1		1		
GAK8	9/22/2021	1	1		1		
GAK1	9/25/2021	1	1	1	1		
GAK2	9/25/2021	1	1		1		
GAK3	9/25/2021	1	1		1		
Total		**27**	**27**	**2**	**27**		
Additional Samples taken in between Stations							
MID	9/14/2021	3					
MID	9/15/2021	6		3		3	
GAK	9/18/2021	3					
GAK	9/19/2021	3					
GAK	9/22/2021	5					
GAK	9/25/2021	3					
Total		**23**		**3**		**3**	

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, Participant: Addie Norgaard

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 all stations. In total 67 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
GAK5	9
GAK9	12
GAK15	13
PWS2	12
GEO	9
	67

Dissolved Oxygen

Participant: None (Addie Norgaard)

A total of 43 samples were taken, alternating samples between surface and bottom bottles for each cast.

Particles & Biogeochemisrty

PI: Andrew McDonnell. Participant: Thomas Kelly, UAF

Optical Instruments

Two rosette-mounted optical instruments were used during the cruise: the underwater vision profiler (Hydroptic UVP5; sn009) and the laser in situ scatterometer and transmissometer (Sequoia LISST-DEEP; sn4041). Both instruments measure particle abundance and size spectra during the downcast. The UVP5 and the LISST-DEEP were used on almost all casts (n = 53 and 65, respectively) and assesses particles between ~250 – 2500 µm and quantifies particles into 32 size classes between 2.5 – 500 µm, respectively. UVP5 was mounted in the place of Niskin #24 on the rosette, while the LISST-DEEP was housed in a custom steel frame attached to the bottom of the rosette riser.

Surface Tethered Sediment Trap

Four (4) deployments of the surface-tethered sediment trap arrays were completed during TXF21. Deployments lasted for 16-20 hours except for the final deployment which was aborted after ~5 hours due to weather. Deployments took place at MID10, PWS2, GAK9 and GAK5. Each array was outfitted with 1 cross-frame placed at 50 m. Four collection tubes allowed for sub-sampling of sinking matter for pigments (Chl-a, phaeopigments; n = 12), carbon and nitrogen abundance and isotopic composition (POC, PON, PIC; n = 15), biogenic silica abundance (bSi; n = 3), non-contamination prone trace elemental analysis (e.g. P; n = 3), and genetic analysis (n = 3). Additionally, preserved sediment trap material was stored in LDPE bottles for future microscopic sorting (n = 3).

Phytoplankton and Microzooplankton

PI: Suzanne Strom
Participants: Kerri Fredrickson, Megan O'Hara (WWU), Jake Cohen (UAF_

Two of the standard LTER transect lines (GAK, MID) were sampled in their entirely, as well as 8 stations in Prince William Sound. Seven intensive stations were sampled spanning the PWS-to-offshore gradient (see red station labels in sampling Table 3). Intensive sampling at MID2 was prohibited due to weather, as was sampling along the entire KOD line.

Phytoplankton biomass and production: Phytoplankton biomass was characterized by size-fractionated chlorophyll at all non-intermediate shelf stations, all Prince William Sound stations, and at the GEO mooring site. GAK-5 was sampled twice. Samples were analyzed fluorometrically on board. Primary production estimates were made 8 intensive stations using the 13-C method and 24-h deck incubations. Six '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 light depth during experiment set-up.

Community characterization: Samples were fixed in acid Lugol's for standard microzooplankton biomass and composition estimates; these were taken from 10 m only at most stations and from 4 depths at intensive stations. Where 10m Lugol's samples were taken, samples were also fixed in borate-buffered formalin for diatom characterization. Microscopy samples, collected at every station along the GAK line and generally every-other station along the MID line, were fixed in glutaraldehyde, DAPI-stained, and made into slides for biomass and composition of nano- and picoplankton with the focus on cryptophytes; paraformaldehyde-fixed samples were collected at nearly every station for flow cytometry (3 depths per station at all stations, O'Hara thesis research). Samples for HPLC analysis of phytoplankton pigments (chemotaxonomy) were taken from all intensive stations; these were from 10m and generally one other euphotic zone depth (often 0 or 20 m). Also at intensive stations, samples were taken from 10 m (in duplicate) for molecular (18S rRNA) characterization of the protist community by the Rynearson laboratory at URI.

Organic carbon characterization: Samples for DOC analysis were filtered and frozen all intensive stations as well as additional stations on the MID line (total profiles = 9); depths sampled were mainly 150 m and above except in the deep intensive casts, and corresponded to nutrient sampling depths (8-10 depths per profile). At intensive stations only, 4 depths were sampled for POC and PIC (total profiles = 10).

Preliminary observations:

The highest chlorophyll-a concentrations were found inner to mid-shelf of the GAK line, where total chlorophyll-a concentrations were ≥ 1 µg/L (Fig. 7). Across all stations, nearly all the biomass was in cells <20 µm. In addition to low chlorophyll, a well-mixed surface layer was observed at most stations, likely a result of persistent storms throughout the cruise.

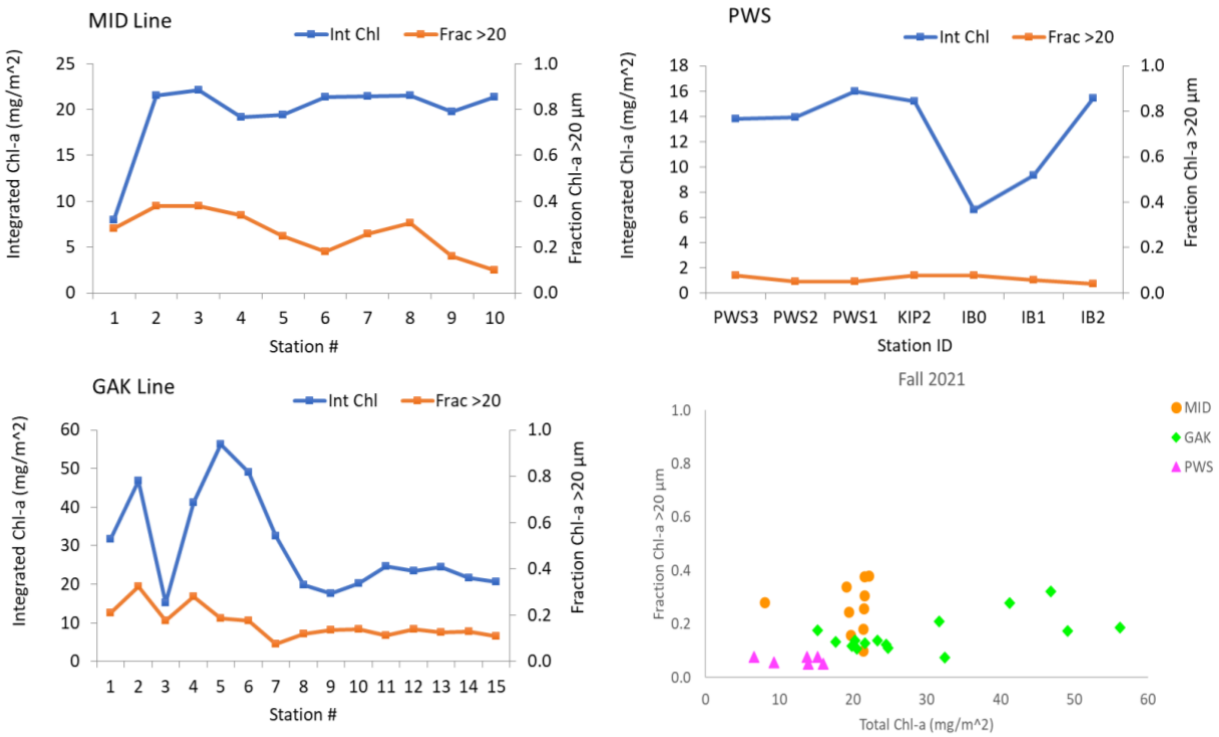


Fig 7. Integrated chlorophyll-a (0-75 m) and fraction of chlorophyll in particles >20 µm along transects during June-July 2021 for the GAK, MID, and PWS stations. Lower Right: Total integrated (0-75 m) chl-a versus fraction of chl-a in large (>20 µm) cells during fall 2021 NGA cruise.

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

Station	SF Chl	Lugols µzoo	Diatom	Nano/ pico	FC	HPLC	Euk Mol	DOC	POC/ PIC	13C prod
RES2.5	x			x	x					
MID10	x	x	x	x	x	x	x	x	x	x
MID9	x	x	x	x	x					
MID8	x				x					
MID7	x	x	x	x	x			x		
MID6	x	x	x		x					
MID5	x	x	x	x	x	x	x	x	x	x
MID4	x	x	x	x	x					
MID3	x	x	x		x					
MID2	x	x	x	x	x					
MID1	x				x			x		
PWS3	x				x					
PWS2	x	x	x	x	x	x	x	x	x	x
PWS1	x				x					
KIP2	x									
GAK9	x	x	x	x	x	x	x	x	x	x
GAK10	x	x		x	x					
GAK11	x	x	x	x	x					
GAK12	x	x		x	x					
GAK13	x	x	x	x	x					
GAK14	x	x		x	x					
GAK15	x	x	x	x	x	x	x	x	x	x
IB0	x									
IB1	x									
IB2	x									
MS2	x	x	x	x						
GAK5	x	x	x	x	x	x	x	x	x	x
GAK4	x	x		x	x					
GAK5(b)	x	x								
GAK6	x	x		x	x					
GAK7	x	x	x	x	x					
GAK8	x	x		x	x					
GEO	x									
GAK1	x	x	x	x	x	x	x	x	x	x
GAK2	x	x		x	x					
GAK3	x	x	x	x	x					
Total #	**35**	**26**	**18**	**23**	**28**	**7**	**7**	**9**	**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)

Lugol's µzoo: 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).

Diatom: water sample preserved in borate-buffered formalin (final concentration 2%) for microscopy analysis of diatom community. Sample collected from 10 m.

Nano/Pico: water samples fixed in glutaraldehyde (final concentration 0.5%), filtered onto a 0.8 µm polycarbonate filter, slide mounted and frozen for later analysis. Three depths sampled (0 and 10m, chl max or 30 m).

FC: Flow cytometer samples preserved with paraformaldehyde, flash frozen in liquid nitrogen and then stored frozen for analysis. Three depths sampled (0 and 10m, chl max).

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.

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

Euk Mol: water sample filtered (0.2 µm) and frozen in liquid N2 for molecular analysis of eukaryotic microbial community composition.

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.

Phytoplankton

PI: Hennon, Participant: Jake Cohen

On the Fall 2021 *Tiglax* cruise, sampling was conducted for flow cytometry and microbial genetics at each sampled station. This consisted of the Middleton and Seward Lines, as well as within Prince William Sound. The Kodiak Line was not sampled due to weather limitations. At each station sampled, with the exception of intermediate "i" stations and Montague Strait, water samples were taken at the surface, 10 meters, and the bottom. One milliliter of seawater was taken from each container and fixed with glutaraldehyde for flow cytometry. This will allow for counts of small cells in the water column to be conducted, with samples gated for picoeukaryotes, nanoeukaryotes, heterotrophic bacteria, *Synechococcus* and cryptophytes. Each water sample was also run through a 0.22 µm Sterivex filter in order for DNA analysis to be conducted. Each Sterivex filter had between one and five liters of water run through it. All DNA obtained will be extracted, PCR amplified for both 16S and 18S, and sequenced at the CORE lab at UAF. In total, 110 samples were collected over the course of the Fall cruise for both flow cytometry and DNA analysis. This data, combined with that collected on other years, will allow for a better understanding of how phytoplankton community structure responds to environmental variables, especially marine heat waves.

Meso/Macro Zooplankton

PI: Hopcroft, Participants: Delaney Coleman, Emily Stidham, Bette Smith, Hannah Kepner

Nets: The Zooplankton sampling operations were divided into distinct day and night activities. During daytime, Quadnets/Calvets (Quad frame has 4 nets, 2 of 150 µm mesh and 2 of 53 µm mesh) casts were conducted with the underwire winch on the starboard crane at all stations (except intermediate "i" stations) to 100 m depth, or within 5 m of the bottom at shallower stations. At Intensive stations, an 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 700 m (PWS2) dividing strata at 600, 400, 300, 200,100, 60, 40, and 20 m. A Deep Tandem Multinet was also deployed at GAK15 to 1200 m, dividing strata at 600, 400, 300, 200,100, 60, 40, and 20 m.

During night-time, 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 along the Seward Line and within PWS. A second collection was made at Intensive stations and preserved in Ethanol for molecular analysis. Finally, Bongo nets (60cm) were employed instead the multinet along the Middleton Line. An SBE 49 "Fastcat" CTD sampling at 16 Hz was attached to the Bongo Nets (deployed off the side arm crane) and used to collected pressure data to gauge the depth. One net from each Bongo deployment, and the drogue net from the Multinet, were also preserved in Ethanol. A Methot net was collected at most night stations and live sorted for jellyfish. The inner Midleton Line (MID2-6) were incompletely sampled due to poor weather and hydraulic failures.

Observations: There was nothing remarkable about the zooplankton communities compared to what is normal for the fall period.

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

Station	Calvet-Quad	Multi Vert.	Multi Tow	Bon	Meth		Station	Calvet-Quad	Multi Vert.	Multi Tow	Bon	Meth
RES2.5	x						KIP2	x		x		x
GAK1	X*	x	X*		x		PWS1	x		x		x
GAK2	x		x		x		PWS2	X*	X*	X*		x
GAK3	x		x		x		PWS3	x		x		x
GAK4	x		x		x		IB0	x				
GAK5	X*	x	X*		x		IB1	X*				
GAK6	x		x		x		IB2	x				
GAK7	x		x		x		MID1	-			-	
GAK8	x		x		x		MID2	X*			X	
GAK9	X*	x	X*		x		MID3	x				
GAK10	x		x		x		MID4	x				
GAK11	x		x		x		MID5	X*				
GAK12	x		x		x		MID6	x			x	
GAK13	x		x		x		MID7	x			x	x
GAK14	x		x		x		MID8	x			x	
GAK15	X*	X*	X*		x		MID9	x			x	
MS2	x						MID10	X*			X	
							33	**44**	**5**	**19**	**9**	**20**

PI: Petra H. Lenz & Russ Hopcroft. **Participant:** (Hopcroft)

Project Goals: *Neocalanus* emergence from diapause, *Neocalanus* preparation for diapause (NSF project - UHM & UAF; PIs: Lenz, Hopcroft, and Hartline) – transcriptional profiling of individuals in the genus *Neocalanus* in the adult stage. 2021 marks the 7th year of fall collection of *Neocalanus flemingeri* from our PWS2 station.

Research Activities:

- The Deep collections taken with vertical Multinet at GAK15 and PWS2 had all deeper strata sorted and imaged for *Neocalanus*.
- Animals were sorted for transcriptomics at PWS2 from the 600-400m layer: all 3 *Neocalanus* species, and *Calanus marshallae*.

Marine bird and marine mammal surveys (USFWS)

PI: Dr. Kathy Kuletz, USFWS. Participant: Dan Cushing, onboard observer and report author

Background

We conducted marine bird and marine mammal surveys in the Northern Gulf of Alaska (NGA), September 9–25, 2021, aboard the 37-m R/V *Tiglax*, as a component of the NGA Long-term Ecological Research (NGA-LTER) cruise led by chief scientist Russ Hopcroft of the University of Alaska Fairbanks (UAF). Station-based sampling was conducted along the Seward and Middleton Lines, and in Prince William Sound (PWS). Seabird and marine mammal surveys were conducted when the vessel was underway, including transits between sampling stations and sampling lines. The seabird component of NGA-LTER was supported by a grant from the North Pacific Research Board (L-37-01A and 01B) and the Exxon Valdez Oil Spill Trustee Council (Project 19120114-M).

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. Observations were recorded using four 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”. 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. Weather conditions during the September 2021 cruise were often poor, with sampling occurring during intervals between successive storm systems. As a result, the Kodiak line was not sampled, and survey coverage of the Middleton Line was incomplete. Data were processed by subdividing survey transects into 3-km segments to calculate density (birds km^{-2}) for each taxon in each transect segment.

Preliminary results

We conducted a total of 1035 linear km of surveys during the September 2021 cruise (Figure 8). On-transect, we observed a total of 1112 individuals of 30 species of birds, with an additional 18 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 4.0 birds km^{-2}. The abundance of birds in many locations was low. Areas of higher abundance occurred near the shelf-break, especially in the vicinity of Middleton Island, and also near the coast, especially in the southwestern passages of PWS (Figure 9). No dead birds were observed.

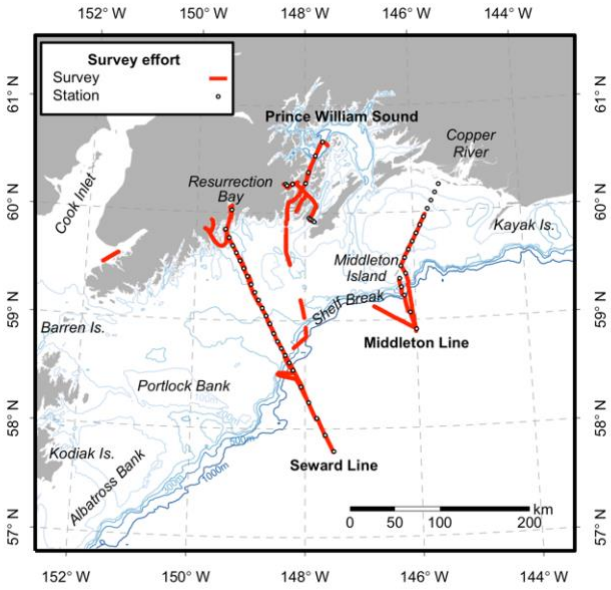


Fig. 8. Location of seabird and marine mammal surveys (red lines).

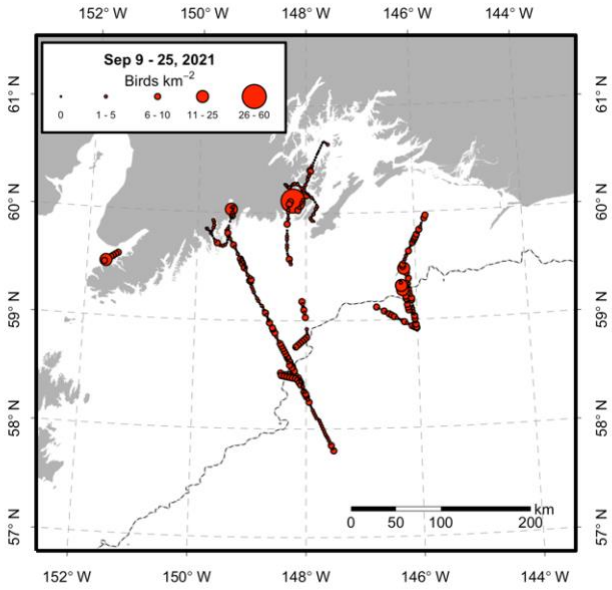


Fig. 9. Densities (birds km^{-2}) of total seabirds (all species combined).

The most abundant avian species during the cruise was the black-legged kittiwake (27.2% of total bird observations; Table 5). Kittiwakes were widely distributed, with areas of higher abundance in both coastal waters and near the shelf-break (Figure 10). Flocks of kittiwakes often occurred near the ship while sampling at offshore stations. The second most abundant species of seabird was the northern fulmar (21.5% of total birds). Fulmars were widely distributed, with the exception of lower-salinity waters of the Alaska Coastal Current and PWS (Figure 11). Fulmars were most abundant near the shelf-break. The third most abundant species was the black-footed albatross (8.9% of total birds). Black-footed albatrosses were concentrated near the shelf-break (Figure 12). While black-footed albatrosses composed an unusually high percentage of total birds seen during surveys, the number of albatrosses that flocked near the ship while sampling at stations was relatively low.

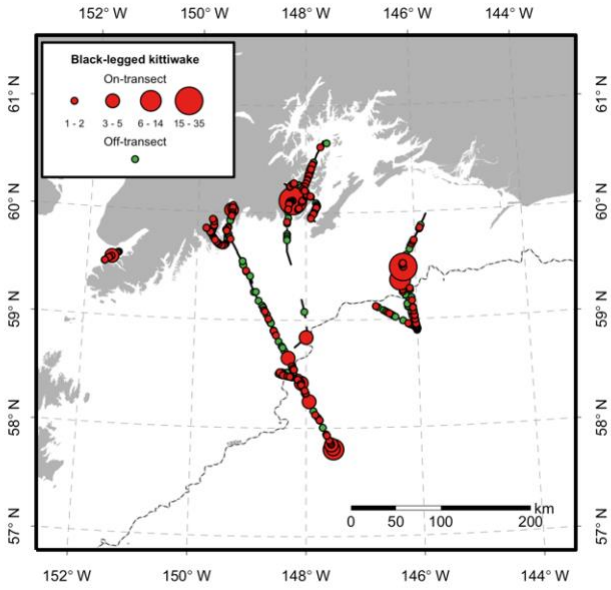


Fig. 10. Black-legged kittiwake distribution.

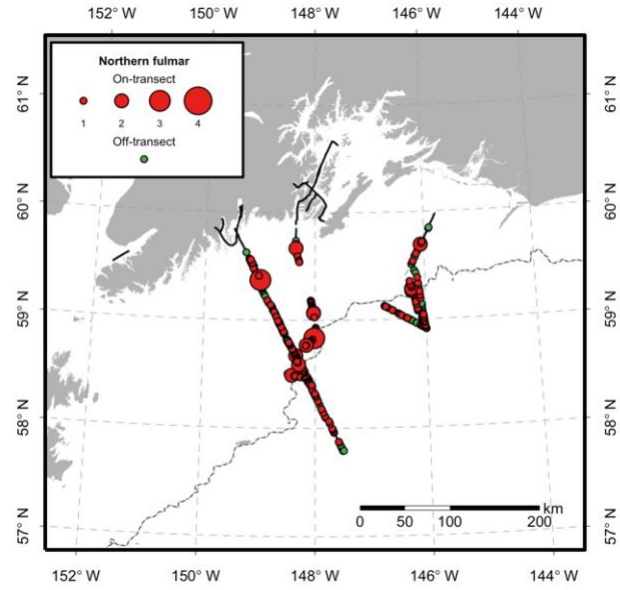


Fig. 11. Northern fulmar distribution.

Table 5. Marine birds observed during the September 2021 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
Canada goose	*Branta canadensis*	*	0
Northern shoveler	*Spatula clypeata*	*	0
American wigeon	*Mareca americana*	*	0
Mallard	*Anas platyrhynchos*	*	0
Northern pintail	*Anas acuta*	*	0
Green-winged teal	*Anas crecca*	1	0.1
Harlequin duck	*Histrionicus histrionicus*	3	0.3
Surf scoter	*Melanitta perspicillata*	4	0.4
White-winged scoter	*Melanitta deglandi*	2	0.2
Black scoter	*Melanitta americana*	*	0
Short-billed dowitcher	*Limnodromus griseus*	*	0
Red-necked phalarope	*Phalaropus lobatus*	21	1.9
Red or red-necked phalarope	*Phalaropus*	4	0.4
South polar skua	*Stercorarius maccormicki*	1	0.1
Pomarine jaeger	*Stercorarius pomarinus*	19	1.7
Parasitic jaeger	*Stercorarius parasiticus*	2	0.2
Unidentified jaeger	*Stercorarius* spp.	1	0.1
Common murre	*Uria aalge*	54	4.9
Murre spp.	*Uria* spp.	2	0.2
Marbled murrelet	*Brachyramphus*	2	0.2
Ancient murrelet	*Synthliboramphus*	*	0
Cassin's auklet	*Ptychoramphus aleuticus*	1	0.1
Parakeet auklet	*Aethia psittacula*	8	0.7
Rhinoceros auklet	*Cerorhinca monocerata*	6	0.5
Horned puffin	*Fratercula corniculata*	3	0.3
Tufted puffin	*Fratercula cirrhata*	70	6.3
Alcid spp.	*Alcidae* spp.	4	0.4
Black-legged kittiwake	*Rissa tridactyla*	302	27.2
Bonaparte's gull	*Chroicocephalus*	1	0.1
Mew gull	*Larus canus*	8	0.7
Herring gull	*Larus argentatus*	18	1.6
Glaucous-winged gull	*Larus glaucescens*	65	5.8
Unidentified gull	*Laridae* spp.	6	0.5
Red-throated loon	*Gavia stellata*	*	0
Pacific loon	*Gavia pacifica*	*	0
Laysan albatross	*Phoebastria immutabilis*	24	2.2
Black-footed albatross	*Phoebastria nigripes*	99	8.9
Short-tailed albatross	*Phoebastria albatrus*	1	0.1
Fork-tailed storm-petrel	*Oceanodroma furcata*	29	2.6
Leach's storm-petrel	*Oceanodroma leucorhoa*	*	0
Northern fulmar	*Fulmarus glacialis*	239	21.5
Buller's shearwater	*Ardenna bulleri*	1	0.1
Sooty shearwater	*Ardenna grisea*	39	3.5
Short-tailed shearwater	*Ardenna tenuirostris*	61	5.5
Sooty or short-tailed shearwater	*Ardenna*	6	0.5
Pelagic cormorant	*Phalacrocorax pelagicus*	2	0.2
Double-crested cormorant	*Phalacrocorax auritus*	3	0.3

Osprey	*Pandion haliaetus*	*	0
Bald eagle	*Haliaeetus*	*	0
Short-eared owl	*Asio flammeus*	*	0
American crow	*Corvus brachyrhynchos*	*	0
Common raven	*Corvus corax*	*	0
American pipit	*Anthus rubescens*	*	0
Pine siskin	*Spinus pinus*	*	0
Total		**1112**	**100**

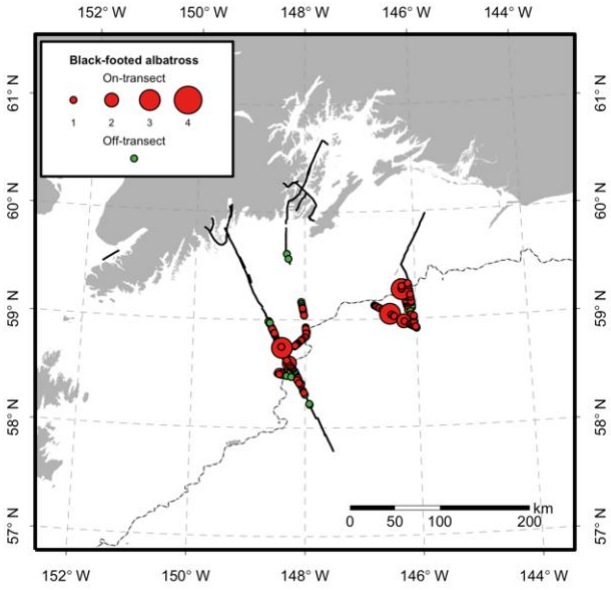


Fig. 12. Black-footed albatross distribution.

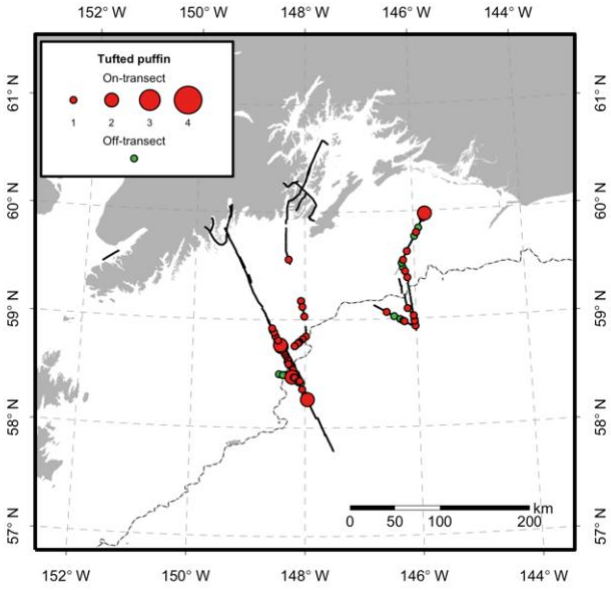


Fig. 13. Tufted puffin distribution.

Tufted puffins composed 6.3% of total birds. Along the Seward Line, they were concentrated near the shelf-break, while they were more widely distributed along the Middleton Line (Figure 13). No tufted puffins occurred in coastal waters. Glaucous-winged gulls composed 5.8% of total birds. Their highest concentrations occurred in coastal waters of PWS and Resurrection Bay, with small numbers of gulls occurring widely throughout the study area (Figure 14). Short-tailed shearwaters composed 5.5% of total birds, while sooty shearwaters composed an additional 3.5%, and unidentified shearwaters composed 0.5%. Shearwaters were widely distributed; short-tailed shearwaters predominated offshore of the shelf-break, while the two species of shearwaters were intermixed over the shelf (Figure 15). A single Buller's shearwater was observed during the cruise.

A notable observation during the cruise was a juvenile short-tailed albatross at stations MID8 and MID7i that exhibited characteristics consistent with it being a Senkaku-type, rather than a Torishima-type bird (Figures 16). These characteristics included smaller body size than Torishima-type (about the same as a black-footed albatross instead of noticeably larger), a proportionally thinner bill, and the absence of any leg bands (nearly all albatrosses on Torishima Island are banded). It has recently been proposed that the morphological, genetic, and ecological differences between Torishima-type and Senkaku-type short-tailed albatrosses support their classification as two separate species (Eda et al., 2020). Senkaku-type short-tailed albatross are less numerous than Torishima-type, composing about 15% of the total (USFWS 2014). However, access to the Senkaku Islands is restricted due to geopolitical tensions, and information about these birds is therefore limited. Photographs and location information were forwarded to Dr. R. Suryan (NOAA), who sent them to colleagues in Japan.

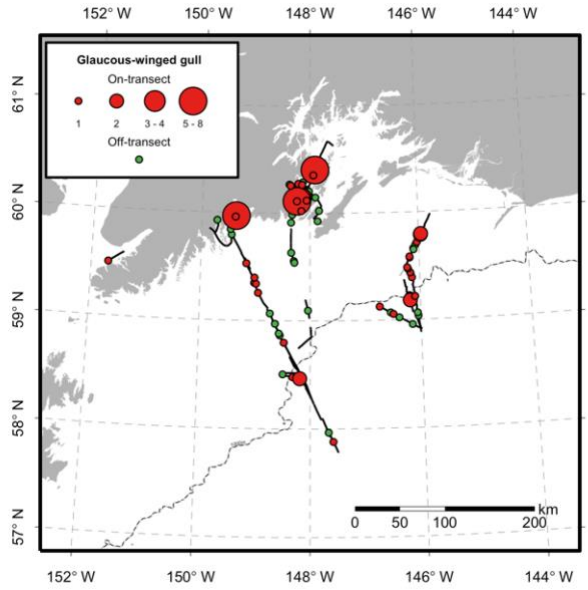


Fig. 14. Glaucous-winged gull distribution.

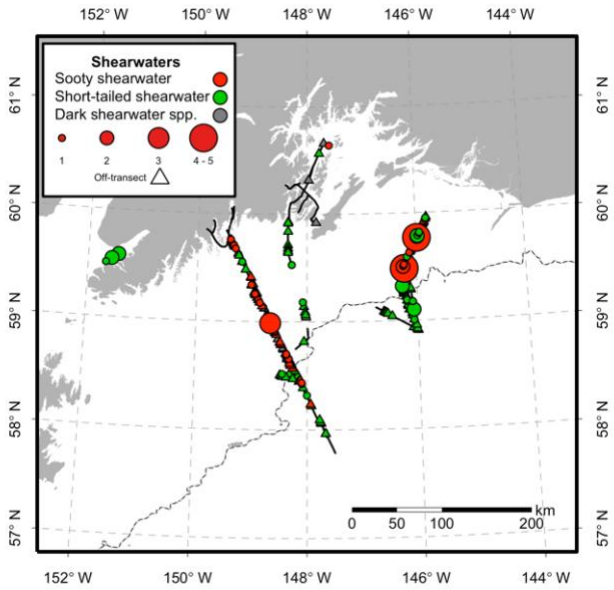


Fig. 15. Shearwater distribution.

Fig. 16. Juvenile short-tailed albatross with Senkaku-type characteristics. Note lack of leg bands on image to right. (photos D. Cushing)

We observed 9 species of marine mammal (Table 6), with 42 individuals on-transect and 113 off-transect. The most abundant toothed whale (odontocete) species was the Dall's porpoise, which was widely distributed (Figure 17), and a single harbor porpoise was observed in Resurrection Bay. A group of 8 killer whales occurred near Port Bainbridge, and a single male was observed north of Middleton Island. Four sperm whales (seen individually) were observed at the shelf-break near Middleton. The most abundant baleen whale (mysticete) species was the fin whale, with most observations near the shelf-break (Figure 18). Two humpback whales occurred in Kachemak Bay, and one was seen near the shelf-break. Pinnipeds were observed near the coast, with harbor seals observed in the inner reaches of fjords, and Steller sea lions hauled out on exposed rocks (Figure 19). Sea otters occurred near the coast in PWS, along the Kenai Peninsula, and in Kachemak Bay.

Literature Cited

Eda, M., T. Yamasaki, H. Izumi, N. Tomita, S. Konno, M. Konno, H. Murakami, and F Sato. 2020. Cryptic species in a Vulnerable seabird: short-tailed albatross consists of two species. Endangered Species Research 43:375-386.

USFWS (U.S. Fish and Wildlife Service). 2014. Short-tailed albatross (*Phoebastria albatrus*) 5-year review: summary and evaluation. U.S. Fish and Wildlife Service, Anchorage, AK. 43 pp.

Table 6. Marine mammal species observed during the September 2021 NGA-LTER cruise.

Common name	Scientific name	Number on-transect	Number off-transect
Fin whale	*Balaenoptera physalus*	3	6
Humpback whale	*Megaptera novaeangliae*	1	2
Sperm whale	*Physter macrocephalus*	0	4
Killer whale	*Orcinus orca*	6	3
Unidentified whale	*Cetacea* spp.	0	2
Dall's porpoise	*Phocoenoides dalli*	11	19
Harbor porpoise	*Phocoena phocoena*	1	0
Steller sea lion	*Eumetopias jubatus*	0	42
Harbor seal	*Phoca vitulina*	2	11
Sea otter	*Enhydra lutris*	18	24
Total		**42**	**113**

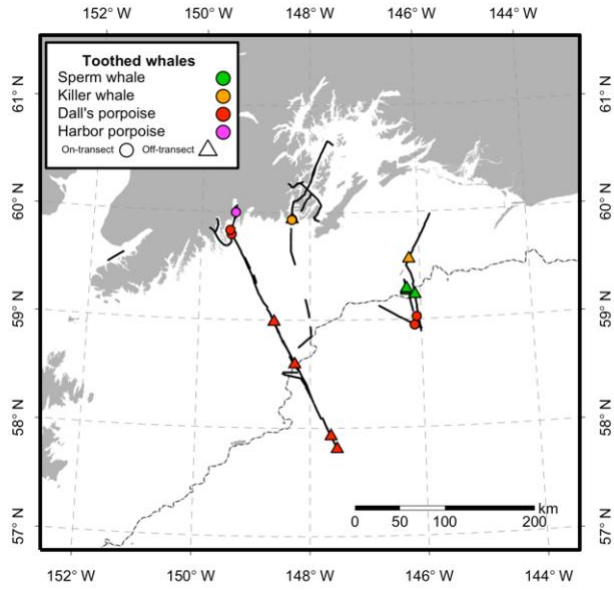


Fig. 17. Toothed whale distribution.

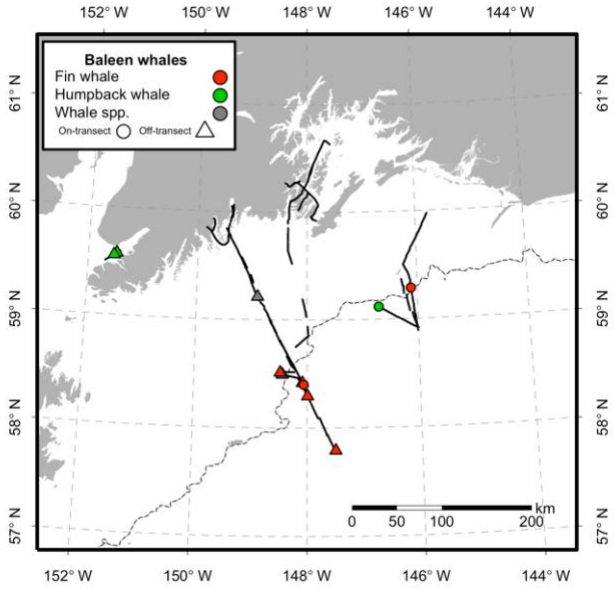


Fig. 18. Baleen whale distribution.

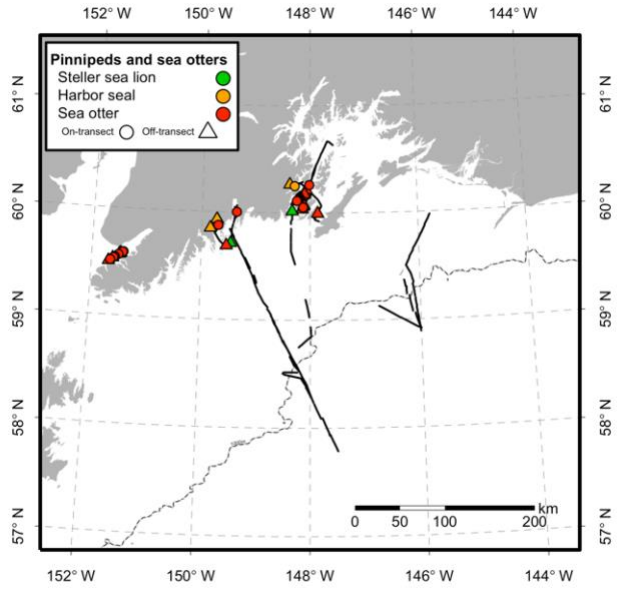


Fig. 19. Pinniped and sea otter distribution.

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	Scientist	Comments
1	CTD 01 Start	RES2.5	9/13/2021 17:26	1:26	60.01906	149.3558	300	Danielson	test
2	CTD 01 Start	RES2.5	9/13/2021 18:30	2:30	60.01860	149.3542	300	Danielson	
3	CTD 01 End	RES2.5	9/13/2021 19:37	3:37	60.01760	149.3550	300	Danielson	
4	CalVET Net Tow Start	RES2.5	9/13/2021 19:50	3:50	60.01510	149.3558	300	Hopcroft	
5	CalVET Net Tow End	RES2.5	9/13/2021 19:57	3:57	60.01420	149.3561	300	Hopcroft	
3	Sediment Trap Start	MID10	9/14/2021 11:15	19:15	58.91085	145.9892	4443	Kelly	
4	CTD 02 Start	MID10	9/14/2021 11:18	19:18	58.91130	145.9888	4443	Danielson	
5	CTD 02 End	MID10	9/14/2021 11:40	19:40	58.90691	145.9841	4443	Danielson	
6	CalVET Net Tow Start	MID10	9/14/2021 11:48	19:48	58.90539	145.9823	4443	Hopcroft	
7	CalVET Net Tow End	MID10	9/14/2021 11:53	19:53	58.90428	145.9815	4443	Hopcroft	
8	CalVET Net Tow Start	MID10	9/14/2021 12:10	20:10	58.89805	145.9955	4443	Hopcroft	gen
9	CalVET Net Tow End	MID10	9/14/2021 12:15	20:15	58.89689	145.9949	4443	Hopcroft	
10	CTD 03 Start	MID10	9/14/2021 12:29	20:29	58.89332	145.9988	4443	Danielson	
11	CTD 03 End	MID10	9/14/2021 13:18	21:18	58.88557	145.9974	4443	Danielson	
12	CalVET Net Tow Start	MID9	9/14/2021 15:10	23:10	59.06430	146.1070	3126	Hopcroft	
13	CalVET Net Tow End	MID9	9/14/2021 15:15	23:15	59.06364	146.1084	3126	Hopcroft	
14	CTD 04 Start	MID9	9/14/2021 15:22	23:22	59.06377	146.1091	3126	Danielson	
15	CTD 04 End	MID9	9/14/2021 16:19	0:19	59.06250	146.1391	3126	Danielson	
16	CalVET Net Tow Start	MID8	9/14/2021 17:53	1:53	59.22571	146.2015	620	Hopcroft	
17	CalVET Net Tow End	MID8	9/14/2021 17:59	1:59	59.22538	146.2050	620	Hopcroft	
18	CTD 05 Start	MID8	9/14/2021 18:07	2:07	59.22480	146.2106	620	Danielson	
19	CTD 05 End	MID8	9/14/2021 18:41	2:41	59.22222	146.2358	520	Danielson	
20	CTD 06 Start	MID7i	9/14/2021 19:28	3:28	59.30524	146.2498	428	Danielson	
21	CTD 06 End	MID7i	9/14/2021 19:43	3:43	59.30415	146.2568	428	Danielson	
22	CalVET Net Tow Start	MID7	9/14/2021 20:26	4:26	59.37755	146.2897	60	Hopcroft	
23	CalVET Net Tow End	MID7	9/14/2021 20:29	4:29	59.37752	146.2898	60	Hopcroft	
24	CTD 07 Start	MID7	9/14/2021 20:35	4:35	59.37755	146.2881	60	Danielson	
25	CTD 07 End	MID7	9/14/2021 20:48	4:48	59.37724	146.2868	82	Danielson	
27	Methot Net Start	MID7	9/14/2021 22:13	6:13	59.37746	146.2872	60	Hopcroft	only filtered 3/4volume thru mouth
28	Methot Net End	MID7	9/14/2021 22:32	6:32	59.37870	146.2672	60	Hopcroft	
29	Bongo 60 cm Start	MID7	9/14/2021 23:27	7:27	59.37798	146.2743	89	Hopcroft	depth shallowing, came up a bit early
30	Bongo 60 cm End	MID7	9/14/2021 23:32	7:32	59.37711	146.2805	89	Hopcroft	
31	Bongo 60 cm Start	MID8	9/15/2021 0:40	8:40	59.23542	146.2724	280	Hopcroft	
32	Bongo 60 cm Bottom	MID8	9/15/2021 0:47	8:47	59.23429	146.2639	280	Hopcroft	
33	Bongo 60 cm End	MID8	9/15/2021 0:55	8:55	59.23481	146.2550	280	Hopcroft	big jelly,have to re-cast.saved side b
34	Bongo 60 cm Start	MID8b	9/15/2021 1:14	9:14	59.22963	146.2334	400	Hopcroft	
35	Bongo 60 cm Bottom	MID8b	9/15/2021 1:20	9:20	59.22866	146.2275	400	Hopcroft	

Event #	Description	Station	Local	GMT	Latitude	Longitude	Depth	Scientist	Comments
36	Bongo 60 cm End	MID8b	9/15/2021 1:27	9:27	59.22858	146.2204	400	Hopcroft	
37	Bongo 60 cm Start	MID9	9/15/2021 3:11	11:11	59.06714	146.1179	1400	Hopcroft	
38	Bongo 60 cm Bottom	MID9	9/15/2021 3:18	11:18	59.06955	146.1118	1400	Hopcroft	
39	Bongo 60 cm End	MID9	9/15/2021 3:25	11:25	59.06809	146.1033	1400	Hopcroft	
40	Bongo 60 cm Start	MID10	9/15/2021 5:01	13:01	58.91140	146.0361	3000	Hopcroft	cast a into formalin
41	Bongo 60 cm Bottom	MID10	9/15/2021 5:08	13:08	58.91213	146.0276	3000	Hopcroft	
42	Bongo 60 cm End	MID10	9/15/2021 5:14	13:14	58.91194	146.0204	3000	Hopcroft	
43	Bongo 60 cm Start	MID10	9/15/2021 5:30	13:30	58.91152	146.0027	3000	Hopcroft	cast b into ethanol
44	Bongo 60 cm Bottom	MID10	9/15/2021 5:36	13:36	58.91169	145.9951	3000	Hopcroft	
45	Bongo 60 cm End	MID10	9/15/2021 5:41	13:41	58.91251	145.9890	3000	Hopcroft	
46	Sediment Trap 1 End	MID10	9/15/2021 7:11	15:11	58.83111	145.9890		Kelly	
47	CTD 08 Start	MID6i	9/15/2021 11:26	19:26	59.42889	146.1678	60	Danielson	
48	CTD 08 End	MID6i	9/15/2021 11:32	19:32	59.42685	146.1673	60	Danielson	
49	CalVET Net Tow Start	MID6	9/15/2021 12:25	20:25	59.49740	146.2480	35	Hopcroft	
50	CalVET Net Tow End	MID6	9/15/2021 12:27	20:27	59.49695	146.2476	35	Hopcroft	
51	CTD 09 Start	MID6	9/15/2021 12:31	20:31	59.49874	146.2508	43	Danielson	
52	CTD 09 End	MID6	9/15/2021 12:40	20:40	59.49814	146.2497	43	Danielson	
53	CTD 10 Start	MID5i	9/15/2021 13:25	21:25	59.57559	146.1777	114	Danielson	
54	CTD 10 End	MID5i	9/15/2021 13:33	21:33	59.57648	146.1792	114	Danielson	
55	CTD 11 Start	MID5	9/15/2021 14:17	22:17	59.64744	146.1080	97	Danielson	
56	CTD 11 End	MID5	9/15/2021 14:36	22:36	59.64526	146.1221	97	Danielson	
57	CalVET Net Tow Start	MID5	9/15/2021 14:40	22:40	59.64596	146.1240	97	Hopcroft	
58	CalVET Net Tow End	MID5	9/15/2021 14:45	22:45	59.64664	146.1255	97	Hopcroft	
59	CalVET Net Tow Start	MID5	9/15/2021 14:58	22:58	59.64946	146.1050	97	Hopcroft	gen
60	CalVET Net Tow End	MID5	9/15/2021 15:03	23:03	59.64997	146.1063	97	Hopcroft	
61	CTD 12 Start	MID5	9/15/2021 15:08	23:08	59.64999	146.1090	97	Danielson	
62	CTD 12 End	MID5	9/15/2021 15:25	23:25	59.64938	146.1164	97	Danielson	
63	CTD 13 Start	MID4i	9/15/2021 16:10	0:10	59.72355	146.0273	72	Danielson	
64	CTD 13 End	MID4i	9/15/2021 16:15	0:15	59.72250	146.0284	72	Danielson	
65	CalVET Net Tow Start	MID4	9/15/2021 17:00	1:00	59.79636	145.9538	70	Hopcroft	
66	CalVET Net Tow End	MID4	9/15/2021 17:04	1:04	59.79571	145.9537	70	Hopcroft	
67	CTD 14 Start	MID4	9/15/2021 17:10	1:10	59.79430	145.9547	86	Danielson	
68	CTD 14 End	MID4	9/15/2021 17:24	1:24	59.79177	145.9560	86	Danielson	
69	CTD 15 Start	MID3i	9/15/2021 18:16	2:16	59.87471	145.8765	103	Danielson	
70	CTD 15 End	MID3i	9/15/2021 18:23	2:23	59.87415	145.8782	107	Danielson	
71	CalVET Net Tow Start	MID3	9/15/2021 19:11	3:11	59.94971	145.8039	85	Hopcroft	
72	CalVET Net Tow End	MID3	9/15/2021 19:15	3:15	59.94956	145.8034	85	Hopcroft	

Event #	Description	Station	Local	GMT	Latitude	Longitude	Depth	Scientist	Comments
73	CTD 16 Start	MID3	9/15/2021 19:20	3:20	59.94954	145.8038	85	Danielson	
74	CTD 16 End	MID3	9/15/2021 19:35	3:35	59.94790	145.8042	85	Danielson	
75	CalVET Net Tow Start	MID3	9/15/2021 19:39	3:39	59.94801	145.8056	85	Hopcroft	RECAST
76	CalVET Net Tow End	MID3	9/15/2021 19:43	3:43	59.94807	145.8058	85	Hopcroft	
77	CTD 17 Start	MID2i	9/15/2021 20:25	4:25	60.02491	145.7292	95	Danielson	
78	CTD 17 End	MID2i	9/15/2021 20:33	4:33	60.02600	145.7296	95	Danielson	
79	CalVET Net Tow Start	MID2	9/15/2021 21:15	5:15	60.10070	145.6508	95	Hopcroft	
80	CalVET Net Tow End	MID2	9/15/2021 21:20	5:20	60.10214	145.6488	118	Hopcroft	
81	CTD 18 Start	MID2	9/15/2021 21:24	5:24	60.10254	145.6467	118	Danielson	
82	CTD 18 End	MID2	9/15/2021 21:41	5:41	60.10424	145.6421	118	Danielson	
83	CTD 19 Start	MID1i	9/15/2021 22:23	6:23	60.17687	145.5755	95	Danielson	
84	CTD 19 End	MID1i	9/15/2021 22:29	6:29	60.17689	145.5721	95	Danielson	
85	CTD 20 Start	MID1	9/15/2021 23:14	7:14	60.24625	145.4903	17	Danielson	
86	CTD 20 End	MID1	9/15/2021 23:21	7:21	60.24897	145.4887	17	Danielson	
87	Bongo 60 cm Start	MID2	9/16/2021 0:44	8:44	60.09900	145.6491	117	Hopcroft	
88	Bongo 60 cm Bottom	MID2	9/16/2021 0:47	8:47	60.09836	145.6469	117	Hopcroft	
89	Bongo 60 cm End	MID2	9/16/2021 0:50	8:50	60.09764	145.6451	117	Hopcroft	
90	CalVET Net Tow Start	PWS3	9/16/2021 9:14	17:14	60.66822	147.6703	732	Hopcroft	
91	CalVET Net Tow End	PWS3	9/16/2021 9:20	17:20	60.66794	147.6719	732	Hopcroft	
92	CalVET Net Tow End	PWS3	9/16/2021 9:24	17:24	60.66967	147.6667	748	Hopcroft	
93	CTD 21 Start	PWS3	9/16/2021 9:29	17:29	60.66982	147.6670	748	Danielson	
94	CTD 21 End	PWS3	9/16/2021 10:06	18:06	60.67553	147.6691	748	Danielson	
95	Sediment Trap Start	PWS2	9/16/2021 11:23	19:23	60.55687	147.7830		Kelly	
96	CTD 22 Start	PWS2	9/16/2021 11:42	19:42	60.53408	147.8023	739	Danielson	
97	CTD 22 End	PWS2	9/16/2021 12:02	20:02	60.53576	147.8004	739	Danielson	
98	CalVET Net Tow Start	PWS2	9/16/2021 12:06	20:06	60.53542	147.8001	739	Hopcroft	
99	CalVET Net Tow End	PWS2	9/16/2021 12:11	20:11	60.53502	147.8000	739	Hopcroft	
100	CalVET Net Tow Start	PWS2	9/16/2021 12:27	20:27	60.53342	147.8021	739	Hopcroft	gen
101	CalVET Net Tow End	PWS2	9/16/2021 12:33	20:33	60.53301	147.8015	739	Hopcroft	
102	CTD 23 Start	PWS2	9/16/2021 12:45	20:45	60.53586	147.8045	739	Danielson	
103	CTD 23 End	PWS2	9/16/2021 13:17	21:17	60.53766	147.7984	727	Danielson	
104	CTD 24 Start	PWS2	9/16/2021 13:44	21:44	60.53435	147.8049	727	Danielson	
105	CTD 24 End	PWS2	9/16/2021 13:57	21:57	60.53432	147.8058	727	Danielson	
106	MultiNet Start	PWS2	9/16/2021 14:36	22:36	60.53711	147.8026	727	Hopcroft	vert-shallow
107	MultiNet End	PWS2	9/12/1921 0:00				727	Hopcroft	late
108	MultiNet Start	PWS2	9/16/2021 15:12	23:12	60.53577	147.8018	727	Hopcroft	deep
109	MultiNet End	PWS2	9/16/2021 15:55	23:55	60.53899	147.7995	736	Hopcroft	

Event #	Description	Station	Local	GMT	Latitude	Longitude	Depth	Scientist	Comments
110	CTD 25 Start	PWS1	9/16/2021 17:11	1:11	60.37345	147.9425	350	Danielson	
111	CTD 25 End	PWS1	9/16/2021 17:39	1:39	60.37520	147.9448	350	Danielson	
112	CalVET Net Tow Start	PWS1	9/16/2021 17:48	1:48	60.37384	147.9427	350	Hopcroft	
113	CalVET Net Tow End	PWS1	9/16/2021 17:54	1:54	60.37430	147.9436	350	Hopcroft	
114	CalVET Net Tow Start	kip2	9/16/2021 18:36	2:36	60.27740	147.9878	580	Hopcroft	
115	CalVET Net Tow Start	KIP2	9/16/2021 18:41	2:41	60.27671	147.9885	580	Hopcroft	
116	CTD 26 Start	KIP2	9/16/2021 18:48	2:48	60.27829	147.9865	580	Danielson	
117	CTD 26 End	KIP2	9/16/2021 19:21	3:21	60.27729	147.9797	580	Danielson	
119	Methot Net Start	KIP2	9/16/2021 20:35	4:35	60.27700	147.9884	580	Hopcroft	
120	Methot Net End	KIP2	9/16/2021 20:55	4:55	60.28260	147.9804	580	Hopcroft	
121	MultiNet Start	KIP2	9/16/2021 21:25	5:25	60.27718	147.9885	580	Hopcroft	
122	MultiNet End	KIP2	9/16/2021 21:54	5:54			591	Hopcroft	late 4 min
123	Methot Net Start	PWS1	9/16/2021 22:40	6:40	60.36341	147.9460	316	Hopcroft	
124	Methot Net End	PWS1	9/16/2021 22:59	6:59	60.37278	147.9414	316	Hopcroft	
125	MultiNet Start	PWS1	9/16/2021 23:13	7:13	60.37241	147.9444	316	Hopcroft	
126	MultiNet End	PWS1	9/16/2021 23:48	7:48	60.39185	147.9216	316	Hopcroft	
127	Methot Net Start	PWS2	9/17/2021 1:05	9:05	60.52221	147.8124	616	Hopcroft	
128	Methot Net End	PWS2	9/17/2021 1:25	9:25	60.53609	147.8056	616	Hopcroft	
129	MultiNet Start	PWS2	9/17/2021 1:45	9:45	60.52808	147.8017	616	Hopcroft	
130	MultiNet End	PWS2	9/17/2021 2:17	10:17	60.54800	147.8053	616	Hopcroft	
131	MultiNet Start	PWS2	9/17/2021 2:49	10:49	60.52987	147.8026	639	Hopcroft	
132	MultiNet End	PWS2	9/17/2021 3:23	11:23	60.54990	147.8055	639	Hopcroft	
133	Methot Net Start	PWS3	9/17/2021 4:23	12:23	60.65887	147.6805	51	Hopcroft	
134	Methot Net End	PWS3	9/17/2021 4:43	12:43	60.66898	147.6660	651	Hopcroft	
135	MultiNet Start	PWS3	9/17/2021 4:58	12:58	60.65987	147.6678	651	Hopcroft	
136	MultiNet End	PWS3	9/17/2021 5:29	13:29	60.67868	147.6703	651	Hopcroft	
137	Sediment Trap End	PWS2	9/17/2021 7:34	15:34	60.45841	147.8337		Kelly	
139	Sediment Trap Start	GAK9	9/17/2021 20:38	4:38	58.69340	148.3215		Kelly	
140	Methot Net Start	GAK9	9/17/2021 20:43	4:43	58.69019	148.3278	275	Hopcroft	
141	Methot Net End	GAK9	9/17/2021 21:04	5:04	58.68586	148.3598	275	Hopcroft	
142	MultiNet Start	GAK9	9/17/2021 21:22	5:22	58.67895	148.3801	275	Hopcroft	
143	MultiNet End	GAK9	9/17/2021 21:54	5:54	58.67487	148.3514	275	Hopcroft	
144	MultiNet Start	GAK9	9/17/2021 22:11	6:11	58.67220	148.3373	280	Hopcroft	
145	MultiNet End	GAK9	9/17/2021 22:41	6:41	58.66827	148.3097	280	Hopcroft	
146	Methot Net Start	GAK10	9/18/2021 0:10	8:10	58.53115	148.1852	1450	Hopcroft	
147	Methot Net End	GAK10	9/18/2021 0:30	8:30	58.52933	148.2167	1450	Hopcroft	
148	MultiNet Start	GAK10	9/18/2021 0:45	8:45	58.52792	148.2257	1450	Hopcroft	

Event #	Description	Station	Local	GMT	Latitude	Longitude	Depth	Scientist	Comments
149	MultiNet End	GAK10	9/18/2021 1:15	9:15	58.52410	148.1954	1450	Hopcroft	
150	Methot Net Start	GAK11	9/18/2021 2:45	10:45	58.39738	148.0924	1800	Hopcroft	
151	Methot Net End	GAK11	9/18/2021 3:06	11:06	58.39866	148.0654	1800	Hopcroft	
152	MultiNet Start	GAK11	9/18/2021 3:20	11:20	58.40149	148.0453	1800	Hopcroft	
153	MultiNet End	GAK11	9/18/2021 3:51	11:51	58.40668	148.0073	1800	Hopcroft	
154	Methot Net Start	GAK12	9/18/2021 5:10	13:10	58.24666	147.9633	2000	Hopcroft	
155	Methot Net End	GAK12	9/18/2021 5:30	13:30	58.24815	147.9358	2000	Hopcroft	
156	MultiNet Start	GAK12	9/18/2021 5:46	13:46	58.24589	147.9169	2000	Hopcroft	
157	MultiNet End	GAK12	9/18/2021 6:16	14:16	58.23761	147.8836	2000	Hopcroft	
158	MultiNet Start	GAK9	9/18/2021 10:02	18:02	58.67558	148.3540	275	Hopcroft	vert-shallow
159	MultiNet End	GAK9	9/18/2021 10:16	18:16	58.67180	148.3581	275	Hopcroft	
160	CTD 27 Start	GAK9	9/18/2021 10:30	18:30	58.68076	148.3412	275	Danielson	
161	CTD 27 End	GAK9	9/18/2021 10:48	18:48	58.67672	148.3477	275	Danielson	
162	CalVET Net Tow Start	GAK9	9/18/2021 10:58	18:58	58.67467	148.3506	275	Hopcroft	
163	CalVET Net Tow End	GAK9	9/18/2021 11:04	19:04	58.67395	148.3532	275	Hopcroft	
164	CalVET Net Tow Start	GAK9	9/18/2021 11:17	19:17	58.68215	148.3359	275	Hopcroft	jen
165	CalVET Net Tow End	GAK9	9/18/2021 11:24	19:24	58.68179	148.3398	275	Hopcroft	
166	CTD 28 Start	GAK9	9/18/2021 11:45	19:45	58.67769	148.3447	275	Danielson	
167	CTD 28 End	GAK9	9/18/2021 12:06	20:06	58.67270	148.3500	275	Danielson	
168	CTD 29 Start	GAK9i	9/18/2021 12:47	20:47	58.61221	148.2821	650	Danielson	
169	CTD 29 End	GAK9i	9/18/2021 13:09	21:09	58.60860	148.2882	650	Danielson	
170	CalVET Net Tow Start	GAK10	9/18/2021 14:00	22:00	58.53053	148.1995	1456	Hopcroft	
171	CalVET Net Tow End	GAK10	9/18/2021 14:06	22:06	58.52951	148.1999	1456	Hopcroft	
172	CTD 30 Start	GAK10	9/18/2021 14:10	22:10	58.52862	148.2001	1456	Danielson	
173	CTD 30 End	GAK10	9/18/2021 15:05	23:05	58.51716	148.2054	1456	Danielson	
174	Sediment Trap End	GAK9	9/18/2021 16:29	0:29	58.49819	148.4802	280	Kelly	
175	CalVET Net Tow Start	GAK11	9/18/2021 18:21	2:21	58.39169	148.0755	1443	Hopcroft	
176	CalVET Net Tow End	GAK11	9/18/2021 18:26	2:26	58.39101	148.0771	1443	Hopcroft	
177	CTD 31 Start	GAK11	9/18/2021 18:32	2:32	58.39048	148.0774	1443	Danielson	
178	CTD 31 End	GAK11	9/18/2021 19:18	3:18	58.37934	148.0856	1443	Danielson	
179	CalVET Net Tow Start	GAK12	9/18/2021 20:28	4:28	58.24129	147.9379	2179	Hopcroft	
180	CalVET Net Tow End	GAK12	9/18/2021 20:34	4:34	58.24042	147.9385	2170	Hopcroft	
181	CTD 32 Start	GAK12	9/18/2021 20:37	4:37	58.24000	147.9379	2170	Danielson	
182	CTD 32 End	GAK12	9/18/2021 21:25	5:25	58.23018	147.9397	2170	Danielson	
183	Methot Net Start	GAK13	9/18/2021 22:28	6:28	58.10054	147.7834	2100	Hopcroft	
184	Methot Net End	GAK13	9/18/2021 22:48	6:48	58.09494	147.8065	2100	Hopcroft	
185	MultiNet Start	GAK13	9/18/2021 23:02	7:02	58.09294	147.8008	2100	Hopcroft	

Event #	Description	Station	Local	GMT	Latitude	Longitude	Depth	Scientist	Comments
186	MultiNet End	GAK13	9/18/2021 23:30	7:30	58.09933	147.8385	2100	Hopcroft	
187	Methot Net Start	GAK14	9/19/2021 0:54	0:00	57.94467	147.6221	3227	Hopcroft	
189	Methot Net End	GAK14	9/19/2021 1:16	9:16	57.94537	147.6493	3227	Hopcroft	
190	MultiNet Start	GAK14	9/19/2021 1:25	9:25	57.94598	147.6597	3227	Hopcroft	
191	MultiNet End	GAK14	9/19/2021 1:59	9:59	57.94910	147.6999	3227	Hopcroft	
192	Methot Net Start	GAK15	9/19/2021 3:35	11:35	57.81113	147.4590	5200	Hopcroft	
193	Methot Net End	GAK15	9/19/2021 3:55	11:55	57.81038	147.4812	5200	Hopcroft	
194	MultiNet Start	GAK15	9/19/2021 4:19	12:19	57.79360	147.4676	5200	Hopcroft	
195	MultiNet End	GAK15	9/19/2021 4:51	12:51	57.79100	147.5027	5200	Hopcroft	
196	MultiNet Start	GAK15	9/19/2021 5:02	13:02	57.78996	147.5139	5200	Hopcroft	
197	MultiNet End	GAK15	9/19/2021 5:37	13:37	57.78498	147.5503	5200	Hopcroft	
198	MultiNet Start	GAK15	9/19/2021 6:43	14:43	57.79226	147.5010	5200	Hopcroft	Vert sort
199	MultiNet End	GAK15	9/19/2021 7:37	15:37	57.79726	147.5221	5200	Hopcroft	
200	MultiNet Start	GAK15	9/19/2021 7:55	15:55	57.78706	147.4777	5200	Hopcroft	
201	MultiNet End	GAK15	9/19/2021 8:06	16:06	57.78696	147.4828	5200	Hopcroft	
202	CTD 33 Start	GAK15	9/19/2021 8:38	16:38	57.78881	147.4940	4240	Danielson	
203	CTD 33 End	GAK15	9/19/2021 8:58	16:58	57.78665	147.4976		Danielson	
204	CalVET Net Tow Start	GAK15	9/19/2021 9:04	17:04	57.79210	147.4982		Hopcroft	
205	CalVET Net Tow End	GAK15	9/19/2021 9:10	17:10	57.79124	147.4993	4829	Hopcroft	
206	CalVET Net Tow Start	GAK15	9/19/2021 9:25	17:25	57.78858	147.4958	4829	Hopcroft	gen
207	CalVET Net Tow End	GAK15	9/19/2021 9:30	17:30	57.78817	147.4966	4829	Hopcroft	
208	CTD 34 Start	GAK15	9/19/2021 9:40	17:40	57.79233	147.5015	4829	Danielson	
209	CTD 34 End	GAK15	9/19/2021 10:25	18:25	57.78439	147.5068	4829	Danielson	
210	CalVET Net Tow Start	GAK14	9/19/2021 11:52	19:52	57.94189	147.6522	3518	Hopcroft	
211	CalVET Net Tow End	GAK14	9/19/2021 11:57	19:57	57.94210	147.6545	3518	Hopcroft	
212	CTD 35 Start	GAK14	9/19/2021 12:03	20:03	57.94080	147.6540	3518	Danielson	
213	CTD 35 End	GAK14	9/19/2021 12:52	20:52	57.92864	147.6566	3518	Danielson	
214	CalVET Net Tow Start	GAK13	9/19/2021 14:17	22:17	58.09727	147.7842	2059	Hopcroft	
215	CalVET Net Tow End	GAK13	9/19/2021 14:22	22:22	58.09684	147.7852	2059	Hopcroft	
216	CTD 36 Start	GAK13	9/19/2021 14:27	22:27	58.09540	147.7852	2059	Danielson	
217	CTD 36 End	GAK13	9/19/2021 15:15	23:15	58.08385	147.7956	2059	Danielson	
218	Methot Net Start	GAK8	9/19/2021 20:49	4:49	58.79926	148.4645	291	Hopcroft	
219	Methot Net End	GAK8	9/19/2021 21:09	5:09	58.80647	148.4979	291	Hopcroft	
220	MultiNet Start	GAK8	9/19/2021 21:22	5:22	58.80931	148.5002	291	Hopcroft	
221	MultiNet End	GAK8	9/19/2021 21:59	5:59	58.81700	148.5548	291	Hopcroft	
222	Methot Net Start	GAK7	9/19/2021 23:01	7:01	58.96309	148.5937		Hopcroft	
223	Methot Net End	GAK7	9/19/2021 23:21	7:21	58.98104	148.6220		Hopcroft	

Event #	Description	Station	Local	GMT	Latitude	Longitude	Depth	Scientist	Comments
224	MultiNet Start	GAK7	9/19/2021 23:30	7:30	58.98312	148.6307	241	Hopcroft	
225	MultiNet End	GAK7	9/19/2021 23:56	7:56	58.99458	148.5974	241	Hopcroft	
226	Methot Net Start	GAK6	9/20/2021 1:22	9:22	59.11733	148.7564	153	Hopcroft	
227	Methot Net End	GAK6	9/20/2021 1:42	9:42	59.12238	148.7311	153	Hopcroft	
228	MultiNet Start	GAK6	9/20/2021 1:52	9:52	59.12490	148.7187	153	Hopcroft	
229	MultiNet End	GAK6	9/20/2021 2:28	10:28	59.13154	148.6804	153	Hopcroft	
230	Sediment Trap Start	GAK5	9/20/2021 4:26	12:26	59.24605	148.8644	ST4	Kelly	
231	Methot Net Start	GAK5	9/20/2021 4:38	12:38	59.24178	148.8817	169	Hopcroft	
232	Methot Net End	GAK5	9/20/2021 4:57	12:57	59.24225	148.9064	169	Hopcroft	
233	MultiNet Start	GAK5	9/20/2021 5:11	13:11	59.24421	148.9324	169	Hopcroft	
234	MultiNet End	GAK5	9/20/2021 5:45	13:45	59.24350	148.8902	169	Hopcroft	
235	MultiNet Start	GAK5	9/20/2021 6:08	14:08	59.24361	148.9349	169	Hopcroft	
236	MultiNet End	GAK5	9/20/2021 6:40	14:40	59.24150	148.8966	169	Hopcroft	
237	MultiNet Start	GAK5	9/20/2021 8:02	16:02	59.24146	148.9368	169	Hopcroft	vert
237.5	MultiNet End	GAK5	9/20/2021 8:10	16:10					
238	CTD 37 Start	GAK5	9/20/2021 8:49	16:49	59.24120	148.9169	169	Danielson	
239	CTD 37 End	GAK5	9/20/2021 9:06	17:06	59.23459	148.9108	169	Danielson	
240	CalVET Net Tow Start	GAK5	9/20/2021 9:22	17:22	59.22852	148.9064	169	Hopcroft	
241	CalVET Net Tow End	GAK5	9/20/2021 9:28	17:28	59.22710	148.9094	169	Hopcroft	
242	CTD 38 Start	GAK5	9/20/2021 9:43	17:43	59.22160	148.9043	169	Danielson	
243	CTD 38 End	GAK5	9/20/2021 10:01	18:01	59.21576	148.8980	169	Danielson	
244	Sediment Trap End	GAK5	9/20/2021 11:20	19:20	59.20603	148.9035	ST4	Kelly	
245	CalVET Net Tow Start	IB0	9/21/2021 12:43	20:43	60.26514	148.3642	332	Hopcroft	
246	CalVET Net Tow End	IB0	9/21/2021 12:49	20:49	60.26489	148.3656	332	Hopcroft	
247	CTD 39 Start	IB0	9/21/2021 12:54	20:54	60.26516	148.3672	332	Danielson	
248	CTD 39 End	IB0	9/21/2021 13:18	21:18	60.26229	148.3666	332	Danielson	
249	CalVET Net Tow Start	IB1	9/21/2021 13:44	21:44	60.24163	148.3342			
250	CalVET Net Tow End	IB1	9/21/2021 13:49	21:49	60.24182	148.3334	150	Hopcroft	
251	CTD 40 Start	IB1	9/21/2021 13:52	21:52	60.24190	148.3348	150	Danielson	
252	CTD 40 End	IB1	9/21/2021 14:08	22:08	60.24207	148.3329	150	Danielson	
253	CalVET Net Tow Start	IB1	9/21/2021 14:13	22:13	60.24271	148.3356	150	Hopcroft	gen
254	CalVET Net Tow End	IB1	9/21/2021 14:19	22:19	60.24311	148.3360	150	Hopcroft	
255	CalVET Net Tow Start	IB2	9/21/2021 14:56	22:56	60.27535	148.2336	160	Hopcroft	
256	CalVET Net Tow End	IB2	9/21/2021 15:02	23:02	60.27548	148.2351	160	Hopcroft	
257	CTD 41 Start	IB2	9/21/2021 15:07	23:07	60.27598	148.2350	160	Danielson	
258	CTD 41 End	IB2	9/21/2021 15:26	23:26	60.27553	148.2430	160	Danielson	
259	CTD 42 Start	MS1	9/21/2021 18:06	2:06	59.95399	147.9265	167	Danielson	

Event #	Description	Station	Local	GMT	Latitude	Longitude	Depth	Scientist	Comments
260	CTD 42 End	MS1	9/21/2021 18:16	2:16	59.95469	147.9265	168	Danielson	
261	CTD 43 Start	MS2	9/21/2021 18:28	2:28	59.94439	147.8974	188	Danielson	
262	CTD 43 End	MS2	9/21/2021 18:44	2:44	59.94285	147.9021	188	Danielson	
263	CalVET Net Tow Start	MS2	9/21/2021 18:48	2:48	59.94125	147.9047	188	Hopcroft	
264	CalVET Net Tow End	MS2	9/21/2021 18:53	2:53	59.93911	147.9081	188	Hopcroft	
265	CTD 44 Start	MS4	9/21/2021 19:16	3:16	59.92066	147.8289	108	Danielson	
266	CTD 44 End	MS4	9/21/2021 19:22	3:22	59.92053	147.8327	108	Danielson	
267	CTD 45 Start	MS3	9/21/2021 19:32	3:32	59.93127	147.8565	164	Danielson	
268	CTD 45 End	MS3	9/21/2021 19:39	3:39	59.93027	147.8582	164	Danielson	
269	MultiNet Start	GAK3	9/22/2021 2:07	10:07	59.55563	149.1917	215	Hopcroft	
270	MultiNet End	GAK3	9/22/2021 3:11	11:11	59.56104	149.2271	215	Hopcroft	
271	MultiNet Start	GAK4	9/22/2021 5:13	13:13	59.41095	149.0505	200	Hopcroft	
272	MultiNet End	GAK4	9/22/2021 5:40	13:40	59.42751	149.0645	200	Hopcroft	
273	Methot Net Start	GAK4	9/22/2021 6:01	14:01	59.41819	149.0551	200	Hopcroft	
274	Methot Net End	GAK4	9/22/2021 6:20	14:20	59.40443	149.0523	200	Hopcroft	
275	CTD 46 Start	GAK4	9/22/2021 6:39	14:39	59.40714	149.0481	200	Danielson	CTD hit bottom of boat after soak. Secondary Cond bad af
276	CTD 46 End	GAK4	9/22/2021 6:56	14:56	59.40701	149.0431	199	Danielson	
277	CalVET Net Tow Start	GAK4	9/22/2021 7:04	15:04	59.40588	149.0416	199	Hopcroft	
278	CalVET Net Tow End	GAK4	9/22/2021 7:09	15:09	59.40580	149.0411	199	Hopcroft	
279	CTD 47 Start	GAK4i	9/22/2021 7:48	15:48	59.33150	149.0010	189	Danielson	
280	CTD 47 Start	GAK4i	9/22/2021 7:56	15:56	59.33102	149.0007	189	Danielson	
281	CalVET Net Tow Start	GAK5	9/22/2021 8:42	16:42	59.24364	148.9313	169	Hopcroft	
282	CalVET Net Tow End	GAK5	9/22/2021 8:48	16:48	59.24305	148.9290	169	Hopcroft	
283	CTD 48 Start	GAK5	9/22/2021 8:51	16:51	59.24331	148.9287	166	Danielson	
285	CTD 48 End	GAK5	9/22/2021 9:07	17:07	59.24327	148.9272	166	Danielson	
287	CalVET Net Tow Start	GAK5	9/22/2021 9:10	17:10	59.24266	148.9269	166	Hopcroft	gen
288	CalVET Net Tow End	GAK5	9/22/2021 9:18	17:18	59.24158	148.9273	166	Hopcroft	
289	Fe Fish Start	GAK5	9/22/2021 9:21	17:21	59.24107	148.9258		Aguilar-Islas	
290	CTD 49 Start	GAK5i	9/22/2021 9:57	17:57	59.17004	148.8476	174	Danielson	
291	CTD 49 End	GAK5i	9/22/2021 10:04	18:04	59.16810	148.8481	174	Danielson	
293	Fe Fish End	GAK6	9/22/2021 10:35	18:35	59.11522	148.7692	200	Aguilar-Islas	
292	CalVET Net Tow Start	GAK6	9/22/2021 10:40	18:40	59.11586	148.7683	200	Hopcroft	
294	CalVET Net Tow End	GAK6	9/22/2021 10:43	18:43	59.11497	148.7699	200	Hopcroft	
295	CTD 50 Start	GAK6	9/22/2021 10:48	18:48	59.11329	148.7732	151	Danielson	
296	CTD 50 End	GAK6	9/22/2021 11:04	19:04	59.10904	148.7791	151	Danielson	
297	Fe Fish Start	GAK6	9/22/2021 11:05	19:05	59.10880	148.7791	151	Aguilar-Islas	
299	CTD 51 Start	GAK6i	9/22/2021 11:44	19:44	59.04579	148.7037	190	Danielson	

Event #	Description	Station	Local	GMT	Latitude	Longitude	Depth	Scientist	Comments
300	CTD 51 End	GAK6i	9/22/2021 11:52	19:52	59.04520	148.7082	190	Danielson	
301	Fe Fish End	GAK7	9/22/2021 12:37	20:37	58.97289	148.6334	190	Aguilar-Islas	
302	CalVET Net Tow Start	GAK7	9/22/2021 12:39	20:39	58.97293	148.6356	240	Hopcroft	
303	CalVET Net Tow End	GAK7	9/22/2021 12:45	20:45	58.97342	148.6381	240	Hopcroft	
304	CTD 52 Start	GAK7	9/22/2021 12:49	20:49	58.97381	148.6401	240	Danielson	
305	CTD 52 End	GAK7	9/22/2021 13:07	21:07	58.97558	148.6467	243	Danielson	
306	Fe Fish Start	GAK7	9/22/2021 13:07	21:07	58.97567	148.6469	243	Aguilar-Islas	
307	CTD 53 Start	GAK7i	9/22/2021 14:02	22:02	58.88416	148.5642	250	Danielson	
308	CTD 53 End	GAK7i	9/22/2021 14:13	22:13	58.88630	148.5655	250	Danielson	
309	Fe Fish End	GAK8	9/22/2021 14:57	22:57	58.81107	148.4953	300	Aguilar-Islas	
310	CalVET Net Tow Start	GAK8	9/22/2021 15:01	23:01	58.80993	148.4964	300	Hopcroft	
311	CalVET Net Tow End	GAK8	9/22/2021 15:06	23:06	58.81040	148.4973	300	Hopcroft	
312	CTD 54 Start	GAK8	9/22/2021 15:11	23:11	58.81081	148.4982	293	Danielson	
313	CTD 54 End	GAK8	9/22/2021 15:33	23:33	58.81281	148.5015	293	Danielson	
314	Fe Fish Start	GAK8	9/22/2021 15:34	23:34	58.81286	148.5016	293	Aguilar-Islas	
315	Fe Fish End	GAK8i	9/22/2021 16:09	0:09	58.74643	148.4195	293	Aguilar-Islas	
316	CTD 55 Start	GAK8i	9/22/2021 16:14	0:14	58.74343	148.4160	292	Danielson	
317	CTD 55 End	GAK8i	9/22/2021 16:26	0:26	58.74322	148.4165	292	Danielson	
317.5	Mooring Start	GEO3	9/22/2021 19:30	3:30			292	Danielson	
318	Mooring End	GEO3	9/22/2021 20:13	4:13	59.01131	148.6923	292	Danielson	
319	CTD 56 Start	GEO3	9/22/2021 20:24	4:24	59.00933	148.7012	235	Danielson	
320	CTD 56 End	GEO3	9/22/2021 20:46	4:46	59.00458	148.6980	235	Danielson	
321	MultiNet Start	Res2.5	9/24/2021 9:47	17:47	60.01961	149.3543	235	Hopcroft	vertical
322	MultiNet End	Res2.5	9/24/2021 10:06	18:06	60.02151	149.3604	235	Hopcroft	
323	MultiNet Start	GAK1	9/24/2021 23:24	7:24	59.82010	149.4765	275	Hopcroft	
324	MultiNet End	GAK1	9/24/2021 23:55	7:55	59.84626	149.4821	275	Hopcroft	
325	MultiNet Start	GAK1	9/25/2021 0:11	8:11	59.83908	149.4841	275	Hopcroft	
326	MultiNet End	GAK1	9/25/2021 0:40	8:40	59.86431	149.4683	275	Hopcroft	
327	Methot Net Start	GAK1	9/25/2021 0:58	8:58	59.85426	149.4775	269	Hopcroft	
328	Methot Net End	GAK1	9/25/2021 1:18	9:18	59.84051	149.4889	269	Hopcroft	
329	Methot Net Start	GAK2	9/25/2021 2:27	10:27	59.70590	149.3306	228	Hopcroft	
330	Methot Net End	GAK2	9/25/2021 2:47	10:47	59.68736	149.3417	228	Hopcroft	
331	MultiNet Start	GAK2	9/25/2021 2:55	10:55	59.68477	149.3407	231	Hopcroft	
332	MultiNet End	GAK2	9/25/2021 3:19	11:19	59.69917	149.3235	231	Hopcroft	
333	MultiNet Start	GAK3	9/25/2021 4:23	12:23	59.57099	149.1797	210	Hopcroft	
334	MultiNet End	GAK3	9/25/2021 4:50	12:50	59.54853	149.1859	210	Hopcroft	
335	Methot Net Start	GAK3	9/25/2021 4:58	12:58	59.54162	149.1879	216	Hopcroft	

Event #	Description	Station	Local	GMT	Latitude	Longitude	Depth	Scientist	Comments
336	Methot Net End	GAK3	9/25/2021 5:19	13:19	59.53382	149.2093	216	Hopcroft	
337	MultiNet Start	GAK1	9/25/2021 7:56	15:56	59.84552	149.4825	269	Hopcroft	vertical
338	MultiNet End	GAK1	9/25/2021 8:11	16:11	59.84453	149.4834	269	Hopcroft	
339	CTD 57 Start	GAK1	9/25/2021 8:30	16:30	59.84458	149.4832	269	Danielson	
340	CTD 57 End	GAK1	9/25/2021 8:49	16:49	59.84296	149.4830	269	Danielson	
341	CalVET Net Tow Start	GAK1	9/25/2021 8:58	16:58	59.84692	149.4815	269	Hopcroft	
342	CalVET Net Tow End	GAK1	9/25/2021 9:03	17:03	59.84612	149.4815	269	Hopcroft	
343	CalVET Net Tow Start	GAK1	9/25/2021 9:19	17:19	59.84474	149.4807	269	Hopcroft	gen
344	CalVET Net Tow End	GAK1	9/25/2021 9:24	17:24	59.84521	149.4812	269	Hopcroft	
345	CTD 58 Start	GAK1	9/25/2021 9:32	17:32	59.84555	149.4823	269	Danielson	
346	CTD 58 End	GAK1	9/25/2021 9:48	17:48	59.84437	149.4802	269	Danielson	deep part
347	CTD 59 Start	GAK1	9/25/2021 10:39	18:39	59.84598	149.4861	269	Danielson	shallow part
348	CTD 59 End	GAK1	9/25/2021 10:51	18:51	59.84445	149.4844	269	Danielson	
349	Fe Fish Start	GAK1	9/25/2021 10:56	18:56	59.84082	149.4810	269	Aguilar-Islas	
350	CTD 60 Start	GAK1i	9/25/2021 11:35	19:35	59.76674	149.4016	263	Danielson	
351	CTD 60 End	GAK1i	9/25/2021 11:46	19:46	59.76586	149.4114	263	Danielson	
352	Fe Fish End	GAK2	9/25/2021 12:25	20:25	59.69350	149.3263	228	Aguilar-Islas	
353	CalVET Net Tow Start	GAK2	9/25/2021 12:39	20:39	59.69396	149.3212	228	Hopcroft	
354	CalVET Net Tow End	GAK2	9/25/2021 12:45	20:45	59.69239	149.3230	228	Hopcroft	
355	CTD 61 Start	GAK2	9/25/2021 12:50	20:50	59.69302	149.3246	228	Danielson	
356	CTD 61 End	GAK2	9/25/2021 13:09	21:09	59.69093	149.3224	228	Danielson	
357	Fe Fish Start	GAK2	9/25/2021 13:10	21:10	59.69080	149.3227	228	Aguilar-Islas	
358	CTD 62 Start	GAK2i	9/25/2021 13:46	21:46	59.62661	149.2589	214	Danielson	
359	CTD 62 End	GAK2i	9/25/2021 13:55	21:55	59.62600	149.2627	214	Danielson	
360	Fe Fish End	GAK3	9/25/2021 14:32	22:32	59.55894	149.1903	216	Aguilar-Islas	
361	CalVET Net Tow Start	GAK3	9/25/2021 14:39	22:39	59.55481	149.1879	216	Hopcroft	
362	CalVET Net Tow End	GAK3	9/25/2021 14:45	22:45	59.55509	149.1885	216	Hopcroft	
363	CTD 63 Start	GAK3	9/25/2021 14:50	22:50	59.55596	149.1889	216	Danielson	
364	CTD 63 End	GAK3	9/25/2021 15:11	23:11	59.55800	149.1914	216	Danielson	
365	Fe Fish Start	GAK3	9/25/2021 15:12	23:12	59.55802	149.1913	216	Aguilar-Islas	
366	Fe Fish End	GAK3i	9/25/2021 15:56	23:56	59.47801	149.1197	205	Aguilar-Islas	
367	CTD 64 Start	GAK3i	9/25/2021 16:05	0:05	59.47953	149.1181	205	Danielson	
368	CTD 64 End	GAK3i	9/25/2021 16:14	0:14	59.48106	149.1183	205	Danielson	
369	CTD 65 Start	GAK4	9/25/2021 16:49	0:49	59.40819	149.0486	202	Danielson	
370	CTD 65 End	GAK4	9/25/2021 16:57	0:57	59.40727	149.0490	202	Danielson	