NGA-LTER Seward Line CRUISE PLAN
July 3 - 18, 2018

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

Chief Scientist: Russ Hopcroft, Zooplankton, rrhopcroft@alaska.edu
Institute of Marine Science
University of Alaska
Fairbanks, AK 99775-1080
Phone: 907-474-7842
Mobile 907-699-3253

Co-Chief Scientist: Ken Coyle, Zooplankton, IMS-UAF (kocoyle@alaska.edu)

Scientific Personnel:

3 Jennifer Questel	Zooplankton (nights), UAF
4 Heidi Mendoza-Islas	Zooplankton (nights), UAF
5 Loring Schiable	Zooplankton (nights), volunteer
6 Suzanne Strom	Phytoplankton/Microzoop, WWU
7 Kelly Bright	Phytoplankton/Microzoop, WWU
8 Clayton Mazur	Phytoplankton/Microzoop, WWU
9 Garrett Michael	Phytoplankton/Microzoop, WWU
10 Ana Aguilar-Islas	Chemistry (Nutrients, Iron), UAF
11 Barkha Singh	Chemistry (Nutrients, Iron), UAF
12 Jessica Pretty	Flux (Sediment Traps & UVP), UAF
13 Thilo Klenz	Physics (CTD), UAF
14 Daniel Cushing	Seabirds/Mammals, FWS
15 Tobey Burke	Seabirds/Mammals, FWS
16 Madison Herron	Microbes, UAF
17 Per Fosstveit	Teacher-at-sea (NY)

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 second cruise of the NSF's Northern Gulf of Alaska Long-term Ecological Program (NGA-LTER), and the first summer cruise since 2004. 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 9th summer cruise for the Seward Line in the NGA, including Prince William Sound (PWS), and the 48th year of observations at GAK1.

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 (including macro-jellies).
6. Conduct surveys of seabirds and Marine Mammals
7. Conduct shipboard experimental work on phyto- and zooplankton.
8. Determine carbonate chemistry (i.e. Ocean Acidification) at selected intensive stations
9. ***Provide at-sea experience for students within the UAF system***
10. ***Share the experience through outreach/media activities.***

SAMPLING

The overall approach of the cruise is to occupy 4 transect lines across the shelf and a circuit within 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 other stations occupied that day. Stations 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 prefiltered 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 GAK1, GAK5, GAK9, GAK13, 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. 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). It is hoped this will not impact transit speed.
7. 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.

8. 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.

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. Bongo nets will be used at all other stations to 200m. At intensive stations along the Seward Line and in PWS an additional collection will be taken with a Bongo net. When leaving intensive stations, a Methot Trawl will be deployed by crane for ~20 minutes while in route to the next station. Additional Methot trawls will be done as time permits.

2. Deep-multinet tows may occur during the night shift as time permits (see #8 above).

Sampling Strategy

In general, we estimate 2 days to complete the Kodiak Line, 1.25 days for Cape Suckling, 2 days for Middleton Island Line, 2.25 days for PWS and 4-5 days for the Seward Line. It is important that all Multinet collections (with the exception of those to 600m) be completed during darkness to allow comparison to prior years. We anticipate that 4-5 Multinet and/or Bongo stations can be conducted per night: sampling starts just after dusk and stops just before dawn, and can be extended slightly when overcast. In July, there is a much 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.

Sampling personnel requirements (and times):

CTD: winch operator, 1-2 scientists (launch and recovery), 30m/min in upper 100m, 60m/min below 100m. Depending on schedule, casts may be limited to 1000m at deep-sea stations.

TMC towfish: 1 Deck person and 1 scientist for launch and recovery (~15-20 min), A deck person (or martec) to watch towfish during towing and communicate with the bridge/science.

Multinet or Bongo: winch operator, 2-3 scientists (launch, recovery, wash-down, re-cock) – Ship speed: 2 knots, Wire speed: ~1 m/sec down, 0.5-1m/sec up (typically 30-40min per deployment). Stern A-frame deployment. Maximum depth on tows 200m. Both systems will have depth transducers to ensure we get close to, but not on the bottom when depths are less than 200m.

Calvets & Ring nets: winch operator, 1-2 scientists (launch, recovery, wash-down) – Ship speed: station keeping, Wire speed: ~1 m/sec for Calvet, 0.5m/sec for Ring net (10 min/cast).

Methot Trawl: winch operator, 1-2 scientists, launch, recovery, wash-down) – Ship speed: ~4 Wire speed: ~1 m/sec for up and down tow-yo to 20m for 20 minutes.

Ship's Science Equipment Supplied:

- CTD (with deep-SUNA, UVP and LISST for integration)
- -40 freezer for macro-nutrient and genetic samples
- Underway sampling system (TSG, GPS) SBE45
- 10 cu ft refrigerator/freezer for chemical and preserved sample storage
- Fume hood for filtration of preserved samples

Scientist's Equipment Needed:

- Trace-metal clean towfish system (access to compress air) (Deck storage 3 palettes)
- Trace Metal Clean Van

- CalVet and ring nets [nets, flow-meters, frames, swivels, weights, spares]
- 2 Multinet system (coarse and fine nets, spare cod ends/nets)
- Bongo nets
- Deckboard incubators (4) connected to ship's seawater system
- Filtration systems
- Fluorometers & Centrifuge
- Laptop computers
- 16 cases (24/cs) of 16-oz zooplankton sample bottles
- 5 cases (12/cs) of 32-oz zooplankton sample bottles
- 3-4 cases of 24 Winkler bottles
- Several coolers with nutrient and TMC bottles
- Microscopes and supplies for handling and incubation of copepods
- Incubators: 4 cu ft. required near work area
- Refrigerated Circulators
- Milk Chocolate

Hazmat: (tentative)

Formaldehyde – 2x20L carboy
Rose Bengal Stain 50g
Ethanol – 40L.
Acetone – 16L
Lugol's solution (1L)
Oxygen Fixation (Sodium hydroxide. Sulphuric acid, Manganous Chloride)
Mercuric Chloride (for DIC fixation)
3N HCl (25% v/v) (500 ml)
Glutaraldehyde (10%) – 500 ml
DAPI stain solution – 100 ml
Liquid N_2 – one 30-L dewar

CRUISE ACTIVITY SCHEDULE

7/1 Main science party leaves Fairbanks ~8am, pickups in Anchorage (~4pm), arrives Homer ~8-9pm, overnights on ship
7/1 Hopcroft flies to ANC, pickup equipment & Strom, drive to Seward & pickup up UHaul to move science equipment to Homer
7/2 Science party begins mobilization ~8am, sets up, science party sleeps on board
7/3 Woldstad sails ~8am, heads to Kodiak Line
7/18 Woldstad return to Homer by 8pm – offload before midnight. Science party stay overnight on vessel
7/19 Science party departs for Anchorage and Fairbanks

Berthing:
Chief – Russ
4bunk: Kelly, Barkha, Jess, Madison
3bunk: Dan, Tobey, Per
3bunk: Clayton, Garrett, Thilo
3bunk: Suzanne, Ana
3bunk: Jenn, Heidi (nights)
2bunk: Ken, Loring (nights)

Transport:
Flying: Jess, Kelly, Clayton, Garrett, Per, Ana
Rental & UHaul: Russ, (Dan?), Suzanne
UAF Van: Jenn, Heidi, Ken, Lorring, Barkha, Madison, Thilo, (Dan?)
In Homer: Tobey

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	147	58.3	PWSE
60	24	146	45	PWSF
Columbia Glacier				
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	15.5	148	20.1	IB1
60	16.3	148	14	IB2
Hogan Bay Line				
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

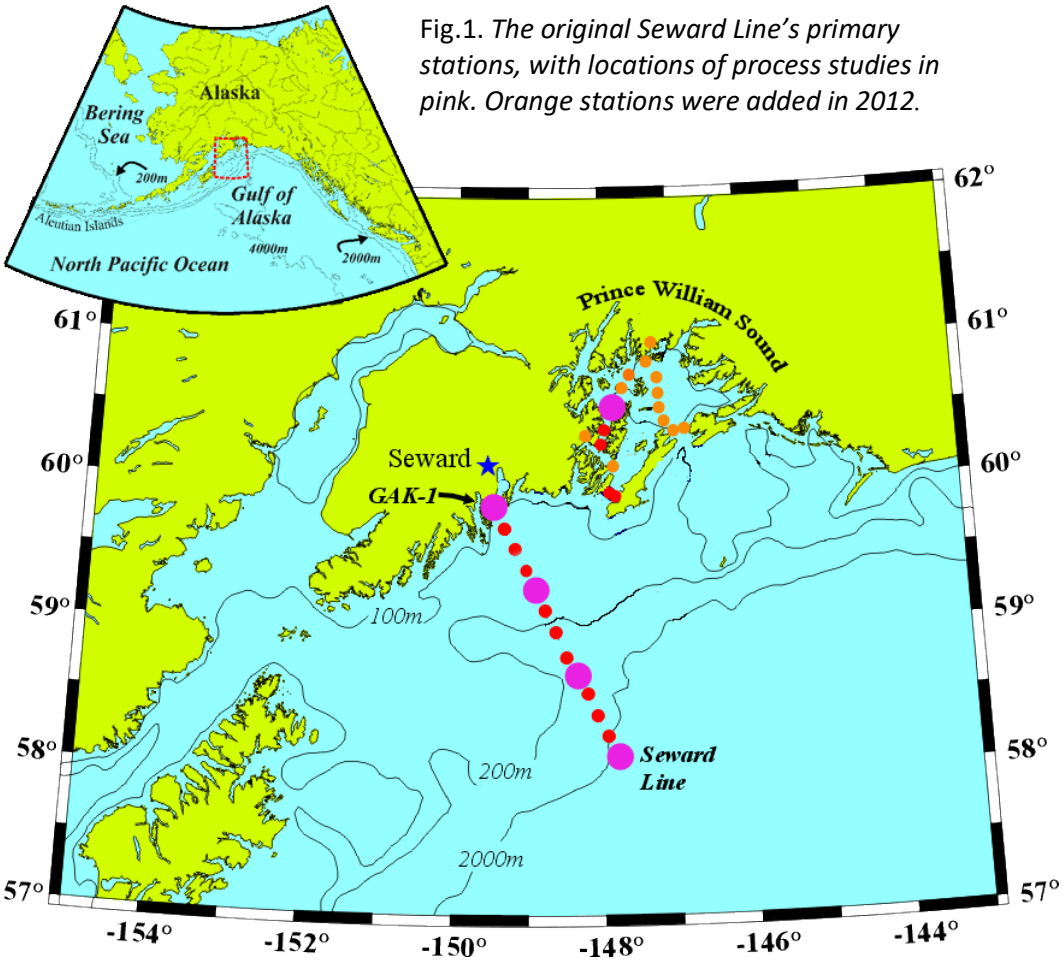

Fig.1. *The original Seward Line's primary stations, with locations of process studies in pink. Orange stations were added in 2012.*

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				
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

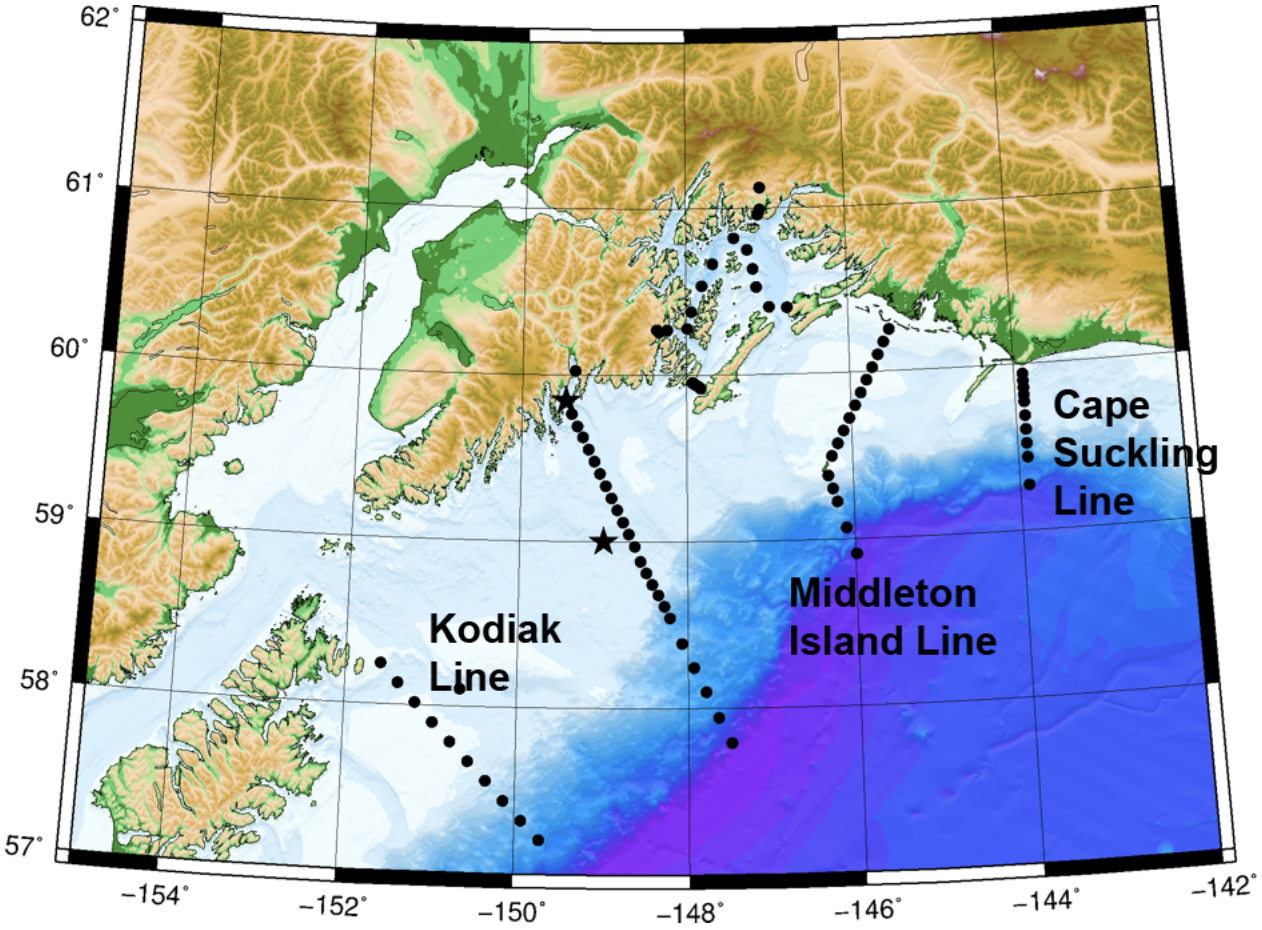

Fig. 2. NGA-LTER sampling stations highlighting 3 new transects line near Kodiak, Middleton Island and Cape Suckling