NGA-LTER Seward Line CRUISE PLAN
June 27 – July 12, 2021
SKQ2021-10S

Funding Source: NSF, NPRB, EVOS, AOOS, UAF

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Scientific Personnel:

	Last Name	First Name	Institution	Role	Team
	Hopcroft	Russ	UAF	Scientist, Chief	zoop
	Smoot	Caitlin	UAF	Scientist, Nights	zoop
	Coleman	Delaney	UAF	Student, Graduate	zoop
	Stidham	Emily	UAF	Student, Graduate	zoop
	Smith	Bette	UAF	Student, Graduate	Zoop (DPI)
	Shipton	Pete	UAF	Scientist	phys
	Fredrickson	Kerri	WWU	Scientist	phyto
	O'Hara	Megan	WWU	Student, Graduate	phyto
	Kandel	Annie	WWU	Scientist	phyto
	Ortega	Emily	UAF	Student, Graduate	nuts, TM
	Promnitz	Alex	UAF	Undergrad	nuts, TM
	Aguliar Islas	Ana	UAF	Scientist	nuts, TM
	Lowin	Ben	UAF	Student, Graduate	optics
	Kelly	Tom	UAF	Scientist	Flux, OA
	Cushing	Dan	USFWS	Scientist	Seabirds
	Cohen	Jake	UAF	Student, Graduate	Phyto/genetics
	Bauner	Megan	UAF	Student, Graduate	Phyto/genetics
	Hoffman	Michele	Microcosm	Media	Media
	Rose	Alex	Microcosm	Media	Media
*	Cousins	Charles	Bellamare	Contractor	DPI training
*	Guigand	Cedric	Bellamare	Contractor	DPI training
*	Danielson	Seth	UAF	Scientist	DPI training
*	Questel	Jenn	UAF	Scientist	DPI training
**	Elmore	Feyne	UAF	Student, Undergrad	optics

* only on for mob and first 2 days ** boards as DPI team disembarks

Scientific Purpose:
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 of the NSF's Northern Gulf of Alaska Long-term Ecological Program (NGA-LTER). The scientific purpose of the core Seward Line project is to develop an understanding of the response and resiliency of this marine ecosystem to climate variability. This cruise marks the 24th consecutive year for the Seward Line in the NGA, including Prince William Sound (PWS), and the 50th year of observations at GAK1.

Special Note: This cruise will be conducted during the COVID-19 Pandemic. Special permissions from UAF, UNOLS and NSF have been required to sail. The full vaccination of the science party has been instrumental in allowing us to return to double berthing and remove the two week quarantine that has been required for the past 4 cruises.

Cruise Objectives

1. Determine thermohaline, velocity, light, and oxygen structure of the NGA shelf.
2. Determine macro- and micro-nutrient structure of the NGA shelf.
3. Determine particle structure and flux rates of the NGA shelf.
4. Determine phyto- and microzooplankton composition, biomass distribution, and productivity.
5. Determine the vertical and horizontal distribution and abundance of zooplankton species.
6. Determine the abundance and composition of Macrojellies.
7. Conduct surveys of Seabirds and Marine Mammals
8. Determine carbonate chemistry (i.e. Ocean Acidification) at selected intensive stations
9. Recover and redeploy the GEO mooring
10. Conduct training for and deploy our new multi-sensor and plankton imaging tow-yo system.
11. Short-term test deployment of benthic camera lander in Res.Bay
12. Provide at-sea experience for students within the UAF system
13. Share the experience through outreach/media activities.

SAMPLING

The overall approach of the cruise is to occupy the Seward Line, Kodiak Line and Middleton Line transects across the shelf and a string of stations within western PWS. Operations are generally divided into distinct day and night tasks, thus requiring each station to be occupied twice. This structure 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 will typically occupy a selected “intensive” station that involves a greater number and range of collections than the other stations occupied that day. Station profiles are supplemented by underway measurements.

DAYTIME ACTIVITIES:

1. Occupy the various hydrographic stations and collect vertical CTD-fluorescence-PAR and particle profiles (see **Figures** & **Tables)**.
2. Collect discrete bottle samples at these stations for nutrients, chlorophyll and microzooplankton. Chlorophyll Size Fractionation (20 µm) will be done at all whole numbered Seward Line and most other stations. Macronutrients samples will be pre-filtered prior to freezing. Chlorophyll will be extracted on fresh filters without freezing.
3. Measure the dissolved carbonate chemistry along the Seward Line and within Prince William Sound from bottle casts at selected intensive stations (tentatively Odd numbered GAK, KIP2, PWS2).
4. CalVet Net casts will be done (CalVet frame has 4 nets) after most the CTD casts to 100m. (NO CALVETs at the “i” stations).
5. At intensive stations an additional CTD cast will collect water to be used for primary production incubations and carbonate chemistry.

6. A trace-metal clean CTD cast will also be undertaken at all intensive stations, and other odd-numbered stations as time permits.
7. We will deploy a tow-body for sampling near-surface iron during the day (and on long transits). Sampling will occur just prior arriving to or just after departure. (It is hoped that this "fish" can simply be left in the water while on station rather than constantly retrieved and deployed).
8. At intensive stations there will be an extra Calvet collection, and along the Seward Line plus PWS2 there will be a vertical deployment of the 150 µm Multinet to 200m. Some of this material will be used for live sorting as well as post-cruise molecular analysis.
9. We will do one deep Multinet tow (to maximum 1200 m) near the end of the Seward Line and one at PWS2 (800m). This normally happens during days but may be done at night in conjunction with Multinet work at those stations if time permits.
10. We will attempt to deploy drifting sediment traps at a subset of the intensive stations, the number to be determined by how they fit into daily logistics. Traps will ideally be deployed for 24 (or 48) hrs.
11. We will recover and redeploy the GEO mooring (~GAK 6i).

NIGHTTIME ACTIVITIES:

1. A towed 505-µm Multinet will be used to collected depth-stratified samples along the Seward Line, and at selected PWS Stations to 200m. Two multinets will be attempted at Intensive stations if time permits.

2. On the Middleton and Kodiak Lines bongo net collections will replace those of the Multinet.

3. A 5 m^2 Methot net will be towed for 20 minutes at each night station.

4. Deep-multinet tows may occur during the night shift as time permits (see #9 above).

Sampling Strategy

The first 2 days of the cruise will be devoted to training with the new tow body, likely followed by a full day's transit with it along the Seward Line.

In general, we estimate 1.5 days for PWS and 4-5 days for the Seward Line, two days for each of the Middleton and Kodiak transects. And a half day for the GEO mooring. It is important that all Multinet collections (with the exception of those to 600-1200m) be completed during darkness to allow comparison to prior years. We anticipate that 4-5 Multinets and/or Bongos can be conducted per night: sampling starts just after dusk and stops just before dawn, and can be extended slightly when overcast. There is always a typically a greater period of light available than of darkness, so execution of daytime stations and activities are designed around being in position to commence night sampling as soon as it is sufficiently dark. Sediment traps are flexible in their deployment timing.

Hazmat: (tentative)

Formaldehyde – 20L carboy
Ethanol – 40L
Acetone – 16L
Oxygen Fixation (Sodium hydroxide. Sulphuric acid, Manganous Chloride)
Lugol's solution (1L)
Mercuric Chloride (for DIC fixation)
Glutaraldehyde (10%) – 500 ml
DAPI stain solution – 100 ml
Liquid N_2 – one 30-L dewar

CRUISE ACTIVITY SCHEDULE

6/22 – Advance Science team, heads to Seward for DPI training.
6/24 – Remainder of science heads to Seward – we will sleep onboard.
6/25-26 – Begin setup at ~8am SMC dock. Depart if possible evening of 26th (do RES2.5).
6/27-28 – Familiar science teams and ships with DPI setup and operations. DPI team and trainees will be shuttled of ship by R/V *Nanuq*, and one member of science party will embark.
6/29 – *Sikuliaq* definitely underway by 6am
7/12 – *Sikuliaq* returns to dock by mid afternoon – packup and demob begin.
7/13 – Science party departs for Fairbanks by early afternoon using vans.

Transport:

Russ' Van: Russ, Caitlin, Delaney, Emily, Bette
Rental car/bus: Kerri, Megan, Annie
Seward Bus: Michele, Alex R, Charles, Cedric
Personal transport: Jenn, Seth, Jake,
UAF Truck: Ana, Emily
TBD: Ben, Tom, Alex P, Dan

Table 1. STANDARD STATIONS (intensive stations highlighted)

Latitude N (degrees, minutes)		Longitude W (degrees, minutes)		Station Name
Resurrection Bay Station				
60	1.5	149	21.5	RES2.5
Seward Line				
59	50.7	149	28	GAK1
59	46	149	23.8	GAK1I
59	41.5	149	19.6	GAK2
59	37.6	149	15.5	GAK2I
59	33.2	149	11.3	GAK3
59	28.9	149	7.1	GAK3I
59	24.5	149	2.9	GAK4
59	20.1	148	58.7	GAK4I
59	15.7	148	54.5	GAK5
59	11.4	148	50.3	GAK5I
59	7	148	46.2	GAK6
59	2.7	148	42	GAK6I
58	58.3	148	37.8	GAK7
58	52.9	148	33.6	GAK7I
58	48.5	148	29.4	GAK8
58	44.6	148	25.2	GAK8I
58	40.8	148	21	GAK9
58	36.7	148	16.7	GAK9I
58	32.5	148	12.7	GAK10
58	23.3	148	4.3	GAK11
58	14.6	147	56	GAK12
58	5.9	147	47.6	GAK13
57	***56.6***	***147***	***39***	***GAK14***
57	***47.5***	***147***	***30***	***GAK15***
Prince William Sound Stations				
60	7.5	147	50	KIP0
60	16.7	147	59.2	KIP2
60	22.78	147	56.17	PWS1
60	32.1	147	48.2	PWS2
60	40	147	40	PWS3
60	49..25	147	24	PWSA
60	45	147	14	PWSB
60	38.1	147	10	PWSC
60	31.5	147	7.6	PWSD
60	24.3	146	58.3	PWSE
60	24	146	45	PWSF
Columbia Glacier (unlikely)				
61	7.4	147	3.8	CG0
60	59.5	147	4.2	CG1
60	57.6	147	5.9	CG2

Icy Bay				
60	16.3	148	21.7	IB0
60	14.5	148	20.1	IB1
60	16.3	148	14	IB2
Hogan Bay Line (unlikely)				
60	11.57	147	42	HB1
60	10.754	147	38.5	HB2
60	9.855	147	34.508	HB3
60	8.807	147	30.04	HB4
Montague Strait Line				
59	57.257	147	55.602	MS1
59	56.6	147	53.7	MS2
59	55.9	147	51.4	MS3
59	55.2	147	49.7	MS4

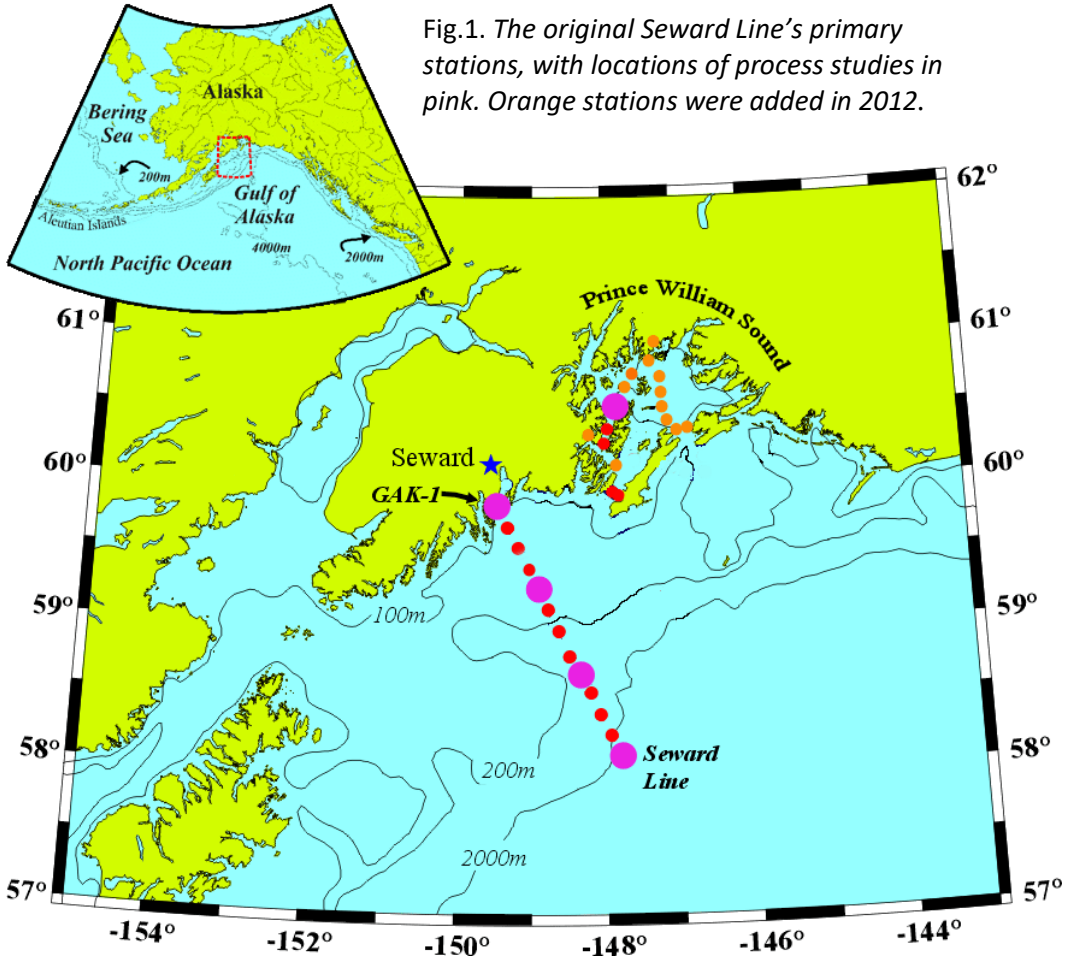

Fig.1. *The original Seward Line's primary stations, with locations of process studies in pink. Orange stations were added in 2012.*

Table 2. New LTER Stations (intensive stations highlighted)

Latitude N (degrees, minutes)		Longitude W (degrees, minutes)		Station Name
Kodiak Line				
58	14.7	151	35.4	KOD1
58	7.8	151	23.07	KOD2
58	0.9	151	10.74	KOD3
57	54	150	58.17	KOD4
57	47.1	150	45.6	KOD5
57	40.26	150	32.97	KOD6
57	33.42	150	20.34	KOD7
57	26.37	150	7.95	KOD8
57	19.32	149	55.56	KOD9
57	12.27	149	43.17	KOD10
Cape Suckling Line (unlikely)				
59	56.35	143	53.5	CS1
59	53.85	143	53.5	CS1e
59	51.35	143	53.5	CS1i
59	48.85	143	53.5	CS1n
59	46.35	143	53.5	CS2
59	41.35	143	53.5	CS2i
59	36.35	143	53.5	CS3
59	31.35	143	53.5	CS3.5
59	26.35	143	53.5	CS4
59	16.35	143	53.5	CS5
Middleton Island Line				
60	15	145	30	MID1
60	10.5	145	34.5	MID1i
60	6	145	39	MID2
60	1.5	145	43.5	MID2i
59	57	145	48	MID3
59	52.5	145	52.5	MID3i
59	48	145	57	MID4
59	43.5	146	1.5	MID4i
59	39	146	6	MID5
59	34.5	146	10.5	MID5i
59	30	146	15	MID6
59	25.7	146	10	MID6i
59	23	146	18	MID7
59	18.267	146	15	MID7i
59	13.534	146	12	MID8
59	4.067	146	6	MID9
58	54.6	146	0	MID10

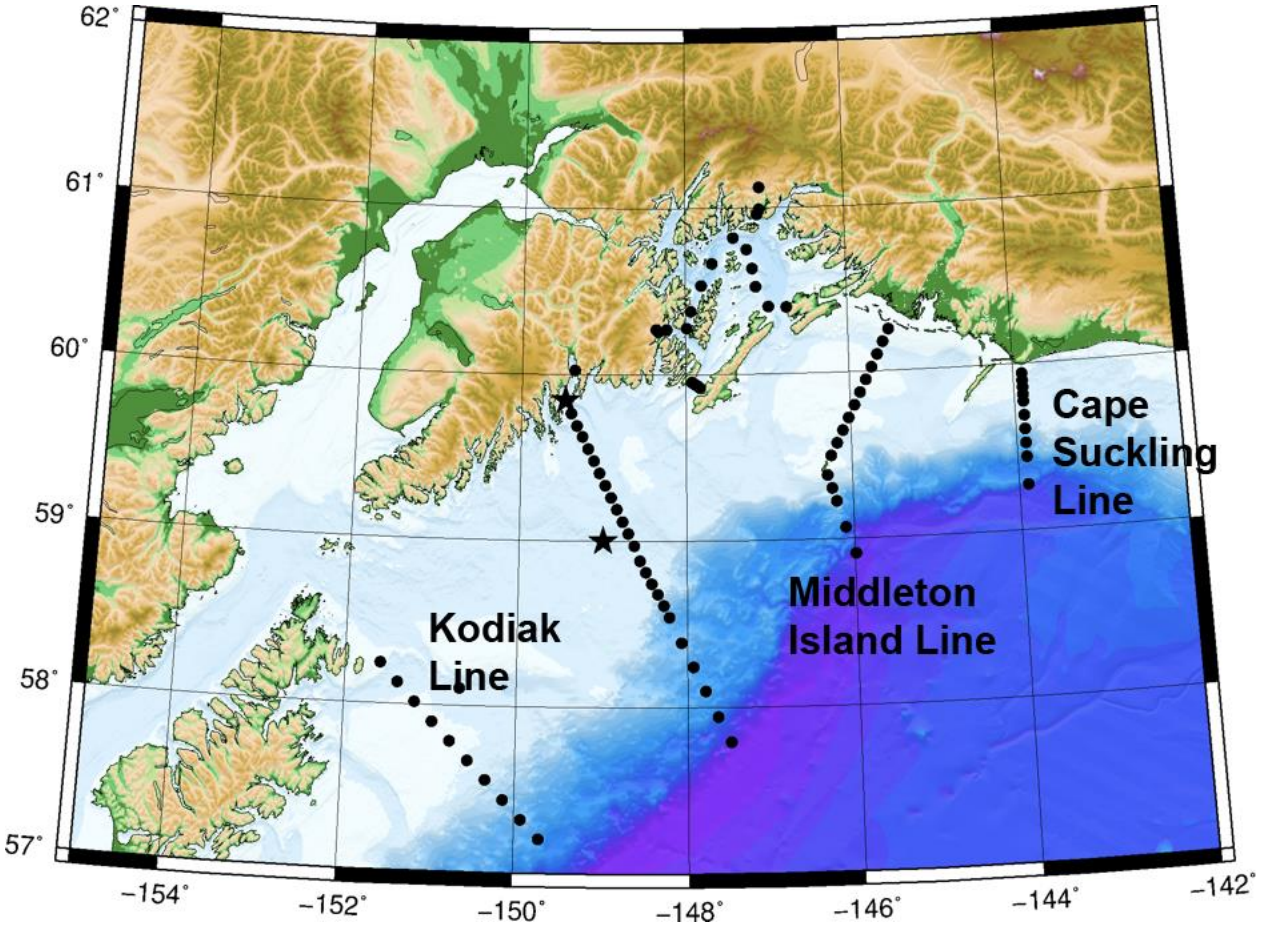

Fig. 2. NGA-LTER sampling stations highlighting 3 new transects line near Kodiak, Middleton Island and Cape Suckling